Awesome Student

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CAPS 401

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Deadly Blooms: Epidemiologist

Abstract

As an epidemiologist apart of the Food Safety and Inspection service in the Department of agriculture, making sure the environment is in optimal condition for wildlife and consumption is the upmost priority. It has been brought to the attention of the department of agriculture that BMAA is being found in ocean life. BMAA has raised concern because it has been linked as one of the possible causes for neurological disorders such as Alzheimer’s (McAuliffe, 2011). After months of investigation, man-made manure lagoons are being manufactured because of an overabundance of animal waste from factory farming (Farm sanctuary, 2107). Man made manure lagoons are the biggest contributing factor to the overabundance of heavy metals in the water supply (Grace, 2017). Therefor, creating conditions where excess nitrogen and phosphorus leaches from the farm fields into nearby waterways (Farm sanctuary, 2017). These chemicals encourage the overgrowth of algae while also depriving marine lifefrom oxygen, and humans with potential health risks (Lutz, 2015). The EPA’s Regulations are that 10mg/l or less of nitrogen and phosphorus are the legal amount permitted in drinking water (USGS, 2017). Being that manure lagoons contains sevaral tons of waste it can be assumed that more than the legal amount can leach into nearby waterways.

However, using revolutionary methods of experimentation, investigations were conducted to seehow nitrogen and phosphorus in manure encouraged the growth of these blooms through a series of tests. Petri dishes were used to measure the rate at which the algae blooms gro?”w with and without added nutrients, and exactly what amount of nutrients needs to be introduced to water to accelerate algae bloom growth. Being that the perti dishes with added nurtients grew at a rate of 4.8 more squares than the preti dishes without added nutrients it was decided to perform the experiment on larger amounts of water (tanks), and the effects of the chemicals on living things. All life introduced to the tanks with added nutrients died in two weeks versus living species in tanks without added nutrients whichhad a survival rate of 98%. The fish were thentested for BMAA using the ELISA test. After careful measurements taken, the fish with the added nutrients showed much higher levels of toxins than the fish without added nutrients. Because of this experiment, proper legislation must be made to control the overabundance of chemicals that are being expelled into the enviornment by factory farming.

Literature Review

Factory farming is a growing problem and concern due to all of the negative affects it has on the enviornment. In the late 1970’s through the 1980’s the first giant factory farms appeared for egg production, dairy, and beef (Factory farming, 2017). One of the biggest factories at the time was in california with over three million chickens. However, due to the chickens aquiring a disease from being so closely confined they had to be terminated (Factory farming, 2017). This was only a minor setback for aspiring mass producers, so in a short period of time factory farms were opening across the nation producing eggs, beef, pork and dairy. These factory farms happened so quickly that the enviornemnt was not taken into consideration when forming regulations for these factories. Now we are faced with detrimental consequences that must be dealt with accordingly.

Factory farming has a lot to do with, if not everything to do with, algae bloom overgrowth.About 11billion land animals in the United States are raised for dairy, meat, and eggs each year today (AWFW, 2016). The animal that is farmed the most in the United States is the chicken coming in at 9.5 billion that are farmed every year for their meat and eggs, followed by pigs at 120 million and cattle at about 39 million (AWFW, 2016). The demand for these animals is extensively high and skyrocketing especially because of fast food restaurants such as McDonalds. Back then in the 1900’s chickens weren’t even used for their meat, just their eggs because chicken meat was very expensive (Factory farming, 2017). Now in modern day’s fast food places have forced these factory farms to increase the amount of livestock to supply the demand and therefor, producing more manure. Manure expelled from these animals contains very high traces of salt and heavy metals which end up in bodies of water and accumulate in the sediment (Harmful algal blooms, 2017). When manure is repeatedly overapplied to farmland it causes dangerous levels of phosphorus and nitrogen in the water supply (Factory farm map, 2017). In such excessive amounts, nitrogen robs water of oxygen and destroys aquatic life. This is why the increase in demand for consumption of these animals only increases the amount of waste produced, therefore, skyrocketing the already overabundance of nutrients like nitrogen and phosphorus.

The US Department of Agriculture estimates that confined farm animals generate more than 335 million ton’s of manure annually, 3 times more raw waste than generated by Americans (Grace, 2017).These are obscene amounts of manure that are not being handled with properly. Usually, normal family farms with plenty of land will use animal waste to fertilize their fields and add essential nutrients. However, Factory farms attempt to dispose of massive quantities of animal manure into limited amounts of land. Anything that does not get recycled onto the land is left untreated and dumped into gigantic, open air, man made lagoonswhere it is left until it can be spread onto other fields (Grace, 2017). This leaves the air and neighboring waters exposed to these high levels of pollutants. Even though smaller farms would normally spread the waste onto their fields as fertilizer, the problem is not so much the action of spreading the waste but more so the quantity that these factory farms produce. Spreading these extensive amounts of manure is what often leads to runoffs into the waterways by leaching through the groundwater and contaminating neighborhood wells (Grace, 2017). This renders the water unsafe for animals and humans.

The resulting overload of nutrients because of water runoffs causes rapid algae growth (St. johns river, 2017). Normal green algae are consumed by fish and are good for the environment because they are microscopic plants whom take fish waste (nitrogen and CO2) and convert it into oxygen through photosynthesis (Lutz, 2006). However, the algae that are produced by factory farms are blue-green algae that are on a high phosphorus and nitrogen diet.Instead of producing oxygen, they deplete the water of oxygen when they die, which in turn, kills large numbers of fish called fish kills, and aquatic life (Lutz, 2006). Though blue green algae produce oxygen through photosynthesis, they also deplete the water of oxygen when they die and decompose through cellular respiration (Lutz, 2016). When these factory farms excrete such massive amounts of nitrogen and phosphorus this causes an increase in the production of blue green algae, which then depletes aquatic life from much needed oxygen. However,some of these algae blooms not only deplete oxygen but they can also be highly toxic (Harmful algal blooms, 2016). Even though it is still unknown what exactly triggers toxin production, it is known that factory farming is a major contributor to blue-green algae overgrowth, therefore, increasing the risk of toxin production.

Blue green algae growth is accelerated when there are high levels of nitrogen and phosphorus but there are also other contributors such as: warm weather, calm waters, and abundant sunlight (Florida department of environmental protection, 2017). Making this type of algae more predominant in places like Florida in bodies of water with low flow and turbulence like rivers, lakes, dams and water storages. Blue-green algae can heavily increase with high amounts of nutrients where they produce “blooms” that look like carpets floating over the top of water (Florida department of environmental protection, 2017). These blue green algae’s can last days, weeks, or even months depending on the conditions (Florida department of environmental protection, 2017). These floating green carpets block direct sunlight, which feed other plants and fish (Florida department of environmental protection, 2017). In addition to the depleted oxygen created by decomposition of these blooms, other plants now cannot form oxygen through photosynthesis because of lack of sunlight.

Due to the possible secretion of neurotoxins from these algae, not only do they kill aquatic life but they can also be very harmful to humans. Because of this, Florida governor Rick Scott has declared a state of emergency (Scott, 2016). The Algal bloom that was the reason for the state of emergency, formed in lake Okeechobee do to run off from nearby factory farms (Scott, 2016). Unlike natural farms where animals roam free and have more space to defecate, factory farms have animals confined to very small quarters where the factory must remove wastes by the truckload. This excessive amount of manure and nutrients causes the overgrowth of algae blooms that are especially toxic to humans if they come into contact with it. If humans come into contact with these algae they can develop skin irritations, short-term memory loss and other cognitive problems in local people (Good, 2015). Human health can also be impacted by manure when it is transported into drinking water sources, which can result in the fatal blue baby syndrome in pregnant woman (Good, 2015). However, an especially harmful toxin called BMAA (B-N-methylamino-L-Alanine) is being excreted by these algae blooms and has been linked to certain neurodegenerative disease such as Alzheimer’s (McAuliffe, 2011), and even though all ocean life can contain traces of BMAA it is more common to be exposed to the toxin through consumption of seafood such as mussels (Jiang et. al, 2014). A blue mussel (*Mytilus edulis*) or oyster (*Ostrea edulis* or *Crassostreagigas*) has a typical shell length of 5 cm that can filter water-containing algae at a rate of around 3–6 liters per hour (Jiang et. al, 2014). Their filter-feeding life style means they may have a large intake of algae, and thus are capable of accumulating toxic substances produced by algae, and in most cases including BMAA.

From factory farming to Alzheimer’s, it is a long chain of events. Existing information can link this exponential algae bloom overgrowth to factory farming. With the information gathered a series of experiments testing exactly what amounts of nitrogen and phosphorus will affect the growth of algae and ecosystem destruction can now be conducted.

Materials and Methods

Even though algae blooms are a natural phenomenon, the rate at which the blooms are presently growing is cause for concern. If the oxygen in the water is depleted enough, the environment can no longer support marine life, causing a hypoxic zone or dead zone (National ocean service, 2014). The United Nations also reported that, “the amount of dead zones around the world has doubled every ten years since 1960” (Science in the news, 2008, ¶ 9).

After much consideration on the basis of how algae blooms can negatively affect the environment and the potential public health risk, an experiment was conducted to investigate the effects of nitrogen and phosphorus on algae growth. It was predicted that the overabundance of nutrients would have an effect on algae overgrowth, and because algae is more predominant in warmer climates the experiment was conducted using water from Lake Okeechobee in Florida. Lake Okeechobee spans 730 square miles, and samples were taken from where the most algae growth was reported (Hoffman, 2003). The most abundant blue-green algae growth was reported from the inlet of port St. Lucie where it trails back to Lake Okeechobee (Dewey, 2016).

In late May where the temperature is fairly warm, a fine, mesh, net, and 5 gallon buckets were used to collect a sum of 20 gallons of lake water and algae. Once in the lab, a series of tests were conducted using 48 petri dishes over a span of a month. Every week 12 new petri dishes were used where six of them had no added nutrients and six had nitrogen and phosphorus added to them. An experiment conducted on the diet of pigs and how much nitrogen and phosphorus is excreted daily through their manure showed that an average of 30g of nitrogen and 6g of phosphorus are being excreted through pig waste daily (Jorgensen et. al, 2013). This means that a calculated average of the manure excreted in one day for pigs, taking account that 120 million are processed a year, would mean that 12 million grams of nitrogen and phosphorus are excreted into the environment daily not including other livestock. With these averages the amount of nitrogen and phosphorus introduced in the experiment were calculated.

To begin the experiment 12 petri dishes were added2 ml of lake water (equivalent to 40 drops of water) mixed with 0.2 grams of blue-green algae. The Algae was passed through filter paper so excess water could be removed for a more accurate weight measurement. Once measured the algae was placed on six of the petri dishes and were then closed and set aside while the other six were introduced nitrogen and phosphorus. Using a micro pipet, 0.5 mg of equal amounts of nitrogen and phosphorus were added to the six remaining dishes daily. The nutrients were added daily because as in a natural environment livestock defecate daily. Once all petri dishes were complete an initial measurement of the amount of algae in each petri dish was recorded using a hemocytometer. A hemocytometer is a microscope slide that has tiny etched (1 x 1 mm) squaremarkings on the glass (Grigoryev, 2014). The algae was then measured using a microscope set to 100x magnification, where how much of the specimen fell into each square determined the span of the algae. An average span of four squares for all 12 samples was recorded. The temperature of Lake Okeechobee was also taken into consideration and recorded at 86 degrees Fahrenheit so similar conditions could be made.

Once all dishes were measured they were then placed into an incubator that measured 86 degrees Fahrenheit. After a month of calculations, measurements, and a new set of 12 fresh dishes a week, the average growth of the algae with added nutrients was significantly different than the dishes with no added nutrients. Each slide had an initial average of four squares per dish of algae sample. Using a microscope with a hemocytometer slide, each algae sample was placed under the slide to measure exactly how many more squares the algae grew daily. The average for the dishes with the added nutrients was about 7.3 mm squares per week while the dishes with no added nutrients only grew and average of 2.5 mm squares per week. Clearly after the results of the first experiment, it supported the hypothesis that an overabundance of nutrients does in fact affect the growth of blue-green algae.

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| |  |  |  |  |  | | --- | --- | --- | --- | --- | | Petri Dishes with no added Nutrients | | | | | |  | Week 1  Average | Week 2  Average | Week 3  Average | Week 4  Average | | Petri Dish #1 | 4 mm | 4 mm | 0 mm | 5 mm | | Petri Dish #2 | 2 mm | 3 mm | 1 mm | 1 mm | | Petri Dish #3 | 6 mm | 1 mm | 2 mm | 3 mm | | Petri Dish #4 | 0 mm | 2 mm | 0 mm | 4 mm | | Petri Dish #5 | 5 mm | 0 mm | 1 mm | 2 mm | | Petri Dish #6 | 4 mm | 5 mm | 3 mm | 1 mm | | Average: 2.5 mm (Squares per week) | | | | | | Petri Dishes With added Nutrients (Phosphorus and Nitrogen) | | | | | |  | Week 1 Average | Week 2 Average | Week 3 Average | Week 4 Average | | Petri Dish #1 | 5 mm | 5 mm | 7 mm | 15 mm | | Petri Dish #2 | 5 mm | 1 mm | 2 mm | 2 mm | | Petri Dish #3 | 4 mm | 22 mm | 9 mm | 6 mm | | Petri Dish #4 | 9 mm | 4 mm | 2 mm | 14 mm | | Petri Dish #5 | 13 mm | 8 mm | 5 mm | 2 mm | | Petri Dish #6 | 10 mm | 14 mm | 4 mm | 6 mm | | Average: 7.3 mm (Squares per week) | | | | | |

After the first experiment was conducted, the second experiment went a step further to see how algae affectmarine life such as plants and fish. After a month of exposure to both environments, tests were run on the tissues of the fish to confirm if the algae were expelling toxins. Back in the St. Lucie inlet, new specimens were obtained for further experimentation. The specimens were obtained in much larger quantities using a larger, fine, mesh, net and hoses that pumped water from the lake to a 500 gallon water tank that was tied down to a flatbed truck. Larger quantities of water and algae were obtained in order to create an environment where plants and fish could be placed.

The specimens then arrived to the lab where the water and algae was transferred to ten individual 48x13 inch, 50-gallon, rectangular tanks. Because the water was placed into the tanks with large pressure hoses, this created turbulent, murky, water that took two hours to settle and proper measurements could be taken. Once the water settled, the algae rose to the top of the water like a floating carpet. Measurements were then taken using a meter stick where the average measurement of the floating algae being 22.3 X 4 inches for all tanks. If one tank had more algae than another, a fine mesh net was used to create similar measurements for each tank. After the measurements were taken, five tanks were left alone without any alteration while the other five tanks were added the nutrients nitrogen and phosphorus. As per the prior experiment conducted, the same guidelines were used in respect to parts of water for parts of nutrients. For every 2 ml of water, 0.5 ml of nitrogen and 0.5ml of phosphorus are added. For every 50 gallons of water, there were 12.5 gallons of phosphorus and 12.5 gallons of nitrogen introduced to the tanks daily. Onceall of the required items were added to each tank, a thermometer with a temperature gauge was placed in each tank to maintain the temperature of the water at 86 degrees Fahrenheit. Oxygen levels were also tested to see how fast the oxygen was depleted as the algae died. An average was taken using a DO meter (Dissolved oxygen meter) where 10 mg/l of oxygen was the initial average for all tanks. Plants and bass (a type of fish common to the Okeechobee river) were then added to the created environment to record how they responded to the algae. Lastly, superficial lights over the tops of the tanks were also added to promote photosynthesis to maintain as much of a natural environment as possible.

Every 24hrs measurement of algae growth, and plant/fish activity were observed and recorded. A calculated average was taken every seventh day of the week for all ten tanks. A month of measuring and calculating resulted in an average growth spurt of 5.1 X 2.5 inches larger than initial measurements, and a 2.1 mg/L depletion of oxygen for non-nutrient added tanks. The tanks that did have the added nutrients grew an average of 13.4 X 5.7 inches Larger than initial measurements, and a 7.4 mg/L depletion of oxygen. As for fish activity, the fish that were in non-added nutrient tanks had a 94% survival rate with only partial covering of the top of the tank by the floating algae carpet. The fish in the overabundant nutrient tanks died within two weeks with almost full coverage of algae growth, therefore inhibiting photosynthesis for plant and fish survival. This led to plant death, and caused the fish to feed on the algae. Both tests resulted in significant differences in measurements and environmental destruction

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| Tanks without added nutrients | | | | | |
|  | Inch & mg/l | Week #1 | Week #2 | Week #3 | Week #4 |
| Tank #1 | Growth | 2 x 1 in | 2 x 1.5 in | 3 x 2 in | 3.2 x 2.1 in |
| O2 Levels | 10 mg/l | 9 mg/l | 8 mg/l | 8 mg/l |
| Tank #2 | Growth | 2 x 2 in | 1 x 2.5 in | 2 x 1 in | 3 x 2 in |
| O2 levels | 9 mg/l | 9 mg/l | 9 mg/l | 8 mg/l |
| Tank #3 | Growth | 1 x 1 in | 2 x 1.5 in | 1 x 2 in | 2 x 3 in |
| O2 Levels | 10 mg/l | 7 mg/l | 7 mg/l | 7 mg/l |
| Tank #4 | Growth | 4 x 3 in | 2 x 1 in | 1 x 4 in | 2 x 3 in |
| O2 Levels | 10 mg/l | 4 mg/l | 3 mg/l | 3 mg/l |
| Tank #5 | Growth | 2 x 4 in | 3 x 1 in | 2 x 1 in | 1 x 1 in |
| O2 Levels | 10 mg/l | 9 mg/l | 9 mg/l | 7 mg/l |
| Average growth: 4.12 x 1.2 inches Average O2 Depletion: 2.1 mg/l | | | | | |
| Tanks with added nutrients: Nitrogen and Phosphorus | | | | | |
| Tank #1 | Growth | 8 x 3 in | 12 x 3 in | 7 x 4 in | 8 x 5 in |
| O2 Levels | 9 mg/l | 7 mg/l | 6 mg/l | 5 mg/l |
| Tank #2 | Growth | 5 x 7 in | 16 x 4 in | 7 x 3 in | 6 x 4 in |
| O2 Levels | 8 mg/l | 4 mg/l | 4 mg/l | 3 mg/l |
| Tank #3 | Growth | 15 x 2 in | 9 x 2 in | 10 x 12 in | 4 x 8 in |
| O2 Levels | 7 mg/l | 5 mg/l | 5 mg/l | 4 mg/l |
| Tank #4 | Growth | 10 x 4 in | 8 x 3 in | 11 x 2 in | 5 x 2 in |
| O2 Levels | 8 mg/l | 6 mg/l | 4 mg/l | 3 mg/l |
| Tank #5 | Growth | 4 x 3 in | 5 x 2 in | 14 x 5 in | 13 x 4 in |
| O2 Levels | 8 mg/l | 6 mg/l | 5 mg/l | 5 mg/l |
| Average Growth: 8.85 x 4.2 Average O2 Depletion: 7.4 mg/l | | | | | |

After a month of conducting the experiment and obtaining substantial results, the fish were then tested using a BMAA ELISA test for traces of toxins that were being expelled by blue green algae. After 48 hours the results were obtained and a significant amount of toxins were reported. While the fish that were in the tanks with no added nutrients showed lower levels of toxins than the ones with added nutrients, it still raised concern if humans are exposed to some of these toxins. The fish that were in the tanks with no added nutrients had average levels of 0.094 ug/g of BMAA per tissue, while the fish in the tanks with high levels of nitrogen and phosphorus had average levels of 0.62 ug/g of BMAA/tissue. The experiment resulted in significant findings that should raise concern for all living things including humans.

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| Fish with No added nutrients | | | | |
| Tank # | Bass capture site (02/24,17) | Production mode | preservation method | BMAA/ Tissue  (ug/g). |
| Tank #1 | Lake Okeechobee | Farmed | Raw | 0.12ug/g |
| Tank #2 | Lake Okeechobee | Farmed | Raw | 0.08ug/g |
| Tank #3 | Lake Okeechobee | Farmed | Raw | 0.10ug/g |
| Tank #4 | Lake Okeechobee | Farmed | Raw | 0.15ug/g |
| Tank #5 | Lake Okeechobee | Farmed | Raw | 0.02ug/g |
| Average per month: 0.094 ug/g | | | | |
| Tanks with added Nutrients | | | | |
| Tank #1 | Lake Okeechobee | Farmed | Raw | 0.48ug/g |
| Tank #2 | Lake Okeechobee | Farmed | Raw | 0.60ug/g |
| Tank #3 | Lake Okeechobee | Farmed | Raw | 0.25ug/g |
| Tank #4 | Lake Okeechobee | Farmed | Raw | 0.90ug/g |
| Tank #5 | Lake Okeechobee | Farmed | Raw | 0.85ug/g |
| Average per month: 0.62 ug/g | | | | |

Results

In conducting this series of experiments and tests the results showed how the train of events caused by factory farming runoffs ultimately leads to ecosystem destruction and potential danger to human health. Laws must be made to better regulate how factory farms dispose of the animal waste while also controlling any runoffs. This has grown to be a major health hazard and if not taken care of, will spiral out of control where the possibility of full ecosystem destruction and higher numbers in Alzheimer’s cases can be attained in a matter of a few years.

The experiment revealed that increased levels of nitrogen and phosphorus promote the overgrowth of algae blooms, deplete oxygen levels in water, and traces of the neurotoxin BMAA in fish that were observed. An overabundance of nitrogen and phosphorus has proven through experimentation, it can greatly affect the speed at which algae grow. In the first experiment where petri dishes were used the algae size was measured using a hemocytomer and the average growth spurt for the dishes with no added nutrients grew at a rate of 2.5 squares per week while the dishes with the added nutrients had a growth spurt of 7.3 squares per week. This compelling discovery invoked the interest to take the experiment a step further were larger amounts of water would be added so that conditions for living species could be manufactured. In making these conditions, the effect algae blooms have on the ecosystem could now be observed and recorded.

Many other factors also contributed to the overgrowth of algae such as warmer climates. Algae thrive in a climate where heat and increased levels of nitrogen and phosphorus are provided. In providing these conditions algae blooms span over large bodies of water causing a severe depletion of oxygen for basic ecosystem survival. In the experiment conducted it showed that the added nutrients depleted the oxygen levels seven times lower than the initial recorded amount in a span of a month. This caused complete death of anything living in the tank. The plants died at a quicker pace than the fish because as the algae began to cover the top of the water it did not allow for the plant to receive the artificial light to undergo photosynthesis. Once all plant life died no oxygen or food continued to be provided to the fish, therefore, causing a lower oxygen level and forcing the fish to feed on the algae. The fish eventually suffocated and died as a result of oxygen depletion and malnutrition.

It was also observed that blue-green algae expel the neurotoxin BMAA, after a series of tests were done on the fish exposed to added and non-added nutrient tanks. Even though many more trials must be done to come to the conclusion that the algae blooms excrete BMAA, it can be concluded that an overabundance of these nutrients causes higher levels of BMAA concentrations. The tanks that had no added nutrients had a BMAA average concentration of 0.094 ug/g of tissue, while the tanks with the added nutrients had an average concentration of 0.62 ug/g of fish tissue. Judging by the results one can assume that there is a significant difference between both results. Being that the discovery of the linkage between Alzheimer’s and BMAA is still fairly new, it is still unknown how much of the neurotoxin ultimately causes a neurodegenerative disease.

Conclusion

The experiments conducted by the Department of Agriculture concluded that factory farming contributes to the overabundance of the nutrients, nitrogen and phosphorus. Excessive nitrogen and phosphorus washes into the water bodies due to improper disposal of animal waste such as man made manure lagoons that often span several football fields (Farm sanctuary, 2017). The animals on these farms produce millions of tons of manure a year and without proper disposal, leak into nearby waterways causing accelerated algae growth, and potential health hazard for any human that comes into contact with the algae (Farm sanctuary, 2017). In time as the algae blooms die and deplete the water of oxygen it causes fish kills and ecosystem destruction (Lutz, 2015). As per the experimental results, the tanks with an excessive amount of nitrogen and phosphorus depleted the oxygen levels by 7.4 mg/l less than the original recording in as short as a month with complete death of any life in the tanks.

After discovering the environmental impact of algae blooms on wildlife, the Department of Agriculture conducted a series of tests to determine toxin levels in fish. After several tests on countless fish it was then discovered that the algae blooms expelled several toxins but the most concerning was BMAA. BMAA raised concern because it has been linked to neurodegenerative diseases such as Alzheimer’s (Kraft, 2016). The levels of BMAA recorded in the fish with excess nitrogen and phosphorus was 0.53 ug/g of tissue higher than fish tanks that had no added nutrients. The levels of nitrogen and phosphorus used in the experiment coincide with the amount of nitrogen and phosphorus expelled by livestock in factory farms. Because of this the assumption can be made that the amount of BMAA recorded from the fish in the experiment coincides with the BMAA levels of fish that are exposed to this blue-green algae in a natural setting.

Discovering the linkage between factory farms to BMAA and Alzheimer’s, has led to the significant contribution to the scientific community. Because of this, measures can now be taken to prevent further contamination and what manifests as a result of algae overgrowth. After careful experimentation and analysis by the Department of Agriculture, some legislative changes can be made to ensure environmental and human friendly, farming. Some preventative suggestions include reviewing the EPA’s clean water act and enforcing stricter rules on preventative measures such as: regulating how many animals can be permitted on certain acreage, ceasing the allowance of livestock near any body of water, including BMAA as one of toxins to be measured and monitored, proper revisions of farming regulations every three to five years, and complete termination of man made manure lagoons. These suggestions would be effective in controlling nitrogen and phosphorus from leaching from factory farms into nearby waterways.

The suggestions proposed can control the amount of livestock on factory farms and the amount of waste expelled. By controlling these factors there will be a significant decrease in the amount of waste that leaches into the nearby waterways by the overflowing of manure lagoons. The EPA is in charge of protecting the environment and human health, and by revising their regulations more often and introducing new regulations, a decrease in the frequency of algae blooms will take place (EPA, 2017). Some who oppose the EPA and would like to abolish it are Matt Gaetz, Barry Leudermilk, Thomas Massie, and Steven Palazzo (Zoppo, 2017). In abolishing the EPA there will no longer be an agency dedicated to protecting the environment and human health. Without proper regulatory measures, factory farms will spiral out of control and the outpour of excessive nutrients will leach into the nearby waters causing algae blooms to grow at a very high rate and detrimental health risks.

Despite the EPA’s efforts, they have been ineffective in controlling and regulating the amounts of nutrients being expelled from these factories (Alexander, 2014). The Natural Resources Defense Council made an attempt to reach out to the EPA to control the pollution that is fueling the rampant growth of blue green algae in the nations waterways with the clean water act’s legal authority (Alexander, 2014). The EPA declined the NRDC’s request and assured them that they would encourage the states to voluntarily do the right thing (Alexander, 2014). Six years later, the crisis has only increased in severity without resolution (Alexander, 2014).

Proper legislation must be made in order to control and prevent public intoxication and environmental destruction. The bill being proposed would not only force factory farmers to comply and properly dispose of animal wastes, but will also control the amount of nutrients that is being expelled into the environment. Assuming that the calculations conducted by Biomed central are correct in regards to pig waste, one can assume that the levels of nitrogen and phosphorus are way over the legal limit of 10 mg/l of the EPA’s regulations. By forcing the EPA to make new and more effective regulations this will promote the effective termination of overabundant nutrients in waterways. Failure of the factories to comply with these laws would result in costly fines and eventual shut down of all operations. The EPA does not need to be abolished; the EPA needs to be properly revised to be more effective in controlling factory farms nutrient abuse, human and environmental destruction.

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