An Ethical Analysis of Marine Aquaculture: Sustainability, Responsibilities to Producers and Consumers, and the Moral Status of Fish

By
Abigail Marie Bradley
Departments of Environmental Science and Philosophy
Allegheny College
Meadville, Pennsylvania

April, 2013

An Ethical Analysis of Marine Aquaculture: Sustainability, Responsibilities to Producers and Consumers, and the Moral Status of Fish

By

Abigail Marie Bradley

Departments of Environmental Science and Philosophy
Allegheny College
Meadville, Pennsylvania

April, 2013

Submitted in fulfillment of the senior thesis requirements of the
Departments of Environmental Science and Philosophy at Allegheny College
and approved by the senior thesis committee.

4/12/13		4/12/13	
Dr. Kate Darby	Date	Dr. Steven Farrelly-Jackson	Date

Pledge

Table of Contents

Acknowledgements 5

Abstract 6

Chapter 1: An Introduction to Marine Aquaculture 7

From Green to Blue 7

The State of the Oceans 9

Declining Populations and Increasing Demand 12

A Solution? 13

Philosophical Approach 14

Ethical Frameworks 15

Chapter Divisions 16

Chapter 2: Responsibilities to the Natural World – Marine Aquaculture and Environmental Sustainability 18

Introduction 18

Anthropocentrism: The Human Problem 19

Shifting Our Perspective 22

Sustainability: Reconsidered 26

The Elephant in the Room 30

Is Marine Aquaculture Sustainable? 32

Chapter 3: Responsibilities to Producers and Consumers – Marine Aquaculture and Humans 36

Introduction 36

The Unknown: Genetically Modified Organisms, the Unlabeled, the Mislabeled, & Potential Impacts on Human Health 37

Food Security and Globalization 42

Chapter 4: Responsibilities to Nonhuman Animals – Marine Aquaculture and Finfish **47**

Introduction 47

Moral Status 47

The Scope of Moral Considerability 49

Do Fish Feel Pain? 52

Should We Eat Farmed Fish? 59

Chapter 5: Are There Ethical Alternatives? **61**

Is There A Solution? 62

References **66**

Acknowledgements

This project would not have been possible without the help and encouragement of a number of wonderful individuals.

First, I'd like to thank my advisors, Dr. Kate Darby and Dr. Steven Farrelly-Jackson, for their patience, support, and encouragement throughout the process. Professor Darby's organization and confidence certainly helped me to maintain my sanity and saved me from myself (I didn't procrastinate nearly as much as I thought I would). Professor Farrelly-Jackson's willingness to listen to my frustrations and discuss—and disagree with—my arguments proved to be invaluable throughout the writing process.

Second, I'd like to thank my family, especially my mother and sister, for their support. Their willingness to listen to my chapters at times when I doubted my clarity was much appreciated, even though they always told me the same thing: "sounds great."

Third, I'd like to thank Adrienne Nelson, Casey Branthoover, C.C. Licina, Emma Dosch, Nicholas Christensen, and Rachel McCarthy for being the best comp group I could have asked for. Sorry for making you read so much philosophy!

Finally, I'd like to thank the Philosophy Club, Evan Woods, and Tommy Mason for listening to my ideas and challenging me to rethink my arguments at times when I found myself falling into the trap of moral relativism.

Abstract

Name: Abigail Marie Bradley Date: Spring, 2013

Majors: Environmental Science and Philosophy

Thesis Committee: Dr. Kate Darby, Dr. Steven Farrelly-Jackson

Title: An Ethical Analysis of Marine Aquaculture: Sustainability, Responsibilities to Producers and Consumers, and the Moral Status of Fish

---

As the oceans undergo rapid changes and face alarming new threats, aquaculture, or fish farming, has become the fastest growing sector of agriculture. Farmed fish now account for the majority of the seafood consumed by humans and demand is only continuing to increase. This makes it important to look at the ethical implications of aquaculture practices. In order to examine common industrialized practices for rearing finfish in marine systems, I break my ethical analysis into three sections. First, I consider the value of nature and argue that we need to rethink sustainability to include recognition of the value inherent in all living organisms. In doing so, I suggest that we are forced to see current practices in marine aquaculture as unsustainable, for these practices threaten ecosystem health and biodiversity. Next, I argue that there are moral obligations to other humans, separate from a concern for nature. Because fish farming fails to consider the welfare of humans and often puts profit first, it fails to meet these obligations. Finally, I argue that fish ought to be accorded moral status because we have reason to believe that they can feel pain. In virtue of this moral status, the unnecessary suffering of fish raised in ocean pens may be seen to be unethical. I conclude my analysis with recommendations for better alternatives that are sustainable, consider the wellbeing of consumers and producers, and preserve the moral status of fish.

Chapter 1: An Introduction to Marine Aquaculture

"Every breath we take, and every drop we drink, depends on a healthy ocean. Now, their life depends on us."
–Disney's *Oceans*

From Green to Blue

I was five or so when my father told me about one of the many crises facing our planet. We were in the wooded land on our property behind our home, climbing over a fallen white oak as we searched for firewood. The tree seemed massive at the time, but things have a way of feeling larger than life when you're five. When I asked him how a tree this large could have fallen over he told me that it was natural for trees to die. Such an answer was followed by a series of questions, as all good five-year-olds are sure to ask, and eventually we began talking about deforestation—a concept that I would not fully grasp until later in life. At the time, all I remember is feeling sorry for the trees that had been knocked down. I quickly dropped the firewood I had been carrying and upon returning home I gave one of the supporting beams of our deck a hug and assured the piece of wood that it was surely a beautiful tree at some time.

I grew up only eight miles from the Chesapeake Bay, just north of Baltimore City. My childhood home is located on the Big Gunpowder Falls within the Chesapeake Bay Watershed. When not in school, I spent nearly all of my time searching for snakes and turtles in the woods and river behind my home, or visiting my grandfather at his home on Delaware's stretch of the bay, only a five minute drive from the ocean. Needless to say, I became passionate about the outdoors. At the same time I quickly became aware of the impact of industrial agriculture. My grandfather's neighbor raised chicken "broilers" and owned an industrialized operation no different from the operations often attacked by animal welfare activists. I used to go into the "chicken shack" to watch the incubating eggs hatch and plead with my grandfather that he let me keep one so that it would not be forced to live with the other chickens.

The point of all of this is that from a young age I became aware of many ethical and environmental issues, but at the same time I was blissfully unaware of one of the greatest problems facing our beautiful planet: overfishing and altering ocean environments. I grew up so

close to the bay, spending many hours out on my grandfather's boat and crying when asked to get out of the water. I was fascinated by the creatures that most people overlook—bats, insects, snakes, and my favorite: fish. Growing up by the water, you become immersed in a certain way of life, a life that revolves around seafood. I was only 15 months old when I first ate Maryland Steamed Crabs and in the many years that followed not once did I stop to think about the wellbeing of crab populations living below our fishing boats. When you grow up so close to the water you tend to believe that the sea is inexhaustible; at least, that is until you step back to consider what is happening in the places we can't see.

The beginning of the modern environmental movement is often credited to Rachel Carson's *Silent Spring*, which brought attention to the environmental impacts of the use of DDT as an insecticide after the Second World War. Carson's book did not reveal new scientific information, but she shed light on the studies surrounding DDT in a way that pulled on Americans' heartstrings. She invoked an emotional and personal response that sparked an environmental passion that would set the United States on a path toward what is often referred to as the "green" or environmental movement.

While many may challenge the success of this movement, what is important to us here is the word *green*. This word, so commonly associated with the environmental movement is problematic. This word captures the major efforts of this movement perfectly insofar as the movement, just as the story about my childhood, focuses on what is "green". Our own status as animals that inhabit the land has led us to focus on the consumption of fossil fuels, greenhouse gases, fracking, mountaintop removal, and deforestation, forgetting about the health of the most important ecosystems on the planet: our oceans. We are disconnected from what happens at sea for no better reason than our physical distance and unfamiliarity; the oceans are largely unexplored and we cannot easily see what is happening below the surface or easily observe fishing practices. When it comes to the state of the oceans, we are often left with no choice but to trust the "experts".

Oceans cover 70% of the planet, provide the majority of the oxygen we breathe, help to stabilize the climate, and are home to the greatest diversity of plants and animals on Earth. Currently more than 50% of the human population lives in a coastal zone and depends on fish as a primary source of protein; by the year 2020 this could be true for at least 75% of the human

population (Dulvy, Sadovy, & Reynolds, 2003; Roberts & Hawkins, 1999; Kent, 1997). With such a large percentage of humans relying on the health of our oceans and their inhabitants, the threats to our oceans ought to be a primary concern. Yet, distance and uncertainty prove to be strong adversaries for a *blue* movement; the oceans continue to remain a topic of mystery, often left out of public discourse.

The State of the Oceans

The seas are often thought to be inexhaustible; no matter how much pressure one puts on the oceans' resources there always seem to be more lurking below the surface. Yet, as we slowly start to explore and study the many mysteries of the sea we are discovering that humans have a much larger environmental footprint than previously imagined. The oceans, it seems, are in an unprecedented state of decline. So what are some of the things we should be worried about?

First, ocean acidification is threatening one of the most biologically diverse and economically important ecosystems on the planet: coral reefs (Hoegh-Guldberg et al., 2007). Ocean acidification is just what the name would suggest—a phenomenon in which ocean water becomes more acidic. Oceans absorb a significant amount of the CO_2 in the atmosphere. While this was originally thought to be beneficial for slowing climate change, scientists are finding that the human-induced increase of CO_2 is so large that it is more than oceans can healthily absorb, and as a result ocean chemistry is quickly changing to become more acidic (Orr et al., 2005). This increased ocean acidity is proving to be devastating for coral reefs, and is only projected to increase as atmospheric CO_2 remains a concern.

Another concern is ocean pollution. Of course, litter and oil spills are of concern in the oceans just as these sources of pollution are of concern on land. However, even those of us who never throw trash on the ground are contributing to one of the strangest and largest garbage dumps in the world: the "Great Pacific Garbage Patch". This floating garbage patch is only one of about five that are known to exist in the world's oceans (Hoshaw, 2009), and although there is no scientific estimate of how large this garbage patch is, some suggest that it stretches from Hawaii to Japan. Filled with plastic that has made its way to the oceans from landfills, harmful toxins that do not dissolve in water, and old fishing lines, garbage patches are killing marine life

across the globe, catching marine organisms in nets or filling their stomachs with plastics and toxins, which may be later consumed by other organisms (including humans) (Hoshaw, 2009).

Another form of pollution that is of concern is chemical waste from industrial agriculture. Nutrient runoff caused by reliance on chemical fertilizers and pesticides is causing increased concentrations of organic matter in coastal ecosystems, a process known as eutrophication (Nixon, 1995). While eutrophication may not initially appear to be harmful to marine environments, when organic matter becomes highly concentrated there are negative effects. As organic matter increases we often see an increase in algae, which causes the water to have a green appearance. However, when these large amounts of algae die and add to the already increased amounts of organic matter, there are more nutrients available to fuel microbial respiration. Because the microbial community consumes oxygen, aquatic hypoxia (decreased oxygen levels) occurs and may create dead zones, or regions of the ocean in which living organisms do not have enough oxygen to survive (Diaz & Rosenberg, 2008). The number of these dead zones has doubled each decade since 1960 (Diaz & Rosenberg, 2008).

In addition to these problems, we are constantly reminded of melting ice and rising sea levels. We fear the impact of rising sea levels on human populations living on the coasts, but we rarely discuss what melting ice and rising sea levels mean for ocean currents and water salinity, both of which would have major impacts on ocean ecosystems. Another concern is mercury emissions from power plants. Mercury is a metal associated with aquatic bioaccumulation, or the buildup of a substance within living tissues. Bioaccumulation is greatest in larger carnivorous or omnivorous organisms, creating a cause for concern for humans who consume large amounts of tuna, shark, dolphin, and other large marine creatures. When humans consume high levels of mercury through the consumption of contaminated seafood they are at risk of developing Minamata Disease and even death.

While the situation I have described may already make the future of our oceans seem bleak, I have not yet mentioned what many (myself included) would declare to be one of the biggest threats to ocean ecosystems: overfishing. This threat is much more difficult to measure not only because of our limited ability to see below the ocean's surface, but also because of the free movement of fish throughout the open oceans. How does one go about tracking and counting populations of animals that are not easy to observe?

The difficulty of determining fish population size is one surrounded by much controversy. Many—like those raised in fishing cultures similar to the one from my own childhood—see the oceans as inexhaustible. There are days when the catch is good and there are days when the catch isn't so great, but no matter how many times you head out to sea it seems that there are always more fish, more crabs, and more shrimp. And fishermen believe this with good reason. To deny the weight of knowledge gained by those whose livelihood is connected with the health of the oceans, those who care deeply about the future of the seas, would be—simply put—wrong.

Yet, there does seem to be some reason to question that knowledge. The collapse of the northwest Atlantic cod fishery is one of many examples where we see that fish populations can indeed be threatened by human activities. The differences in observations are not well explained. How can one support his or her argument that there are plenty of fish in the sea while another supports an argument that there are few fish in the sea? It is conceivable that the difference in observation is one of scale—fishermen are the local experts of the areas in which they work, while scientists tend to study global trends. Perhaps there needs to be some balance or interaction between local knowledge and the knowledge of "experts", but that is a discussion best left to another paper.

The truth is that we cannot deny events like the cod collapse. We cannot deny that trash, chemical pollution, melting ice, rising sea levels, and ocean acidification are having some impact on fish populations. We cannot deny that these problems, when paired with the high demand for wild-caught fish to fulfill human appetites and meet the demand for animal feed (often made from corn/soybeans and fish) will have an increasingly significant impact on marine populations and the ocean environment.

Scientists concerned about declining ocean health have invested much time and energy into determining an accurate means of estimating species populations. In doing so scientists have determined that global fish populations of larger predatory species have been depleted by 90% in the last 50 to 100 years (Myers & Worm, 2005). It is estimated that 9% of fish populations are underexploited, 23% are moderately exploited, 44% are fully to heavily exploited, 16% are overexploited, 6% are depleted, and only 3% are recovering (Botsford, Castilla, & Peterson, 1997). While the exact numbers are disputed between scientists, policy makers, regulators, and

fishermen, what is no longer in dispute is that the combined threats described above, combined with overfishing, are creating hostile marine environments and threatening—at a minimum—populations of predatory fish, forcing many fishermen to look for new species to exploit.

Declining Populations and Increasing Demand

As stated above, a growing percentage of the human population relies on fish as a primary source of protein, and this is putting increased pressure on marine populations. The problem with this, of course, is that fish populations have already declined by up to 90% (even if this percentage is disputed there is a general consensus that populations have declined significantly) and as the demand for seafood from an already struggling ecosystem increases, populations will only continue to decline and, in turn, become threatened with endangered status or extinction.

A perfect example of this can be seen in the case of the Atlantic Bluefin Tuna. In 1981 the International Commission for the Conservation of Atlantic Tunas was informed that the Atlantic Tuna population was threatened and scientists recommended that catches be reduced to as close to zero as possible (Safina, 1993). Instead of following this advice, the Commission managers set an annual quota of 1160 metric tons, and later raised this quota to 2660 metric tons, despite the warnings by scientists of the alarming declines in breeding age population sizes, which had declined by 24% over a 12 month period in 1991 (Safina, 1993). Since then, quotas have been lowered to 1523 in 2005, though, not surprisingly, the U.S. commercial catch was only 10% of that quota in 2006, and in 2007 commercial fishers only caught 63% of what was caught in 2006 (Safina & Klinger, 2008). The failure of fishermen to meet catch quotas by this much is alarming, and scientists now fear that unless an immediate moratorium is placed on Bluefin Tuna the species will be threatened with extinction within the next few years. Despite agency concern, the United States Department of Commerce's National Oceanic Atmospheric Administration (NOAA) denied the protection of Atlantic Bluefin Tuna under the Endangered Species Act. The agency admits to concern, especially in light of the recent Deepwater Horizon BP oil spill, which was located in the Gulf of Mexico where Atlantic Bluefin Tuna spawn, but states they will revisit their decision in 2013 with new science (NOAA, 2011) – a date that may be too late for the Bluefin Tuna.

A Solution?

Recognizing the many problems threatening the oceans, nations have looked for ways of reducing pressures created by fishing without having to limit consumer demand. While this may sound like an impossible goal, some believe they have found a solution in aquaculture. Aquaculture—or fish farming—is a system of rearing aquatic organisms for food or other purposes, including the aquarium trade, pharmaceutical and biotechnology industries, and sometimes restoring threatened wild populations (NOAA, 2013). Farmed organisms can be either marine or freshwater organisms including shellfish, finfish, and algae, but 55% of aquaculture production is reared from ocean-based systems (Primavera, 2006). For this reason, and due to space constraints, I will focus only on marine aquaculture and the farming of finfish.

Marine aquaculture can occur on land in controlled man-made systems, but ocean-based systems are most common and will be the focus of this paper. These ocean-based systems consist of pens or cages either resting on the seafloor or suspended in the water column (NOAA, 2013). Most marine aquaculture systems in the United States raise shellfish, importing finfish reared in aquaculture systems around the world. However, finfish that are found in marine fish farms in the U.S. often include salmon, cod, moi, yellowtail, barramundi, sea bass, and sea bream (NOAA, 2013).

The rationale behind marine aquaculture being seen as an integral part of the solution to the problem of overfishing and increasing demand goes something like this: because fish are raised and fattened in enclosures, just like cows on a farm, the demand for wild-caught fish will decline and we can raise and grow our own seafood as wild populations have time to recover. In fact, some have even been so bold as to declare that "if the past history of agriculture is any guide, aquaculture will surely find a way to meet the world's demand for fish" (*The Economist*, 2003, p. 21). In the last thirty years, the number of fishers and aquaculturists has grown at a rate faster than the world's population, and faster than employment in traditional terrestrial agriculture, with aquaculture providing more than 32.4% of the world's supply of fish, crustaceans, mollusks, and other aquatic animals (Food and Agriculture Organization of the United Nations, 2007). By 2030, aquaculture may account for roughly 68% of global fish supply, as capture fisheries can no longer maintain current yields (Brander, 2007).

Of course, in order for marine aquaculture to meet this growing demand, one can expect aquaculture projects to be quick to adopt technological advances, expand areas of cultivation,

and produce higher yields per unit area (Bruge're & Lindler, 2004). This would make large aquaculture projects, especially those in coastal and open ocean environments, large-scale polluters on a par with other highly recognized polluters that have brought about irreversible environmental changes (Pillay, 1992), such as those brought about by the coal and oil industries. Prized for its efficiency in production, marine aquaculture projects are comparable to the industrialized farms surrounded by so much environmental and social controversy.

Philosophical Approach

With the oceans facing alarming new threats, and with an increase in demand for marine aquaculture projects, it has never been more important to examine the ethical implications of modern fish farming. Aquaculture's presence in ocean habitats raises concerns about environmental ethics, but it also raises important ethical questions concerning the ethical treatment of workers, consumers, and the animals being raised for consumption. Do we have a moral obligation to sustain healthy natural environments? If so, is ocean aquaculture sustainable? Do we have an obligation to sustain current human lives? If so, does marine aquaculture threaten food security? Do consumers have a right to know what they are eating and that what they are eating is safe? If so, what do consumers actually know about farmed fish and are the fish raised in these systems safe for consumption? Should we be concerned about the welfare of fish, and if so, are we treating farmed fish humanely? These are the types of questions I answer in my research through a philosophical discussion and critical examination of large-scale marine aquaculture projects. I demonstrate many ethical problems with current forms of marine aquiculture practices and offer better alternatives.

Choosing the right course of action requires one to make personal judgments and determine priorities, often in a short period of time and acting on intuition. The unique nature of ethical dilemmas makes it difficult to apply a set formula to such problems; thus, I use Ben Mepham's ethical matrix, which combines utilitarian and deontological theories, as well as Rawls's theory of justice (Mepham, 2000), as a model for my argument. Mepham's ethical matrix requires one to examine intentions, consequences, and fairness when determining ethical actions in ways that traditional theories cannot when used in isolation.

Although the ideas behind these three ethical principles are expressed in Mepham's ethical matrix, he uses different terminology. Mepham classifies the three ethical principles as

respect for wellbeing, autonomy, and justice (Food Ethics Council, 2010). It should also be noted that I will not apply all three of these theories to each chapter. Instead, I will pull from relevant ethical frameworks when they are most appropriate. That is, in discussing responsibilities to the natural environment, wellbeing and justice are of concern. In my discussion on responsibilities to humans, wellbeing, autonomy, and justice are all important. Finally, in my discussion of responsibilities to farmed fish, wellbeing is my primary concern. I have chosen to pull from relevant frameworks, as opposed to applying each principle to each problem I address because, although all three approaches could probably be applied, not all are as relevant or useful in coming to a conclusion about the ethicality of marine aquaculture.

Ethical Frameworks

The first theory mentioned above, utilitarianism, generally holds that one is morally required to act in such a way as to maximize utility. While measured in many different ways among utilitarians, our focus here will generally be on maximized happiness. Utilitarians are concerned with the consequences of an action, as opposed to the intentions or fairness of the action. For instance, suppose one must decide between two courses of action: (*A*) sustainable fishing operations or (*B*) unsustainable fishing operations. Suppose that decision *A* will result in an ocean full of fish for future generations to rely on as an important food source. Then suppose that decision *B* will result in the extinction of fish from the sea, thus eliminating a potential food supply for future generations. Presumably, choosing option *B* will make individuals happy in the short term, since fisheries will make short-term economic gains and individuals will not have to reduce consumption of a much-loved food source. But option *B* will also cause a greater amount of suffering than option *A* in the long-term, since option *A* will ensure that fisheries will remain in business and both current and future generations will always be able to consume fish. Thus, a utilitarian may argue that option *A* will lead to the greatest happiness, and is therefore the right decision.

The principle of wellbeing is closely related to utilitarianism, for wellbeing employs a sort of cost/benefit analysis concerning outcomes and overall happiness to determine right action (Food Ethics Council, 2010). In the context of food ethics, Mepham lists animal welfare, adequate income and working conditions, availability of safe food, and protection of biota as

examples of one application of this principle (Mepham, 2000), all of which are concerned with the consequences of actions and promoting welfare.

The second principle, autonomy, is Kantian or deontological in nature, for it is concerned with treating others as ends in themselves—fairly similar to the "Golden Rule" (Food Ethics Council, 2010). According to a deontologist, it is not the outcome that is important, but one's duty or intention when he or she acts. Examples provided by Mepham with respect to autonomy are behavioral freedom and maintenance of biodiversity (Mepham, 2000). If we hold that causing unnecessary suffering is wrong in all cases, one has a duty to act according to this conclusion; one must make decisions that do not cause unnecessary suffering. With respect to autonomy, one might argue that fish ought to be self-determining (or autonomous), though this is not the position I take in Chapter Four. It would then seem as though using fish in marine aquaculture would be unethical, since doing so limits a fish's ability to be self-determining.

The third and final principle, justice, corresponds to Rawls's theory of justice—most simply understood—as *fairness* (Food Ethics Council, 2010). Justice is a common topic of discussion in environmental affairs. For instance, the field of environmental justice is often concerned with disproportionate (or unfair) exposure to environmental and health hazards that often impact low income communities or ethnic/racial minorities (Boone & Modarres, 1999). Mepham lists fair treatment in trade and law, universal affordability of food, and sustainability among his examples of justice in the context of food ethics (Mepham, 2000). In marine aquaculture, food security is of major concern, as I explain in the chapters that follow. Individuals in developed nations consume large amounts of seafood, reducing the amount of seafood available to those in developing nations who rely on fish as a major source of protein. The principle of justice arises when we consider the fairness of consuming a threatened food source when other sources of protein are available to us. Is it fair—or just—to consume a food source (i.e. fish) for health benefits or enjoyment, when consuming that food source results in less privileged individuals going hungry?

Chapter Divisions

As stated, the first division focuses on responsibilities to the environment and the ways in which ocean aquaculture impacts the natural environment. In this chapter I engage with philosophical arguments concerning the value of the environment and human responsibilities to

conserve natural resources for future generations. I argue that there are both anthropocentric and nonanthropocentric reasons for an environmental ethic, including an argument for recognizing intrinsic value within all living organisms. Because there are nonanthropocentric reasons for valuing the natural world, I suggest that we ought to reconsider the way we think about humans and nature, ultimately moving toward an ethic centered on environmental sustainability. I argue that modern fish farms are unsustainable and, therefore, fail to meet moral obligations toward natural systems and species, making them unethical.

The second division—the chapter on responsibilities to other humans—argues that we have a moral obligation to help and protect consumers and producers on a global scale. In this chapter I discuss globalization, suggesting that the globalization of marine aquaculture causes unethical treatment of both consumers and producers. Some, like Amartya Sen, believe that the world should strive toward globalization as a sign of progress (Sen, 1999), while others (myself included) argue that globalization is inevitably tied to global hunger and many violations of basic human rights. Many marine aquaculture projects benefit from industrial technologies that maximize profit and minimize or decrease worker and consumer welfare, making these practices unethical.

In the final division, responsibilities to farmed fish, I argue that fish ought to be granted moral status. There is little literature on this topic, for most animal ethicists focus on the humane treatment of mammals and birds. As a result, I discuss the moral relevance of pain in granting moral status to mammals and birds, and then reflect on what can be known about a fish's ability to experience pain. I do so through an examination of the scientific evidence/theories surrounding pain and pain in fish, ultimately arguing that we have reason to believe that fish are capable of experiencing pain and that this is enough for us to grant fish moral status. I then argue that marine aquaculture does not grant moral status to fish, often forcing fish to suffer unnecessarily. Of course, I again conclude that marine aquaculture is, for this reason, unethical.

In my concluding chapter I summarize why modern aquaculture is unethical when one accepts my arguments in the previous chapters. I then provide better alternatives to the practices I've described, such as veganism, aquaponics, or sustainable wild fisheries. I also encourage continued discussion surrounding the ethics of marine aquaculture based on the contributions I've made to this specific area of study.

Chapter 2:

Responsibilities to the Natural World – Marine Aquaculture and Environmental Sustainability

"Alas, our technology has marched ahead of our spiritual and social evolution, making us, frankly, a dangerous people."
–Steven M. Greer

"For most of history, man has had to fight nature to survive; in this century he is beginning to realize that, in order to survive, he must protect it."
- Jacques-Yves Cousteau

Introduction

As the human population exceeds 7 billion, the ability of the Earth to meet the demand for natural resources is becoming a topic of concern. In developed nations, such as the United States, where consumerism is the way of life, natural resources are being used faster than they are able to be replaced. Conventional agriculture, commercial fishing, deforestation, extraction of oil, blowing up mountaintops for coal, or developing land for human uses, are common and often unsustainable practices. This notion of sustainability—or more specifically, environmental sustainability—is not only essential to scientists and environmentalists who are increasingly concerned about climate change, but is becoming a major topic of discussion in politics, media, and education on a global scale.

But what exactly does environmental sustainability mean? According to Donald Scherer, there are many possible understandings of what it is to be environmentally sustainable:

> To call an energy *choice* sustainable is to assert that persons like us can make that same energy choice continually and indefinitely. To claim that a *lifestyle* is sustainable is to claim that the impacts of that lifestyle cause no degeneration of the environment incompatible with continuation of that lifestyle. To designate water a sustainable *resource* is to assert that, within the limits of regeneration, biomass can continue to be available for human use (2003, p. 334).

What becomes clear from Scherer's various understandings of environmental sustainability, which I will simply call sustainability throughout this paper, is that all are based on a concern for the availability of natural resources or a healthy natural environment for future generations of *humans*.

Similarly, the 1987 Brundtland Commission Report on Environment and Development focused on sustainability as it relates to future *people*. The report emphasized the struggles of scientists, politicians, and economists to assess, advise, and adapt to the quickly changing natural environment. The report linked concerns for the natural environment to human problems, such as poverty, illness, and contamination of natural resources, suggesting that "humanity has reached a crossroads in its relationship with nature" (Brundtland, 1987, p. 4). These problems were recognized as serious, although hope was provided through technological advances and sustainable development, in which sustainable development was described as meaning "nothing less than a new industrial era," in which "economists make the best ecologists" (Brundtland, 1987, p. 6).

While it would clearly be absurd to suggest that the natural environment is not important *because* it sustains human lives, it may also seem strange to suggest that there is no value in nature outside of those which are a means to human ends. The natural environment sustains human life, but it also sustains the lives of plants, animals, and all other living organisms. All living beings are dependent on the nonliving and the living world—nature in its entirety—for life. The question, then, is not whether nature is important, but *why* and for *whom* it is important, and how far should one go to sustain natural systems for future generations.

Anthropocentrism: The Human Problem

Human beings are unique creatures; we use a distinct human language, prescribe value, follow ethical codes, follow religions, control reproduction, create and use advanced technologies, alter our appearance, keep written records of our past, find unique ways to exploit nature (e.g. harvest milk from cows or create paper from trees), etc. Humans are remarkable in many ways, but perhaps we are most remarkable in the ways in which we often perceive ourselves. Human beings are arrogant creatures. We perceive ourselves to be a significant force often outside of—or beyond—nature; that is, humans seem to believe that they control nature just as gods are said to create or control us. Such a view is slowly being recognized as

problematic as we become more concerned about sustainability, for this shallow means of looking at the world may be the reason we face many of the environmental problems seen today. One environmental philosopher, Warwick Fox, explains such a shallow ecology:

> Humans are perceived as the significant figures against a ground that only assumes significance in so far as it enhances humans' images of themselves *qua* important figures. Shallow ecology thus views humans as the source of all value and ascribes only instrumental (or use) value to the nonhuman world (2003, p. 252).

Such a view, which Fox labels as shallow ecology, is more commonly referred to as anthropocentrism. Anthropocentrists do not believe that natural objects are of moral concern, except insofar as natural objects are of instrumental value to humans. For instance, Bluefin tuna may be valued for its use in the Japanese delicacy, Bluefin tuna sashimi. These tuna, although critically endangered, are highly valued by Japanese producers and consumers who are willing to pay a premium for the raw meat of this ancient fish. However, instrumental value is not limited to simple materialistic ends; another dimension of instrumental value is bound up with the pleasure caused by natural objects, such as the aesthetic pleasures many find in wild spaces.

Anthropocentrism is often based on a hierarchy of life, which places human beings just below the gods. Such a belief is said to stem from Judeo-Christian religions that emphasize human superiority over nature. Some even suggest that these religions have permeated the west so that nearly all humans in western nations now see nature as an object that can be dominated, conquered, or subdued by men and women (Schultz, Zelezny, & Dalrymple, 2000). One study, in which biblical passages were interpreted and measured, shows a strong correlation between a literal belief in the Bible and a strong concern for oneself and other people over a concern for plants and animals. Such results have led some to argue that Judeo-Christian religions are to blame for the ecological crisis, but such claims are unfounded, for there is little evidence to declare that Judeo-Christian religions—anthropocentric or not—are anti-environment (Schultz, Zelezny, & Dalrymple, 2000).

Although there is an historical and a religious basis for anthropocentric thought, it should also be recognized that not all anthropocentrists have to appeal to a higher power to justify their feelings of dominance over the natural world. One can easily recognize his or her power and unique abilities as a human without believing in a god or gods. Regardless, the argument remains the same: that humans are, in fact, dominant over nature. For this reason, I will discuss

anthropocentrism that appeals to religion, although one can easily subtract god(s) from the equation.

Saint Thomas Aquinas suggests that it is the way of God that humans, as rational beings, govern the lesser creatures just as God governs humans (2010). Within this hierarchy, it is supposed that humans are the core of all value systems, above all other living creatures on Earth. Of course, within this hierarchy it is assumed that mammals and birds follow humans, with other animals and plants at the bottom of the hierarchy, for they have the least in common with humans and gods.

Anthropocentrists such as John Stuart Mill and John Locke use this mechanistic and hierarchical view of nature as a means of justifying an ethical code based strictly on nature's instrumental value to humans. Nature is amoral and imperfect and it is man's position to "obey nature in such as manner as to command it" (Mill, 2010, p. 75). Locke suggests that God "has given the earth to the children of men" and therefore men are to use the earth for the "support and comfort of their being" (Psalm cxv. 16 in Locke, 2010, p. 77). With humans at the top of Earth's hierarchy, closely linked to divine beings, it follows—for anthropocentrists—that human beings are not only moral agents, but the only beings worthy of moral consideration. Nature is amoral, irrational, and imperfect, and therefore only valuable to humans (who are moral and rational) for its instrumental value.

It would be irrational for one to deny that there is instrumental value in nature. As humans, we rely on nature to sustain our lives. Everything humans do is connected to something in the natural world and it is inconceivable that this could ever change. However, although it is true that the natural world is valuable to and for humans, such an argument fails to recognize that people are *a part of* the natural world. The awkward arrogance that we have taken on makes us the leaders and manipulators of nature while ignoring our connection to—and reliance on—the natural world. Such a view prevents us from recognizing that it is not we who control nature, but nature that controls us. For instance, we can invent new methods of mastering fishing in order to meet growing human appetites through technological advancements, but our appetites must be limited by the number of fish in the sea. Similarly, we can cut down forests and consume natural resources, but we are limited by the availability of those resources and the impacts of our own

consumption (e.g. warming climate, increasing occurrence of natural disasters, or worsening air quality).

Once we are able to recognize this, we can begin to shift our perspective to recognize that there may be value in nature beyond human uses, in order to combine anthropocentric and nonanthropocentric ethics. While anthropocentrism is not always appealing in its denial of non-instrumental value, as stated, it would be irrational to deny that there is instrumental value in nature. The problem I hope I have made clear is that the dogmatic attitude that is often portrayed by anthropocentrists fails to recognize that there is value beyond means to human ends. We cannot simply dismiss anthropocentrism as wrong, but instead we must recognize its weaknesses and expand our discussion to recognize greater value within the natural world.

Shifting Our Perspective

In order to demonstrate where this non-human value lies, let us consider a thought experiment developed by Richard Sylvan (2003). In this thought experiment, suppose that there is only one living person left in the world. This man is absolutely certain that he is the last living person; therefore he knows that he cannot reproduce and after he dies there will only be plants, non-human animals, and other living organisms left on the non-living planet. With this knowledge, let us suppose that he takes it upon himself to eliminate all other living beings (he has some kind of superpower which will enable him to do so).

An anthropocentrist would likely argue that the man has done nothing morally wrong, for after his death there will be no future human life and therefore nature has no instrumental value, leaving it absent of value entirely and of no moral concern. In fact, this man could justifiably blow up Earth! As previously stated, it is believed that the "lesser beasts" (plants and other living organisms included) were given to humans by God (or are hierarchically lower than people) and are to be used for human ends. If humans are eliminated from the planet, what is the purpose of—or value in—the continued existence of other living beings?

Although such an action by the last man from an anthropocentric stance could be considered moral, this action seems to go against most human intuitions. It *does* seem as though there is something wrong with the last man destroying the natural world simply because there will be no future for humans. As Richard Sylvan, a supporter of a nonanthropocentric viewpoint

states, "human interests and preferences are far too parochial to provide a satisfactory basis for deciding on what is environmentally desirable" (2003, p. 52). Though nonanthropocentric value is difficult to articulate, largely due to our limited ability to escape our humanness, this thought experiment seems to suggest that there is some *intrinsic* value in the natural world (absent of humans).

Where, then, does the value in nature lie? Let us imagine that the last man was to destroy all houses and manmade objects, instead of destroying what one would consider to be a part of the "natural" world. Would we still feel uncomfortable with his actions? Perhaps we might feel saddened knowing that the Eiffel Tower would no longer exist, but without humans to enjoy it we may be able to accept that there would be nothing wrong with destroying it because it is not *living*. A building cannot be *harmed* in the way that a living organism can, since it has no interests or welfare states. As such, we may come to recognize that there is value inherent within living organisms, since living things are capable of being harmed or benefited in ways that the non-living cannot.

Paul W. Taylor offers a solution in which he suggests that human-centered ethics are inadequate, and instead offers a life-centered system, known as ecocentrism. He says that humans have moral obligations to wild plants and animals *for their own sake*, for plants and animals have inherent worth and are deserving of a sustainable and healthy life undamaged by human hand (2003). In a life-centered ethic, humans regain their place in the natural world as a part of an interconnected system. While human beings are unique for all of the reasons listed above, we are connected to other living organisms in our reliance on each other and in our shared state of wellbeing (or lack of). That is, every living organism—as a result of being alive—has states in which it is able to reach its full potential or greatest good. While such a state may be more obvious for humans and non-human animals, we have an obligation to try to understand the states of other forms of life and take them into ethical consideration. Let us consider the welfare of plants. Taylor states:

> I take it that trees, for example, have no knowledge or desires or feelings. Yet it is undoubtedly the case that trees can be harmed or benefitted by our actions. We can crush their roots by running a bulldozer too close to them. We can see to it that they get adequate nourishment and moisture by fertilizing and watering the soil around them. Thus we can help or hinder them in the realization of their good. It is the good of trees themselves that is thereby affected (2003, p. 63-64).

According to ecocentrism, then, it would be *immoral* for the last man to destroy the rest of the natural world, because he is preventing other living organisms from reaching or realizing their own good. He is failing to consider the wellbeing of other living organisms and natural systems, of which he is a part.

The intrinsic value found in nonhuman entities is often difficult to articulate, though it is crucial to understanding how a tree can realize its own good. Such ideas can be attributed to philosophers such as Aristotle:

> As Aristotle and many others after him have asserted, there must be some things that are valuable in themselves because, if that is not the case, we would confront an endless regression where one instrumental value is justified with another instrumental value. Then the question is, what is the locus, or what are the loci, of noninstrumental value making other things instrumentally valuable? More specifically, is there natural richness among these intrinsically valuable things? (Oksanen, 1997, p. 541).

Suggesting that plants and other non-sentient beings have intrinsic value may seem strange to most, but let us consider the following. Returning to ideas expressed in the last man thought experiment, let us imagine that instead of the last man the decision maker about the future of the planet is the last *sentient being.* By sentience I simply mean the ability to feel or experience stimuli in a way that indicates consciousness. This could mean that the last sentient being is human or canine, among a wide variety of other sentient organisms, and the remaining life forms are only those incapable of conscious experience. What if, after the death of our decision maker, there ceases to be any sentient beings and only the continued existence of plant life and other similar organisms? While some may argue that there would be nothing morally wrong with destroying a world full of plants, I argue that we ought to consider Taylor's statement about the welfare states of such organisms. Plants may be incapable of pain sensations

or suffering, but it is true that, as living organisms, there are states in which they are able to thrive – they are capable of being *harmed*.

Moving beyond the restrictions of this thought experiment we may also want to consider the potential future for a world consisting of only non-sentient beings. Arguably, such a world would be similar to the state of the planet at its origin, before sentient beings were known to exist. Despite the fact that these organisms lack so many of the characteristics humans hold as important characteristics of life, these living organisms are no less complex than sentient life, they are merely *different*. Such organisms cannot be created by human beings, they exist in a rare set of circumstances in which life is able to exist at all, and they are capable of reproducing to create future generations given the continued existence of these circumstances. In destroying a world absent of sentient life, one is still destroying something of value. It cannot be denied (except by some religions) that a world composed of only non-sentient beings can again evolve to create new life–new sentient life. In recognition of the power of life, it is hard to deny that all living things have value.

Ecocentrism, of which I am a proponent, requires humans to see themselves as being a part of nature rather than superior to it. It requires humans to accept that value does not strictly lie in being human, but in being alive. Thus, as human beings we must recognize ourselves as *members* (as opposed to leaders) of the biotic community, and should treat other living beings as worthy of moral consideration because they are alive.

Of course, moving away from the widely embraced anthropocentric environmentalism is difficult. From our situated human perspective, anthropocentrism seems natural and unproblematic; it is never easy to see beyond one's self. Strict anthropocentrism is so deeply rooted in human thought that the very means in which we frame sustainability illustrates the very problem we are failing to recognize.

The mere definition we ascribe to environmental sustainability, as demonstrated in the definition above, is, in itself, problematic. Environmentalists, the media, and politicians all tend to frame concerns for sustainability in human terms, further demonstrating our own arrogance. The question surrounding sustainability has become what humans can do to save or conserve nature for future generations of humans. Such an understanding can be read as: what can *humans* (an entity outside of and in control of nature) do to *save* or *conserve* (as if our actions will

destroy nature itself) *nature* (a separate entity) for future generations of *humans* (no concern for other living organisms).

Such a framework for looking at nature may be linked to the problem famously labeled by Ehrenfeld as "the arrogance of humanism," in which humans believe that they, as a controlling entity, are capable of solving all of the world's problems on their own (1981). He quotes George Orwell's "Inside the Whale," stating "get inside the whale—or rather, admit you are inside the whale (for you are, of course)" (Orwell in Ehrenfeld, 1981, p. 2), demonstrating the arrogant and false-status perceived by men as being grand, independent beings. Thus, labeling concerns about environmental sustainability as strictly human-created and human-solved issues is framing sustainability in strictly anthropocentric terms, which is problematic when we accept that humans are only one part of the natural world, and when we accept that there is value inherent in all living organisms.

Sustainability: Reconsidered

If we accept human arrogance as a problem then we must adapt our understanding of sustainability to include a concern not only for the future of humans, but also plants, nonhuman animals, and other living organisms. Such a change in our understanding of what it means to be sustainable could be as simple as considering the future of other living organisms within our definition of environmental sustainability.

If we accept that we ought to consider all forms of life when we determine what is sustainable, important questions arise concerning how this obligation should be applied. Does recognition of the value of life mean that we cannot harm any living being? Surely, the answer to such a question is no. If ecocentrists were to hold this then we would all die, for even eating would become an unethical action. Such a position would be absurd, so there needs to be some sort of balance in weighing the value of life.

Do we have an obligation to *individual* living organisms? While I believe that we do to some extent (see Chapter Three and Chapter Four), I do not think individualized obligations can be easily applied in the context of sustainability. When concerned about the natural environment and sustainability we are required to think holistically. The loss of a whale shark may be bad for that one whale shark, but the loss of that one shark will not have serious implications for the

natural environment. Consider deer populations in the Eastern United States. Because wolf populations have been hunted to the point of extinction in this region deer populations have grown significantly. If we were to be concerned about each individual deer because we recognize the value of each deer's life, we may be inclined to argue that hunting is always unethical. However, such an argument fails to consider this problem in the context of sustainability.

Due to a lack of predation large deer populations are now threatening forest ecosystem health and biodiversity. While each deer has value so long as it is living, the same can be said of each plant that the deer consumes or each animal that struggles to find food because deer have browsed desirable plant species. An individualized—or polycentric—ethic cannot always guide one to a clear course of action. However, when we are concerned about the survival of a species or ecosystem health, the right course of action is much easier to determine. In the case of unchecked deer populations we can justify hunting because hunters serve as the predators that have been removed from the system. Hunting, when regulated properly, can maintain sustainable populations of deer, and in turn, help to maintain the natural balance of forest ecosystems and biodiversity. Though, it should be noted that such a justification can become dangerous when we start to replace humans or human technologies with natural objects simply because they perform similar services as natural objects. One must keep in mind that there is still a moral obligation to maintain living systems both for their instrumental *and* intrinsic value.

Now, with this holistic approach in mind, we may want to consider how this will alter our strictly anthropocentric understanding of sustainability. Many philosophers are concerned about sustainability because it requires us to have some knowledge or understanding of the future (DesJardins, 2006). While I agree that we cannot *know* about the future, we are justified on the basis of present evidence to project, inductively, certain requirements for sustaining life. All living organisms require basic nutrients and certain conditions to sustain life. We can be relatively certain that, should future generations of plants and nonhuman animals exist, these living creatures will need healthy habitats large enough to sustain healthy populations. Thus, in order to provide these most basic necessities for future generations we must make an effort to sustain the necessary resources.

But to what extent are we morally obligated to ensure that all of these necessities are around for future generations and are we obligated to sustain all living species or population sizes? Such questions are more difficult to answer.

One idea, which has become a popular topic for discussion in fisheries management, is the idea of shifting baselines. Shifting baselines point out the peculiar situation behind conservation efforts; conservationists or those concerned about sustainability often aim to maintain natural environments and populations, yet each generation has a new reference point (Sheppard, 1995). That is, each generation faces different struggles and new understandings of "normal" or "natural". For instance, conservation efforts today aim to slow or sustainably manage deforestation, restore fish populations to those in the recent past, or save the polar bears from extinction. However, conservation efforts of previous generations would have been significantly different. There was a time when, presumably, conservation efforts would have been aimed at protecting wolves in the eastern United States. "Normal" fish populations or "sustainable" fishing yields would have been much greater. And even further back, conservation would require a world with *significantly* smaller human populations.

When our understanding of "natural" or "normal" is always changing, future generations of humans, nonhuman animals, plants, and other biotic organisms will simply have new baselines. Is there anything wrong with accepting shifting baselines and using such an idea to justify unsustainable choices? Can we even meaningfully conceive of conservation when we consider shifting baselines? Obviously we cannot restore the natural world to a state similar to the Earth's origin, but there remain strong reasons to protect living organisms rather than writing off their extinction as a normal part of a changing world.

One could argue that human beings are a nuisance to the natural world, and although humans are a part of nature we are a part of nature that could cease to exist and, as a result, other living organisms would benefit. It may be difficult to accept, and I am certainly not suggesting this as a solution, but the ultimate demonstration of our concern for sustaining the natural environment could be to eliminate humans from the picture entirely. In fact, we can see that the extinction of many living organisms, in isolated cases, would not cause any great losses on the natural environment as a whole:

> Will a world without the blue whale miss it? Will future generations that have never experienced a wilderness area, rain forest, or grizzly bear care about such things? Do we miss the dodo bird? The passenger pigeon? Would we really miss the snail darter or the California condor (DesJardins, 2006, p. 83)?

It does not seem that future generations (human and nonhuman) would truly suffer from the loss of living creatures that they never had the opportunity to experience. Surely, we do not *miss* the dinosaurs, nor do we think that our happiness is lessened because they no longer exist. The ecosystems that are present today are not suffering as a result of the extinction of the saber-toothed tiger, woolly mammoth, or passenger pigeon. Surely, over time ecosystems have evolved as a result of the loss of species, but these changes do not occur overnight and are rarely the result of the loss of a single species or organism. For instance, when the last remaining Pyrenean ibex, known as Celia, was killed by a falling tree in 2000 (Zimmer, 2013), natural ecosystems were not threatened by the loss of a single species. Similarly, the loss of wolves in eastern U.S. forests has not drastically altered forest dynamics, and these ecosystems are still said to be natural and healthy. However, this does not mean that there is no reason to protect what can still be conserved. DesJardins explains:

> If we failed to preserve all Renaissance paintings, for example, and all records of this art were lost to future generations, surely they could not be said to miss them. If future generations knew nothing of these paintings, they could not feel their loss. But their lives would nonetheless be impoverished by that loss (2006, p. 86).

It is because present generations see value in wilderness areas, or in grizzly bears, or blue whales, that we see these things as important for the happiness of future generations. If a present generation values the aesthetic qualities of a natural forest, that generation has reason to believe that future generations would be happier with natural forests than they would with none.

While such conclusions are obviously anthropocentric, it is important to remember that anthropocentrism is an important component of the value in nature. As stated earlier in this chapter, anthropocentrism is not wrong; there is instrumental value in the natural world and denying this would be fallacious. However, when we consider what DesJardins has to say through an ecocentric lens we may come to similar conclusions for non-human animals and other living organisms. For instance, if coral reefs are a crucial part of maintaining biodiversity and

performing important system functions in ocean habitats, we would be justified in assuming that those reefs are important for future ocean inhabitants and sustained healthy ocean environments. Even if the loss of isolated natural resources or living organisms will not directly impact the lives of those who do not yet exist, we know today that future generations would be missing out on something of value, which could enrich lives in a way that they would not know is possible. Preserving such resources—especially as a whole (natural systems/communities)—would therefore increase the welfare of living organisms (which have been shown to be inherently valuable within ecocentric ethics) and is a reason for sustainability.

The Elephant in the Room

Before I begin my critique of marine aquaculture in the context of environmental sustainability, I must address an underlying problem with the argument I've made in this chapter thus far; for while it may not be obvious here, it will become obvious in the chapters that follow if it remains unaddressed. I have argued that we ought to recognize that humans are not in control of nature, but a part of it. Humans are natural beings whose actions are limited by the natural environment. Humans do not control nature, but are controlled by nature. While I still hold that this is true, it seems as though we must separate humans from the rest of nature in order to make sense of environmental problems.

Every living creature has an impact on the natural world. Bacteria and fungi consume nitrates and ammonium from decomposing organic matter, thus limiting nutrient availability for intake by plant biota. Deer browse on saplings of specific species of trees, thus limiting forest diversity and limiting availability of those resources to other organisms. Transpiration is an essential part of the water cycle in forest ecosystems, thus when diseases or natural disasters remove a significant number of trees from a section of forest, excess water resulting from the temporary disturbance causes significant impacts on that ecosystem.

Yet, despite recognizing that every living organism has an impact on the natural world, there is something unique about humans. Nature, considered separate from humans, has a sort of natural check-and-balance system. For instance, when deer populations grow too large less browse will be available for consumption during winter months and deer will die from starvation, and over time deer populations may decline. Similarly, if a bird lays seven eggs but

can only feed five offspring, the bird will not raise seven weak offspring, but will instead only raise the five that it can support, pushing the remaining two from the nest or allowing them to starve (Hardin, 2010). Nonhuman organisms cannot impact or manipulate the natural world in a way comparable to humans.

Human cognition and unique physical abilities, combined with technological innovations, allow for human populations to manipulate the natural world in ways that other organisms cannot. In fact, humans are, arguably, the sole reason that the current "environmental crisis" exists. Advances in medical technology have allowed for us to protect ourselves from viruses, bacteria, and diseases that would normally serve as natural population control—natural selection or survival of the fittest, if you will. Humans are able to successfully raise a great number of offspring because of advances in agriculture and miscellaneous conveniences. Manipulation of nature and mass consumption of resources allows for humans to have a significant impact on the rest of the natural world, which creates an illusion of superiority or mastery over nature. However, it is important for us to remember that this separateness or dominion is just that – an illusion.

While we are certainly unique, we are not superior to nature. The scale of our impact on other living organisms may be much greater than those of other species, but that does not mean that we are in control. Some might suggest that humans are capable of resisting natural urges or that human rationality and human intelligence allows us to resist the sort of natural cycles and processes to which other animals are slaves. Yet such an argument fails to recognize that all things we consider to be unique about human ability and human behavior are simply a part of human nature – a part of nature.

The list of unique human abilities is long, but these unique abilities are still a part of nature. They exist in the natural world and often arise out of natural human instincts and desires. We are not the only social creatures on the planet. Wolves, chickens, and lions, among others, all form social hierarchies and social orders. Dolphins have recently been declared to create, assign, and recognize names (Owen, 2006). Forms and complexities often vary, but all are still a part of nature. Humans create rules and laws. Humans are moral creatures with a deep understanding of their environment, yet all of these capacities are still a part of human nature. Humans are unique because it is in their nature. I hope it is clear that we should not be so quick to suggest that we

can defy nature. We follow natural instincts in unique ways, but so do other living organisms. For instance, a dolphin does not follow natural instincts in the same way that a dung beetle does. Dolphins can look in a mirror and show signs of self-recognition and they can communicate through a language more complex than we associate with any other nonhuman animal. Unique abilities should not lead us to the conclusion that we are an entity that exists beyond the limits of nature or natural instincts. Doing so may lead us to the dogmatic position described above that limits our understanding and appreciation of the world to human significance.

However, if we agree that we ought to be concerned about sustainability, we cannot simply ignore the significant differences in human nature or human ability to influence the natural world. Thus, for the remainder of this paper I will distinguish between "Nature" and "nature", where Nature with a capital N refers to the natural world of which humans are undeniably a part and nature with a lowercase n refers to the natural world as the common social construct in which humans are separated from other living organisms for the reasons expressed above.

Is Marine Aquaculture Sustainable?

Now that we may understand why the natural world is valuable and why we ought to be concerned about sustainability, we can apply the above arguments to marine aquaculture in order to understand how commonly practiced ocean-based methods of raising fish are unethical.

As stated in the first chapter, ocean-based fish farms often mimic intensive industrialized terrestrial farms. As such, aquaculture projects have been quick to adopt technological advances, to expand areas of cultivation, and to produce higher yields per unit area (Bruge're & Lindler, 2004). In consequence, many marine aquaculture systems are large-scale polluters on par with other highly recognized polluters—such as industrial farms and oil and coal companies—that have brought about irreversible environmental changes (Pillay, 1992). Within ocean-based fish farms, the hazards to the environment and threats to sustainability include, but are by no means limited to, escaping fish, spread of diseases, habitat loss, and using wild-caught fish for feeding farmed fish.

Such threats have obvious implications for sustainability, since wild populations are threatened by ocean-based fish farms in addition to the unrelated demand for wild fish and

declining conditions of the sea. If we then accept the argument made earlier in this chapter concerning the need for a ecocentric ethic and the broadening of our understanding of what it means to be sustainable, we may see that ocean-based aquaculture poses a serious threat to what we have already determined to be ethical.

Escaped fish in netted ocean-based systems are so commonplace that the Food and Agriculture Organization of the United Nations (FAO) previously recommended that when new species are introduced to ocean-based pens those species should also be considered an introduction to the wild, even if any given fish farm's facility is considered a closed system (Naylor et al., 2005). The introduction of farmed fish into natural habitats is of particular concern for the biotic community because it increases competition for food sources, space, and mates (Naylor et al., 2005). The concern surrounding growing populations of escaped fish is of particular importance when one considers that many farmed fish may be genetically modified or are a product of artificial selection in controlled breeding operations. Studies on farmed salmon have demonstrated that farmed fish often have a noticeable size advantage over wild fish and show greater aggression when competing for food and habitats. As a result, wild fish are experiencing higher rates of mortality and slower growth rates, and may be forced to move to habitats that are less suitable to a successful life (Fleming et al., 2000). It is also important to recognize the problems associated with hybrid fish formed as a result of interbreeding between wild and escaped fish. Due to genetic differences selected for ideal farm conditions, farmed fish often reproduce at lower levels than wild fish, and as a result there has been a noticeable loss in the fitness and productivity of hybrid fish in the wild (Naylor et al., 2005). In studies conducted on salmon it has been discovered that the successful mating of hybrids may lead to entire wild populations descended from farmed fish that have escaped. In fact, one Norwegian study showed that 55% of farm escapes contributed to 19% of the genes in adult fish only one generation later (Fleming et al., 2000; Naylor et al., 2005).

The second threat, the spread of diseases from farmed fish to those living in the natural habitats surrounding fish farms, arises in large part due to the concentration of fish and the inability to naturally cope with health risks in crowded pens. Studies on farmed salmon have shown that even the presence of parasites found in farmed fish populations have the potential to be devastating for wild fish. One study on the spread of sea lice from farmed populations into wild populations demonstrated that although sea lice may be found on wild adult salmon,

juveniles rarely come into contact with sea lice until later in life because they enter the sea several months before the return of adult wild salmon (which is when they are naturally introduced to the lice). However, in areas where fish are being farmed in ocean environments, juveniles are introduced to sea lice at a younger age, and as a result schools of infested moribund juvenile salmon are present, with an mortality rate ranging anywhere between 9 and 95% (Krkošek, Lewis, Morton, Frazer, & Volpe, 2006).

Habitat loss, a serious problem for natural systems as a whole (at least in the immediate area), is also a product of high concentrations of fish within a small confined region. One of the greatest impacts of marine aquaculture on natural environments can be seen in coastal systems, especially in mangrove forests that are being cleared and replaced with fish farms. Although Asia may suffer the greatest loss of natural habitats as a result of coastal aquaculture,

> Globally, more than a third of mangrove forests have disappeared in the last two decades, and shrimp culture is the major human activity accounting for 35% of such decline. This transformation results in loss of essential ecosystem services generated by mangroves, including the provision of fish/crustacean nurseries, wildlife habitat, coastal protection, flood control, sediment trapping and water treatment (Primavera, 2006, p. 535).

As a result of large numbers of fish concentrated in small areas, concentrations of toxic fish waste, such as ammonia and nitrites, are high and water quality quickly declines. Overstocking and overfeeding of farmed shrimp and fish, combined with low levels of dissolved oxygen, have been known to form thick layers of sludge in and around pens, resulting in fish kills, phosphorous bound in sediments, growth of red tides, and blooms of toxic organisms, resulting in significant environmental impacts (Primavera, 2006).

Finally, the use of wild-caught fish for the use of farmed fish meal is threatening ocean environments well beyond the region in which the farms exist. As previously stated, even as more people are relying on farmed fish for supplying their seafood, the demand for wild-caught fish is showing little signs of decreasing. Such a trend may be explained when one realizes that between 1986 and 1997, four of the top five and eight of the top 20 capture species were used in feed production for farmed fish and livestock (Naylor et al., 2000); thus, even as we begin to rely on farmed fish as our primary source of seafood, we are fishing lower-level wild-caught fish in order to feed the fish raised on farms. In fact, “many intensive and semi-intensive aquaculture

systems use 2-5 times more fish protein, in the form of fish meal, to feed the farmed species than is supplied by the farmed product" (Naylor et al., 2000, p. 1018).

As one can imagine, the negative impacts on wild populations of fish, ocean life and ocean habitats, although unpredictable, can be devastating. Such impacts are only magnified when we consider that human demands on wild caught fish have shown little signs of decreasing, even with the growing demand for farmed products. As human demand for wild-caught fish remains constant, it is important that fish are able to reproduce and survive to sexual maturity. However, the introduction of escaped fish from ocean-based aquaculture, the spread of disease, and the loss or decline in health of natural habitats is, as stated, posing a serious threat to the ability of wild populations to thrive.

Returning to ecocentrism in light of these problems one can quickly recognize why ocean-based aquaculture may be considered unethical. The practices described above fail to seriously consider conservation of wildlife and the maintenance of biodiversity, as well as demonstrate a lack of concern for environmental sustainability with respect to future generations of all living organisms. When we accept that the natural world is valuable insofar as life has intrinsic value and the natural world is composed of living organisms, we ought to expect marine aquaculture practices to demonstrate concern for natural environments and sustainability. However, the threats caused to natural environments, wild populations of fish, and the continued depletion of an already threatened resource demonstrate that sustainability, conservation, and biodiversity are not a priority of marine aquaculture. This will become even more apparent as we begin to examine the implications for humans and farmed fish in the chapters that follow.

Chapter 3: Responsibilities to Producers and Consumers – Marine Aquaculture and Humans

"Today, the rich are the haves and the poor are the have-nots.
Tomorrow, the rich will be the have-food and the poor will be the have-not food."
–Bill Gaede, *Why God Doesn't Exist*

Introduction

Once we recognize the intrinsic value of living organisms and we accept that sustainability is a moral obligation, it may seem unnecessary to discuss responsibilities to humans; for as stated in the previous chapter, humans are a part of Nature cannot be separated from Nature. If we have moral obligations to Nature then we have moral obligations to the human species as well.

While there is a moral obligation to be actively concerned about environmental sustainability that obligation does not exist in isolation from other moral duties. One ought to do his or her best to maintain biodiversity or natural habitats, but as stated in Chapter Two, this does not mean that one cannot justify the use or manipulation of nature, so long as it is done sustainably. If we can justify marine aquaculture and other practices which require much manipulation of nature, while remaining cognizant of moral obligations toward Nature, we must also be aware of other moral obligations to individuals.

It would be fallacious to deny that we do grant additional moral consideration to humans, which is easily seen through "rights" talk that is not present in concern for Nature. We believe that humans have some level of autonomy; that is, they are ends in themselves. Humans ought to have *some degree* of freedom and self-determination. Because of this, we often consider obligations to individuals as an essential part of ethical decisions, since looking at the species as a whole would fail to consider the autonomy of individuals.

When examining marine aquaculture in light of environmental sustainability, we see that commonly adopted practices threaten the health of ocean ecosystems and numerous wildlife populations. However, these practices do not seem to have obvious implications for humans. It

could be argued that marine aquaculture is an added threat to our oceans which could result in an increased risk for ecological collapse, which would in turn have devastating impacts on the human species. While this is certainly true when we accept that marine aquaculture is not sustainable, it still fails to consider obligations to humans in the way we often do and should.

When we choose the right course of action, unavoidable consequences arise for humans, invariably impacting human livelihood and wellbeing. Recognizing wild-caught intensive fishing operations as a problem, we are investing more time and energy into marine aquaculture as a more sustainable solution (though we have seen that this proposed solution is not as sustainable as it is given credit for). In doing so, new complications arise with direct impacts on human autonomy, wellbeing, and livelihood. Fishermen may see fish farming as a threat to their cultural heritage. Consumers are unaware of where the fish they are eating comes from, or even what type of fish is on their plate. Disguising unsustainable marine aquaculture as a sustainable solution raises new complications for globalized markets and awareness about the impacts of what we eat.

If we accept that humans deserve separate attention, we may then consider marine aquaculture in the context of a human-centered ethic. In this chapter I discuss the major ethical concerns, such as labeling, globalization, and food security, which all have a direct impact on the producers and consumers of farmed fish.

The Unknown: Genetically Modified Organisms, the Unlabeled, the Mislabeled, & Potential Impacts on Human Health

Genetic modification is a relatively new technology, allowing for the manipulation of the genetic makeup of living organisms. Manipulations may include the removal of an existing gene, the blocking of a gene's proper function/operation, or transgenic modification (the introduction of genetic material from another organism, including genes from a different species) (Singer & Mason, 2006). Genetic modification of food products is usually done in order to increase efficiency and productivity.

Although genetically modified fish have not yet been approved by the FDA (for human consumption), much research is being done regarding genetic modification and the FDA is likely

to approve genetically modified fish in the near future. Because of this, there are several concerns regarding the safety of genetically modified organisms (GMOs).

The first is regarding human health effects. Because genetic modification of our food is relatively new, individuals are concerned about long-term consequences of consuming modified food. Will GMOs pose serious health risks in the future?

Many scientists respond to this concern by assuring the public that GMOs have been proven to be safe for human consumption and people should not worry about adverse health effects (Singer & Mason, 2006). It should be noted, however, that because this is a relatively new innovation, not many long-term studies have been performed. In addition, the same scientists that claim GMOs are safe for human consumption also admit that just because current GMOs are safe for consumption does not indicate the safety of new GMOs; each GMO must be checked for safety (Singer & Mason, 2006). Many individuals have also expressed concern that genetically modified organisms can cause increased exposure to allergens, especially in locations like the U.S., where GMOs do not have to be labeled. However, such claims are usually surrounded by much controversy, and officials always call for more research.

Another concern arises when we consider patents. Ever since the Supreme Court decided that it was legal to patent a living organism, the biotechnology industry has been quick to patent new discoveries. It is probably a justified assumption that when the FDA finally approves genetically modified fish for human consumption those fish will be patented by the biotechnology industry that created the modified organism. These patents may create dependencies for fish farmers who want to be able to compete in global markets. When fish farmers are poor this dependency on a company that serves to make a profit off of its invention can be devastating to those who may not be able to afford modified products, thus reducing their ability to compete with other fish farmers.

The problems associated with genetically modified organisms only become further complicated when we consider that in some nations, such as the United States, GMOs do not have to be labeled. This means that if current regulations remain unchanged, when genetically engineered fish reach commercial markets consumers will have no way to know whether or not they are consuming a genetically modified animal (or "Frankenfish," as the media has popularly labeled these modified organisms). In many European countries GMOs are labeled, allowing

consumers to make a choice about whether or not they want to take a "risk" when consuming genetically modified products.

When we accept that humans are autonomous individuals, it is easy to see the problems associated with selling unlabeled GMOs. If an individual has the right to be self-determining, he or she, presumably, has the right to decide what potential health risks he or she wishes to be exposed to. While it's possible that GMOs are safe for consumption, it is clear that there is not enough information about the long-term safety of this new technology to make consumers feel comfortable trusting government and corporate assurances. Not only are consumers of unlabeled modified food products unaware that they could be exposing themselves to potential health risks, they are also uninformed about the environmental implications of GMOs mentioned in the previous chapter. In the case of marine aquaculture, the environmental impacts of genetically engineered farmed fish on wild populations could be devastating, yet consumers purchasing unlabeled products will have no way to determine that the fish they are consuming has been modified.

In addition, unlabeled GMOs are suspected to limit a person's ability to avoid consuming animal products. As stated in Chapter One, not all fish raised on farms are raised for human consumption. Marine aquaculture is also a new component of the biotechnology industry. One technology that is currently being studied is the use of genes from arctic fish in tomatoes, potatoes, and strawberries. It is believed that genes from arctic fish may increase frost, salt, and heavy metal tolerance in these fruits and vegetables (Rowland, 2002). Thus, if this technology is successful, vegetarians and vegans living in nations where GMOs are unlabeled cannot easily ensure that they are not consuming fruits and vegetables without genetic material from arctic fish. As these technologies advance, one can expect the biotechnology industry invest more money in marine aquaculture as a cost-cutting measure in new research and development projects, further limiting a person's ability to freely make decisions about the food he or she wishes to consume.

In addition to concerns about GMOs, the aquaculture industry is now mislabeling farmed fish so consumers no longer know what is on their plate. In the United States, 80% of seafood is imported and more than 1/3 of seafood is mislabeled (Jaquet & Pauly, 2008). The mislabeling of seafood is made possible due to lax regulation surrounding the capture and production of marine

products. No U.S. law requires that labels on fish indicate whether fish are wild or farmed, nor do producers have to list where fish were farmed or captured (internationally or domestically).

In 2000, fish farmers in the southern United States did not feel that Vietnamese catfish should be labeled as catfish, so catfish from Vietnam were labeled and sold to consumers as "Vietnamese". Later that year, U.S. Congress introduced a bill that required Vietnamese catfish to be properly labeled, but they did not extend proper labeling requirements to any other type of fish. In 2001, the U.S. Farm Bill restricted the catfish label to only include catfish caught or farmed in the southern U.S., meaning all imported catfish could no longer be labeled as such (Jaquet & Pauly, 2008). Of course, this bill still failed to address the mislabeling of other types of fish.

In addition to the mislabeling of farmed catfish, mislabeled salmon is a growing problem in the United States. More than half of salmon sold in the United States during the offseason that are labeled as "wild" are actually farmed (Jaquet & Pauly, 2008). In the United Kingdom, studies on the mislabeling of fish show that roughly 15% of wild salmon, 11% of wild sea bream, and 10% of wild sea bass are actually farmed (Jaquet & Pauly, 2008). Jaquet and Pauly suggest:

> It is rare, but occasionally this type of mislabeling occurs by accident. In one study, a farmed salmon escaped to the wild—in spite of salmon farm claims of zero escapement—and was then caught and sold as wild, its ghost posing deep ontological questions (2008, p. 313).

Another misleading label for consumers of seafood is the label "organic", which many may believe to mean that the fish they are consuming is wild-caught or raised on farms that do not use chemicals. However, when the U.S. National Organic Standards went into effect in 2002, after much heated debate, fish and shellfish were left out, meaning that there is no federal rule for the use of the word "organic" in marketing fish to consumers (Mansfield, 2004).

So, why are so many farmed fish being mislabeled? While there are obvious economic benefits in selling fish labeled "organic" (e.g. higher price tags are associated with organic products and organic products often attract environmentally conscious consumers), the intentions behind mislabeling farmed fish as wild fish may not be as obvious, though the incentives are also financially motivated. A study in New York City showed that wild salmon can sell for US$64/kg, while farmed salmon only sells for US$11-26/kg. During the offseason, farmed

salmon mislabeled as wild salmon can sell for *more* than US$64/kg (Burros, 2005; Jaquet & Pauly, 2008).

Of course, this mislabeling has serious consequences for protecting human autonomy. For those against marine aquaculture or fish farms, buying wild fish is not a definite solution since fish are so commonly mislabeled. Asking individuals to support wild fisheries is problematic when wild fish are not actually wild fish.

The mislabeling of fish is a widespread problem, not limited to marine aquaculture. Wild fish are also often mislabeled. Thus, a consumer eating what she believes to be swordfish is actually a mako shark. Misleading consumers jeopardizes their capacity to prevent making decisions that could conflict with their beliefs or even threaten their lives. Not only do many of the mislabeled species contain large concentrations of mercury (e.g. shark, tuna, and whale), but uninformed consumers are also unknowingly exposed to allergens, risking anaphylaxis and even death. Unless the United States and other nations strengthen regulations on labeling fish products, it is feared that this problem will only continue and expand into newly developing fish farms, which can then produce fish at a low cost and sell mislabeled fish for a much higher profit.

A third unknown threat that has the potential to violate a person's autonomy and wellbeing is exposure to antibiotics. Due to high fish densities in many marine pens, the risk of bacterial infections in farmed fish is significant. To reduce the risk of infection, just as in many terrestrial agricultural practices, large amounts of antibiotics are administered in fish feed for both preventative and therapeutic purposes (Sapkota et al., 2008). The heavy use of antibiotics may lead to adverse health outcomes for both fish farmers and consumers.

The use of antibiotics often leaves an antibiotic residue in aquaculture environments. This residue is not likely to cause acute toxic effects in humans, but it is suspected that chronic effects are possible, though these effects are largely unstudied (Jones et al., 2004). In a study conducted on fish farms in Thailand and the Philippines it was found that when workers are feeding fish they are regularly exposed to carcinogenic antibiotic residue, often lacking appropriate gear and uninformed about the potential health risks of regular ingestion and dermal exposure to this residue (Sapkota et al., 2008).

Consumer autonomy and welfare is threatened when consumers eat fish that have been fed heavy doses of antibiotics. Studies have shown that antibiotic-resistant plasmids can be transferred between fish isolates and human isolates, supporting the theory that bacterial antibiotic resistance in aquaculture environments can contribute to the alarming bacterial antibiotic resistance that is occurring among human populations (Sapkota et al., 2008). Many farmers also use metal-based compounds, pesticides, animal and human excreta, and other agrochemicals in aquaculture projects, further increasing the risk for human exposure toxins (Sapkota et al., 2008), limiting autonomy, and risking future wellbeing.

Food Security and Globalization

In addition to the environmental problems discussed in Chapter Two, and the threats to human autonomy described above, concerns for justice and human wellbeing arise when we consider the global impacts of the enormous pressures humans place on global fisheries.

As I hope has been made clear by now, humans have a large appetite for seafood. The demand placed on our oceans by people around the globe is only increasing with time, while global fish populations continue to decline. As a result, marine aquaculture, labeled as the sustainable solution to the overfishing problem, is gaining interest by nations around the world. Because the most desired fish species are higher trophic level organisms, most aquaculture projects raise higher level organisms for human consumption. Of course, when we raise organisms from higher trophic levels in enclosed pens we must then use wild-caught "feeder fish" to feed the fish that we are farming (Naylor et al., 2000). This means that in addition to the environmental threats described in Chapter Two, fish farms actually *increase* pressures on wild fish populations. Not only are we catching wild fish to feed the fish we raise on farms, but we are catching fish that are an important food source for wild populations. If marine aquaculture is supposed to solve the overfishing problem while allowing time for threatened wild populations to recover, we cannot continue to use recovering population's food sources to feed farmed fish. If we wanted to resolve this problem, it would be more sustainable simply to consume the fish that we are catching as feeder fish (e.g. anchovies) and stop consuming fish raised on farms (Clover, 2008). However, because we continue to disguise aquaculture as the solution to overfishing, we do not often stop to question its practices. As a result, we continue to fish

unsustainably, limiting the availability of fish as a primary source of protein for those who need it most.

To better understand this, let us consider what unsustainable fishing has meant for Ghana. In Ghana, subsistence fishing is extremely important for the survival of poor populations. Fishing has been an important part of Ghana's culture since the 1800s, but the globalization of fishing is now threatening this way of life (Atta-Mills, Alder, & Rashid Sumalia, 2004). Although the impact on subsistence fishing in Ghana is caused by overfishing—due to demand for wild fish for direct use/consumption and demand for farmed or feeder fish around the world—fishing fleets from the European Union probably have the most direct impact on West African waters. The EU's industrialized fleets fish just offshore of West Africa, significantly reducing the number of fish available for Ghanan fishermen (Atta-Mills, Alder, & Rashid Sumalia, 2004).

The EU has access agreements with countries in West Africa which allows EU fleets to exploit offshore fish stocks, despite the fact that landings by the EU in West African waters are not counted as African production nor as African exports (Smith et al., 2010).While an inability to catch enough fish to provide adequate protein to Ghana's population is certainly a cause for concern, the impact of overfishing does not stop there. Recent research in Ghana has demonstrated that when fishermen are unable to compete with yields of industrialized fleets from developed nations, there is a resulting increase in the hunting of protected bush animals, resulting in sharp declines in biomass of 41 wildlife species (Brashares et al., 2004), forcing Ghana to again look for alternative sources of protein in a highly stressed natural environment.

Meanwhile, as Ghanans and others around the globe struggle to find enough protein, people in developed nations are told that they ought to *double* their seafood consumption (NOAA, 2012). Japan, the United States, and the European Union are all well-nourished and have many options for protein sources, yet they are among the largest net importers of seafood (Smith et al., 2010). Interestingly, though not surprisingly, 92% of global animal aquaculture production occurs in developing countries, which also happen to be countries where people are the most undernourished and regulations are the most ineffective (Smith et al., 2010). This suggests that although individuals raising fish in aquaculture systems are unable to meet nutritional requirements they continue to export fish products to those living in nations who do

not *need* to consume fish. Of course, the environmental impact of these practices should also not be overlooked; for the unsustainable aquaculture practices described in Chapter Two are then most common in developing nations, placing an even *greater* burden on already struggling individuals, and increasing the appearance of sustainability in developed nations who are unable to see the impact of the food they eat.

The impacts of global markets on food security raise important ethical questions about justice. Is it just or fair that the greatest demand for fish is by those who need fish the least? Can people living in developed nations justify doubling demand for seafood as others struggle to find any source of protein?

It is generally agreed upon that humans have value or rights worth protecting. While a utilitarian may argue that humans have potential pleasures that ought to be protected and a deontologist may suggest that it is a person's right to autonomy that is of importance (Warren, 1998), there is no reason that both autonomy and potential pleasures cannot be of importance here. Granted, then, that most would agree that humans are autonomous individuals with potential pleasure states, and that we have some moral obligation to protect human "rights" or potential happiness, we can then try to answer questions about justice.

Marine aquaculture is an important part of the global economy, and it is in developing nations that many fish farms are established. After all, if marine aquaculture is as sustainable as we are led to believe, it would seem as though developing nations could only benefit from offshore systems. Surely farming fish from one's own shores will help meet the demand for protein that the nation is otherwise struggling to acquire. Of course, as seen with Ghana, such solutions are never quite this simple. Not only does the continued pressure on wild-caught fish continue to limit the ability of Ghanan fishermen to catch fish, but, as Becky Mansfield explains, "aquaculture also leads to dispossession of resources used by the poor, as coastal fishing grounds are either turned into fish farms or ruined by pollution from nearby farms (2011)." While Ghana has been slow to invest in marine systems (though some do exist, most of Ghanan aquaculture is still land-based), other nations, especially in Asia have been quick to adopt ocean-based systems. In fact:

> Asia accounts for roughly 90% of global aquaculture production, and China alone contributes more than two-thirds of the total. Europe, North America and Japan collectively produce just over one-tenth of global aquaculture output but consume the bulk of farmed seafood that is traded internationally (Naylor et al., 2000, p. 1018).

In Asian countries, where the majority of aquaculture projects exist, the greatest disturbance of coastal and marine habitats (e.g. mangroves) is observed, further threatening food security in a continent with so many people living in poverty (Islam & Wahab, 2005).

Returning to the question of justice, I hope that the unfairness of the majority of burdens being disproportionately placed on the poor—who also happen to be raising the majority of the farmed fish that we consume—has become apparent. When developed nations place so much pressure on both wild and capture fisheries, they are effectively limiting the autonomy and threatening the future (and even current) wellbeing of those overseas. If human autonomy and future wellbeing is worth protecting, we ought to question our actions when we try to justify eating more than we need, especially if we are aware of the consequences of our actions. It is a bizarre and unethical situation when we begin to justify a world in which the poor feed the wealthy, yet we—perhaps unknowingly—do this on a regular basis.

Perhaps the reason we are so capable of justifying overconsumption of fish is our physical distance from the consequences of our actions. Consuming fish makes us happy. To people of developed nations it may appear as though doubling consumption of fish could only maximize overall happiness, but this only appears to be so because we cannot see the suffering caused by our actions in places like Ghana or Asia. If fish farms were a part of my childhood story from Chapter One, surely I would have been more aware of the problems facing our oceans. But fish farms are not something we are faced with on a regular basis; they are not in our backyard. The U.S., the U.K., and Japan—the three largest consumers of seafood—import fish from developing nations who are forced to deal with the burdens while the rest of us are told that marine aquaculture is the solution to overfishing. How can we know any better? How do we determine what is sustainable or what is just when practices are so well hidden?

Global trade has made it easy to forget about what is not right in front of us. Globalization is a strong economic, social, political, environmental, and moral force, impacting all forms of life and doing so on a global scale. Currently run by a profit-first or nationalist

mindset, the very questions that should be at the forefront of all discussion when one is dealing with global exploitation are being pushed aside, with a large acceptance by a blind or apathetic population in the west, as we've seen in the case of aquaculture.

One should not ignore the way that the cultures and lifestyles of developed nations undermine traditional modes of living and social customs, allow for a "European domination and the gradual consolidation of global white supremacy" (Mills, 1997, p. 20), and create an *illusion* of global economic prosperity and advancements in free and fair trade. Many of the successes of globalization are concentrated in the west (Amin, 2006; Cavanagh & Mander, 2004; Mills, 1997; Nussbaum, 2011), benefiting Europeans at the expense of majority races (non-whites). In the globalization of fishing Japan is the major exception to this, though Mills would likely suggest that the Japanese are white in the context of the racial contract.

The sustainability and fairness of marine aquaculture is an illusion that exists in the west. In nations where people are struggling to find sources of protein, or are farming fish in systems that pollute ocean ecosystems, marine aquaculture is a threat to autonomy and future wellbeing caused by serving the unsustainable appetites of developed nations.

Amartya Sen boldly suggests that globalization and its consequences for the cultures of developing nations is acceptable, since global trade and economic expansion and development is something for all nations to strive for (1999). The lives of individuals in developed nations are worth living, and therefore the loss of cultural traditions that are in direct conflict with economic globalization are a justifiable loss. Yet, it is, arguably, in an effort to be a participant in globalized trade that developing nations are, as previously stated, raising and exporting fish in aquaculture systems rather than worrying about the nutritional deficiencies of the people of developing countries. A system that functions like this, serving the wealthy at the expense of the poor, surely cannot be promoting the greatest happiness or protecting the autonomy of the poor. Instead, it seems as though this system only creates an increased dependency on developed nations. Poor nations farm fish to feed the United States, the United Kingdom, and Japan, damaging marine environments in the process, and further limiting their ability to find safe sources of protein.

Chapter 4: Responsibilities to Nonhuman Animals – Marine Aquaculture and Finfish

"The question is not can they reason, nor can they talk, but can they suffer?"
–Jeremy Bentham, *The Principles of Morals and Legislation*

"You never have to wonder if the fish on your plate had to suffer. It did."
–Jonathan Safran Foer, *Eating Animals*

Introduction

In Chapter Two, on responsibilities to the natural world, I came to the conclusion that life if intrinsically valuable. As a result, I argued that one ought to protect natural systems and species as a whole, but did not extend my argument to individuals. In this chapter I will look at concerns for individual nonhuman animals. What conditions must be met in order for us, as humans, to grant moral status to nonhuman animals? And if we grant moral status to a nonhuman animal, how far do our obligations toward that animal extend? There are no simple solutions to such questions, for we are limited in our ability to know what it is to be a nonhuman animal.

Moral Status

The phrase "moral status" indicates a moral responsibility toward the object in which moral status is granted. Assigning moral status means that we recognize the moral significance of the needs of the being or object to which moral status is granted. For instance, most would grant moral status to a child, meaning that we, as moral agents, have a responsibility to constrain our actions toward that child. Throwing the child across the room is not likely to be permissible, since the child's moral status suggests that the child has needs worthy of moral consideration. Mary Anne Warren explains moral status as follows:

> To have moral status is to be morally considerable, or to have moral standing. It is to be an entity towards which moral agents have, or can have, moral obligations. If an entity has moral status, then we may not treat it just in any way we please; we are morally obliged to give weight in our deliberations to its needs, interests, or well-being. Furthermore, we are obliged to do this not merely because protecting it may benefit ourselves or other persons, but because its needs have moral importance in their own right (Warren, 1998, p. 3).

To further explain this, let us consider an example. I would argue that my dog, Monster, has moral status. Because he has moral status, his needs, interests, and well-being are morally significant and therefore it would be unethical for me, as his caretaker, to allow him to go hungry or to cause him unnecessary suffering. My obligations to Monster do not simply exist because protecting him may benefit myself (abusing him could result in fees or jail time), but these obligations exist because his needs and well-being are morally significant in their own right. We often grant similar considerations to nonhuman animals, even going so far as to create laws that protect the moral status of animals. Around the world, laws exist to protect food animals, yet the majority of these laws only consider the welfare of chickens, pigs, and cattle (Welty, 2007).

Of course, once one understands moral status, it then becomes crucial to understand why moral status was granted. What is it about my dog that makes him "morally considerable"? Which capacities or characteristics cause one to grant moral status? Answers to such a question will vary greatly depending on who is asked, though common responses may include capacities such as being alive, being sentient, being self-conscious or self-aware, having an ability to reason (rationality), being capable of experiencing pain and/or suffering, or showing aversive states and/or preferences.

In this chapter I argue that the only capacity necessary for granting moral status is an ability to feel pain. I argue—despite the controversy surrounding fish and pain sensations—that we have reason to believe that finfish *can* feel pain, and therefore they ought to be granted moral status. This, of course, has major implications for fish farms, and I go on to argue that such farms are unethical.

The Scope of Moral Considerability

For many philosophers rationality is central when discussing issues of morality. When one argues that the ability to reason is a reason for granting moral status, it is often argued that not having a capacity to reason is cause for denying moral status. For most, this means that humans are the only living creatures granted moral status, since the ability to reason is thought to be a capacity limited to human (or mammalian) life. For instance, in his *Nonhumans as Machines,* Descartes suggests that "dumb," or nonhuman animals are not capable of thought or language, and that they operate like machines, with their organs acting like the gears on a clock (2010).

Of course, even if one argues that reason is a necessary capacity for moral status, this does not necessarily mean that one does not have cause to treat living organisms that lack an ability to reason with some degree of decency or kindness. Thomas Aquinas believed that the affection of reason holds that people are free to treat animals as they please, since God granted humans dominion over the beasts; God does not care about nonhuman animals since he gave men power over them. Yet Aquinas also believed that an affection of sentiment caused men to feel pity for the pain animals feel, and the person who feels pity for the suffering of animals is more likely to have compassion for other humans. That is, compassionate people treat animals well, but the righteous treat their fellow humans well. Thus, one who treats animals cruelly may still be righteous (Passmore, 1975).

Moving beyond religion, many anthropocentrists seem to suggest that moral significance arises due to the inherent differences in humans and animals. While the ability to reason is one of these differences, many philosophers also emphasize human sentience, self-consciousness or self-awareness, and even an ability to use language to communicate.

While it is undeniable that humans have these capacities, such claims ignore the fact that other living beings are capable of things that humans are not. Bats are able to fly and move through the night with a built in sonar system. Sharks are able to smell from great distances and detect the presence of other beings through the ampullae of Lorenzini—or electroreceptors—on their heads. All belief of human significance stems from human values, which is an unfair, limited, and biased basis for judgment of other forms of life, and one that seems irrelevant when considering an organism's moral status.

As expressed by Aquinas, who did not extend moral status to nonhuman animals, a *sentiment* for nonhuman animals surely arises when we consider that they may be capable of experiencing pain. If someone were to slowly murder an infant surely most would not make an argument that the action is justified simply because the infant cannot use language or reason. Certainly, one could argue that we grant moral status to an infant because the infant is likely to become a person capable of reason. However, can the same be said of individuals with disabilities which limit their ability to reason?

Most would not argue about whether or not a dog or a cow can feel pain and we feel great discomfort when we observe these animals demonstrating that they are in pain, despite the fact that many might question their ability to reason. Our discomfort about the action arises in our own perception of its ability to feel pain and in the disregard of the moral status of the individual. Pain, unlike developed language or rationality, is the reason we often question whether or not animals ought to become moral subjects. We empathize with that individual because we know, from our own experience, that pain is a negative experience that we would rather avoid.

Of course, when we ask why pain matters we may run into some difficulty, for many simply believe that pain is a negative experience that should be avoided with no real justification as to why. However, some, such as philosopher Peter Singer, argue that pain demonstrates that things can matter to an animal in a particular way and that this kind of mattering is the basis for moral considerability (1975). Thomas Nagel argues that in normal circumstances everyone is unreflectively averse to pain, and therefore its moral importance seems self-evident (1989).

I believe there is something to be said about the reason behind experiencing pain. We seem to forget that pain is a biological response, not a sensation related to human excellence. For instance, Dawkins states:

> Pain evolved because, by being unpleasant, it keeps us away from the larger evolutionary disaster of death. Pain is a part of a mechanism for helping us to avoid immediate sources of injury, and also to refrain from repeating actions that have resulted in damage (Dawkins in Palmer, 2010, p. 14).

Pain sensations indicate that something is harming the body in some way; an ability to experience pain seems to serve as a type of warning to organisms capable of withdrawing from—or responding to—harmful stimuli. Although such a belief is not universal (it is denied by

several religions) we do have scientific reasons to believe that animals (humans included), which all emerged from common ancestors, share this evolutionary sensation (Palmer, 2010). If we can, at a minimum, accept that pain is a negative sensation that most would wish to avoid, we may be willing to accept that this is a reason for granting moral status. For instance, if we can accept that a fish is capable of experiencing pain in a way similar to a human's ability to experience pain, then it is conceivable that such an experience indicates an ability to suffer. When we are concerned about the wellbeing—or maximized happiness—of an organism, the ability to feel pain or an ability to suffer would significantly influence our action. Understandably, wellbeing is maximized the same time that pain and suffering is minimized.

Because we have not yet addressed whether or not fish can feel pain, let us consider another example using a mammal that most people would grant such a capacity to. Let's say that the mother of a baby gorilla at your local zoo has died. Now, for some reason the zoo has failed to care for the baby, and as a result the gorilla has not eaten in three days. The pain of hunger starts to overwhelm the gorilla as it unsuccessfully searches for food in its empty exhibit. You visit the exhibit, and just so happen to have a bundle of bananas in your backpack. Watching the gorilla for a few minutes, you recognize that the gorilla is hungry and probably experiencing a great deal of discomfort. You reach into your backpack and throw most of your bananas to the animal.

The question is, why would a person witnessing an animal in pain feel the need to help? It's possible that the desire to help stems from selfish motivations. Perhaps you may feel some sort of self-gratification in being a Good Samaritan, though there is probably a better explanation. When we witness another animal in pain, we recognize that the animal is suffering. The animal has needs or preferences that are not being met and its life—or health—is at risk as a result. Because we can empathize with an animal experiencing pain, we assume that the animal has a desire to put an end to his negative experience and an interest in avoiding pain, and we recognize its right to do so. We recognize that the needs and welfare of this animal are morally significant in their own right.

Do Fish Feel Pain?

Determining which organisms are capable of experiencing pain is a challenging—if not impossible—task. How can we know what another animal is feeling? Such a question is even difficult to answer within the human species. How do I know that a woman who has just cut her finger with a steak knife is experiencing pain? How can I be certain that another person's pain is similar to the pain that I experience? These questions become even more difficult when we cross species barriers, since the physiological differences become much greater.

Our initial reaction to pain arises from behavioral indicators. We recognize aversive states and preferences through reactionary responses similar to our own. For instance, when someone crushes a dog's leg with a car the dog will react by crying out and/or guarding the injured leg and resisting the natural desire to place the leg on the ground, a response referred to as pain-guarding (Palmer, 2010). Because a person would have a similar response to having his or her leg crushed by a car, we assume that the pain we feel is also being experienced by the dog.

Relying on behavioral indicators in determining what organisms can experience pain seems logical. Surely, a human child incapable of experiencing pain might learn to react to stimuli from observing the reactions of others, thus their behavioral response could be a false indication of pain. However, animals cannot easily learn to mimic pain-guarding and human responses to pain, so the similarity we see in their response may be a good indication of their ability to experience pain.

Of course, we must consider the ability of different species to pain-guard. We see this ability in mammals and birds, which also happen to have similar physiological structures that are associated with pain in humans (discussed later). It is no coincidence, then, that the animals that most humans grant moral status to are mammals and birds (Palmer, 2010; Maclean, 2003). Moral status is often denied to fish, reptiles, amphibians, etc. and it is important that we consider why in light of behavioral indicators. Unlike a dog or other mammals and birds, fish are incapable of pain-guarding or crying out/squealing (Palmer, 2010). Because a fish lacks the ability to stand and has limited mobility, it cannot guard an injured part of its body. Similarly, you cannot easily tell if touching an injured part of a fish causes the fish pain through an observation of fish behavior. Due to the normal response of fish when touched by foreign stimuli (a fish almost always moves away from unfamiliar stimuli), we cannot know that an aversion to having an

injury touched by some object is a demonstration of pain states. Thus, it seems as though behavioral indicators are incapable of demonstrating whether or not fish can feel pain.

Those who argue that fish cannot feel pain often believe that fish have simply not evolved the biological characteristics that permit sentience and an ability to feel pain (Chandroo, Duncan, & Moccia, 2004). One woman, who, like many, chooses to eat fewer land animals and eat more sea animals because they are thought to be less evolved, explains that "a fish, unlike a cow or some other mammal, 'isn't going to look me in the eye with any sensitivity'" (Singer & Mason, 2006, p. 116). Those who believe that fish cannot feel pain often evoke the evolutionary response to the pain problem, arguing that behavioral indicators are not good indicators of an organism's ability to feel pain because behavioral responses to stimuli that might indicate pain could also be a reflex reaction with which no pain is experienced.

The evolutionary model, of course, is concerned with the central nervous system and the function of the neocortex—the part of the brain in humans that is associated with consciousness, sensory perceptions, and language. Those who might suggest that humans are the only conscious beings or the only beings with an ability to use language often argue that this can be explained by the presence of a larger neocortex in humans compared to other mammals. Fish lack a neocortex, so when we compare a fish's brain to the brain of a human or mammal many suggest that the lack of a neocortex indicates an inability to experience pain, since the neocortex is so important in conscious awareness and ability to experience pain for mammals and humans (Rose, 2002).

Those who emphasize the importance of a neocortex in experiencing pain hold that there is significant evidence to believe that the brainstem (rather than a cerebral cortex) is the main controlling factor in a fish's neurobehavioral control (Rose, 2002). Because the cerebral hemisphere is often small in comparison with the brainstem when compared to mammals, scientists believe that this indicates the importance of the brainstem in fish behavior and response to stimuli (Nieuwenhuys, Donkelaar, & Nicholson, 1998). Because of this difference in brain anatomy, it is believed that all behavioral responses that we may be inclined to link to an ability to experience pain are simply reflexive reactions unassociated with a conscious ability to experience pain in the way that humans and other mammals do.

However, despite differences in brain anatomy some scientists claim that fish *are* capable of feeling pain. These scientists, such as Victoria Braithwaite, are aware of the absence of a

neocortex in fish brains, but argue that the neocortex is not a necessary component of brain anatomy in experiencing pain sensations. While the neocortex may be crucial in our understanding of human and mammalian pain, physiological differences among living organisms is not a definite indicator of difference in ability.

Those who argue that fish can feel pain suggest that what is important is not the existence of a neocortex or similar brain structure, but an ability to detect injury through nociception and a conscious ability to detect pain through nociception (Braithwaite, 2010). Nociception is the process through which stimuli trigger signals to the spinal cord causing a reflex reaction to occur. Nociception alone is not enough to indicate pain, so what becomes crucial is the process through which the signal and reflex reaction is translated into a conscious experience that an organism experiences as painful (Braithwaite, 2010). Granting that there is much uncertainty surrounding the conscious experiences of others, Victoria Braithwaite argues that we ought to accept that there are many different levels of consciousness due to differences between organisms, but these differences do not mean that consciousness does not occur in nonhuman animals like fish (2010).

The different levels of consciousness that Braithwaite mentions are fairly simple to understand. The most basic level of consciousness is known as conscious cognition, which requires an organism to be aware of internal and external stimuli. An organism with primary consciousness is able to "generate a mental scene in which diverse information is integrated for the purpose of directing behavior" (Edelman & Tononi, 2000; Chandroo, Duncan, & Moccia, 2004, p. 226). "Motivational affective states" include a variety of conscious experiences such as pain, fear, hunger, thirst, and pleasure, all of which, according to Chandroo, Duncan, & Moccia, have long been recognized as the adaptive products of evolution (2004).

In a recent study on trout, scientists demonstrated the capability of nociception in fish. However, as stated, this reflexive reaction is not what is debated, since few would question the ability of fish to respond to stimuli. Thus, in order to demonstrate that nociception in fish can be translated as a conscious pain experience, scientists administered a noxious chemical to the lips of rainbow trout to assess changes in behavior and physiology (Sneddon, 2003). Fish given these noxious stimuli showed little to no change in swimming activity or use of cover, but they did begin to rock on either pectoral fin from side to side and rubbed their lips into the gravel and onto the walls of their tank (Sneddon, 2003). Physiological changes were also observed, where a

twofold increase in opercular beat rate (gill or ventilation rate) was observed in fish given the noxious stimuli (Sneddon, 2003). When morphine was administered to the treated fish these pain-related behaviors were significantly reduced (Sneddon, 2003). Scientists argue that the responses observed during this experiment are not reflexive and are, in fact, similar to the responses observed in other vertebrates, including humans (Roughan & Flecknell, 2001; Sneddon, 2003). These researchers argue that such responses are enough for us to believe that fish are capable of experiencing pain.

Many argue that memory is an important part of consciousness, so demonstrating that fish have the capacity to learn or remember can indicate an ability to be conscious of pain sensations as well. Fish have demonstrated an ability to learn a correct choice when given a reward for some action and learn to expect punishment when given a shock or some other negative stimuli (Topál & Csányi, 1999; Braithwaite, 2010). Studies have also shown that fish have the capacity to remember and recognize landmarks, allowing for them to successfully navigate to their home range in the wild (Odling-Smee & Braithwaite, 2003) or successfully navigate through mazes in a laboratory setting (Braithwaite, 2010; Saito & Watanabe, 2010). Studies have also demonstrated that some fish can recognize and remember other individuals that they have observed in battle, choosing not to compete in territorial fights with known winners and instead fighting with fish they have observed to be weaker/losers (Oliveira, McGregor, & Latruffe, 1998; McGregor, Peak, & Lampe, 2001; & Braithwaite, 2010).

Because differences in brain anatomy are a cause for concern in our ability to accept that fish can feel pain, some scientists have conducted studies in which they remove parts of fish brains in order to observe changes in behavior. The results of these studies have indicated that fish brains are "backwards" insofar as the structures that are on the inside of our brains are located on the outside of fish brains, suggesting that the differences pointed out as significant indicators of a lack of consciousness by Rose (mentioned above) may be the result of looking in the wrong place (Braithwaite, 2010). Looking in different parts of the brain allowed for the discovery of a limbic system, which are the brain structures associated with emotion (Kötter & Meyer, 1992). As a result, many studies have been performed around the limbic system in order to demonstrate a fish's ability to show fear and anxiety with much success (Chandroo, Duncan, & Moccia, 2004). The hypothalamus—the portion of the brain linked to the nervous and endocrine systems—of fish is well studied. The hypothalamus of fish is shown to be involved in

sexual and social behavior, just as in other vertebrates, and is also responsible for integrating a variety of environmental and internal signals, including those associated with emotional learning (Fox, White, Kao, & Fernald, 1997; Portavella, Vargas, Torres, & Salas, 2002; Chandroo, Duncan, & Moccia, 2004). In addition, experiments involving apomorphine treatment on fish behavior have lead researchers to believe that fish have the necessary brain structures to mediate fear responses (Chandroo, Duncan, & Moccia, 2004).

Of course, even if we are to accept that an ability to experience pain is enough to warrant the consideration of moral status, one should also consider the limitations of our ability to know what other organisms can experience, as well as the limitations of science.

The former limitation, famously expressed by Thomas Nagel in his brilliant *What Is It Like to Be a Bat* (1974) gives rise to the latter limitation. In this essay Nagel calls attention to the peculiar situation of consciousness and our inability to comprehend what it is like to be an animal. Because we are limited to our own sensations and our own perspective, it is impossible for us to *know* what another conscious being is feeling or thinking. Nagel states:

> [Consciousness] occurs in countless forms totally unimaginable to us, on other planets in other solar systems throughout the universe. But no matter how the form may vary, the fact that an organism has conscious experience at *all* means, basically, that there is something it is like to *be* that organism…something it is like *for* the organism…the subjective character of experience (1974, p. 436).

To better understand what Nagel is arguing, let us consider an example from marine aquaculture. Marine aquaculture is growing, in large part, due to its efficiency. Fish can be raised inexpensively, crowded into small pens, and fattened over a relatively short period of time. Essentially, the practices which make aquaculture profitable and efficient also make marine aquaculture no different from a concentrated animal feeding operation (CAFO). Due to the overcrowding of fish in ocean pens these animals become stressed, are unable to form social hierarchies they would form in the wild, and thus begin to cannibalize each other (Foer, 2009). In addition to cannibalization, major causes of concern are the method of slaughter and the abundance of sea lice, which thrive in the dirty water associated with overcrowded. Foer explains:

> [Sea] lice create open lesions and sometimes eat down to the bones on a fish's face—a phenomenon common enough that it is known as the "death crown" in the industry. A single salmon farm generates swarming clouds of sea lice in numbers thirty thousand times higher than naturally occur.
>
> The fish that survive these conditions (a 10 to 30 percent death rate is seen as good by many in the salmon industry) are likely to be starved for seven to ten days to diminish their bodily waste during transport to slaughter and then killed by having their gills sliced before being tossed into a tank of water to bleed to death…no law requires the humane slaughter of fish (2009, p. 190).

Foer states that because most fish are not stunned before they are killed, they convulse in pain as they die and he claims that:

> Although one can realistically expect that at least some percentage of cows and pigs are slaughtered with speed and care, no fish gets a good death. Not a single one. You never have to wonder if the fish on your plate had to suffer. It did (2009, p. 193).

Foer clearly supports the argument for pain being enough to grant moral status, but how can he be so certain about the suffering of fish raised in these ocean pens? We've seen that fish are not capable of pain-guarding in the way that humans, other mammals, and birds are capable. We've also seen that scientists disagree about necessary evidence for pain, arguing over the importance of the neocortex and consciousness of fish. How, then, can we be justified in accepting that fish feel pain?

What Nagel's argument suggests is that we cannot ever be truly certain about what is experienced by other organisms. If a fish is conscious, there is certainly something that it is like to be that fish, but due to the subjective nature of experience we cannot know what it is like. Our inability to share a conscious experience with others limits our ability to truly *know* that another is experiencing pain.

Nagel's argument would seem to force us into a sort of skeptical position in which we cannot assume that conscious experiences are shared between individuals. However, it does seem as though we have to—and do—make these sorts of assumptions on a regular basis. Perhaps I do not know that a friend's pain is similar to mine, but I still have reason to believe that it is, as seen through the discussion of behavioral and scientific arguments.

So, how then, do we decide whether or not fish can feel pain? I've summarized the main scientific evidence and arguments above, but how one decides which argument is right still seems unclear. While it is understandable that many scientists believe the neocortex to be an important part of an organism's conscious ability to experience pain, other scientists have demonstrated that such a belief is conditioned by theories of human and mammalian physiology. This is problematic insofar as it is based on an assumption that human and mammalian brain anatomy is the only possible structure in which an organism can have experiences similar to those of humans.

Such an argument certainly demonstrates our limited understanding of the world, but it also emphasizes the ideas surrounding human arrogance from Chapter Two. Arguing that humans are a model to which other organisms ought to be compared is problematic. I would argue that this view is a sort of "speciesism," as Peter Singer coined the term, making a parallel with other "isms" like racism and sexism (2009). The idea behind speciesism is that humans control nature and that a "biological commonality entitles us to superior status over those who are not members of our species" (Singer, 2009, p. 572).

When we argue that the human brain is *the* model for which other organisms ought to be compared we are demonstrating this sort of attitude. Similarly, putting the scientific arguments aside, it should be noted that we often limit moral considerability to those who we view as "cute and cuddly" or those who are most like us. This sort of attitude certainly supports a sort of hierarchy that is related to speciesism, putting organisms like fish, reptiles, amphibians, and other animals at the bottom of the hierarchy because we cannot easily compare these animals to humans.

If we recognize the problems with a speciesist approach we may be able to accept that there may be validity in the arguments made in support of the capacity for fish to feel pain. We may recognize that comparing all other living creatures to humans and requiring those creatures to be similar to humans in order to even consider the possibility that they can be conscious beings is not only speciesist, but it suggests that we know what it is like to be another animal.

Should We Eat Farmed Fish?

As stated above, farmed fish are often crowded into pens in what is essentially an underwater concentrated animal feeding operation (CAFO). Just as on any other CAFO, overcrowding is a form of neglect that causes stress and many forms of pain or suffering. As Foer mentioned, fish living in these conditions often become cannibalistic, suffer from large infestations of sea lice, and are not protected by humane laws.

If we are to accept that there is good reason to believe that fish have a conscious ability to feel pain and that this is enough to grant moral status, what are the implications for marine aquaculture?

An obvious solution is that ocean-based fish farms ought to raise fewer fish per pen, which would reduce the incidence of cannibalism and sea lice. Decreasing the concentration of fish within a pen would certainly reduce suffering, but this solution fails to consider the value placed on system efficiency. Decreasing the number of fish in a pen will mean a loss of profit; for more pens will have to be built and cared for in order to raise the same number of fish. Unfortunately, this is not a solution that is likely to be considered favorable by the industry.

Another problem raised by this suggestion is how far our moral obligation to the welfare of fish extends. If fish have moral status, can fish farming, or any form of fishing, ever be ethical? It is important to remember that moral status in the way we have defined it does not *necessarily* mean protection from harm. Warren states:

> It is to be an entity towards which moral agents have, or *can* have, moral obligations. If an entity has moral status, then we may not treat it just in any way we please; we are morally obliged to give *weight in our deliberations* to its needs, interests, or well-being [emphasis added] (1998, p. 3).

Thus, having moral status implies moral obligation in recognition of the significance of an organism's needs in their own right, but that obligation is not always clear. The way moral status has been defined quite clearly means that we must give serious consideration to the needs and wellbeing of those to which we grant moral status. Does this obligation require a commitment to veganism or—at the very least—a fish-free diet? I am not sure that there is a right answer to this question. It may be that the decision is left up to the moral actor, who has to weigh the moral status of a fish with the value or benefit of eating fish.

As a vegetarian, I believe that the welfare of fish is more important than my desire to eat them. I agree with Foer when he says that every fish consumed by humans has suffered. Simply removing a fish from the water is a form of suffering since it limits the fish's ability to breathe. Because fish are not protected by humane laws, they can be legally tossed fully conscious onto an ice slurry, where it can take up to 14 minutes for them to die (Foer, 2009, p.189).

I also acknowledge that there is a biological or evolutionary justification for eating fish. Humans are natural omnivores, so it is only natural for humans to consume meat. As a part of Nature, we take part in natural predator and prey relations. However, because humans are also moral agents they must consider the ethical implications of their food choices. If pain grants a food animal moral status then people have a responsibility to decrease suffering to the best of their ability. The only way for a person to prevent his or her diet from inflicting pain on animals, of course, is by becoming a vegan. While adopting a vegan diet is certainly better for the environment and animals, there are always going to be consequences of the foods we eat. Vegans may be able to reduce their environmental impact and eliminate the need for treating animals as a means to human ends, but their diet still has consequences for human populations (see preceding chapter). Thus, because our food choices will never be without consequence, it does not seem as though veganism is the only option.

Of course, this means that one cannot justifiably support a system of rearing food that causes a great amount of suffering. One cannot justify eating fish that have been crowded into tanks, have been forced to live in high concentrations of their own waste, have been attacked by sea lice, and have died a miserable or prolonged death. Eating fish raised in such conditions not only ignores the moral status of fish, but it ignores the moral agency that we hold in such high esteem as a part of being human. It seems, then, that we are forced to accept that eating fish raised in industrialized marine aquaculture pens is unethical until we change the system to significantly decrease suffering.

Chapter 5: Are There Ethical Alternatives?

By now it is clear that marine aquaculture is unethical in its current form. Recognizing both anthropocentric and nonanthropocentric values in Nature, and human reliance on the natural world, we are better able to appreciate the importance of environmental sustainability. Unlike the aquaculture industry and its supporters would have us believe, marine aquaculture has proven to be unsustainable. We have seen that the overcrowding of fish in ocean-based pens causes a variety of environmental impacts including the spread of diseases, contamination of ocean habitats, and continued pressure on already threatened fisheries. These impacts threaten the long-term sustainability of global fish populations and healthy ocean environments, both of which have direct implications for terrestrial ecosystems.

Marine aquaculture also restricts human autonomy, threatens human wellbeing, and leads to environmental justice issues on a global scale. If "Frankenfish" are approved for sale in the United States, where genetically modified organisms do not have to be labeled, consumers could be exposed to potential health risks or could be contributing to major environmental changes without even knowing it. Consumer autonomy and wellbeing is further threatened by mislabeled fish, leading consumers to believe that they are eating much healthier wild fish when in fact they are eating mislabeled fish from farms. Consumers and producers are also unaware of—or uninformed about—the risks of antibiotics used to treat fish in overcrowded pens, which have the potential to lead to antibiotic resistance and chronic health problems in humans. Finally, both because of newly recognized health benefits of eating fish a primary source of protein and because marine aquaculture is marketed as the sustainable solution to overfishing, many consumers in developed nations are doubling demand for farmed fish, giving rise to concerns about food security in developing coastal nations that cannot catch enough fish to sustain healthy human populations.

Lastly, despite the fact that scientists have demonstrated that we have reason to believe that fish are capable of experiencing conscious pain and even emotions (i.e. fear and stress), fish farmers fail to grant moral status to fish, overcrowding them in pens and subjecting them to a life plagued with disease and/or sea lice, followed by painful and often prolonged deaths.

Is There A Solution?

The image of marine aquaculture that I have provided is not one that leaves us with much hope. When one attempts to fulfill all of his or her moral obligations to the natural environment, humans, and fish it does not seem as though there is any realistic option that can meet all three requirements. While we may be able to satisfactorily fulfill one or two obligations, obligations to the other(s) are left unfulfilled. This will become obvious in my discussion of potentially *better* alternatives to marine aquaculture that I recommend below.

As stated in the concluding section of Chapter Four, an obligation to eliminate the pain and suffering of the animals we eat seems to require one to adopt a vegan diet. Yet, I also stated that vegan diets may only *reduce* environmental impacts and eliminate the suffering of food animals. A vegan diet is not necessarily sustainable, nor does a vegan diet eliminate the consequences for humans around the planet.

Vegan diets may eliminate the impact of fish farms and terrestrial animal agriculture from their diets, but a diet of fruits, grains, and vegetables is not necessarily sustainable. Industrial agriculture uses large amounts of chemical fertilizers and pesticides, both of which lead to serious consequences for the natural environment and human health. As explained in Chapter One, runoff from industrial agriculture results in high concentrations of nutrients in streams, rivers, and oceans resulting in eutrophication, and over time, dead zones.

Unless a vegan can grow all of the nutrients he or she needs in a small organic garden or on a nearby farm, vegans will have to buy food and/or nutritional supplements from grocery or health food stores. These stores sell ingredients year-round (e.g. pineapple) that you can only consume by importing from across the country or overseas. One example of the impact a vegan diet can have on people across the globe can be seen with the much-loved vegan meat substitute: quinoa. Replacing meat with this nutritious grain, grown in Peru, became so popular that the appetite of developed nations "pushed up prices to such an extent that poorer people in Peru and Bolivia, for whom it was once a nourishing staple food, can no longer afford to eat it. Imported junk food is cheaper" (Blythman, 2013). Thus, while a vegan diet is a better solution than the current practices associated with marine aquaculture, and it may eliminate the need to inflict pain on animals that a vegetarian or omnivorous diet does not, it still fails to fulfill obligations to the natural environment and humans.

Another solution that could be said to be better than intensive marine aquaculture is another form of fish farming: aquaponics. Unlike aquaculture, aquaponics is a system of rearing fish in enclosed (often indoor) systems that utilize fish waste to grow plants and fish for human consumption. Properly designed systems are nearly closed loop, though they usually require small inputs such as electricity, water, and/or fish feed. However, the efficiency of these systems can be improved by using dehumidifiers to capture water from the air and using that water to maintain water levels in fish tanks. Inedible plant material can also be turned into compost used to raise worms that can be fed to the fish.

While these systems are prized for their model of sustainability, aquaponics does not offer the perfect solution, either. Small-scale aquaponics operations have the potential to be a great solution, but when we consider the necessity of meeting global demands for fish, small-scale operations may no longer be a viable option.

Of course, just as in marine aquaculture, we can probably expect developing nations to invest in aquaponics technologies, exporting fish to the United States, the United Kingdom, and Japan. While this would potentially solve the overfishing problem, or at least reduce the stress on ocean environments, it would not solve the justice issues associated with a system in which the poor feed the wealthy. Additionally, in order to increase efficiency and meet the growing demand for seafood, fish would not only continue to be killed, but they would also continue to be genetically modified and crammed into systems in order to increase productivity. Because fish waste is ultimately helping plant production in this cyclical system, generally, the more fish waste you have the more plant life you can support, providing another incentive to dismiss the wellbeing of fish.

A third, and in my opinion, the best solution, is sustainable wild fisheries. Because recommendations for sustainable yields are often ignored by regulators and fishermen, as in the case of the Atlantic Bluefin Tuna described in Chapter One, quotas remain too high. If regulations are strengthened with sustainability and the natural environment in mind, it is conceivable that, eventually, wild fisheries could be managed successfully. For example, proposed sustainable, ecosystem-based fisheries in Alaska include precautionary and conservative catch limits, limits on bycatch and discards, marine protected areas to maintain adequate habitat for healthy fish populations, protection of popular prey species for mammals

and seabirds, comprehensive monitoring and regulation, and public participation (Witherell, Pautzke, & Fluharty, 2000).

Not only could such a model prove to be environmentally sustainable, such operations could protect both fish and humans (though admittedly, not perfectly). If fish populations are given time to recover and are then managed successfully, people in developing nations would no longer have to worry as much about food security or exploitation by biotechnology industries. Additionally, eating more wild fish would decrease the cause for concern about GMOs, the use of antibiotics, and resulting consequences for human wellbeing and autonomy.

While fish would still die for human consumption—and probably just as painfully—it is important to remember that because veganism does not satisfy our moral obligations to the natural environment or humans, we are not obligated to adopt a vegan diet. A benefit to consuming wild fish, as opposed to farmed fish, is that while farmed fish may lead lives full of suffering only to reach a painful end, wild fish live freely and, presumably, free from human-induced pain until they are captured and killed (Foer, 2009). Therefore, eating wild fish may not eliminate suffering, but it certainly reduces overall suffering endured by these animals.

Perhaps what is most important to all three of these better alternatives to marine aquaculture is also the most challenging obstacle to overcome. Each of these alternatives: veganism, aquaponics, and sustainable fisheries, can only work if we have the will power to modify our behavior. Unfortunately, changing our behavior proves to be one of the most difficult things we can ask of ourselves. We can be presented with alarming information, heartbreaking photographs, or even experience difficult situations first-hand, yet we still cannot break old habits or change our ways. For instance, many environmentalists know that animal agriculture, specifically raising cattle, is one of the largest contributors of methane on the planet – a greenhouse gas much worse than CO_2. Despite being well aware of this information, many environmentalists still cannot or will not stop eating beef. Unless we are willing to change our behavior to decrease personal consumption of fish, it is unlikely that these better alternatives will be realized.

While I wish that I could end this project more optimistically, the truth is that there is no clear solution to the problems that I have described, nor will I pretend to have the answers. I

hope that my ethical analysis, at the very least, has sparked a much needed debate about fish farming and the many urgent threats facing the oceans today.

Jonathan Safran Foer said it best: “Whether we change our lives or do nothing, we have responded. To do nothing is to do something” (2009, p. 38). I hope that you find it within you to respond, to consider the impact of the fish on your plate the next time you take a bite, and act accordingly.

References

Amin, S. (2006). Eurocentrism. In P. S. Rothenberg (Ed.), *Beyond borders: Thinking critically about global issues* (pp. 97-99). United States of America: Worth Publishers.

Aquinas, T. (2010). Humans as moral ends. In D. R. Keller (Ed.), *Environmental ethics: The big questions* (pp. 63-64). Chichester, West Sussex, UK: Blackwell Publishing.

Atta-Mills, J., Alder, J., & Rashid Sumaila, U. (2004). The decline of a regional fishing nation: The case of ghana and west africa. *Natural Resources Forum, , 28*(1) 13-21.

Blythman, J. (2013). Can vegans stomach the unpalatable truth about quinoa? *The Guardian.*

Boone, C. G., & Modarres, A. (1999). Creating a toxic neighborhood in los angeles county. *Urban Affairs Review, 35*(2), 163.

Botsford, L. W., Castilla, J. C., & Peterson, C. H. (1997). The management of fisheries and marine ecosystems. *Science, 277*(5325), 509-515.

Braithwaite, V. (2010). *Do fish feel pain?* OUP Oxford.

Brander, K. M. (2007). Global fish production and climate change. *Proceedings of the National Academy of Sciences, 104*(50), 19709-19714.

Brashares, J. S., Arcese, P., Sam, M. K., Coppolillo, P. B., Sinclair, A. R., & Balmford, A. (2004). Bushmeat hunting, wildlife declines, and fish supply in west africa.*Science, 306*(5699), 1180-1183.

Bruge´re, C., & Lidler, N. (2004). Global aquaculture outlook in the next decades: An analysis of national aquaculture production forecasts to 2030. FAO Fisheries Circular No. 1001: 1–48. (ftp://ftp.fao.org/docrep/fao/007/y5648e/y5648e00.pdf).

Brundtland, G. H. (1987). World commission on environment and development. *Our Common Future*, 8-9.

Burros, M. (2005). Stores say wild salmon, but tests say farm bred. *New York Times, 10*

Cavanagh, J., & Mander, J. (2004). *Alternatives to economic globalization: A better world is possible* Berrett-Koehler Publishers.

Chandroo, K., Duncan, I., & Moccia, R. (2004). Can fish suffer?: Perspectives on sentience, pain, fear and stress. *Applied Animal Behaviour Science, 86*(3), 225-250.

Clover, C. (2008). *The end of the line: How overfishing is changing the world and what we eat*. Los Angeles: University of California Press.

Descartes, R. (2010). Nonhumans as machines. In D. R. Keller (Ed.), *Environmental ethics: The big questions* (pp. 69-72). Chichester, West Sussex, UK: Blackwell Publishing.

DesJardins, J. R. (2006). *Environmental ethics: An introduction to environmental philosophy* (4th ed.). Boston, MA: Wadsworth, Cengage Learning.

Diaz, R. J., & Rosenberg, R. (2008). Spreading dead zones and consequences for marine ecosystems. *Science, 321*(5891), 926-929.

Dulvy, N. K., Sadovy, Y., & Reynolds, J. D. (2003). Extinction vulnerability in marine populations. *Fish and Fisheries, 4*(1), 25-64.

Edelman, G. M., & Tononi, G. (2000). *A universe of consciousness: How matter becomes imagination* Basic Books (AZ).

Economist, The. (2003). Special Report: The promise of a blue revolution – Fish farming. The Economist, 368(8336): 20–23.

Ehrenfeld, D. W. (1981). *The arrogance of humanism* Oxford University Press, USA.

Fleming I.A., Hindar K, Mjolnerod I, Jonsson B, Balstad T, Lamberg A. (2000). Lifetime success and interactions of farm salmon invading a natural population. *Proceedings: Biological Sciences,* 267, 1517–1523.

Foer, J. S. (2009). *Eating animals*. New York: Back Bay Books.

Food and Agriculture Organization of the United Nations, Rome (FAO). (2007). The state of world fisheries and aquaculture 2006, Rome, pp. 1–180. (ftp://ftp.fao.org/docrep/fao/009/a0699e/a0699e.pdf).

Food Ethics Council. (2010). Ethical matrix. Retrieved from http://www.foodethicscouncil.org/system/files/Ethical%20Matrix_1.pdf

Fox, H. E., White, S. A., Kao, M. H., & Fernald, R. D. (1997). Stress and dominance in a social fish. *The Journal of Neuroscience, 17*(16), 6463-6469.

Fox, W. (2003). Deep ecology: A new philosophy of our time? In A. Light, & H. I. Rolston (Eds.), *Environmental ethics: An anthology* (pp. 252-261). Malden, MA: Blackwell Publishing.

Hardin, G. (2010). The ecological necessity of confronting the problem of human overpopulation. In D. R. Keller (Ed.), *Environmental ethics: The big questions* (pp. 434-442). West Sussex, UK: Blackwell Publishing Ltd.

Hoegh-Guldberg, O., Mumby, P., Hooten, A., Steneck, R., Greenfield, P., Gomez, E., Caldeira, K. (2007). Coral reefs under rapid climate change and ocean acidification. *Science, 318*(5857), 1737-1742.

Hoshaw, L. (2009). Afloat in the ocean, expanding islands of trash. *New York Times, 9*

Islam, M. S., & Wahab, M. A. (2005). A review on the present status and management of mangrove wetland habitat resources in bangladesh with emphasis on mangrove fisheries and aquaculture. *Aquatic biodiversity II* (pp. 165-190) Springer.

Jacquet, J. L., & Pauly, D. (2008). Trade secrets: Renaming and mislabeling of seafood. *Marine Policy, 32*(3), 309-318.

Jones, O., Voulvoulis, N., & Lester, J. (2004). Potential ecological and human health risks associated with the presence of pharmaceutically active compounds in the aquatic environment. *Critical Reviews in Toxicology, 34*(4), 335-350.

Kent, G. (1997). Fisheries, food security, and the poor. *Food Policy, 22*(5), 393-404.

Kötter, R., & Meyer, N. (1992). The limbic system: A review of its empirical foundation. *Behavioural Brain Research, 52*(2), 105-127.

Krkošek, M., Lewis, M. A., Morton, A., Frazer, L. N., & Volpe, J. P. (2006). Epizootics of wild fish induced by farm fish. *Proceedings of the National Academy of Sciences, 103*(42), 15506-15510.

Locke, J. (2010). Nature as economic resource. In D. R. Keller (Ed.), *Environmental ethics: The big questions* (pp. 77-81). Chichester, West Sussex, UK: Blackwell Publishing.

Maclean, N. (2003). Genetically modified fish and their effects on food quality and human health and nutrition. *Trends in Food Science & Technology, 14*(5-8), 242-252.

Mansfield, B. (2004). Organic views of nature: The debate over organic certification for aquatic animals. *Sociologia Ruralis, 44*(2), 216-232.

Mansfield, B. (2011). Is fish health food or poison? farmed fish and the material production of Un/Healthy nature*. *Antipode, 43*(2), 413-434. doi: 10.1111/j.1467-8330.2010.00743.x

McGregor, P. K., Peake, T. M., & Lampe, H. M. (2001). Fighting fish betta splendens extract relative information from apparent interactions: What happens when what you see is not what you get. *Animal Behaviour, 62*(6), 1059-1065.

Mepham, B. (2000). A framework for the ethical analysis of novel foods: The ethical matrix. *Journal of Agricultural and Environmental Ethics, 12*(2), 165-176.

Mill, J. S. (2010). The amoral status of nature. In D. R. Keller (Ed.), *Environmental ethics: The big questions* (pp. 73-77). Chichester, West Sussex, UK: Blackwell Publishing.

Mills, C. W. (1997). *The racial contract* Cornell University Press.

Myers, R. A., & Worm, B. (2005). Extinction, survival or recovery of large predatory fishes. *Philosophical Transactions of the Royal Society B: Biological Sciences,360*(1453), 13-20.

Nagel, T. (1989). *The view from nowhere* Oxford University Press, USA.

Nagel, T. (1974). What is it like to be a bat? *The Philosophical Review, 83*(4), 435-450.

National Oceanic and Atmospheric Administration. (2011). Endangered species listing for atlantic bluefin tuna not warranted: Agency remains concerned; will revisit decision with new science. Retrieved, 2013, from http://www.noaanews.noaa.gov/stories2011/20110527_bluefintuna.html

National Oceanic and Atmospheric Administration Fisheries. (2012). Making the case for U.S. aquaculture. Retrieved, 2013, fromhttp://www.nmfs.noaa.gov/aquaculture/homepage_stories/aquaculture_video.html

Naylor, R., Hindar, K., Fleming, I. A., Goldburg, R., Williams, S., Volpe, J., . . . Mangel, M. (2005). Fugitive salmon: Assessing the risks of escaped fish from net-pen aquaculture. *Bioscience, 55*(5), 427-437.

Naylor, R. L., Goldburg, R. J., Primavera, J. H., Kautsky, N., Beveridge, M. C. M., Clay, J., Troell, M. (2000). Effect of aquaculture on world fish supplies. *Nature,405*(6790), 1017-1024.

Nieuwenhuys, R., Donkelaar, H. J., & Nicholson, C. (1998). *The central nervous system of vertebrates* Springer Verlag.

Nixon, S. W. (1995). Coastal marine eutrophication: A definition, social causes, and future concerns. *Ophelia, 41*(1), 199-219.

Nussbaum, M. C. (2011). *Creating capabilities: The human development approach* Belknap Press.

Odling-Smee, L., & Braithwaite, V. A. (2003). The role of learning in fish orientation. *Fish and Fisheries, 4*(3), 235-246.

Oksanen, M. (1997). The moral value of biodiversity. *Ambio,* 541-545.

Oliveira, R. F., McGregor, P. K., & Latruffe, C. (1998). Know thine enemy: Fighting fish gather information from observing conspecific interactions. *Proceedings of the Royal Society of London.Series B: Biological Sciences, 265*(1401), 1045-1049.

Orr, J. C., Fabry, V. J., Aumont, O., Bopp, L., Doney, S. C., Feely, R. A., Joos, F. (2005). Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms. *Nature, 437*(7059), 681-686.

Owen, J. (2006). Dolphins name themselves with whistles, study says. *National Geographic News*

Palmer, C. (2010). *Animal ethics in context*. New York: Columbia University Press.

Passmore, J. (1975). The treatment of animals. *Journal of the History of Ideas, 36*(2), 195-218.

Pillay, T. (1992). *Aquaculture and the environment* Wiley Online Library.

Portavella, M., Vargas, J., Torres, B., & Salas, C. (2002). The effects of telencephalic pallial lesions on spatial, temporal, and emotional learning in goldfish. *Brain Research Bulletin.*

Primavera, J. H. (2006). Overcoming the impacts of aquaculture on the coastal zone. *Ocean & Coastal Management, 49*(9–10), 531-545. doi: 10.1016/j.ocecoaman.2006.06.018

Roberts, C. M., & Hawkins, J. P. (1999). Extinction risk in the sea. *Trends in Ecology & Evolution, 14*(6), 241-246.

Rose, J. D. (2002). The neurobehavioral nature of fishes and the question of awareness and pain. *Reviews in Fisheries Science, 10*(1), 1-38.

Roughan, J. V., & Flecknell, P. A. (2001). Behavioural effects of laparotomy and analgesic effects of ketoprofen and carprofen in rats. *Pain, 90*(1), 65-74.

Rowland, I. R. (2002). Genetically modified foods, science, consumers and the media. *The Proceedings of the Nutrition Society, 61*(1), 25-9. doi: http://dx.doi.org/10.1079/PNS2001135

Safina, C. (1993). Bluefin tuna in the west atlantic: Negligent management and the making of an endangered species. *Conservation Biology, 7*(2), 229-234.

Safina, C., & Klinger, D. H. (2008). Collapse of bluefin tuna in the western atlantic. *Conservation Biology, 22*(2), 243-246.

Saito, K., & Watanabe, S. (2010). Experimental analysis of spatial learning in goldfish. *The Psychological Record, 55*(4), 9.

Sapkota, A. R., Kucharski, M., Burke, J., McKenzie, S., Walker, P., & Lawrence, R. (2008). Aquaculture practices and potential human health risks: Current knowledge and future priorities.*Environment International, 34*(8), 1215-1226.

Scherer, D. (2003). The ethics of sustainable resources. In A. Light, & H. I. Rolston (Eds.), *Environmental ethics: An anthology* (pp. 334-358). Malden, MA: Blackwell Publishing Ltd.

Schultz, P. W., Zelezny, L., & Dalrymple, N. J. (2000). A multinational perspective on the relation between judeo-christian religious beliefs and attitudes of environmental concern. *Environment and Behavior, 32*(4), 576-591.

Sen, A. K. (1999). *Development as freedom* Oxford University Press.

Sheppard, C. (1995). The shifting baseline syndrome. *Marine Pollution Bulletin, 30*(12), 766-767.

Singer, P. (1975). Animal liberation: A new ethics for our treatment of animals,(NY) new york review.

Singer, P., & Mason, J. (2006). *The ethics of what we eat*. United States: Rodale, Inc.

Singer, P. (2009). Speciesism and moral status. *Metaphilosophy, 40*(3-4), 567-581.

Smith, M. D., Roheim, C. A., Crowder, L. B., Halpern, B. S., Turnipseed, M., Anderson, J. L., Khan, A. (2010). Sustainability and global seafood. *Science,327*(5967), 784-786.

Sneddon, L. U. (2003). The evidence for pain in fish: The use of morphine as an analgesic. *Applied Animal Behaviour Science, 83*(2), 153-162.

Sylvan, R. (. (2003). Is there a need for a new, an environmental, ethic? In A. Light, & H. I. Rolston (Eds.), *Environmental ethics: An anthology* (pp. 47-52). Malden, MA: Blackwell Publishing.

Taylor, P. W. (2003). The ethics of respect for nature. In A. Light, & H. I. Rolston (Eds.), *Environmental ethics: An anthology* (pp. 74-84). Malden, MA: Blackwell Publishing.

Topál, J., & Csányi, V. (1999). Interactive learning in the paradise fish (macropodus opercularis): An ethological interpretation of the second-order conditioning paradigm. *Animal Cognition, 2*(4), 197-206.

Warren, M. A. (1998). *Moral status: Obligations to persons and other living things* Oxford University Press, USA.

Welty, J. (2007). Humane slaughter laws. *Law and Contemporary Problems, 70*(1), 175-206.

Witherell, D., Pautzke, C., & Fluharty, D. (2000). An ecosystem-based approach for alaska groundfish fisheries. *ICES Journal of Marine Science: Journal Du Conseil, 57*(3), 771-777.

Zimmer, C. (2013) Bringing them back to life: The revival of an extinct species is no longer a fantasy. but is it a good idea? *National Geographic Magazine.*