
Should the Federal Government Mandate Compliance by Fishing Vessels with the Food & Drug Administration's HACCP Regulations to Better Protect US Consumers?

Using Florida as an example: An Opinion Paper

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Introduction

Harvesting of marine resources for human consumption is inextricably linked to and part of the natural environment. While many marine organisms can survive in a degraded environment, seafood can become unfit for consumption due to natural and human induced causes. Oceans and waterways are conduits for pollution from a variety of sources. Human and animal waste, storm water runoff, legal and illegal dumping of toxic waste are seriously degrading the oceans which impact the safety of seafood. This degradation impacts the health of seafood consumers which in turn affects the economic health of the seafood industry. The phenomenon of harmful algal blooms and natural occurring pathogens add to the risks associated with any unregulated seafood consumption.

Not all illnesses caused by seafood consumption are reported, so the numbers of outbreaks and cases published by the Center for Disease Control and the Food and Drug Administration represent only a small percentage of the actual number of cases. For example, "Using information about the probable amount of underreporting for each type of illness, FDA constructed a likely baseline number for each illness by inflating these numbers between zero and 1,000 times the amount reported."¹

The absence of a federal seafood safety program became prominent in the media during the 1980's. While the Florida Department of Natural Resources seafood quality program² was in effect in Florida, there was no federally mandated seafood inspection program within the US Food & Drug Administration (FDA) to specifically address seafood safety on a national basis. Prior to the HACCP rule publication, "FDA estimated that between 5,000 and 19,000 cases of seafood illness and death will be reduced by the proposed action annually."³ On December 18, 1997 the Hazard Analysis and Critical Control Points (HACCP) regulation was implemented.⁴

In the process of moving from a HACCP concept to the creation of their seafood HACCP program, FDA stated a HACCP program would reduce illnesses derived from eating seafood and at the same time provide nutritional benefits for people who consume seafood. FDA was well aware of the anxiety associated with the consumption of seafood because of all the public concern being brought before the federal lawmakers.

There was extreme interest in Congress which held over 10 hearings on seafood safety. Twenty proposed seafood safety related programs were filed in a short five year period.⁵ The need for a federal seafood safety program was fully demonstrated and with the support of most of the seafood industry, a federal seafood HACCP program was born.

Thus all seafood products sold wholesale in the United States became the first major animal protein commodity to be regulated under a federal HACCP program.

Those covered by the HACCP regulation were importers and domestic and foreign processors. The definition for processor used by FDA in their rule means, "any person engaged in commercial, custom or institutional processing of fish or fishery products either in the United States or in a foreign country. Processing means, handling, storing, preparing, heading, eviscerating, shucking, freezing, changing into different forms, manufacturing, preserving, packing, labeling, dockside

¹ Federal Register/Vol. 59, No. 19/Friday, January 28, 1994 page 4188

² Chapter 62N-27, Florida Department of Environmental Protection

³ Federal Register/Vol. 59, No. 19/Friday, January 28, 1994, page 4188

⁴ HACCP Regulation 21CFR part 123.

⁵ Federal Register/Vol. 59, No. 19/Friday, January 28, 1994, page 4188

unloading or holding fish or fishery products.”⁶ This definition encompasses nearly any activity connected with the flow of fishery products on the US market anywhere in the world.

However, there were four sectors of the worldwide seafood industry exempted from HACCP; fish harvesting vessels, retail seafood markets, transportation and practices such as heading, eviscerating or freezing intended solely to prepare a fish for holding on a harvest vessel⁷. Consequently, there is concern within the fishing industry and among seafood professionals that the exemption of fishing vessels throughout the world by the US Food and Drug Administration could jeopardize the integrity of the seafood HACCP program and in turn cause economic hardship on the seafood industry.

After the US Food and Drug Administration (FDA) implemented the seafood HACCP program, the US Department of Agriculture (USDA) implemented a HACCP Program for poultry and beef. These protein industries are inspected by USDA. This was a Congressional decision based on the fact USDA has been inspecting beef and poultry processors for decades and farmers are familiar with this USDA policy.

No other animal protein is exported to the United States in such a great quantity as fishery products (FDA 1995). The US Department of Commerce reports that over 200 countries export fishery products to the US⁸ and every processor in all these countries must comply with the US FDA HACCP regulations. The United States imported over 3 billion pounds of edible fishery products in 1997, valued at \$7.8 billion which was more than a \$1 billion increase from 1996. Shrimp is by far the most valuable species, accounting for almost \$3 billion dollars for 648.3 million pounds of product.⁹

According to an unpublished report by Dr. Jim Cato, Director of Sea Grant for the State of Florida, “30% of the fish caught for human consumption enters international trade.” Further he states, “Exports from developing countries account for almost 50% of global fish exports.” These imported fishery products help meet the demand for seafood in the US. At the same time these fishery products have the potential to cause illnesses if handling and sanitation procedures are not required. Surveillance of imported fishery products has become one of the major challenges of the US Food and Drug Administration due to the large volume of fishery items entering the US from foreign sources.

Other than pond raised shrimp, pen raised salmon and a few other species produced under aquaculture conditions, most imported fishery products are harvested by fishing vessels. However, as stated previously, both foreign and US harvesting vessels are exempt from HACCP. This exemption precludes any FDA oversight of vessels pertaining to seafood safety or sanitation practices. The current FDA HACCP regulations are triggered when the fishery product is received by the processor, not when the product is harvested or transported.

One reason the FDA exempted fishing vessels from HACCP was that it could not generate the financial resources needed to include vessels in the rule.¹⁰ The decision was made even though the *Committee on Evaluation of the Safety of Fishery Products*, a committee under the Food and Nutrition Board, Institute of Medicine, noted that most seafood safety problems are evident before and at harvest.¹¹

⁶ Hazard Analysis and Critical Control Point Training Curriculum, page 129

⁷ Hazard Analysis and Critical Control Point Training Curriculum, page 129

⁸ Dept. of Commerce/NMFS. http://www.st.nmfs.gov/st1/trade/trade_cntry_allprdcts_mth.html. Feb 1, 1999

⁹ *FISHERIES OF THE UNITED STATES - 1997*. NMFS/Office of Science & Technology/Fisheries Statistics & Economics Division. <http://www.st.nmfs.gov/st1/fus/fus97/index.html>. May 23, 1999

¹⁰ Federal Register / Vol. 60, No. 242 / Monday, December 18, 1995, page 65153

¹¹ Ahmed, Farid E., *Seafood Safety*, National Academy Press, Washington DC 1991, Executive Summary

The report suggests seafood safety should begin at the harvest level. For example, when a marine resource is harvested and dies, biological changes occur within certain species such as Spanish mackerel, king mackerel and mahi-mahi to name a few, which can cause sickness and on rare occasions death if the internal temperature of the fish rises above 45 degrees Fahrenheit and stays there for an extended period of time.

Through a natural process scombroid toxin forming species can develop histamine which makes some people very ill. Histamine poisoning is caused by a small number of species, some of which are listed above. The risk histamine related illness can be minimized according to one seafood safety specialist, "if the fish are properly handled from the boat to the throat."¹² Other scombroid toxin forming species include the common harvests for tuna, mahi-mahi, bluefish and amberjack. Likewise. Certain groupers, snappers and hogfish from known reef areas also pose potential risk because they accumulate ciguatera toxin. "Ciguatera is a naturally, sporadically occurring fish toxin that affects a wide variety of popularly consumed reef fish. Ciguatera becomes more bioconcentrated as it moves up the food chain. Ciguatera and related toxins are derived from dinoflagellates, which herbivorous fish consume while foraging through macro-algae."¹³

Other safety risks include oyster harvest from warm waters. *Vibrio vulnificus* is a safety risk for immune suppressed consumers because septicemia can result from the consumption of raw oysters which can lead to death. Also large swordfish and certain species of sharks which contain methyl mercury in excess of 1 PPM cause concern as a potential safety risk, especially for expectant mothers.

Other risks associated with the harvest and consumption of seafood include the use of sodium bisulfite as a preservative. This chemical can cause an allergic reaction in some consumers. Improper use of drugs and chemicals used in aquaculture and runoff from agricultural operations and development also are potential sources of pollution which affects the safety of seafood. Parasites pose a risk when certain fishery products are undercooked or are consumed uncooked.

Another concern is the safety risk associated with recreational fishing. There are 800,000 licensed saltwater anglers in Florida. These recreational anglers and their families, as well as patrons on charter and party boats, catch, consume and sometimes sell the same species of fish harvested by commercial harvesters. Most of the fish are taken home and shared with friends and neighbors but many sport caught fish are sold.

King and Spanish mackerel, mahi-mahi, tuna, shark, reef fishes and even oysters and clams are harvested by recreational fishermen who are subjected to the same potential risk as the non-boating consumers who eat seafood that has been unloaded, reported and checked by licensed wholesale seafood dealers. The fact that recreational anglers catch the majority of some species, especially scombroid species, should be cause for concern within the Food & Drug Administration.

For example, numerous king mackerel tournaments are held throughout Florida with prizes reaching over \$100,000. In a high stakes tournament, an angler must catch and timely land the biggest fish (weight) to win the prize. Under federal and state regulations only 3 king mackerel can be landed per person so if the angler catches fish in the morning and catches bigger fish in the afternoon, the ones caught earlier will be returned to the water dead because three is the limit. If fish are kept all day and not properly iced, there is a possibility of the king mackerel being able to develop histamine poison. If these fish are caught, brought to shore, weighed and then sold on the local market, there is a possibility that someone will get sick. With up to 1,000 recreational fishing boats fishing in these king mackerel tournaments in the warm summer months there is a need for some oversight on the sale. The threat to the general public would be removed if the king mackerel taken in sportfishing tournaments were not allowed to be sold for human consumption.

¹² Otwell, W.S., Report to Southeastern Fisheries Association, May 1992

¹³ Centers for Disease Control 5/28/99. <http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/00020758.htm>

With these facts in mind, “Should the FDA HACCP regulations, requiring that at least one person within an entity selling fishery products in the US be trained in the concept of HACCP, be applied to fishing vessels to protect US consumers?”

Chapter One – Historical Perspective of the Florida Seafood Industry

Seines, weirs, and hook and line fishing were commonly used by Timuquan Indians 15,000 years ago in the Fernandina Beach area of Florida.¹⁴ Windover Pond in Brevard County, Florida, is a remarkable archaeological site. It contains peat deposits which were used by the people in 8,000 years ago to bury their dead. From items discovered at this site one could assume they were able to use nets to catch fish as they had the ability to weave fabric from a variety of available plants including palms and palmettos.¹⁵

A well established native society utilizing food from the sea was evident when Ponce de Leon landed in Florida in 1513. What was originally a hunting and gathering existence by ancient ancestors turned into a subsistence fishing activity as coastal villages began to be used year-round. Many species such as shark, mullet and turtles harvested and consumed thousands of years ago are still consumed today.

Spanish explorer Pedro Menendez established the first permanently settled city in the United States when he dropped anchor in St. Augustine's Matanzas Bay in 1565 to unload settlers. His ship's manifest listed fishing nets as part of the cargo according to records at the St. Augustine Historical Society. The University of Florida's Dr. Michael Gannon, in his latest booklet on the history of Florida, notes that fifty years before the Pilgrims arrived in Massachusetts, there was government and a societal infrastructure in St. Augustine including a "fish market".

According to the earliest written history of Florida, in the 1500's fish of all kinds were abundant. Mullet, redbfish, pompano, eels and "fish with snouts so long and strong they could break both fishing line and nets" were found throughout the region.¹⁶ As more and more Europeans came to the New World, fishing techniques used in their homeland were utilized to harvest the virgin stocks of fish from Canada to the Keys on the Atlantic coast and from the Alaska territory to Mexico on the Pacific coast. The Gulf of Mexico was being developed by Greeks in Tarpon Springs, Bahamians in Key West, Italians in Fernandina and St. Augustine and Frenchmen all along the Louisiana and Mississippi coasts.

In the 1800's the seafood industry was continuing to develop. Population in Florida was still small and the state economy was in shambles after the Civil War. With a small population and no major industrial manufacturers, rivers, streams, bays and oceans were relatively free from pollutants.

In 1871 the United States Commission on Fish and Fisheries was created by President Ulysses S. Grant.¹⁷

By 1898 most fisheries in Florida were being utilized for consumption. The commercial fishing landing data, which served as a trend in total catch, were being collected by port agents and by 1898 was reported annually in government statistical bulletins. This far-sighted decision by the federal government provided a baseline of tracking what was happening to marine resources. This data is invaluable and provides a rationale for the oversight and regulation of the commercial seafood industry.

¹⁴ St. Claire, Dana., *Arts & Sciences Magazine*, Feb-May, 1995, pages 8 & 9

¹⁵ Gannon, Michael., Editor., *The New History of Florida*, University Press of Florida, Gainesville, Fl. p.4

¹⁶ Barcia. *Chronological History of the Continent of Florida*, University of Florida Press, Gainesville, Florida.1951

¹⁷ *Our Changing Fisheries*, U.S. Government Printing Office, 1971.

In Florida, commercial offshore shrimping began in the early 1900's. As Florida's economy recovered from the Civil War and its population increased, the Florida fishing industry expanded. World War I and World War II contributed to the growth of the seafood industry because of the need to maximize harvests in order to feed troops and civilians population who were under a Food Rationing Program during the war. Increasing commercial harvest of seafood during this time period was a major government initiative.

A major occurrence that changed the fabric of the seafood industry was by Dr. John Gorrie's¹⁸ invention of mechanical refrigeration. Before refrigeration was developed, salting, curing, live wells and drying were state of the art for fish preservation. After Gorrie's invention, Clarence Birdseye pioneered freezing of food and his techniques were adopted by seafood processors. Freezing greatly enhanced the shelf life of seafood and its availability to consumers far from the coast. Fish processing entrepreneurs realized the potentials of freezing fishery products when they were plentiful and selling them at a later time when their value should be higher.

One Florida seafood pioneer was H. Heber Bell of St. Petersburg, whose family migrated to Florida from Cincinnati, Ohio. Clarence Birdseye vacationed in St. Petersburg during the winter. It was during one winter that young fisherman by the name of Heber Bell was hired by Mr. Birdseye for charter fishing for king and Spanish mackerel. It was through this association with Birdseye that Bell learned how to freeze and glaze fish in such a fashion that the shelf life and quality of the fish could be extended for months.¹⁹ Bell built his company, Harry H. Bell and Sons and American Freezers of St. Petersburg, into the premier fish processing and freezing business in the Southeastern United States.

In the mid 1940's, a marine biologist, Robert Maurice Ingle, was hired by the Florida Board of Conservation to establish a scientific perspective aimed at conservation and management of Florida's marine resources. In 1947, state scientists working under Ingle at the Florida Board of Conservation lab identified a "previously undescribed microscopic organism".²⁰ This unknown microorganism was given the name of *Gymnodinium breve* and is commonly referred to as Red Tide. As far as seafood safety is concerned, human deaths from Red Tide are rare events but there have been reported cases of human mortality.²¹ Florida has allocated significant resources to study Red Tide and to determine if there are actions that might be taken upstream that would reduce Red Tide episodes.

Another safety issue is mosquito control. Killing mosquitoes is particularly critical to the economic well being of Florida because of the ever expanding tourist industry and the threat of disease to citizens and visitors. In the past, DDT and other toxic chemicals were effectively used to kill mosquitoes but there were adverse impacts on larval shrimp and fish. The same or similar chemicals were being used throughout America.

Furthermore, according to Beatrice Hunter," The salt marsh area of Chesapeake Bay, sprayed repeatedly for mosquito control, had experienced massive kills of fish and crabs, with DDT residues as high as 46 PPM."²² It is likely that chemicals used for spraying in Chesapeake Bay were similar to chemicals being used around Florida's waters and the impact on fish, crabs and shrimp in the estuaries was similar. In addition to the effect of mosquito control operations on marine organisms, dumping of untreated waste into the ocean, rivers and bays was prevalent until the Florida

¹⁸ Dr. John Gorrie was granted the first U.S. patent for artificial refrigeration in 1851.

¹⁹ Personal interviews with Heber Bell, 1964-65 and with his son Robert P. Bell in 1999.

²⁰ Torpey, John and Ingle, Robert M. *The Red Tide*. Florida Board of Conservation, Educational Series No.1 (1948)

²¹ Ibid

²² Hunter, Beatrice Hume. *Consumer Beware!*, Simon and Schuster, New York, New York, 1971, page 184.

legislature established a classification system for state waters and better regulations to protect Florida's water became law.²³

However, ocean outfalls still persist in South Florida but their cumulative impact on the nearshore waters and offshore environment is not well understood. For example, the main sewage outfall pipe in Dade county empties 143 MGD (millions of gallons per day of treated sewage) into the Atlantic Ocean. The discharge end of the pipe is located 18,971²⁴ feet from shore or just beyond the 3 mile state boundary and is therefore exempt from regulation and monitoring by the state. It operates under a federal discharge permit issued by the US EPA.

Moving from the pollution impact on fishery products into the political impact on the harvest of fishery products, the most far reaching event concerning seafood production in the US occurred in 1976 when Congress extended the US fishing zone to 200 miles from shore²⁵. Seafood and conservation of the resource became more important to the Congress. The allocation of seafood resources between the sportfishing industry and the seafood industry has become a very intense struggle over who gets the fish.

As more and more regulations limiting commercial harvest were enacted, the amount of imported fishery products increased to meet the reduction in domestic supply. Moreover, imports continued to increase to meet rising consumer demand for seafood.

This policy decision which increased imported seafood creates a challenge for FDA's enforcement personnel who monitor and inspect seafood from all parts of the world destined to be sold in the US.

²³ 376.041 Pollution of waters and lands of the state prohibited.--The discharge of pollutants into or upon any coastal waters, estuaries, tidal flats, beaches, and lands adjoining the seacoast of the state in the manner defined by ss. 376.011-376.21 is prohibited. History.--s. 4, ch. 70-244; 1970.

²⁴ Characteristics of Southeast Florida Publicly Owned Treatment Works, 1997. FDEP

²⁵ The Magnuson Fishery & Conservation Act of 1976, P.L. 94-265

Chapter Two – Seafood Safety Programs in Florida

Prior to the enactment of HACCP by the FDA, several Florida state agencies were responsible for maintaining a safe supply of seafood. Among them were the Department of Agriculture & Consumer Services, the Florida Department of Environmental Protection, the Florida Marine Patrol and the Department of Health & Rehabilitative Services (HRS). The FDA has authority under their general laws enacted decades ago by Congress to protect consumers from adulterated seafood.

The Florida shellfish industry is regulated under the National Shellfish Sanitation Program (NSSP). This program was created in 1925 by the US Public Health Service to handle health problems associated with eating raw oysters, clams and mussels following a typhoid fever outbreak in Chicago, New York and Washington DC during the winter of 1924. This outbreak was traced to oysters polluted by sewage.²⁶ Shellfish illnesses were also occurring in Europe during this period and added impetus for the creation of a national program.

As a result of the creation of the NSSP, the Florida Health Department, now part of HRS, had a prominent role in regulating the sanitation of shellfish. Local health officials made routine inspections of food processing plants and issued inspection reports. Their responsibility changed when Florida's government was reorganized and after the Interstate Shellfish Sanitation Commission (ISSC) was formed.

In 1975, the two fishing industry groups, Southeastern Fisheries Association and the Organized Fishermen of Florida persuaded the Florida Board of Conservation to adopt a rule known as, "The Seafood Quality Control Code". The code established requirements for harvesting vessels (primary producer), the unloading facilities (secondary producer) and the processing plants within the state. This code is still applicable to commercial fishing vessels and shoreside facilities and is enforced by the Florida Marine Patrol.²⁷ Southeastern Fisheries Association also published "A Buyer's Guide", concerning quality and safety issues for companies importing seafood from Central and South American countries bordering the Gulf of Mexico and Caribbean Sea.²⁸

The Department of Agriculture and Consumer Services (DACS) has responsibilities at the retail and processing plant level and the DACS Bureau of Food and Residue Laboratory is an integral part of Florida's seafood safety program. DACS also investigates consumer fraud such as product substitution, mislabeling, short weight, spoilage, pathogens, toxins, and parasites.²⁹

Under an inter-agency agreement with FDA, DACS inspectors are authorized to conduct federal HACCP inspections of all Florida seafood processors. This arrangement gives the HACCP program much wider coverage because of the increase in the number of inspectors. DACS routinely adopts FDA rules and regulations. It has adopted the federal HACCP regulation (21CFR Part 123) as a Florida rule. DACS also has limited regulatory authority dealing with aquaculture.

The Department of Health and Rehabilitative Services issues Health Advisories for levels of mercury in fish above 1 PPM. Closure of Florida waters to fishing has been primarily in certain South Florida canals and polluted Lakes.³⁰

²⁶ The History of the National Shellfish Sanitation Program. http://www.issc.org/What/History_NSSP.htm 1/31/99

²⁷ Chapter 62N-27, Florida DEP. <http://www.dep.state.fl.us/ogc/documents/rules/rulelistpa.htm#marine>, 1/31/99

²⁸ Otwell, W. Steven, author. Funded by USDOC Award No. NA90AA-H-SK047

²⁹ Authorized under Chapter 500.02, Florida Statutes. http://www.leg.state.fl.us/citizen/documents/statutes/1998/ch0500/SEC02_.HTM#0500.02 February 2, 1999

³⁰ Chapter 381.006, Florida Statutes, http://www.leg.state.fl.us/citizen/documents/statutes/1998/ch0381/SEC006_.HTM#0381.006 February 2, 1999

As inconsistent as seafood inspection seems to have been over the years, it was in fact quite broad and included the harvester, packing houses, trucking and processing sectors of the commercial seafood industry in Florida. The one fishing sector not subject to any inspection for quality or safety was and is the substantial number of recreational anglers . As long as recreational anglers consume the fish their catch, safety risks will be limited to that family. However, if recreationally caught fish enter the market and are not inspected and handled properly, the consuming public can be exposed to health risks.

Chapter Three - Food Safety Issues in Florida

Certain popular species of fish consumed in Florida such as tuna, king mackerel, Spanish mackerel, mahi-mahi and bluefish can develop histamine in their flesh naturally as a result of time/temperature abuse. For example, if Spanish mackerel is caught and stored with little or no method of keeping the fish cool, histamine poison can develop in the flesh of the fish. To some humans, histamine is toxic. As stated in the FDA Hazards Guide:

“Certain bacteria produce the enzyme histidine decarboxylase during growth. This enzyme reacts with free histidine, a naturally occurring amino acid which is present in larger quantities in some fish than in others. The result is the formation of histamine.”³¹

This chemical reaction will not occur if these fish species are kept at the proper temperature from the time they are harvested until the time they are consumed. If these types of fish are time/temperature abused and “go through a heat”, a toxic level of histamine can develop in the fish. Once it is in the flesh, the histamine cannot be removed by cooking, freezing or any other method known at this time. Histamine formation has been defined as a safety issue by the FDA.

From 1973 to 1986 there were 178 outbreaks of scombroid poisoning affecting 1096 people but there were no fatal cases reported. The outbreaks occurred in 30 states with Hawaii accounting for 51 cases followed by California with 29 and New York with 24.³² According to data from the University of California at Davis, mackerel that were allowed to spoil in ice, had histamine levels which rarely exceeded 5mg/100g of fish, even when it became unfit to eat (Murray et al., 1982). However, storage at higher temperatures (especially above 10°C) resulted in high levels of histamine with rates of exponential production.³³

Ciguatera poison is another safety issue. Ciguatera has been linked to reef fishes in certain parts of the world. The Virgin Islands, Hawaii and the Tortugas area in South Florida are the areas mentioned most prominently in ciguatera illnesses. Like scombroid poison, ciguatera cannot be detected by sight, feel or smell and like histamine poison, once ciguatera is present in the flesh of the fish it cannot be removed or destroyed or eliminated by cooking. The US Institute of Medicine says ciguatera poisoning is more debilitating than histamine poisoning but does not occur as often as scombroid poisoning.³⁴

But even with all the potential risk of seafood, the following quote is from the FDA and was given during the time public interest groups were lobbying Congress for mandatory federal inspection in all seafood processing establishments (FDA *Backgrounder* 1991):

“To put the seafood safety issue in perspective, food poisoning from fin fish or shellfish represents only a small percentage of the total number of food poisoning cases. Seafood includes both fresh and saltwater fin fish and shellfish, whether raised on a “fish farm” (aquaculture) or caught wild. According to the U.S. Centers for Disease Control in Atlanta, from 1973 to 1987 shellfish accounted for 2.8 percent of all cases of food poisoning and fin fish for 2.2 percent—a total of 5 percent. FDA data show that cases and outbreaks of seafood-related illness are actually decreasing relative to the increasing consumption of seafood. Pound for pound, chicken is more likely to cause illness than seafood, except for raw and undercooked molluscan shellfish. The risk from molluscan shellfish can be reduced substantially by thorough

³¹ *Fish & Fisheries Products Hazards & Control Guide*. US Food & Drug Administration. 1998, page 73.

³² Centers for Disease Control. <http://www.cdc.gov/epo/mmwr/preview/mmwrhtml/00001361.htm>

³³ <http://www-seafood.ucdavis.edu/Pubs/safety1.htm#Ciguatera>

³⁴ *ibid.*

cooking and proper handling. Deaths associated with molluscan shellfish are limited almost exclusively to people who have liver disease and who are vulnerable to a particular, naturally occurring marine bacterium, *Vibrio vulnificus*. This bacterium is readily killed during cooking.”³⁵

Consumption of raw molluscan seafood can expose people with an immune-suppressed system to several *Vibrios* spp. and is thus a seafood safety issue. *Vibrio vulnificus* (Vv) has been linked to the death of people with cancer and liver diseases in the US. Healthy individuals are not usually affected by this naturally occurring *Vibrio* and proper cooking destroys *Vibrios*.

Seafood is a natural reservoir for bacteria because it reflects the quality of the water from which it was harvested. Bacteria, including pathogenic bacteria can be controlled through proper cooking procedures. Under FDA Guideline/Tolerance, fish cooked so that the internal temperature of the fish reaches 145 (°F) for 15 seconds either destroys the pathogens or reduces the number to an acceptable level.³⁶

Parasites are also common in the water environment but are killed by proper cooking or freezing. However, with the popularity of sushi bars and more and more seafood being consumed raw, parasites are a safety issue. FDA recommends that all fish and shellfish intended for raw (or semi-raw such as marinated or partly cooked) consumption be blast frozen to -35°C (-31°F) or below for 15 hours, or be regularly frozen to -20°C (-4°F) or below for 7 days. The practical problem with this guidance is that most sushi restaurants demand raw fresh seafood which causes a major sales problem for fish processors. According to data collected by the University of California at Davis, “Fewer than 30 cases of illnesses resulting from the presence of parasites in sushi or sashimi were reported in the U.S. during 1986, and most were on the West Coast. More fish are infected—and therefore more humans—on the West Coast than the East because the primary hosts for the parasites are marine animals commonly found in the Pacific, such as seals, porpoises, sea lions, and whales.”³⁷

There are two types of parasitic worms that can infect human beings, the larvae of several types of roundworms and fish tapeworms. Roundworms are sometimes found in cod, plaice, rockfish, herring, pollock, sea bass and flounder. Tapeworms are sometimes found in freshwater fish such as pike and perch and in anadromous fish such as salmon which spend part of their life cycle in freshwater streams, rivers and lakes according to research published by the University of Delaware. Traditional cooking such as broiling, frying and baking kill all the worms if the internal temperature of the fish being cooked reaches 145⁰ F for at least 5 minutes.

Shrimp is a very popular seafood item. Shrimp have no known natural toxins, *Vibrios* or poisons associated with their consumption. A seafood safety problem does occur if the harvesting vessel or processing plant uses sodium bisulfite to prevent black spots from developing on the shrimp. Some consumers have a violent reaction to sodium bisulfite. Therefore proper screening and labeling is mandatory under the HACCP regulations for shrimp products that have been treated with sodium bisulfite.

The recreational harvest and consumption of millions of pounds of fish also lead to illnesses if the fish are not properly handled. Dr. Steve Otwell of the University of Florida Institute of Food and Agricultural Science and Frank Lawlor, Seafood Extension specialist, say in their most recent publication on this subject, “In 1989, the Commissioner for the U.S. Food and Drug Administration stated, “...fish is by far the safest source of muscle protein available.” When problems do occur, they are usually caused by contaminants present prior to capture or due to mishandling of the

³⁵ University of California at Davis, Cooking to Destroy Pathogens, <http://www.seafood.ucdavis.edu/haccp/compendium/process/cook.html>, October 2, 1997

³⁶ *ibid.*

³⁷ University of Delaware Sea Grant. <http://www.ocean.udel.edu/mas/seafood/raw.html>

catch. For these reasons, a significant portion of the annually reported seafood borne illnesses involve a recreational catch and/or at home preparation.”³⁸

Because recreational fishing occurs in all waters of Florida, it is imperative during the outbreak of Red Tide that recreational anglers are made aware of the potential risk of eating fish and mollusks exposed to the Red Tide organism. Most native Floridians in areas that have historical and routine outbreaks of Red Tide, such as the Tampa Bay area, are well informed and avoid fishing in or near the area. Tourists or recently arrived citizens on the other hand who are ignorant about any aspect of this naturally occurring phenomenon might subject themselves and their family to risk if they go fishing if they are unaware of the dangers associated with eating seafood contaminated by Red Tide.

The National Academy of Science has estimated that 20% of the fishery products consumed in the United States are caught by recreational anglers. If that is the national average it is safe to assume that the percentage in Florida must be more than 20% because of the weather, proximity to fishing grounds and the fact there are over 800,000 licensed recreational anglers in the state. Even though only 800,000 individual saltwater licenses are sold each year, the Florida department of Environmental Protection says, “.....that there are more than 3 million anglers looking for fish in Florida’s salt waters.” That’s a bunch. At our best, we can be a mighty force in protecting our priceless marine resources. At our worst, we could, in a single year, damage it severely. It’s no longer enough simply to be law-abiding. If each of us took just one legal redfish of average size (4 pounds) we would harvest 12 million pounds of reds, more than the poundage of the entire inshore stock.”³⁹

After considering all of the fisheries in Florida, the four seafood safety issues I will examine for seafood risks to determine if HACCP regulations should be applied to fishing vessels are: histamine poison, ciguatera poison, *Vibrio vulnificus* and sodium bisulfite.

³⁸ <http://hammock.ifas.ufl.edu/txt/fairs/16093>.

³⁹ http://www.dep.state.fl.us/marine/html/ofmas/fishing_lines/ethics.html. May 17, 1999

Chapter Four - HACCP and fishing vessels

Following is a very brief description of the Florida commercial fishing fleet.

In 1995, Florida had 2,311 commercial fishing vessels and 8,919 commercial fishing boats. Vessels are documented craft greater than 5 net registered tons and boats are craft less than 5 net registered tons.⁴⁰ The basic species of fish harvested, where the boats operate and type of gear utilized by the Florida commercial fishing industry are categorized as follows:

INSHORE - Boats/Vessels fishing inside the colregs⁴¹ line

Type of Boat/Vessel	Primary type gear used
Bay shrimpboats	otter trawls & roller rigs
Bay Scallop boat	otter trawl
Oyster boats	oyster tongs
Cast net boats	hand thrown cast net
Bluecrab boats	wire traps
Hook & line boats	rod & reel
Baitfish boats	tarpaulin seine

NEARSHORE - Boats/Vessels fishing outside colregs line to the FCZ⁴²

Type of Boat/Vessel	Primary type gear used
Bay shrimpboats	otter trawls
Baitfish boats	tarp seine and purse seine
Cast net boats	cast nets
Crawfish boats	wooden and plastic traps
Stone crab boats	wooden and plastic traps
Hook & line boats	hook and line

⁴⁰ *Fisheries of the United States 1996*. US Department of Commerce-NOAA/NMFS. p.133

⁴¹ The International Regulations for Avoiding Collisions at Sea, commonly referred to as the nautical rules of the road. http://www.geocities.com/~diraux_west/colregs.html, January 31, 1999

⁴² A Congressionally designated fisheries management zone established in 1976 adjacent to the coastal United States and its territories that begins at the outer point of states boundaries and extends offshore to a point 200 miles from shore except in those areas in which a foreign country is closer than 200 miles. In those instances a line equidistant from each country is negotiated and established.

OFFSHORE - Vessels fishing primarily outside state waters in FCZ

Type of Boat/Vessel	Primary type gear used
Documented shrimp vessels	otter trawls
Scallop boats	modified otter trawl
Wreckfish boats	deepwater hook & line
Fin fish gillnet boats	runaround gillnet
Fin fish hook & line boats	multiple rods and reels
Crawfish boats	wooden & plastic traps
Stone crab boats	wooden & plastic traps
Golden crab boats	wire traps
Reef fish boats <ul style="list-style-type: none"> - Longline - "bandit" rig - fish trap 	multi-hook line of various lengths pulley type hook & line rig wooden, wire & plastic traps
Shark/tuna/swordfish boats	long line and hook & line

In general, inshore commercial fishing boats are smaller than offshore vessels. many are referred to by the commercial fishing industry as "day trippers" i.e., they seldom stay at sea or away from unloading facilities for more than 24 hours at a time. There are of course exceptions. One main aspect of short time at sea and proper handling is the positive impact on the quality, safety and shelf life of seafood harvested. This sector is probably where the words "fresh seafood" originated. But if the seafood was not properly iced it decomposes rapidly and can become compromised within an hour or so if it lays uncovered in the sun.

Bay shrimp boats

Bay and nearshore shrimping with power began around 1902 in Fernandina, Florida, when Italian immigrant, Soliceto Salvador installed an engine with enough power to pull an otter trawl⁴³ in his small shrimp boat. Fernandina shrimpers pioneered the otter trawl net in 1913 and started using them to harvest shrimp from the Atlantic Ocean off Northeast Florida.⁴⁴

Most Bay shrimp boats do not use sodium bisulfite⁴⁵ or any chemical additive. Bay shrimp boats unload their shrimp before black spot⁴⁶ develops. Their shrimp are often de-headed on board the vessel, washed and immediately placed on ice. Other times, depending on the size of the shrimp harvested and other considerations, the shrimp are placed on ice with the heads intact and brought to shore for de-heading or sold in the whole condition to a limited restaurant trade.

Bay shrimp boats that use small otter trawls (less than 500 square feet of mesh) do not usually drag their trawls in the water for as long as the larger vessels shrimping offshore. Shorter trawl times in the bay shrimp fishery, particularly in warm water, produces a higher quality product as

⁴³ (2) "Trawl" or "trawl net" means a net in the form of an elongated bag with the mouth kept open by various means and fished by being towed or dragged on the bottom. <http://www.dep.state.fl.us/mfc/ch46-31.htm> May 23, 1999

⁴⁴ Pacetti, Derald, *Shrimping at Fernandina, Florida before 1920* FSU Thesis 1980. <http://www.southeasternfish.org/Documents/pacetti.pdf>

⁴⁵ "sodium bisulfite An acid salt (NaHSO₃), usually prepared by passing sulfur dioxide through a solution of sodium carbonate. It is unstable and is generally known only in solution. It is used to sulfite oils employed in fatiquoring leather, and, because of its capability of liberating sulfur dioxide, in bleaching leather." <http://palimpsest.stanford.edu/don/dt/dt3191.html>. January 31, 1999

⁴⁶ "Blackspot is a common discoloration of shrimp. It is called melanosis and is not caused by bacterial growth. It results from natural chemical reactions uniquely related to the shell and molting cycle for shrimp and crustacea." *Seafood Product Quality Code*. Southeastern Fisheries Association, Florida Sea Grant & IFAS Extension Service 1985.

rigor mortis begins soon after icing or freezing. There is also less compression of the shrimp flesh and fewer shrimp are broken into pieces when the cod end (bag) of the net is not tightly packed and dragged for three to six hours before hauling back and dumping the bag on the deck.

Oyster boats

Oyster boats or skiffs are generally wooden, flat bottom boats powered by an outboard motor. There is a small cabin near the stern to protect the oyster harvester from the weather.

Oysters are generally tonged by hand in Florida which means the harvester must anchor over an oyster bar. Using the 12 foot long oyster tongs, which operate like post hole diggers, the harvester lowers the tongs to the bottom while in the open position. He then works them back and forth in such a manner to break oysters loose from the bottom. The harvester then raises the tongs from the water by sliding his hands down the tongs as he pulls them to the surface. Once the oysters are out of the water they are placed on the culling board which is usually in the front or middle of the skiff. This process is repeated for as long as oysters are available. At various times during the day, the harvester ceases tonging and proceeds to cull the oysters he has placed on the culling board. The harvester accomplishes this by separating the legal size oysters from any cluster. Undersized oysters are then returned to the water where they can reattach to the bottom, grow and spawn for the following season.

Oyster harvesting is allowed for a longer period per day when water temperature is below 65° F because *Vibrio vulnificus* (Vv)⁴⁷ is less prevalent. “ The higher the temperature of the water from which the oyster was harvested, the sooner it must be refrigerated.”⁴⁸ The Florida Department of Environmental Protection determined the impact warm water has on the growth of Vv and adopted a rule on handling which says in part, “ Throughout the year, shellfish shall be harvested between sunrise and sunset. During the months of November, December, January, February, and March, shellfish shall be refrigerated within the same day as harvest. During the months of April, May, and October, shellfish shall be refrigerated within twelve (12) hours of the time of harvest, or within the same day as harvest, whichever is earlier. During the months of June, July, August, and September, shellfish shall be refrigerated within six (6) hours of the time of harvest, or within the same day as harvest, whichever is earlier. All shellfish shall be delivered directly to a certified dealer possessing a shellfish processing plant certification license.”⁴⁹ This rule is intended to keep oysters from becoming hot which would increase the amount of *Vibrio vulnificus* in the oyster.

There are other forms of pathogens and bacteria that can be present in the water which is why state and federal agencies have established a protocol for opening and closing shellfish harvesting.

Vibrio vulnificus in oysters is a high profile issue. In June of 1998, the Center for Science in the Public Interest (CSPI) filed a petition with the U.S. Food and Drug Administration requesting that FDA take regulatory action to establish a non-detectable level of *vibrio vulnificus* in raw molluscan shellfish. CSPI based their request partly on an outbreak of *vibrio parahaemolyticus* in the Northwest Pacific that sickened 209 people and killed one. The petition states that even though 4,500 people a year die from meat and poultry borne illnesses when a comparison is made

⁴⁷ *Vibrio vulnificus* (Vv) is an opportunistic pathogen affecting certain at risk persons with immuno-suppressed systems. “It is a potential harmful marine bacterium found in oysters and transmitted to people consuming them raw or partially cooked.” FDA Control Plan for Oysters.

⁴⁸ ISSC *Vibrio Vulnificus Control Plan for Oysters*. Center for Disease Control. <http://vm.cfsan.fda.gov/~ear/vvoyster.html> page 1. February 1, 1999

⁴⁹ DEP Rule 62R-7 The Comprehensive Shellfish Control Code - effective 11/3/98. <http://www.dep.state.fl.us/ogc/documents/rules/mainrule.htm>

between the consumption of 55.14 billion pounds of meat and poultry against 11.65 million pounds of oysters it makes oysters eleven times more deadly.⁵⁰

The CSPI petition asserts new technology invented by the AmeriPure Company will reduce *Vibrio vulnificus* to a non-detectable level and the oysters will retain the same taste and texture as an untreated oyster. The patented method used by AmeriPure involves a low heat process that kills the oyster but also reduces *Vibrio vulnificus* to a non-detectable level. The cost is about 8 cents per oyster according to a company spokesman.

The CSPI petition urges FDA to use any of several sections of their existing law to enact a non-detectable level and to declare raw shellfish is adulterated if it contains any trace of *Vibrio vulnificus*. The industry response to the CSPI petition was filed by the Gulf Oyster Industry Council (GOIC) which is composed of shellfish harvesters, processors and distributors from the states of Florida, Alabama, Mississippi, Louisiana, and Texas.⁵¹

GOIC asserts that foods (oysters) cannot be considered adulterated from a naturally occurring substance. GOIC cites, "court cases have found that shellfish containing *Vibrio vulnificus* cannot be determined to be unfit for human consumption or defective and are not unreasonably dangerous." GOIC also points out oysters are marketed as a "raw" product which they claim any reasonable person would recognize that the raw form would be more of a risk than the cooked form. GOIC stresses that forcing the industry to process all raw shellfish to a non-detectable level of a naturally occurring bacteria such as Vv is not reasonable and strongly urges the FDA to reject the CSPI petition.

GOIC reiterates in their response the role of the Interstate Shellfish Sanitation Conference (ISSC) in developing regulations pertaining to shellfish and suggests that the ISSC is the proper venue for the CSPI petition and not a direct move to FDA. This response to the petition states that although the ISSC includes industry people as part of the conference, the final authority during the conference rests with the state agency Designated Voting Delegate (DVD). Subsequent to the decisions made at the conference the proposals adopted by the ISSC have a final review by FDA, a requirement which is stipulated in the Memorandum of Understanding between FDA and ISSC.

GOIC refers to several court cases in which the decisions are similar in determining that oysters containing Vv are not unreasonably dangerous to the ordinary consumer. As a California court determined in another food safety issue, bones are a natural part of chicken and it can be said that Vv is a natural part of raw oysters.

GOIC describes the lengths AmeriPure has gone to get their patented process required for all Gulf of Mexico oysters which would be of great financial gain for AmeriPure. GOIC questions the claims that treated oysters retain quality and texture as their experience with the process is quite a bit different and they see a rapid deterioration as time elapses after treatment. GOIC believes that keeping the oysters at 45° F throughout the harvesting and marketing chain would result in a significant lowering of *Vibrio vulnificus* bacteria in shellfish.

Dr. W.G. Hlady and K.C. Klontz described the epidemiology of *Vibrio* infections in Florida, 1981-1993 as follows:

"The epidemiology of 690 *Vibrio* infections reported in Florida during 1981-1993 is described. Most infections resulted in one of three clinical syndromes: gastroenteritis (51%), wound infections (24%), or primary septicemia (17%). Case fatality rates were 1% for gastroenteritis, 5% for wound

⁵⁰ Jacobsen, Michael F. & DeWaal, Caroline Smith, Petition for Regulatory Action to Establish a Standard for *Vibrio vulnificus* in Raw Molluscan Shellfish of Undetectable Levels. June 28, 1998, page 4.

⁵¹ Thompson, Richard E., Comments submitted in regard to Petition for regulatory Action to Establish A Standard for *Vibrio Vulnificus* in Raw Molluscan Shellfish of Undetectable Levels. March 10, 1999.

infections and 44% for primary septicemia. While gastroenteritis had seasonal variation, 91% of primary septicemias and 86% of wound infections occurred from April through October, mostly due to the seasonality of *Vibrio vulnificus* and *Vibrio parahaemolyticus* infections. Infected wounds were largely a result of occupational activities around seawater. Some 68% of gastroenteritis cases and 83% of the primary septicemias were associated with raw oyster consumption. Preexisting liver diseases were present in 48% of patients with primary septicemia and was associated with a fatal outcome in both wound infections.”

Additionally the Florida Behavioral Risk Factor Survey (BRFS) says that 3 million persons in Florida eat oysters of which 71,000 believe they have a liver disease. The annual rate of illness from consuming raw oysters was 72 persons per million with liver disease as compared to 0.9 persons per million without liver disease. The annual rate of death for persons with liver disease was 45 per million compared to 0.2 per million without liver disease. Persons with liver disease should avoid eating raw oysters.

Shrimp Vessels

Nearshore shrimp vessels include Bay shrimp boats as well as offshore shrimp vessels. At certain times of the year when shrimp are close to shore there are many different sizes of shrimp boats working in that area. Most bay boats can safely work one to three miles out depending on the weather and the larger bay boats can work even further from shore. Under Florida law⁵², shrimp nets with more than 500 square feet of mesh can only be used beyond one mile from shore on the Atlantic coast and beyond 3 miles from shore in the Gulf of Mexico.

Shrimp boats fishing within the restricted nearshore area can only utilize 500 square yards of mesh per net and can only use two nets total. This restriction causes many vessels to fish outside the restricted area. Offshore shrimp vessels generally range in size from 60 to 85 feet in length and some about 100'. Depending on the time of the year and the distance from shore, shrimp boats stay on average 7 to 14 days at sea before returning to port to unload. Most all offshore trawlers have the fuel and holding capability to stay at sea for extended periods of time up to a month or more.

Shrimp boats are classified as ice boats or freezer boats depending on their method of refrigeration. Ice boats that remain at sea for more than a few days either dip their shrimp in sodium bisulfite or Everfresh dip in order to control black spot (melanosis) which reduces the value of the shrimp once it occurs. The sodium bisulfite dip has been declared a chemical hazard by FDA and if it's use results in a residual amount exceeding 100 parts per million (PPM) on the shrimp, they are then deemed to be adulterated. Everfresh dip has been designated as GRAS, "Generally Regarded As Safe" by the FDA. Industry spokesmen estimate 85% of the ice boats use sodium bisulfite.

The other 15% do not stay at sea long enough for black spot to develop as many buyers demand a shrimp product that has not been treated with sodium bisulfite.

Reef Fish vessels

The size of reef fish vessels is varied. Some are as small as 35' and range to 65' with a few larger. Reef fish vessels that use hooks and lines dropped over the side of the boat attached to electric or hydraulic rigs avoid much of the nearshore waters because of the large number of recreational fishing boats fishing in shallow water.

⁵² Florida Constitution, Article X, Section 16, *Limiting Marine Net Fishing*

All reef fish vessels that use bottom longlines do not activate their fish finders until they are at least in 20 fathoms (120 feet) of water. Federal regulations for the Gulf of Mexico bottom longline reef fish vessels prohibit fishing inside 20 fathoms forcing these vessels to fish well offshore.

Ciguatera is a very debilitating illness. It produces opposite sensations i.e. hot is cold and cold is hot. Diarrhea, vomiting, stomach pain, dizziness, aches, anxiety and numbness⁵³ are the symptoms. Worldwide there have been a few cases of paralysis and death but in most instance victims recover. Ciguatera has been identified as a chemical hazard by the FDA. Certain reefs areas have been pin pointed as major ciguatoxin areas. Hawaii, Puerto Rico, part of the Virgin Islands and a small area in the southern part of Florida have been linked to ciguatera poisoning. Most of the reef fishes harvested by Florida's commercial fishing vessels are free from any ciguatera according to the FDA.⁵⁴

According to a report by the University of California at Davis, "World-wide, there may be as many as 50,000 cases of ciguatera per year (Ragelis, 1984). In the U.S., between 1970 and 1980, 94 outbreaks (418 cases) of ciguatera were reported to the CDC, making it the most frequently reported food-borne illness associated with consumption of seafood (Morris, 1980)."

There is no quick lab method to determine the presence of ciguatoxin and the only way to completely avoid the potential risk of ciguatera is to totally abstain from eating tropical reef fish. A Mouse bioassay is the most popular method used today to determine the presence of ciguatera. There are problems with this method because it requires a steady supply of mice in the 20 gram weight category. These mice are then injected with lipid extracts of fish tissue. The mouse is then observed for up to 48 hours to determine if there is any sign of the poison. The test can vary as different mice have different sensitivities, the test is expensive, it cannot be used except in the lab and animal testing is becoming politically incorrect.

Mackerel vessels

Mackerel gillnet boats are generally in the range of 45 to 60 feet in length. These are fast boats that can quickly run to intercept or move ahead of a school of fish once the school has been located. Mackerel are fast swimmers so the speed of the boat helps in efficiently setting the gillnet.

Spanish Mackerel boats are considered day boats because they go to sea and return to the fish house within 12 hours after the fish are caught. The mackerel boats are capable of holding up to 40,000 pounds of fish but are limited to 10,000 pounds of Spanish mackerel per day by federal regulations.⁵⁵ King mackerel trip limits are more restrictive.

Not being able to quickly remove the fish gilled in the nets while at sea creates a potential for these fish to go through a heat. Scombroid fish without ice on them for too long can develop toxins. Fish not handled properly can develop histamine in their flesh and the histamine cannot be removed from the flesh once it forms.

Scombroid fish poisoning associated with king mackerel, Spanish mackerel, tuna (e.g. skipjack and yellowfin), mahi-mahi, bluefish, amberjack, sardines, abalone and a few other species remains "one of the most common forms of fish poisoning in the United States."⁵⁶ Because the fishery products capable of developing histamine are so widely distributed throughout the United States there is no specific locality where histamine poisoning is more prominent. There have been well over 100 incidents with many of the illnesses resulting from imported canned tuna, canned

⁵³ FDA report. <http://vm.cfsan.fda.gov/~mow/chap38.html> Feb. 3, 1999

⁵⁴ *Fish and Fishery Products Hazards and Controls Guide*, HACCP Alliance, NC State publisher, Raleigh, NC. January 1998, page 65

⁵⁵ Coastal Migratory Pelagic Fishery Management Plan, NMFS, US Dept. of Commerce.

⁵⁶ FDA report. <http://vm.cfsan.fda.gov/~mow/chap38.html> Feb. 3, 1999

abalone, canned anchovies and a variety of fresh and frozen fish. Inadequate temperature control is the main problem. Fish left at room temperature undergo bacterial breakdown of tissue which turns histidine to histamine and saurine. Spoiled fish have a sharp, peppery taste.

Because of the Limited Marine Fishing amendment to the Florida Constitution adopted in 1995, there are no mackerel type fish caught with gillnets in Florida waters, therefore the threat of scombroid poisoning from finfish produced commercially in Florida waters by nets has vanished. There is still a hook & line mackerel fishery in state waters but the fishermen put the fish on ice as they are caught and well before the fish has a chance to go through a heat.

Prior to the Limiting Marine Net Fishing constitutional amendment, Spanish mackerel harvest and processing was a major industry. Fast freezing of the fillets produced a high quality, high nutritional source of protein and made them a favorite menu item at Morrison's Cafeteria and other major restaurants and supermarkets throughout America. The Spanish mackerel fishery on Florida's east coast goes back to 1895 and during World War II, millions of pounds were caught for the war effort. At one time Florida harvested in excess of 85% of all the Spanish mackerel on the east coast of the United States.

However, since the South Atlantic Fishery Management Council gained authority over the fish in the federal fishery zone (waters outside a state boundary out to 200 miles from shore) on the east coast, and after the gillnet ban, the frozen mackerel fillet industry has practically disappeared and both of the major processing and freezing plants in the Tampa Bay area that handled 90% of the mackerel have been sold to other interests.⁵⁷

There is still a modest Spanish mackerel gillnet fishery in federal waters (outside 3 miles in the Atlantic Ocean and outside 3 marine leagues in the Gulf of Mexico). The quota in the Atlantic zone is around 3 million pounds with a daily limit of 10,000 pounds per boat. The daily trip limit decreases as the total quota limit is approached. On the Gulf of Mexico side of Florida the total commercial catch of Spanish mackerel for 1998 was only 400,000 pounds even though the Total Allowable Catch (TAC) allowed to be harvested under federal regulations is over 7 million pounds. The point being that Florida commercial fishermen don't harvest anywhere near the amount of mackerel they once did so the potential of histamine poison has been decreased substantially.

⁵⁷ Personal communication from Robert P. Bell, owner of American Freezers. St. Petersburg, Florida.

Chapter Five - Conclusions

My conclusions on which harvesting vessels should come under HACCP regulations follow.

It should be noted that in regard to food safety issues, from 1988 to 1992, improper holding temperature and poor personal hygiene practices of food handlers were responsible for more food borne diseases than any other sources and that food obtained from unsafe sources was the least commonly reported factor for the 5 years covered in the report from the Centers for Disease Control (CDC).⁵⁸

Shrimp Harvesting vessels

The *Fish and Fishery Products Hazards & Controls Guide*⁵⁹ determined that shrimp harvested in the wild do not have any biological or chemical hazards if they are fully cooked prior to consumption. This declaration includes the absence of pathogens, parasites, natural toxins, chemicals and drugs. Florida shrimp boats that harvest shrimp from open waters, maintain the shrimp at 45° F. or less, use proper handling techniques at sea and unload shrimp without dipping them in sodium bisulfite provide a risk-free seafood product for the consumer if it is fully cooked.

Shrimp boats that use sodium bisulfate as a preservative create a risk for shrimp consumers who have an allergic reaction to sodium bisulfite⁶⁰. Requiring a HACCP plan for shrimp vessels that use sodium bisulfite would reduce the potential risk to consumers and provide training for the Captain and crew in the proper use of sodium bisulfite. Preparation of a hazard analysis, identification of the critical control point of preparing the dip solution, cooling the shrimp down as soon as possible and mandatory sanitation requirements would provide an even safer product than it is today.

Consequently I feel that the data indicate shrimp vessels in Florida using sodium bisulfite should be under the HACCP regulation in order to provide consumers with the safest possible shrimp product on the market.

Oyster harvesting Boats

Oyster harvesting from warm waters present a potential hazard because *Vibrio vulnificus* is naturally present. Oyster harvesting boats often have a long way to travel to the open harvesting areas and the skiffs are not designed to keep the oysters cool or shaded. Time limitation and shading of the oysters on board the boat has been mandated by rule.

Additionally, a public interest group has filed a petition with the FDA that was addressed earlier to establish a non-detectable *vibrio vulnificus* standard for oysters. Pressure to reduce consumption of raw oysters is gaining national support. Raw oysters, because of a naturally occurring vibrio present in the environment, can harm persons at risk.

Because of the danger to those people in a sub-group of the United States population who could die from eating raw oysters with Vv, oyster boats in Florida should come under the HACCP regulation.

⁵⁸ Centers for Disease Control. <http://cdc.gov/epo/mmrwr/preview/mmrwrhtml/00044241.htm>

⁵⁹ A comprehensive guide issued by FDA relating to the final regulations (21 CFR 123) that require fishery processors to develop and implement a HACCP program for each of their operations. Department of Health and Human Services, Public Health Service, FDA, Center for Applied Nutrition. January 1998

⁶⁰ Residue on shrimp from sodium bisulfate shall not exceed 100 PPM according to FDA regulation. Any use of sodium bisulfate requires proper labeling of the shrimp product at the processor level.

Scombroid-toxin forming Species Harvesting Boats and Vessels

Histamine formation in fish, which occurs due to temperature abuse, causes illness. It has been proven that if scombroid toxin forming species of fish are kept cold from the time they are harvested until they are consumed, the chances for histamine development is minimal. Histamine occurs in tuna, mackerel, skipjack and other members of the family scombridae. The Centers for Disease Control keeps track of scombrotoxin outbreaks and cases but many cases are never reported because the symptoms might not be too severe and after a few days of upset stomach and other symptoms, the system returns more or less to normal. The University of Florida's Seafood Specialist, Dr. Steve Otwell, has stated during his HACCP training classes that less than 50% of scombroid cases are reported to a state Health Department or a federal agency.

Because this hazard is widespread, has been highlighted by FDA and because hundreds of illnesses occur annually due to histamine poisoning, vessels harvesting scombroid toxin forming species should come under the HACCP regulation.

Ciguatera Species Harvesting Boats and Vessels

The prime areas of ciguatera incidents are Hawaii, the Virgin Islands and certain reefs in South Florida. There is little risk reef fish caught elsewhere in Florida or in the other Gulf states contain ciguatera. There is no quick test to determine if a fish has developed ciguatoxin and the toxin can not be seen, smelled, tasted or killed by cooking or freezing. The number of outbreaks and cases reported by CDC's Morbidity and Mortality Report, like scombroid are also probably off by 50% because the sickness is not always reported. The only way to be absolutely sure a consumer doesn't become sick from ciguatoxin is for the consumer not to eat carnivorous fish caught on reefs.

Because there is no way to quickly determine the presence ciguatoxin and because most of the reef fish harvested are ciguatoxin free, reef fish harvesting vessels should not be under the HACCP regulation from a ciguatera standpoint but should remain aware of the potential hazards. Sanitary practices on board the harvesting vessels should be written and followed. When scientists determine the location of ciguatoxin reefs, the reef harvesting vessels should be prohibited from fishing on those reefs.

Therefore, of the harvesting vessels examined by this paper to determine if they should come under the Food and Drug Administration's (FDA) Hazard Analysis and Critical Control Point (HACCP) seafood safety Program i.e.: shrimp, oyster, scombroids and reef fish, I conclude that based on available data, shrimp, oyster and scombroid species harvesting vessels should come under FDA HACCP program.

Reef fish vessels should be exempt from HACCP as there is no quick or practical way to determine the presence of ciguatoxin.

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