

A POLICY-ORIENTED ETHNOGRAPHY OF
THE WINTER BLUEFIN TUNA FISHERY IN
BEAUFORT AND MOREHEAD CITY, NORTH CAROLINA

By

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ABSTRACT

In the mid-1990s, sport fishermen from the Outer Banks of North Carolina stumbled upon a winter population of bluefin tuna in the shallow waters near shore. Each winter since then, fishermen have braved icy waters and frigid temperatures to capitalize on this resource. In their quest for a commercial share of the U.S. quota, these local fishermen have shown a unique interest in making their voices heard. They now play a significant role in the data collection and management of bluefin tuna, working side-by-side with scientists and forming a non-profit organization. This MP aims to document the cultural system of these fishermen and incorporate recommendations for more effective bluefin tuna management. In an effort to accomplish this goal I produced a policy-oriented ethnography that characterizes the social, economic and regulatory structure of the sport and commercial bluefin tuna fishery in Beaufort and Morehead City, North Carolina.

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INTRODUCTION

In the mid-1990s, sport fishermen from the Outer Banks of North Carolina stumbled upon a winter population of Atlantic bluefin tuna (*Thunnus thynnus thynnus*) in the shallow waters near shore; prior to this event, the U.S. bluefin tuna fishery had historically occurred only in the waters off New England. Local fishermen have braved icy waters and frigid temperatures to recreationally fish for these bluefin each winter since this discovery.

Local fishermen have taken many steps towards establishing a commercial quota for a local winter fishery, despite their relatively short time bluefin fishing. In 2001, the fishermen lobbied the National Marine Fisheries Service (NMFS) for a portion of the western Atlantic quota. When they were subsequently denied in 2002, the fishermen formed the Winter Bluefin Association (WBA) with the goal of getting federal fisheries authorities to reserve some of each year's tuna quota for the south Atlantic fishery in the winter months.

In addition to forming the WBA, local fishermen have also established lasting relationships with scientists in the Tag-A-Giant (TAG) program. Since its arrival in Morehead City in 1999, TAG has worked with local fishermen to obtain more detailed behavioral data about bluefin, and has promoted the role of the fishermen in the research every step along the way.

Summary and Dynamics of the Local System

The human ecology diagram is a method of visualizing the stakeholders involved in a management scenario. Additionally, it addresses both the natural and social science

bonds that connect the groups. I have diagrammed the human ecology of the North Carolina winter bluefin fishery in the diagram below (Figure 1):

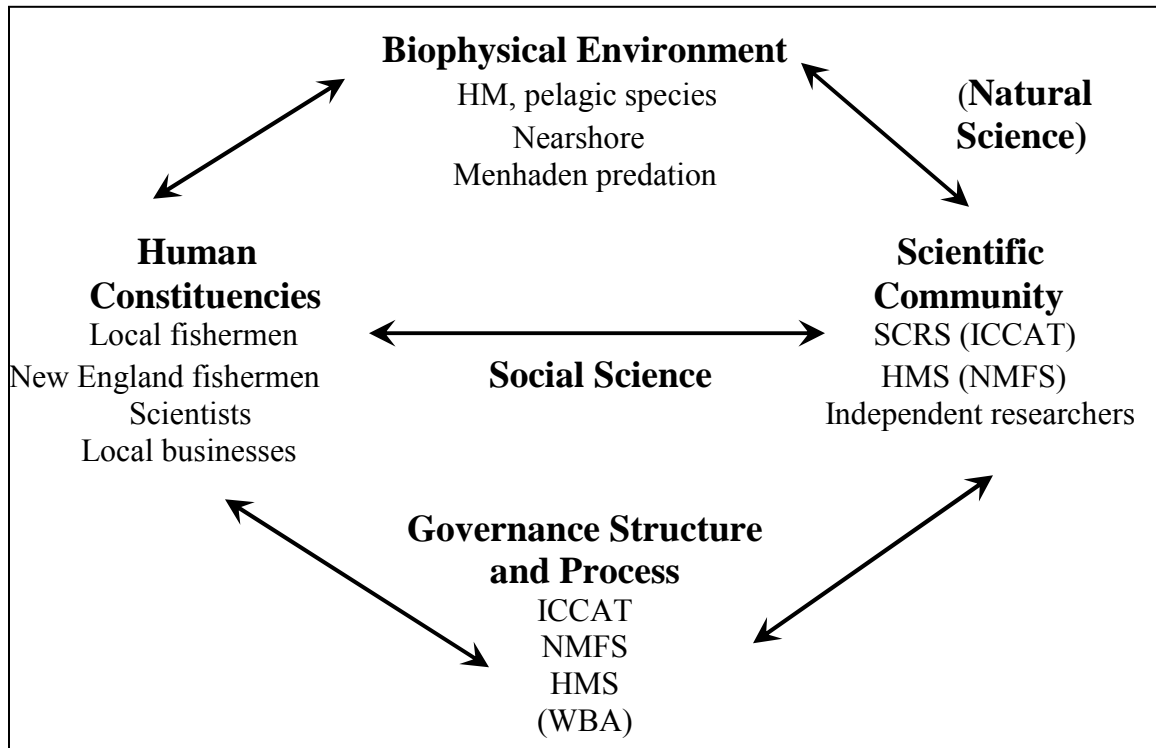


Figure 1: The human ecology diagram of the winter bluefin tuna fishery in North Carolina.

Biophysical Environment

The Atlantic bluefin tuna is a highly migratory, pelagic species of great economic value. Atlantic bluefin tuna live throughout the water column and can be found in all parts of the ocean. The winter bluefin tuna fishery occurs in the nearshore waters off the coast of North Carolina's outer banks where these fish have been caught less than a mile from shore in only 50 feet of water. Fishermen and scientists speculate that the large

aggregations of menhaden that spawn off the Outer Banks during the winter attract the bluefin tuna to the area.¹

Scientific Community

The Standing Committee Research and Statistics (SCRS) of the International Commission for the Conservation of Atlantic Tunas (ICCAT) monitors populations and conducts annual stock assessments upon which quotas are based. Outside of the government, independent researchers are playing a major role in bluefin tuna research. One of the most prominent bluefin tuna researchers in the nation, Dr. Barbara Block, conducts her research with the local fishermen and works from the Duke University Marine Laboratory in Beaufort, North Carolina. Her role in this winter fishery has drawn a significant amount of support and attention to the area.

Governance Structure

Through the Convention, it is established that ICCAT is the only fisheries organization that can undertake the range of work required for the study and management of Atlantic bluefin tuna. It holds supreme authority in bluefin tuna management. From this level, ICCAT delegates the responsibility of bluefin tuna management to individual countries. The 1990 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) are known as the Fishery Conservation Amendments and give the Secretary of Commerce the authority to manage tuna in the U.S. Exclusive Economic Zone (EEZ). At that time, the Secretary delegated authority to manage these

¹ Kade, Tyson. The Natural and Social Science Implications of Bluefin Tuna Migrations off the Coast of North Carolina. Duke University Marine Laboratory Masters Project. May, 2000.

Atlantic Highly Migratory Species (HMS) to NMFS, the “federal agency, a division of the Department of Commerce, responsible for the stewardship of the nation's living marine resources and their habitat.”² In turn, NMFS created the HMS Management Division. This Division manages and regulates the Atlantic HMS fisheries within the United States. This division requires that “international cooperation and rebuilding programs must reflect traditional participation in the fisheries by U.S. fishermen, relative to foreign fleets.”³ Even though the WBA has neither authority nor responsibility in the management of a North Carolina winter bluefin tuna fishery, it is a driving force in establishing management procedures and bringing about change in the fishery management process. The WBA directly influences the actions of both the HMS Division of NMFS and NMFS itself, and therefore should be recognized under the category of Governance Structure and Process.

Human Constituencies

The web of human constituencies in the North Carolina winter bluefin fishery extends to many stakeholder groups. For the purpose of this project, I have chosen what I believe to be the four constituencies most affected. The primary group affected by this fishery is the fishermen themselves. Many local fishermen anticipate the arrival of the bluefin and their chance at making a year’s pay in two months. Earning, on average, \$5 to \$16 per pound for their bluefin, fishermen stand to turn a significant profit off bluefin

² NMFS. About National Marine Fisheries. <http://www.nmfs.noaa.gov/what.htm> Accessed November 30, 2004.

³ NMFS. Introduction to the Highly Migratory Species Management Division. http://www.nmfs.noaa.gov/sfa/hms/intro_HMS.htm. Accessed November 25, 2004.

tuna. Additionally, fishermen profit off of people who charter their boat in the hopes of catching a bluefin tuna.

New England fishermen should also be included in this human ecology diagram. Since the bluefin tuna fishery in New England has declined in the last few years many fishermen make the trip south every winter to have one last chance at fishing. With encouragement from the executive director of the East Coast Tuna Association, many of the 700 to 1,100 boats that participate in the bluefin tuna fishery in New England consider making the trip to North Carolina each winter.⁴

Scientists also play a significant role in the human constituent part of the human ecology diagram. Dr. Barbara Block conducts her research with the local fishermen and works from the Duke University Marine Lab oratory. Her role in this winter fishery has drawn much support and attention to the area, while the fishery itself has provided Dr. Block with an ideal platform from which to conduct her research.

Finally, local businesses thrive off the North Carolina winter bluefin tuna fishery. For instance, the dock master at Beaufort Docks said that bluefin tuna season has boosted his business by about 75 percent during the winter while the owner of Anchor Inn restaurant in Morehead City said his business is feeding probably 20 to 25 more people a day because of bluefin tuna fishing.⁵

The goal of this master's project is to characterize the regulatory, social, and economic structure of the sport and commercial bluefin tuna fishery in Beaufort and Morehead City, North Carolina. I accomplished this objective through in-depth

⁴ Smith, P. "Delay sought for catch of bluefin tuna." Jacksonville Daily News. November 13, 2004.

⁵ Smith, P. "Tuna auctions begin." Jacksonville Daily News. December 3, 2003.

participant observation, informal interviews, and personal communication with the local bluefin fishermen. I participated in the commercial bluefin season while it was open in December 2004 and January 2005, working as a crew member on various boats. I also participated in the Tag-A-Giant program while it was in place in January 2005, as the angler on one of the surgery boats.

Studies have shown that the greater the involvement of constituent groups, the more effective the management of the species.^{6,7,8} I believe that this project sets the stage for future research on the local bluefin tuna fishery which will ultimately lead towards more effective management of this declining resource.

⁶ Mikalsen, K.H., & Jentoft, S. From user-groups to stakeholders? The public interest in fisheries management. *Marine Policy* 25: 281-292 (2001).

⁷ Brodziak, J.K.T., Mace, P.M., Overholtz, W.J., and Rago, P.J. Ecosystem trade-offs in managing New England fisheries. *Bulletin of Marine Science* 74(3): 529-548 (2004).

⁸ Caddy, J.F. and Seij, J.C. This is more difficult than we thought! The responsibility of scientists, managers and stakeholders to mitigate the unsustainability of marine fisheries. *Philosophical Transactions of the Royal Society of Biological Sciences* 360(1453): 59-75 (2005).

BIOLOGY AND ECOLOGY OF BLUEFIN TUNA

The Northern Atlantic Bluefin Tuna, *Thunnus thynnus thynnus* (Linnaeus, 1758) is a pelagic highly migratory species (HMS). Noted for their large size, extensive migrations, and remarkable speed, bluefin were sought after for thousands of years by fishermen and scholars. Many early scientists, including Aristotle, were drawn to the bluefin's natural beauty, impressive power and complex migratory habits.⁹

Bluefin are one of the largest bony fish in the sea – they reach lengths of over 10 feet and tip the scales at nearly 1,500 lbs. In addition, they can reportedly live for thirty years.¹⁰ Their coloration is distinctly dark-blue along the dorsal part of the body, while the lateral and ventral areas are silvery-white. Occasionally the belly area is lightly spotted. The first dorsal fin is most often blue while the second dorsal fin is most often reddish-brown. The anal fin and caudal finlets are bright yellow edged in black; the caudal fin is black. As with most fish, these colors fade and lose their brilliance once the bluefin has died.

Many of the fishermen who have been lucky enough to catch a bluefin consider them to be one of the strongest fish in the ocean. Their fusiform bodies, retractable fins, and powerful crescent-shaped tails allow them to reach speeds of up to 60 miles per hour in short bursts,¹¹ earning them the additional title of one of the fastest fish in the sea. The word “tuna” appropriately originates from the Greek word “to rush.”

Bluefin have other physiological adaptations, including the ability to elevate their body temperature to the point where they become nearly warm blooded. This adaptation

⁹ Buck, E.H. Atlantic Bluefin Tuna: International Management of a Shared Resource. Congressional Research Service Report. March 8, 1995.

¹⁰ Ibid.

¹¹ _____. “Bluefin Tuna Fish File.” National Coalition for Marine Conservation. http://www.savethefish.org/PDF_files/fish_file_6_bluefin_317.pdf. Accessed February 5, 2005.

allows them to thrive in a wider thermal niche than most fish, convert food to energy more rapidly, sustain increased visual and mental facilities, and enhance their physiological and biochemical functions, making them more efficient swimmers.¹²

Bluefin devour massive amounts of food to fuel their powerful bodies. Their diets include practically every oceanic creature smaller than themselves. Sand lances, only inches long, are some of the smallest prey consumed by bluefin. Bluefish and striped bass, at two to three feet long and longer, are some of the largest prey consumed. While bluefin are considered feared by most oceanic inhabitants, they are not without predators themselves. Sharks, orcas, pilot whales and humans all prey on bluefin.

Young, smaller bluefin tend to travel together in schools of five to fifty or more individuals; larger bluefin prefer to travel solo or in pairs.¹³ Scientists conducting aerial surveys have documented schools of bluefin estimated to number in the hundreds. One school, photographed on August 8, 1993, was determined by a surface count to contain an estimated 1,290 bluefin.¹⁴ Even more impressive, surface feeding aggregations of greater than 5,000 individuals have been recorded in the Gulf of Maine.¹⁵

Despite the bluefin's pelagic nature they can also be found in waters adjacent to land, occasionally coming quite near to shore. Bluefin distribution in the western Atlantic occurs from Labrador to Brazil; however, they most often congregate off Nova Scotia and Prince Edward Island, New England waters, the canyons offshore of New York and New Jersey, North Carolina waters, and the Bahamas. Bluefin distribution in

¹² Kade, T. The Natural and Social Science Implications of Bluefin Tuna Migrations off the Coast of North Carolina. Duke University Marine Laboratory Masters Project. May, 2000.

¹³ Personal observation.

¹⁴ Whynott, D. Giant Bluefin. North Point Press. New York. 1995.

¹⁵ Lutcavage, M.E., Brill, R.W., Skomal, G.B., Chase, B.C. and Tutein, J. Tracking adult North Atlantic Bluefin tuna (*Thunnus thynnus*) in the northwestern Atlantic using ultrasonic telemetry. *Marine Biology*. 137:347-358 (2000).

the eastern Atlantic occurs from Norway to northern West Africa. Due to the wide geographic range of bluefin, management must start at the international level. The International Commission for the Conservation of Atlantic Tunas (ICCAT) is the international body that manages Atlantic bluefin tuna. ICCAT defines an “eastern” and a “western” stock of Atlantic bluefin tuna as the populations east and west of the 45°W Meridian, respectively. However, scientists have presently amassed enough evidence to say that significant mixing occurs between populations.¹⁶

Scientists have identified two clear spawning areas for bluefin: the Gulf of Mexico and the Mediterranean Sea. Spawning in the Gulf of Mexico occurs from April to June when the waters reach a temperature of between 76.8 and 85.1 °F (24.9 to 29.5 °C); spawning in the Mediterranean occurs from June to August in water between 66 and 70 °F (19-21 °C).¹⁷ Spawning age varies between the Gulf of Mexico and Mediterranean: eight years of age and four to five years of age, respectively.¹⁸ Bluefin are oviparous and the females release their eggs into the water first and then the males externally fertilize them. At sexual maturity a large female bluefin may release upwards of 10 million eggs during spawning,¹⁹ however these larvae have only one chance in 40 million of reaching adulthood four to eight years later. Fingerlings grow rapidly and reach two feet long and

¹⁶ Proceedings from the Second Symposium on Fisheries, Oceanography and Society, Woods Hole, MA, 8/27-29, 2001.

¹⁷ Gardieff, S. “Bluefin Tuna Biological Profile.” Florida Museum of Natural History. <http://www.flmnh.ufl.edu/fish/Gallery/Descript/BluefinTuna/BluefinTuna.html>. Accessed November 2, 2004.

¹⁸ ICCAT. Report of the SCRS. 1998. Website unavailable.

¹⁹ Bougher, T. “Bluefin Tuna Biology.” Cornell College. <http://people.cornellcollege.edu/t-bougher/geo105/biology.html>. Accessed April 25, 2005.

weigh nine pounds by the end of their first year.²⁰ Overall, very little is known about the spawning patterns of bluefin as they have yet to be observed firsthand.

Bluefin tuna migrations vary depending on fish size and age class, and are assumed to reflect a search for optimal predatory and spawning conditions. After spawning in the Gulf of Mexico, western Atlantic bluefin migrate north along the U.S. coast towards New England and into Canadian waters. Electronic tagging studies have specifically shown that bluefin move from the Carolinas along the Gulf Stream northern edge in spring and toward the New England and Canadian shelf in the early summer, where the fish remained through autumn and returned to the Carolinas or Bahamas by winter.²¹

²⁰ _____. Field and Stream magazine.

<http://www.fieldandstream.com/fieldstream/fishing/saltwater/article/0,13199,356195,00.html>. Accessed November 12, 2004.

²¹ Block, B.A., Dewar, H., Blackwell, S.B., Williams, T.D., Prince, E.D., Farwell, C.J., Boustany, A., Teo, S.L.H., Seitz, A., Walli, A., and Fudge, D. Migratory movements, depth preferences, and thermal biology of Atlantic bluefin tuna. *Science* 293, 1310-1315 (2001).

HISTORY OF THE WESTERN ATLANTIC BLUEFIN TUNA FISHERY

The sport fishery for bluefin tuna in the western Atlantic arose in the early 1900s. The pursuit of small bluefin developed off the coast of New York and New Jersey while the hunt for larger bluefin expanded in the Gulf of Maine and eastern Canada. The Sharp Cup in Nova Scotia was a distinguished international bluefin tournament held from the early 1930s through the 1960s, and drew a wide range of participants. The tournament's most successful year occurred in 1949 when anglers landed 1,760 bluefin.²² Bluefin held very little commercial value at this time and were either discarded or sold to animal-feed plants for less than twenty-five cents per pound.²³

Until the mid-to-late 1950s, the only methods used for catching bluefin were hand-held harpoons, hook-and-line, and traps. A hand-held harpoon consists of a long shank with a sharpened triangular head, thrown from the "stand," an extension of the bow of the boat. After they are struck, the bluefin tows a buoy attached to a line until the fishermen can bring the fish aboard the boat. Bluefin were also caught using rod-and-reel and handlines (fishing lines managed by hand), and traps (net cages). The first purse seiner appeared in Cape Cod Bay in 1958, and brought with it the idea of using nets to encircle and catch large numbers of bluefin at one time. This method of fishing has proven to be highly effective in catching very large amounts of fish in a relatively short period of time. These purse-caught fish were destined for canneries.

In the 1960s, the Japanese introduced the idea of using longlines to catch bluefin to U.S. fishermen. A longline is fishing gear that is set horizontally in the water column

²² National Academy of Sciences. National Research Council. *An Assessment of Atlantic Bluefin Tuna*. Washington D.C., National Academy Press, 1994.

²³ Personal communication with Eric Brazer, Sr., Joe Jancewicz, and Dana Kangas (commercial bluefin tuna fishermen from New England)

suspended by floats, and includes a main fishing line up to 50 miles long strung between two floats, and hundreds or thousands of secondary lines branching off the main line. Each secondary line has a baited hook. Soon, thousands of miles of fishing line, complete with hundreds of thousands of hooks, blanketed the east coast of the U.S. and the Gulf of Mexico. Japanese fishing vessels set 12 million nautical miles of longlines in the Gulf of Mexico alone in 1962.²⁴ The effects were devastating. In only one year, Japanese and American longline fleets took approximately 10,000 giant bluefin from the Gulf of Mexico, one of the only two known spawning grounds.²⁵

As the bluefin fishery expanded during the late 1960s so did the market. In the early 1970s, an entrepreneurial Boston-based fish dealer named Gerald Abrams pioneered a bluefin tuna export market in Japan.²⁶ With the advent of air freight, soon fresh bluefin were packed in ice and shipped directly to Tokyo's Tsukiji Central Wholesale Market, arriving on the auction block the next day.

The Japanese demand for high quality bluefin for sashimi (raw fish) and sushi (raw fish with rice) skyrocketed and caused the price paid for bluefin to swell dramatically. Dockside bluefin prices increased significantly from roughly \$0.20 per pound to \$8.00 per pound and beyond.²⁷ Purse seiners targeting small bluefin began exclusively fishing for the more lucrative giants (greater than 81 inches curved fork length, or CFL).

²⁴ Williams, T. "The Last Bluefin Hunt. Saving the Diminishing Population of Giant Bluefin Tuna." *Audubon*, July/August 1992.

²⁵ NMFS. "Historic Rationale, Effectiveness, and Biological Efficiency of Existing Regulations for the U.S. Atlantic Bluefin Tuna Fisheries." Washington D.C., September 1, 1996.

²⁶ Williams, T. "The Last Bluefin Hunt. Saving the Diminishing Population of Giant Bluefin Tuna." *Audubon*, July/August 1992.

²⁷ NMFS. "Final Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks Volume I." Washington D.C., April, 1999.

A rewarding market, fueled by intense fishing pressure, quickly pushed the bluefin stocks onto the verge of collapse. In the western Atlantic, landings peaked at nearly 20,000 metric tons (mt) in 1964, but plummeted to less than 5,000 mt by 1968. By the mid-1970s and early 1980s, annual western Atlantic catches averaged 6,100 mt before harvests declined further in response to imposed quotas.²⁸ This can be seen in the chart below (Figure 2):

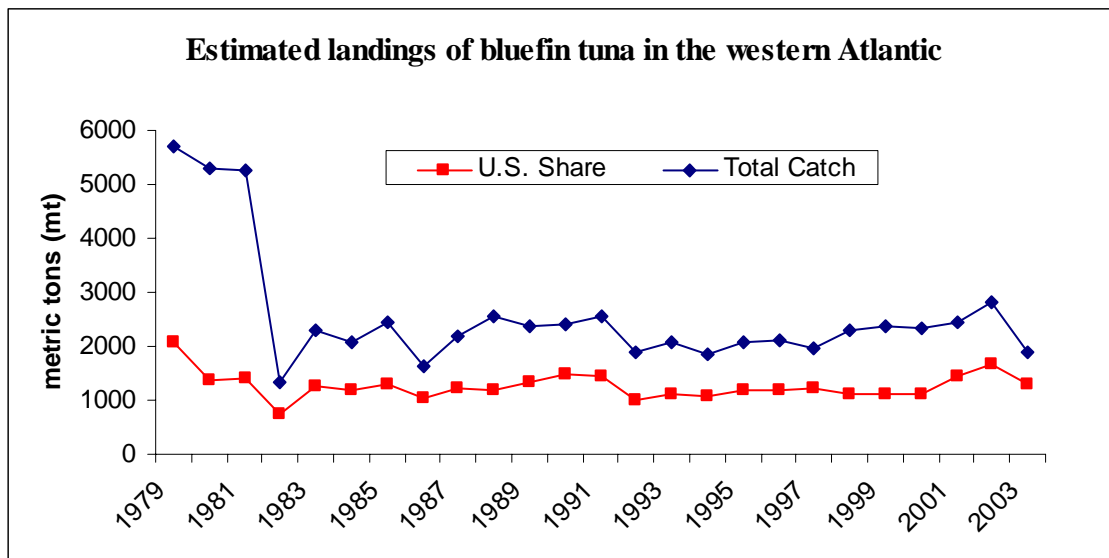


Figure 2: Estimated landings of bluefin tuna in the western Atlantic, 1979-2003.

²⁸ National Academy of Sciences. National Research Council. *An Assessment of Atlantic Bluefin Tuna*. Washington D.C., National Academy Press, 1994.

The available shows that the western Atlantic bluefin stock is overfished and overfishing is occurring, as can be seen in the table below (Figure 3):²⁹

Species	Current Relative Biomass Level	Minimum Stock Size Threshold	Current Fishing Mortality Rate	Maximum Fishing Mortality Threshold	Outlook
West Atlantic Bluefin Tuna	SSB ₀₁ /SSB _{MSY} = 0.31 (low recruitment); 0.06 (high recruitment) -- SSB ₀₁ /SSB ₇₅ = 0.13 (low recruitment); 0.13 (high recruitment)	0.86SSB _{MSY}	F ₀₁ /F _{MSY} = 2.35 (low recruitment scenario) -- F ₀₁ /F _{MSY} = 4.64 (high recruitment scenario)	F _{year} /F _{MSY} = 1.00	Overfished; overfishing is occurring

Figure 3: Stock assessment table for western Atlantic bluefin tuna.

²⁹ NMFS. "Pre-Draft of the Highly Migratory Species Fishery Management Plan Including the 2005 Stock Assessment and Fishery Evaluation (SAFE) Report for Atlantic Highly Migratory Species." Washington D.C., February 2005.

POLICY STRUCTURE

International Commission for the Conservation of Atlantic Tunas

The International Convention for the Conservation of Atlantic Tunas was signed in 1966 at a Conference of Plenipotentiaries to mediate conservation measures among international countries for tunas and tuna-like species. The objective of this convention was to “co-operate in maintaining the population of tunas and tuna-like species found in the Atlantic Ocean and the adjacent seas at levels that will permit the maximum sustainable catch for food and other purposes.”³⁰ Out of this convention and in response to declining catch of Atlantic tunas and swordfish ICCAT was born and signed that same year in Rio de Janeiro, Brazil. The convention was ratified by the U.S. in 1967, and entered into force on March 23, 1969.

ICCAT is the governing body that establishes a species’ total allowable catch and recommends a quota for each of the member-states. Through the Convention ICCAT is established as the only fisheries organization that can undertake the range of work required for the study and management of tunas and tuna-like fishes in the Atlantic.³¹ The United States was one of only three contracting parties (the others were Japan and South Africa) included in the original convention. This number has recently expanded to 40 contracting parties, including the most recent additions of the Philippines, Norway, Nicaragua, Guatemala, and Senegal in 2004.

ICCAT is comprised of eight panels or committees. The Commission is made up of the Chairman and the Vice-Chairman of the Commission and representatives from the

³⁰ Hedley, C. “International Convention for the Conservation of Atlantic Tunas.” Internet Guide to International Fisheries Law. <http://www.oceanlaw.net/texts/summaries/iccat.htm>. Accessed December 1, 2004.

³¹ ICCAT. Introduction to ICCAT. <http://www.iccat.es/introduction.htm>. Accessed December 1, 2004.

Contracting Parties and is responsible for performing intercessional tasks of the Commission. The Secretariat heads coordinating and facilitating the work of the Commission. Four panels on Tropical, Northern Temperate, and Southern Temperate Tunas and Swordfish, Billfishes and Small Tunas review research results and draft management measures. The Compliance Committee reviews compliance by contracting parties. The Permanent Working Group on ICCAT Statistics and Conservation Measures reviews compliance by non-member states. The Standing Committee on Finance and Administration reviews and monitors the finances of ICCAT. Finally, the Working Group on Allocation Criteria evaluates criteria for the allocation of allowable catches amongst contracting parties. These committees are seen in the figure below (Figure 4):

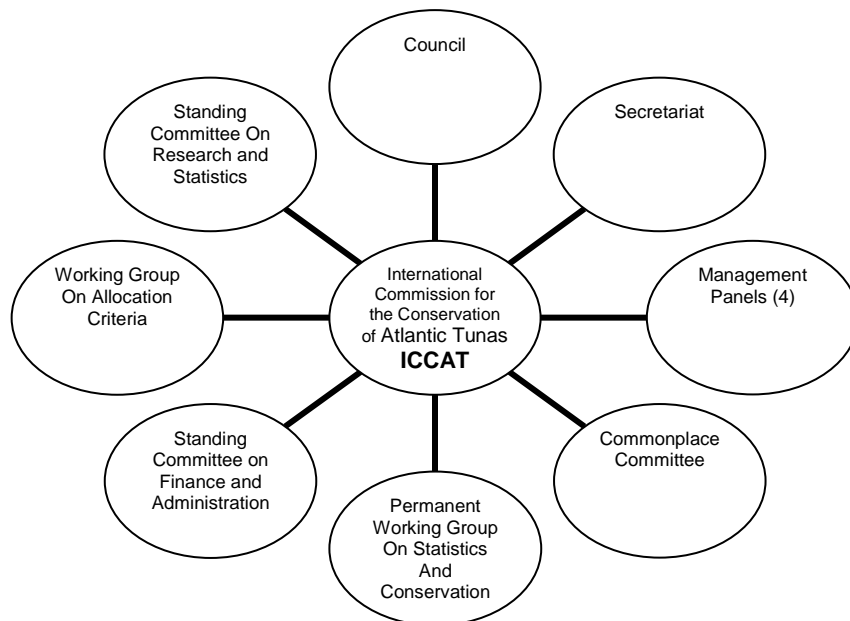


Figure 4: Structure of the International Commission for the Conservation of Atlantic Tunas

Included in this confusing matrix of ICCAT composition, the Standing Committee on Research and Statistics (SCRS) is behind the coordination and execution of all matters related to monitoring and assessment. The SCRS conducts annual stock

assessments on the managed species and uses this data to negotiate quotas and other management recommendations. If recommendations are adopted by ICCAT, then under the Atlantic Tunas Convention Act (ATCA 16 U.S.C. 971), they must be implemented by the U.S and other contracting parties. The SCRS oversees the following sub-committees:

- species groups that assess individual stocks and provide advice to the Panels
- the Subcommittee on Statistics that researches quality control and policy for fishery statistics
- the Subcommittee on the Environment that studies the effects of the environment on ICCAT fisheries
- the Bycatch Subcommittee that reviews data collection for bycatch (principally sharks)
- the Cooperative Billfish Tagging Program that coordinates tagging of billfishes
- the Bluefin Year Program that coordinates research on Atlantic bluefin
- the Bigeye Year Program that coordinates research on bigeye tuna
- the Methods Working Group that evaluates assessment methods
- the Ad Hoc Working Group on the Precautionary Approach that examines the implications of the Precautionary Approach for ICCAT stocks
- the SCRS Organization Ad Hoc Working Group that provides advice on measures to improve the efficiency of the SCRS.³²

In 1981, major recommendations swept through ICCAT including: (a) a bluefin catch as near zero as possible for scientific monitoring in the Western Atlantic (quota set at 1,160 MT for 1982); (b) acceptance of the two-stock management hypothesis with stocks separated at 45 degrees West Longitude; and (c) elimination of directed fishing in the Gulf of Mexico to protect the spawning stock.³³

³² ICCAT. Organization within ICCAT. <http://www.iccat.es/organization.htm>. Accessed December 1, 2004.

³³ Buck, E.H. Atlantic Bluefin Tuna: International Management of a Shared Resource. Congressional Research Service Report. March 8, 1995.

The two-stock theory is the basis for differences in western and eastern Atlantic allocations. ICCAT currently manages the Atlantic bluefin tuna stock as two separate populations divided by the 45°W meridian. Research has shown that the eastern Atlantic population spawns in the Mediterranean Sea while the western Atlantic population spawns in the Gulf of Mexico.³⁴ Each population is subject to different management restrictions with the most prominent difference being a strict quota for the western fishery dominated by U.S. catch (2,394 mt) and a higher quota for the eastern fishery dominated by European nations (40,494 mt).³⁵

Mixing between western and eastern Atlantic bluefin has been evident for more than four decades, as is shown in the current scientific literature. However, recent research involving tagging bluefin tuna with satellite telemetry tags indicates that the capacity for the western Atlantic bluefin tuna to move into the eastern Atlantic management zone is much higher than previously thought.³⁶ Despite this research, ICCAT continues to this day to manage the Atlantic bluefin tuna as two distinct, non-mixing populations.

National Marine Fisheries Service

The U.S. fishery for bluefin tuna is overseen by the National Marine Fisheries Service (NMFS), a branch of the National Oceanic and Atmospheric Administration (NOAA), and acting for the Secretary of Commerce (Secretary) under the authority of the

³⁴ Block, B. et al. Migratory movements, depth preferences, and thermal biology of Atlantic bluefin tuna. *Science* 293, 1310-1315 (2001).

³⁵ Block, B.A., Dewar, H., Farwell, C., and Prince, E.D. A New Satellite Technology for Tracking the Movements of Atlantic Bluefin Tuna. *Proceedings of the National Academy of Sciences of the United States of America*. 95: 9384-9389 (1998).

³⁶ Ibid.

Atlantic Tunas Convention Act (ATCA) and the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA).³⁷ NMFS is the governing body responsible for the management, conservation, and protection of living marine resources within the United States' Exclusive Economic Zone (EEZ). NMFS worked with the eight regional councils to “assess and predict the status of fish stocks, ensure compliance with fisheries regulations, [and] work to reduce wasteful fishing practices... work to promote sustainable fisheries and to prevent lost economical potential associated with overfishing, declining species and habitats... [and] strive to balance competing public needs and interest in the use and enjoyment of our oceans' resources.”³⁸ Most fish species found in the U.S. EEZ are managed by the eight regional councils. However, tuna and other highly migratory species such as sharks, swordfish, and billfish in the Atlantic are managed under the highly migratory species (HMS) division of NMFS.

The HMS division of NMFS was created in 1990 when former President George Bush Sr. signed into law H.R. 2061, or the “Fishery Conservation Amendments of 1990.” These amended the then-current FCMA. Approved on November 28, 1990, this law accomplished many things, including:

- (1) amending the Magnuson Fishery Conservation and Management Act. This Act is the primary domestic legislation for Federal fisheries;
- (2) defining HMS to be tuna species, marlin (*Tetrapturus* spp. and *Makaira* spp.), oceanic sharks, sailfishes (*Istiophorus* spp.), and swordfish (*Xiphias gladius*). Tuna species further defined as albacore tuna (*Thunnus alalunga*), bigeye tuna (*Thunnus obesus*), bluefin tuna (*Thunnus thynnus*), skipjack tuna (*Katsuwonus pelamis*), and yellowfin tuna (*Thunnus albacares*);

³⁷ NMFS. “Final Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks Volume I.” Washington D.C., April, 1999.

³⁸ NMFS. About National Marine Fisheries. <http://www.nmfs.noaa.gov/what.htm>. Accessed March 1, 2005.

- (3) giving Secretary of Commerce (Secretary) the authority (effective January 1, 1992) to manage tuna in the exclusive economic zone (EEZ) of the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea (16 U.S.C. 1811); and
- (4) transferring from the Fisheries Management Councils to the Secretary, effective November 28, 1990, the management authority for the other HMS in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea (16 U.S.C. 1854(f) (3)).³⁹

AUTHORITY STRUCTURE

The Atlantic Tunas Convention Act

Management of Atlantic tunas (including the bluefin) in U.S. waters falls under the authority of the Atlantic Tunas Convention Act (ATCA). Congress enacted the ATCA, (16 U.S.C. 971) in 1975 to provide the framework for U.S. participation in ICCAT. Since ICCAT is not self-executing, it has the authority to administer a treaty, but does not hold the authority to implement actual management measures. Specific management measures must be implemented by nations participating in the treaty in areas of their EEZ jurisdiction, or on their citizens in areas outside of their EEZ jurisdiction. The ATCA provides ICCAT with suggested recommendations, and delegates the necessary authority to the Secretary to implement the ICCAT recommendations in the U.S.. Under the ATCA, the Secretary “is authorized to administer and enforce all provisions of ICCAT and to use the personnel, services and facilities of any agency of any party to the Convention, any other Federal department or agency or any agency of any State... [to] issue regulations deemed necessary to implement the Convention.”⁴⁰ In

³⁹ NMFS. Introduction to the Highly Migratory Species Management Division. http://www.nmfs.noaa.gov/sfa/hms/intro_HMS.htm. Accessed March 1, 2005.

⁴⁰ NOAA Coastal Services Center. Legislative Summaries: Atlantic Tunas Convention Act. <http://www.csc.noaa.gov/opis/html/summary/atca.htm>. Accessed March 1, 2005.

addition, the ATCA authorizes the President to appoint three delegates to serve as U.S. ICCAT Commissioners. Section 971i of the ATCA outlines congressional reporting on measures on research and monitoring bluefin tuna:

The Secretary of Commerce must submit in 1995 to Congressional committees a report on research and monitoring activities on Atlantic bluefin tuna and other highly migratory species. The Secretary also must submit a report on catches and exports to the U.S. of highly migratory species, and on nations acting inconsistently with the Convention. Biennial reports to Congress must include:

- (1) the level of taking of bluefin tuna by U.S. fishermen in Convention Waters;
- (2) the status of bluefin tuna stocks within Convention waters and population trends; and
- (3) related information from the observer program under the Magnuson Act.

The Secretary in 1995 is to develop and implement a comprehensive research and monitoring program for conservation and management of Atlantic bluefin tuna and other highly migratory species. This is to be done in cooperation with the Atlantic Tunas Convention Act advisory committee, the U.S. Commissioners on the International Commission for the Conservation of Atlantic Tunas, and the Secretary of State. (16 U.S.C. 971(i))

In response to this requirement, a Supplemental Draft Environmental Impact Statement (SDEIS) was prepared in 1995. This revision updated the DEIS developed in 1994 which was based on the November 1994 SCRS findings and subsequent revisions to the ICCAT recommendations.⁴¹

⁴¹ NMFS. "Final Environmental Impact Statement for a Regulatory Amendment for the Western Atlantic Bluefin Tuna Fishery." Washington D.C., 1995.

The Magnuson Fishery Conservation and Management Act

A milestone in domestic fisheries management, the Magnuson Fishery Conservation and Management Act (MFCMA), also known as the Fishery Conservation and Management Act (FCMA), came about primarily in response to the increased presence of foreign factory trawlers fishing in U.S. waters. Fishermen, lobbyists, and managers were deeply concerned with the large amount of fish these vessels were taking and the resulting negative impact on the fish populations and the U.S economy.

On April 13, 1976, Congress approved the Magnuson-Stevens Fishery Conservation and Management Act. This Act established a 200-mile domestic fishery conservation zone (effective March 1, 1977) and provided a mechanism for preemption of State law by the Secretary. Additionally, the Act instituted eight Regional Fishery Management Councils, comprised of members knowledgeable about the fishing industry and federal and state officials, are responsible for the preparation of fishery management plans (FMPs) to achieve the optimum yield (OY) from U.S. fisheries in their regions. However, these regional fishery management councils had little effect on the bluefin fishery.

The regional fishery management councils held neither authority nor responsibility in managing bluefin tuna policy, due to the inclusion of a HMS exemption in the MFCMA from its formation in 1976 until the act was amended in 1990. This provision was originally added due to lobbying pressure from the United States' high-seas tuna fleet. This fleet fished for various tuna species in the Pacific and only fished in the waters off other countries and not within the U.S. EEZ. As a result of this, the fleet sought to avoid retaliatory measures from other nations for several reasons: 1) the highly

migratory nature of tunas necessitates international management, 2) multiple economic jurisdictions would allow each country to charge an access fee, placing unreasonable economic burden on the United States fishers, and 3) if the United States recognized exclusive jurisdiction, other nations could prohibit the United States fleets from their waters.⁴² Due to the difficulties and inconsistencies brought on by this exemption, it was removed from the act in 1990.

The MFCMA specifies that NMFS “must provide fishing vessels of the United States with a reasonable opportunity to harvest any allocation or quota of an ICCAT species to which the United States has agreed.”⁴³ Under this act, the Secretary is designated the authority “to adopt regulations necessary to carry out the purposes and objectives of the Convention” and the ATCA, and to promote regulations “as may be necessary and appropriate to carry out” the recommendations of ICCAT.⁴⁴

Fishery Conservation Amendments

The 1990 amendments to the ATCA are known as the Fishery Conservation Amendments. One of the most important accomplishments of the amendments was the establishment of formal definitions of HMS to be tuna species, marlin (*Tetrapturus* spp. and *Makaira* spp.), oceanic sharks, sailfishes (*Istiophorus* spp.), and swordfish (*Xiphias gladius*). Second, the amendment transferred the management authority (effective November 28, 1990) for the other HMS in the EEZ from the Fishery Management

⁴² Kade, T. “The Natural and Social Science Implications of Bluefin Tuna Migrations off the Coast of North Carolina.” Duke University Marine Laboratory Masters Project. May, 2000.

⁴³ NMFS. “Final Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks Volume I.” Washington D.C., April, 1999.

⁴⁴ NMFS. “Historic Rationale, Effectiveness, and Biological Efficiency of Existing Regulations for the U.S. Atlantic Bluefin Tuna Fisheries.” Washington D.C., September 1, 1996.

Councils to the Secretary of Commerce. Finally, the amendments gave the Secretary of Commerce the authority (effective January 1, 1992) to manage tuna in the EEZ. At this time, the Secretary delegated authority to manage these Atlantic HMS to the NMFS. In turn, NMSF created the HMS Management Division. This Division manages and regulates the Atlantic HMS fisheries within the U.S. EEZ.⁴⁵

The Sustainable Fisheries Act

The MFCMA was amended multiple times in its existence and in 1996 the passage of the Sustainable Fisheries Act (SFA) both reauthorized the MFCMA and modified it to become the MSFCMA. In particular, the SFA embodied a precautionary approach to US fishery management and “brought substantial changes in the requirements to prevent overfishing and rebuild overfished fisheries. Each FMP is required to specify objective and measurable criteria for determining when a stock is overfished or when overfishing is occurring, and to establish measures for rebuilding the stock. The SFA also added several new definitions, including definitions for overfishing and overfished, and for fishing communities.”⁴⁶

The SFA includes a requirement that NMFS establish advisory panels to assist the Secretary in preparing an FMP or an amendment to an FMP with respect to specific HMS fisheries. In preparing the FMP or amendment, the Secretary is directed to “diligently pursue, through international entities, comparable international fishery management measures with respect to fishing for highly migratory species and to ensure that

⁴⁵ NMFS. Introduction to the Highly Migratory Species Management Division. http://www.nmfs.noaa.gov/sfa/hms/intro_HMS.htm. Accessed November 25, 2004.

⁴⁶ NMFS. “Implementing the Sustainable Fisheries Act: Achievements from 1996 to the Present.” http://www.nmfs.noaa.gov/sfa/SFA-Report-FINAL7_1.pdf. Accessed January 8, 2005.

conservation and management measures promote international conservation and are fair and equitable in allocating fishing privileges among U.S. fishermen.”⁴⁷

NMFS developed and published the “Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks” in 1999 in an effort to bring together all HMS management measures. This plan established the permitted use for each gear type employed in targeting the addressed species. ICCAT determines the overall allocation levels for the United States, and the FMP distributes this allocation among seven categories of gear type including general, harpoon, longline, trap, purse seine, angling, and a reserve category.

Amendment 1 to the “Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks” was published in 2003. No major amendments to bluefin tuna management were made in it.

The Convention on International Trade in Endangered Species

Currently the bluefin tuna is not, and has never been listed as “endangered.” However, this does not mean that attempts have not been made to have it listed as one. In a 1992 Swedish fishing report released to the National Audubon Society and the International Game Fish Association (IGFA), Sweden pressured the Convention on International Trade in Endangered Species (CITES) into listing the bluefin as endangered, effectively suspending all commercial fishing for bluefin to allow the population to rebuild. That same year, US fisherman and scientist Carl Safina set out to petition the domestic government the same way. The request was written “with the hope

⁴⁷ Magnuson-Stevens Fishery Conservation and Management Act.
<http://ipl.unm.edu/cwl/fedbook/magfish.html>. Accessed January 10, 2005.

that one international treaty organization- CITES- could force another treaty organization- ICCAT- to act responsibly.”⁴⁸

Japan reacted massively to Sweden’s proposal at the 1992 CITES Conference. Questioning Sweden’s stake in the bluefin fishery (bluefin is neither eaten nor fished in Sweden today), Japan maintained that tuna is included in their traditional food, sushi, and therefore had a traditional right to fish it. Bowing to political pressure from Japan and elsewhere, “the Swedish delegation at the 1992 CITES Conference was cowed by Japan, acting in concert with other countries: in spite of great support from a number of the world’s leading environmentalist agencies, Sweden was forced to take back their proposal to protect the bluefin.”⁴⁹ The same scenario unfolded back in the U.S.- congressional pressure prompted NMFS to recommend against listing bluefin as endangered under CITES. At the annual ICCAT meeting one year later, the issue resurfaced. In response, ICCAT passed a resolution that (1) requested that CITES consult fully with ICCAT concerning listing proposals for species within the competence of ICCAT and for the current review of listing criteria; (2) reaffirmed ICCAT's intention to provide CITES with a report on the status of Bluefin tuna populations; and (3) expressed its wish that ICCAT's views be taken fully into account.⁵⁰

This intricate and complex policy and authority structure can be seen in the figure below (Figure 5):

⁴⁸ Safina, C. *Song for the Blue Ocean*. Henry Holt & Company. 1998.

⁴⁹ Olsson, J. “Bluefin Tuna in Scandinavian Waters.” <http://www.outdoor.se/sportfishnews/articles/bluefin/index.htm>. Accessed December 1, 2004.

⁵⁰ _____. “Bluefin Tuna.” <http://www.american.edu/projects/mandala/TED/bluefin.htm>. Accessed December 1, 2004.

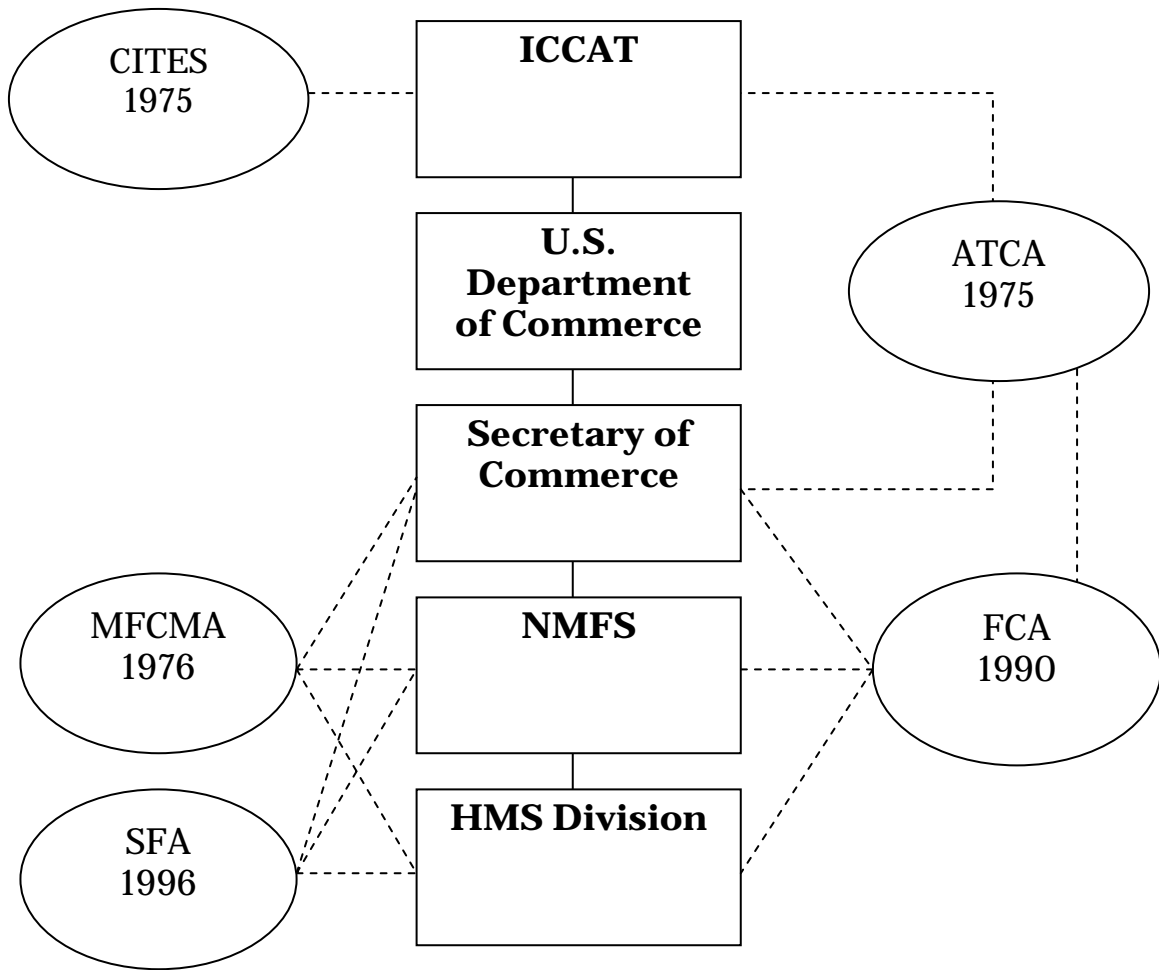


Figure 5: The policy and authority structure involved in managing Atlantic bluefin tuna.

CURRENT BLUEFIN TUNA MANAGEMENT

Size Classes

Bluefin are divided into six size classes for management and analytical purposes: young school, school, large school, small medium, large medium, and giant. “Young school” bluefin measure less than 27 inches curved fork length (CFL) (less than 20 inches pectoral fin curved fork length, or PFCFL) with an approximate round weight of less than 14 lbs. No bluefin of this size can be retained by fishers in any permit category.

“School” bluefin have a CFL of between 27 and less than 47 inches (20 inches to less than 35 inches PFCFL) and an approximate round weight of 14 to less than 66 lbs.

“Large school” bluefin fall between 47 and less than 59 inches CFL (35 to less than 44 inches PFCFL) and weigh approximately 66 to less than 135 lbs, round weight. “Small medium” bluefin measure between 59 and less than 73 inches CFL (44 to less than 54 inches PFCFL) and are estimated to weigh between 135 and less than 235 lbs, round weight. “Large medium” bluefin are the smallest bluefin allowed to be commercially sold and fall between 73 and less than 81 inches CFL (54 to less than 60 inches PFCFL) and are estimated to have a round weight of 235 to less than 310 lbs. “Giants” are the largest size class of bluefin and have a CFL of 81 inches or greater (60 inches or greater PFCFL) and weigh approximately 310 lbs or more.

User Groups

NMFS allocates the annual U.S. share among seven user categories – angling, general, harpoon, purse seine, trap, and incidental. Fishermen need category-specific permits to fish within the category. NMFS established quotas for each category in 1992,

based on the historical share of the catch in each category between 1983 and 1991.

NMFS retains the authority to transfer portions of quotas among categories and to close the fishery when the category quota is reached or is projected to be reached. Currently, annual under/over harvests are added or subtracted from the individual category for the subsequent fishing year.

The angling category is restricted to recreational fishermen using hook-and-line gear only. Catches cannot be sold, however anglers are allowed to keep one bluefin per day under 73" CFL and one bluefin per fishing year over 73". NMFS allocated 288.6 mt (19.4 percent of the U.S. quota) to the angling category in 2004. That year 20,245 fishermen held angling permits.⁵¹

Fishermen participating in general category fishery are restricted to using hand gear including hook-and-line and hand-held harpoons. Fishermen will often purchase a general category permit as an "insurance policy" if they catch a sellable bluefin while fishing under the angling category. Currently the general category quota is further subdivided into time periods: June – August (60 percent of the general category quota), September (30 percent of the general category quota), and October – January (10 percent of the general category quota).⁵² The U.S. has also implemented "closed fishing days" in the General Category as a means of spreading the quota more equitably and to allow for a late-season fishery. General category fishermen are allowed to retain between one and three bluefin per day, depending on the condition of the stock and the level of quota

⁵¹ HMS angling permits became effective March 1, 2003 and include all HMS, not just bluefin tuna.

⁵² NMFS. "Pre-Draft of the Highly Migratory Species Fishery Management Plan Including the 2005 Stock Assessment and Fishery Evaluation (SAFE) Report for Atlantic Highly Migratory Species." Washington D.C., February 2005.

caught. NMFS allocated 689.8 mt (46.3 percent of the U.S. quota) to the general category in 2004. 5,057 fishermen held general permits in 2004.⁵³

The harpoon category permit allows fishermen using only hand-held harpoons to land and sell one large-medium plus an unlimited number of giant bluefin per day. NMFS allocated 57.1 mt (3.8 percent of the U.S. quota) to the harpoon category in 2004.⁵⁴ That year, 49 fishermen held harpoon permits.⁵⁵

The purse_seine category currently employs the least number of vessels (five) but is allocated the third largest share of the U.S. quota: 272.4 mt, or 18.3 percent.⁵⁶ When the captain locates a school of fish, the main vessel and assisting skiff encircle the fish with a net. The bottom of the net is then pulled closed with a drawstring known as a purse cable. The net is pulled out of the water by the main vessel like a giant "purse" full of fish. The five vessels are owned by three owners and have exclusive right to harvesting the purse seine quotas since their establishment in 1982.

The incidental category is mainly used by longline fishermen pursuing swordfish or other tunas. Any incidental takes of bluefin count towards this quota. Strict permit provisions require a minimum landing on non-bluefin target species to qualify to land a bluefin, however bluefin tuna discards are not currently counted against the incidental

⁵³ Ibid.

⁵⁴ NMFS. "Notice: NOAA Fisheries Proposes Initial Atlantic Bluefin Tuna Quotas, Effort Controls for 2004." [http://www.nmfspermits.com/other/04BFTSpecs_FaxNotice.12-7-2004\[1\].pdf](http://www.nmfspermits.com/other/04BFTSpecs_FaxNotice.12-7-2004[1].pdf). Accessed December 7, 2004.

⁵⁵ NMFS. "Pre-Draft of the Highly Migratory Species Fishery Management Plan Including the 2005 Stock Assessment and Fishery Evaluation (SAFE) Report for Atlantic Highly Migratory Species." Washington D.C., February 2005.

⁵⁶ NMFS. "Notice: NOAA Fisheries Proposes Initial Atlantic Bluefin Tuna Quotas, Effort Controls for 2004." [http://www.nmfspermits.com/other/04BFTSpecs_FaxNotice.12-7-2004\[1\].pdf](http://www.nmfspermits.com/other/04BFTSpecs_FaxNotice.12-7-2004[1].pdf). Accessed December 7, 2004.

quota.⁵⁷ Longliners are allowed to retain 1 bluefin per vessel per trip provided that 2,000 lbs of directed catch (other than bluefin) are offloaded and sold; 2 bluefin per vessel per trip for a total of 6,000 lbs of directed catch; and 3 bluefin per vessel per trip for a total of 30,000 lbs of directed catch.⁵⁸ In 2004, the incidental category held 143.6 mt, or 9.6 percent of the total U.S. quota⁵⁹ and 213 permits were issued.⁶⁰

In the trap category owners of vessels operating pound nets that may result in the incidental taking of bluefin must obtain a trap category permit. 1.5 mt (0.1 percent of the U.S. quota) was allocated to this category in 2004.

In the Charter/Headboat category, vessels are able to participate in both the general and angling categories. Any vessel that carries passengers for hire must obtain a HMS charter/headboat category permit. Fishermen must follow the angling category retention limits for Small, Large School and Small Medium bluefin, but are allowed to land one Large Medium or Giant per vessel per year. 3,881 charter/headboat permits were issued in 2004.⁶¹

The remainder of the U.S. quota (36.6 mt, or 2.5 percent) is placed into a reserve category, and becomes available if unexpected overages are encountered with any of the permit categories during the fishing season. In 2004 the reserve category held.⁶²

⁵⁷ Buck, E.H. Atlantic Bluefin Tuna: International Management of a Shared Resource. Congressional Research Service Report. March 8, 1995.

⁵⁸ NMFS. "Atlantic Tunas Program Brochure." <http://www.nmfspermits.com/other/03RegBrochure.pdf>. Accessed February 4, 2005.

⁵⁹ NMFS Notice: NOAA Fisheries Proposes Initial Atlantic Bluefin Tuna Quotas, Effort Controls for 2004. [http://www.nmfspermits.com/other/04BFTSpecs_FaxNotice.12-7-2004\[1\].pdf](http://www.nmfspermits.com/other/04BFTSpecs_FaxNotice.12-7-2004[1].pdf). Accessed December 7, 2004.

⁶⁰ NMFS. "Pre-Draft of the Highly Migratory Species Fishery Management Plan Including the 2005 Stock Assessment and Fishery Evaluation (SAFE) Report for Atlantic Highly Migratory Species." Washington D.C., February 2005.

⁶¹ Ibid.

⁶² NMFS Notice: NOAA Fisheries Proposes Initial Atlantic Bluefin Tuna Quotas, Effort Controls for 2004. [http://www.nmfspermits.com/other/04BFTSpecs_FaxNotice.12-7-2004\[1\].pdf](http://www.nmfspermits.com/other/04BFTSpecs_FaxNotice.12-7-2004[1].pdf). Accessed December 7, 2004.

Permit Requirements

All permits cost \$22.00 and can be applied for online or through the mail. All fishermen are required to purchase a permit or certification to fish for, take, retain or possess bluefin tuna during the fishing year. The established fishing year runs from June 1 through May 31 of the following year. However, the commercial season closes January 31 or when the quota is filled, whichever comes first. An initial application is required for the permit; after receiving the initial permit, a renewal application must be completed for each fishing year.

According to the NMFS Permitting website:

- All owners/operators of vessels (except charter/headboats and recreational vessels) fishing for and/or retaining regulated Atlantic tunas (Atlantic bluefin, yellowfin, skipjack, albacore, and bigeye tunas) in the Atlantic Ocean, including the Gulf of Mexico and Caribbean Sea, must obtain an Atlantic tunas permit;
- All owners/operators of vessels fishing recreationally for and/or retaining regulated Atlantic Highly Migratory Species (Atlantic tunas, sharks, swordfish and billfish) in the Atlantic Ocean, including the Gulf of Mexico and Caribbean Sea, must obtain an Atlantic Highly Migratory Species (HMS) permit;
- All owners/operators of charter/headboat vessels fishing for and/or retaining regulated Atlantic Highly Migratory Species (Atlantic tunas, sharks, swordfish and billfish) in the Atlantic Ocean, including the Gulf of Mexico and Caribbean Sea, must obtain an Atlantic Highly Migratory Species (HMS) permit.⁶³

Exempted fishing permits and scientific research permits are issued often at times when bluefin fisheries are closed; this allows for the collection, sampling and/or tagging that would otherwise be prohibited at that specific time.

⁶³ NMFS. Permit Shop. <http://www.nmfspermits.com/PermitList.asp>. Accessed February 23, 2005.

No Directed Fishing Pressure on the Spawning Stock

In 1992, NMFS published regulations to prevent directed fishing for spawning bluefin tuna in the Gulf of Mexico and to enhance enforcement of the current regulations. This announcement came on the heels of a large problem of unreported longline bluefin catches. While unreported catch is a significant problem in fisheries in general, this particular situation is intensified by the fact that these actions occurred in known spawning areas. These regulations:

- prohibited retention of the Atlantic bluefin tuna harvested from the Gulf of Mexico, except for vessels permitted in the Incidental Catch category;
- reduced the incidental catch limit for Atlantic bluefin tuna from two to one fish per vessel per trip in the longline fishery operating south of 36° N. latitude (southern area);
- conditioned the incidental catch limit of one Atlantic bluefin tuna on the landing of at least 2,500 pounds of other species in the southern area.”⁶⁴

Dealer Reporting

Reporting requirements are another major domestic standard implemented by NMFS. Each bluefin tuna that is landed is tagged and documented in accordance to the Bluefin Statistical Document (BSD) program. If bluefin tuna are exported from, or imported to the U.S., dealers submit the BSD to NMFS as part of the monitoring program. In 1993, NMFS required bluefin tuna dealers to submit daily landing reports and bi-weekly comprehensive reports to give NMFS better information for quota monitoring and to allow NMFS to make decisions on seasonal closures to adjustments on

⁶⁴ NMFS. “Historic Rationale, Effectiveness, and Biological Efficiency of Existing Regulations for the U.S. Atlantic Bluefin Tuna Fisheries.” Washington D.C., September 1, 1996.

a real-time basis. Currently NMFS is developing a system that would enable dealers to submit electronic bluefin landing reports, biweekly bluefin reports, and bluefin statistical documents using the Internet.⁶⁵

Fishing Seasons

The bluefin season traditionally opens on June 1 of any given year. The length of the season depends on the catch rate; the season shuts down when the quota is reached, or on December 31, whichever came first. Currently the general category quota is further subdivided into time periods: June – August (60 percent of the general category quota), September (30 percent of the general category quota), and October – January (10 percent of the general category quota).⁶⁶ These allocations are based on historical seasonal catches. Recently, the WBA petitioned NMFS to extend the season until January 31 to allow North Carolina fishermen a fair share at the resource.

NMFS imposes restricted fishing days within the general category to alleviate fishing pressure on the stock and to lengthen the season.

⁶⁵ NMFS. “Pre-Draft of the Highly Migratory Species Fishery Management Plan Including the 2005 Stock Assessment and Fishery Evaluation (SAFE) Report for Atlantic Highly Migratory Species.” Washington D.C., February 2005.

⁶⁶ Ibid.

HISTORY OF THE NORTH CAROLINA BLUEFIN TUNA FISHERY

Nobody really knows whether bluefin tuna have always inhabited the nearshore waters off North Carolina's Outer Banks, or if their appearance is a relatively recent phenomenon. Some researchers speculate that North Carolina is a "new winter pit stop" for bluefin to replenish their energy stores while they migrate from New England to the Gulf of Mexico to spawn.⁶⁷ Others say that the bluefin have been here all along, but that fishermen have not focused any fishing effort on the stock because they did not realize the bluefin were present. This claim is backed up by announcement of bluefin tuna being caught in nets or washing ashore in North Carolina the 1950s and 1960s. Additionally, reports from commercial fishers in Hatteras during this time claim sightings of large tunas foraging near their seines and trawls.⁶⁸ Records from the Cooperative Tagging Center of NMFS indicate that conventional tags have been deployed in bluefin tuna off the coast of North Carolina for decades. These tagging events occurred during the summer months between 1955 and the early 1990s, and the winter months of 1970, 1971, and 1989.⁶⁹

A sport fishery did not develop in North Carolina until the mid-1990s, despite the apparent presence of bluefin off the coast. Prior to the discovery of this lucrative fishery, fishermen used the winter months primarily to haul their boats out of the water to either store or repair them. Now, these fishermen who normally pursued other pelagics such as mahi, kingfish, yellowfin tuna, and various billfish species, re-rig their boats with heavier gear for a winter bluefin fishery.

⁶⁷ Boustany, A. Tracking of Atlantic Bluefin Tuna (*Thunnus thynnus thynnus*) off Cape Hatteras, North Carolina: A Comparison of Acoustic, Archival and Pop-up Satellite Tagging. Unpublished. 1998.

⁶⁸ Kade, T. "The Natural and Social Science Implications of Bluefin Tuna Migrations off the Coast of North Carolina." Duke University Marine Laboratory Masters Project. May, 2000.

⁶⁹ Ibid.

Oceanographic Conditions

The waters off the coast of North Carolina are littered with thousands of shipwrecks. These waters lay claim to the title of “Graveyard of the Atlantic” with one of the highest densities of shipwrecks in the world. These wrecks serve as fish aggregation devices and attract numerous species of marine life. The Gulf Stream, with its 21-24 degree C waters in winter and 27-29 degree C waters in summer, flows as close as 50 km from shore in some places, and brings with it an upwelling of nutrient-rich waters from the deep. High concentrations of primary producers attract spawning fish (spot, croaker, and menhaden) which, in turn, attract larger predators including bluefin. Bluefin stomach sampling projects have demonstrated a heavy reliance upon Atlantic menhaden as a food source. Since the menhaden are distributed throughout the waters above the continental shelf, researchers believe that bluefin traveling in the Gulf Stream exit this northbound surface current to feed above upon the menhaden near shore.⁷⁰

Quotas

North Carolina has seen an astonishing increase in fishing pressure on the winter bluefin population over the last decade. Prior to 2000, this effort had come from sport fishermen only, as no commercial bluefin fishery existed in North Carolina. Bluefin fishermen in the Cape Hatteras, North Carolina logged approximately 2,900 boat trips in 1996, where there had been none just a few years prior.⁷¹

⁷⁰ Ibid.

⁷¹ Bohnsack, B. L., Ditton, R.B., Stoll, J.R., Chen, R.J., Novak, R., and Smutko, L.S. The Economic Impacts of the Recreational Bluefin Tuna Fishery in Hatteras, North Carolina. *North American Journal of Fisheries Management*. 22:165-176 (2002).

As the North Carolina bluefin fishery developed, NMFS decided to make three adjustments to the bluefin fishery: they set a quota of 40 mt for the angling category for the southern U.S., set size limits, and imposed a provision to encourage the development of a largely catch-and-release fishery.⁷² In 1998, North Carolina fishermen were concerned with the unreliability of bluefin angling landings and requested a mandatory tag requirement accounting for every legal bluefin tuna landed. NMFS granted their request.

The once-thriving Hatteras bluefin fishery has slowly dwindled in recent years as bluefin have stopped appearing in that area. Instead, the bluefin have shown up in the nearshore waters off Beaufort and Morehead City, approximately 80 miles south of Hatteras, as can be seen below (Figure 6):

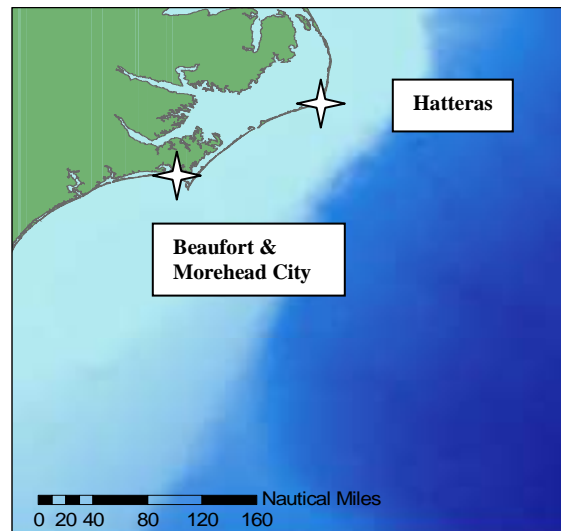


Figure 6: Bluefin Tuna Fishery Locations in Coastal North Carolina

Nobody can conclusively determine the reason for this relocation, however prey aggregations or oceanographic conditions are thought to play important roles.

⁷² Ibid.

In 2000, bluefin fishermen in New England did not catch their entire commercial quota as in years past, and left approximately 50 mt of their summer allocation unharvested. In response, NMFS then gave the North Carolina fishermen the opportunity to take advantage of this underage by adding the remaining quota to the winter allocation, which happens to occur when the bluefin are located in the waters off North Carolina. State records show that in that year, North Carolina fishermen caught and sold approximately 59 mt of bluefin tuna worth about \$1.2 million.⁷³ Had NMFS not added fishing days and upped the catch limit from one to two fish per day earlier in the year for the northern fishery, there would have been more than 100 mt left for a winter fishery in North Carolina.⁷⁴ The North Carolina Division of Marine Fisheries (NCDMF), seeing the potential for establishing a permanent state fishery, petitioned NMFS in 2001 to set aside 50 mt of quota for a winter fishery in North Carolina. They were subsequently denied.

In response to the denial, a group of commercial and sport fishermen formed the Winter Bluefin Association (WBA) in 2002. The primary goal of this nonprofit organization was to persuade NMFS to allocate a portion of each year's commercial bluefin tuna quota for a winter fishery. Their request was granted in November 2002, when NMFS acknowledged that the commercial bluefin tuna season would open December 1 with a 60 mt of quota and would close on December 31 or whenever the quota ran out, whichever came first.⁷⁵

⁷³ Smith, P. "Nonprofit group comes together over bluefin tuna." Jacksonville Daily News. January 23, 2002.

⁷⁴ Ibid.

⁷⁵ Smith, P. "Fishermen hoping Christmas bonuses swim their way." Jacksonville Daily News. November 27, 2002.

On December 1, 2003, after NMFS subtracted 150 mt from the 2003 general category quota to cover an overage from the previous year, the commercial season opened with approximately 48 mt available for harvest. The quota was quickly reached and the season was shut down in only 10 days. As a result of political and stakeholder pressure NMFS reopened the commercial season on January 2, 2005 with 11.6 mt of quota transferred from other categories.

In December of 2003, NCDMF was successful in getting NMFS to extend the general category season from December 31 to January 30. The general quota, which covers commercial hand-held fishing gear, runs from June 1 to December 31, but has historically been harvested by fishermen in northern states by early October prior to when the bluefin move into waters off North Carolina. This extension allowed North Carolina fishermen to take advantage of the increased January market demand for bluefin.

NORTH CAROLINA BOATS AND GEAR

Boats

The Morehead City and Beaufort charter fleets are fairly similar in many characteristics. Collectively, the general style of the boats along these waterfronts is referred to as a “Carolina Sportfisherman.” This style of boat is distinguished by deep entry, a sharply pointed bow, an exaggerated flare of the foredeck, the flattening of the hull from fore to aft, and a flying bridge. This design attributes allow the boat to slice through rough waters while deflecting spray away from the boat, and provides an efficient hull capable of weathering heavy seas. Additionally, the flat chines and convex surfaces aft help the boat get up on plane, increasing the boat’s ability to cruise at a higher speed (Photo 1).



Photo 1: Carolina Style Fishing Boat (photo courtesy of Dr. Barbara Block).

Appearance is an important factor in drawing customers to the boats. A boat that is new and glistening usually draws more attention than one that is old and run down. Despite the fact that most of the fleet was custom built within the last five or eight years, the captains haul their boats into drydock each year to maintain their appearance. Many boat builders produce Carolina-style fishing boats, but three or four builders dominate the

local waterfronts. Names like Jarrett Bay, Hatteras, and Buddy Davis are the most popular, while you only occasionally see a C&L or Island Boatworks. All of these charter boats range from forty to sixty feet long, although most boats tend to fall in the mid-to-low fifty-foot range. These boats often require two engines to accommodate their large size and maneuverability. The most popular type of engines are Volvo, Cummins, and Caterpillar, and range from 500 to over 800 horsepower apiece. These massive engines can push these boats to cruise at over 30 nautical miles an hour (knots).

Each boat includes a salon, galley, stateroom, and bridge. The salon (cabin) is often spacious, quite comfortable, and comes equipped with couches, wall-to-wall carpet, and finished wood paneling. Entertainment centers, complete with satellite television and radio, are not uncommon. Air conditioning and heat are a must when dealing with the hot summer and frigid winter weather. In the galley, one can find a refrigerator, a sink, and often a microwave. These amenities are necessary for keeping and preparing the food required for running full-day offshore charter trips. The design of the stateroom area in these boats tends to vary between owners. Layouts range from a king-size bed with matching comforter, to two or three sparse bunks with old pillows. This resting area is used by the charter customers to relax during the trip. However, when the boats are run for commercial, not charter purposes during the winter bluefin season, this area is used less for relaxation and more for storage. Adjacent to the stateroom is a marine head, often complete with a small shower.

While the below-deck area focuses on comfort, the above-deck area is where all of the fishing action takes place. The deck is usually spacious and occupied by up to three fighting chairs, which are used to battle the largest game fish including bluefin and

billfish. The bridge is located above the cabin and is where the captain spends nearly the entire trip. From here the captain runs the boat and all of the safety and nautical electronics, including radar, sonar, GPS, and VHF radio. From this elevated command post, the captain has an advantage spotting anything on the horizon including breaking fish, diving birds, and working boats (Photo 2).



Photo 2: The captain running the boat from the bridge (photo courtesy of Eric Brazer, Jr.).

Gear

When targeting bluefin tuna, the captains and crew must replace their normal light-weight gear with heavy gear. Some fishermen attempt to land bluefin using smaller rods and lighter lines, referred to as “light tackle” or “stand-up gear.” The angler does not use a fighting chair in these situations, but battles the fish standing up. This is common for fishermen who are more interested in fighting the fish than landing it. Beaufort and Morehead City charterboat fishermen are more concerned with selling their catch (during commercial season) than the experience of the fight, and only use heavy tackle and the fighting chair to land bluefin.

Local bluefin anglers most often use AFCO rods made by Shimano and Penn; relatively few fishermen use rods made by Biscayne. These fiberglass rods are also referred to as “130-lb class” or “130s” because they are matched with reels with a 130 gear ratio. Characteristics of these rods include machined guides, a bent butt, and their sheer size. This bent butt of the rod lowers the reel for greater angler comfort and increases the fulcrum lever to the angler’s advantage (Photo 3).



Photo 3: “130-lb class” rods (photo courtesy of Eric Brazer, Jr.).

Local bluefin anglers most often use reels made by either Shimano or Penn, specifically the Shimano Tiagra and the Penn International II. Both reels are also “130s” and made of aluminum so they are lightweight yet strong. The defining characteristics of these reels are their great size and multiple gear ratios: a higher gear for gaining line while the fish is near the surface, and a lower gear used to power fish up that are deep below the boat. The brute size of the reels allows them to hold nearly 1000 yards of 200-lb fluorocarbon line; this is essential for the fast-swimming and far-running bluefin (Photo 4).



Photo 4: Penn International II reel (photo courtesy of Dr. Barbara Block).

Most fishermen use fluorocarbon, or “fluoro” as their primary fishing line. This is common because it is a standard manufactured fishing line. However, some fishermen use a synthetic fishing line known as Spiderwire. High-spun, polyethylene fibers produce a very strong and very thin fishing line. Whereas normal Shimano or Penn 130s can hold 1000 yards of 200-lb fluorocarbon, the same reel can hold nearly twice as much Spiderwire. The advantage of using Spiderwire is that the fishermen can put more line on the reel and significantly decrease their chances of being “spooled” – having the fish pull off all of the line and break away. However, the disadvantage of using Spiderwire is that its thin diameter and braided fibers will produce serious cuts if the line brushes against bare skin as the fish pulls line off the reel. Very few fishermen use this type of line, mainly for this reason.

A 300-lb fluorocarbon leader connects the main fishing line to the lure. This leader is made of heavier strength line because of the chafing that occurs near the lure

when the crew (who assumes the title of “wireman” at this point) grabs the line or when the line rubs against the bluefin during the fight. Fishermen usually use one of two types of leaders: a normal leader or a wind-on leader. The normal leader is short (between 10 and 20 yards) and is attached to the main line with a large snap swivel. This swivel does not fit through the rod guides and as a result the angler can only bring the fish in as far as the start of leader. At this point, the wireman steps in and pulls (“wires”) the fish in the rest of the way by hand. A wind-on leader is longer than the normal leader (between 50 and 70 yards) and is attached to the main line with a small swivel. This swivel is small enough for the angler to wind the leader onto reel and allows the angler to bring the fish directly to the boat.

The local bluefin tuna fishermen use a small, pelagic fish known as a ballyhoo for bait. They are small (6 to 12 inches long), blue-backed, and silver-bellied; however they are most notably recognized by the extension of their lower jaw into a beak. This beak reaches lengths of up to one-quarter of the ballyhoo’s total body length. Peculiarly, ballyhoo are not known to inhabit the waters of North Carolina and therefore should not be familiar to bluefin at this location and time. However, ballyhoo are inexpensive to purchase, can be rigged more easily than the menhaden local to these waters, and work successfully (Photo 5).



Photo 5: Ballyhoo, *Hemiramphus brasiliensis* (image courtesy of NMFS SEFS).

Ilander lures have a weighted bullet head with large yellow eyes, black pupils, and two artificial skirts (one inner skirt and one outer skirt). This lure is threaded onto the leader and directly in front of the ballyhoo, giving the appearance that the bait has its head buried in the lure's skirt. The skirts are brightly-colored and come in one and two colors. Most fishermen remove the inside skirt to make the overall skirt cover less dense, citing that "less is more." Fishermen will occasionally purchase these lures and remove the entire skirt, adding their own color combination and a density to their liking. Generally, fishermen use some combination of pink, white, and blue in their Ilanders. However, it is not uncommon for them to troll a randomly-chosen color combination such as chartreuse and purple if traditional colors aren't producing any strikes (Photo 6).



Photo 6: Ballyhoo rigged with Ilander lures (photo courtesy of Salt Water Sportsman magazine)

Summary

The fishermen that I encountered frequently mix-and-match their gear. Rarely did I see four identical rods with four identical reels. This happens because the fishermen acknowledge the superior capability of these different types rods and reels, and are not intent on purchasing a single brand of gear. The gear required to battle bluefin tuna is not cheap and cost in excess of \$2,000 or \$3,000; the captain may purchase one or two brand-new rods and then attempt to save money by looking for similar used rods to buy. The

fact that fishermen use similar gear may be due to the superiority of the gear itself, or simply that the small number of local tackle shops stock identical gear; “if everyone is selling it, everyone is buying it.”

Many of the fishermen I met used monofilament instead of Spiderwire, mostly for safety reasons. Stories of gaping wounds, missing digits and even severed rods are not uncommon. To most fishermen, this injury is not worth the risk. Most captains were skilled enough at matching the bluefin’s runs and dives with the appropriate boat maneuvers so as to not let the fish pull off the entire spool of line. This ability supersedes the need for having more line on the reel.

I observed very minimal differences in the rigging of the lures and the baits. Every fisherman uses Ilanders rigged with ballyhoo. For the most part, all fishermen use the similar lure color combinations and rigged their ballyhoo the same way. Nearly everyone fisherman uses a recurved J-hook rather than a circle or a straight J-hook. Straight J-hooks often hook a fish in the gills, throat, or stomach, rather than the mouth, and this often causes internal damage that may potentially threaten the fish’s chance of survival after release. Circle hooks, which often hook a fish in the corner of the mouth (thereby reducing injury to fish) are difficult to use in trolled baits because they cause the bait to swim unnaturally. A recurved J-hook is a middleground between the hook designs, and has the straight shank that the normal J-hook has, but also the recurved point of the circle hook (Photo 7).



Photo 7: J-, Recurve J-, and Circle hooks, respectively (photos courtesy of www.boatersworld.com, and www.newenglandmarine.com).

THE FISHING PROCESS

Preparation

Preparation for the trip starts before the captain or crew even steps foot on the boat. The crew is most often responsible for rigging the baits. This involves thawing the frozen ballyhoo, breaking off their beaks, breaking their backbones, and removing their eyes and entrails (breaking their backs and removing their eyes and entrails allows the bait to act more naturally while being trolled. Breaking off their beaks allows the bait to position itself more naturally behind the lure). Next, the ballyhoo is threaded onto an 11/0 hook and its beak is wired shut. One trick of the trade is to apply permanent marker to the point of the hook. This prevents rust from developing on the hook point, thereby dulling it. The lure is then threaded onto the line ahead of the bait. These tasks can be completed at home or on the boat, either the night before a trip or during the steam to the fishing grounds. The captain, meanwhile, must determine where to fish that day. This decision is based on a combination of traditional knowledge, and the weather and sea conditions that day

The first step in preparing the boat for the trip is to start it and warm up the engines. After both the captain and the crew have arrived the captain tends to ready the boat while the crew tends to ready the gear. Once the captain gives the word to head out, the boat idles out of its slip and into the intercoastal waterway. The captain commands the boat from the bridge while the crew works on deck or in the salon. Most boats leave the dock between 4:00 and 5:00 am, and form a daisy chain as they creep along in the darkness. Some boats will have their decks illuminated in addition to having their

running lights on. These beacons allow the crew to ready the gear, but also allow the boats to follow each other more easily through the channel and out the inlet.

Boats that are faster and larger (or captains that are more confident or brash) will occasionally break rank and accelerate past the line of boats. This action creates a large wake and makes it more difficult for the line of boats to follow each other. Safety is a large concern for all fishermen and such actions result in anger and tenseness. Once the boats reach the mouth of Beaufort Inlet, they depart from their soldier formation and spread out, speeding off on their own paths towards their targeted area.

Most boats troll four rods, which are stored in the cabin overnight and are brought out each morning. While the captain is steering the boat, the crew fetches these rods and places them in the rod holders on the rail or in the fighting chair. If the baits have not been rigged, he must rig them before the boat arrives at its destination. After the baits are prepared and have been snapped on to the lines they are placed on the deck of the boat, to await the time at which they are thrown overboard.

Planars are essentially small metal wings. When towed behind the boat, the pressure of the water flowing over the planar pushes it downward. Planars serve the same purpose as downriggers: they allow baits to be trolled at a depth rather than just on the surface. These lengths of rope attach the planar to a cleat on the stern of the boat and are towed independently of the baits. Each planar is tied to two different lengths of line. This allows them to be trolled at different depths. While each individual captain has his own preference for depths, most often one planar will be set at 20-30 feet while the other will be set at 40-60 feet, depending on the depth of the water in which he is fishing.

After the crew has prepared the gear he has some downtime before being called into action again. He may use this time to chat with charter members or the captain, prepare more baits, or just relax. However, once the captain reaches the predetermined fishing spot, the crew must be ready to act.

The captain will signal the arrival at the fishing area by either calling to the crew or simply pulling back on the throttle. On nearly every fishing boat, any change in the throttle signals that something is happening – the captain will not adjust the boat’s speed for no reason. Once the boat has slowed down to its trolling speed (approximately 6 knots, depending on the captain’s personal preference and previous experiences) the crew sets the rods in their respective rod holders. Two rods will be placed in the holders at the corners of the stern, one rod will be placed in a holder farther back on the starboard rail, and the fourth rod will be placed in the same holder on the port rail. Sometimes rods are fished from the holders in the fighting chair as well. Each of these rods has a safety rope that secures the rod to the boat, preventing any accidental loss of gear. Finally, the crew sets out the planars. Once the planars have settled at their preset depth, the crew is ready to set the baits.

Nearly every captain will troll, or “pull” a spread of four baits. Four baits is the optimal trolling number because while trolling more baits may increase the chances of hooking up, it decreases the chances of actually landing the fish. The addition of one more line increases the chances that lines will get tangled and fish will be lost. Usually two lines are pulled from the planars and two lines are pulled from outriggers. To fish baits on planars, the crew ties a rubber band to the fluoro, approximately 5-15 yards from the bait. A small length of fluoro with one small snap swivel on each end is attached to

this rubber band. One snap swivel is attached to the loop of the rubber band while the other snap swivel is attached to the line connecting the planar to the cleat. When this rig is complete, the drag is released and the small length of mono slides down the planar line to the pre-determined depth. This same process is repeated for the second planar.

While planars allow baits to be fished at great depths, outriggers function in a reverse manner – they allow baits to be fished on the surface great distances from the boat. The remaining two lines are strung through break-away clips, one on each of the port and starboard outriggers. Once again, the drag is released until the bait reaches the desired distance from the boat. Usually one bait will be pulled at a greater distance from the boat than the other bait. Four baits staggered at multiple depths and various distances from the boat allows the captain to fish more of the water column and theoretically increase the chances of hooking up.

Once a bait has reached its respective depth or distance from the boat, the drag is re-engaged. The drag is set at an amount that is high enough to keep the force of towing the bait from pulling out more line, but low enough to allow the bluefin to take line after it swallows the bait. This amount of drag varies among fishermen, but usually falls somewhere between 20 and 50 lbs of drag.

Finding the Fish

The captain searches from the bridge for signs of fish. Less experienced captains will simply follow other boats around until they come upon bluefin, rather than find the fish for themselves. They rely less on their own knowledge of bluefin and the waters off North Carolina, and “free ride” on those who are more experienced. While all captains

use each other for information, a captain will form some sort of fishing plan before he even steps foot on the boat in the morning. The charter fishermen in Beaufort and Morehead City are quite computer-literate and utilize NOAA and other websites that give real-time oceanographic information. Weather buoys and orbiting satellites provide timely information such as sea surface temperature, wind speed and direction, wave height, and visibility. A captain will often check these websites the morning of the charter to equip himself with the best, most opportunistic information. The captain formulates a fishing plan for the day by combining this information with other information such as the location of the fish the previous day, historical knowledge of the fishery, local geography and his knowledge of bluefin tuna behavior. Throughout the day the captain is constantly revising his plan based on the current fishing conditions, the location of the fleet, and the behavior of the fish. If his plan is not working, he must make changes to increase his chances of hooking up.

Once the captain reaches his target fishing area he is constantly scanning the horizon for telltale “fishy” signs, including birds diving on baitfish, color changes and temperature breaks in the water, “greasy” slicks, or bluefin themselves swimming or crashing baits at the surface. Baitfish are often good indicators of larger, predatory fish. Therefore, the captain is not only looking for bluefin but the baits upon which they feed as well. Certain birds such as gulls and gannets are known to be an indicator of bluefin, possibly feeding on the bluefin’s preferred prey source. Changes in the water temperature or color often will indicate areas of higher productivity. This attracts baitfish, which in turn attracts bluefin. “Greasy” slicks are small, calm areas on the otherwise choppy surface of the water. These patches occur when bluefin feed

voraciously on a pod of bait below. This bait is often menhaden, a notoriously oily fish. When bluefin eating, the oil is released into the water and floats to the surface, resulting in a thin oily film developing on the surface. This film has calming effects and results in an area of water more tranquil than the surrounding waters.

When bluefin come to the surface, they are often either “running” (swimming along at the surface, creating visible wakes) or “breaking” (crashing baits, creating visible whitewater). In general, the waters off North Carolina are often rough; running bluefin are not as common as breaking bluefin.

In addition to scanning the horizon, the captain must also focus on his electronics and look for temperature breaks or activity below the surface. Depth sounders easily pick up bait or bluefin below the surface. Bluefin are distinguished from a school of bait by the color and shape appearing on the depth sounder – a ball of bait will appear yellow while a bluefin will appear red or orange and will have a general upside down “U” shape.

The captain must also monitor his VHF radio while searching for fish. In general, the level of communication varies between captains: some spend a lot of time on the radio while others almost never speak. In addition to exchanging information, the radio is used as a way of passing the time and allows captains to chat amongst themselves. In this situation, conversations are often lighthearted and jesting. Subjects include sports, fishing, or even a captain’s run of bad luck. While most captains won’t spend a significant amount of time having these cheerful conversations, they will engage in them occasionally throughout the day. Often, however, captains communicate over the radio as a way of giving or receiving information about their success (or lack of) at finding

fish. If a captain is not able to locate any fish he may get on the radio to find out how the other boats are doing.

One of the disadvantages of exchanging information over the radio is the possibility of receiving bad or false information. If the captain talks with someone whom he knows and trusts, it is safe to say that the other captain is not trying to mislead him. However, it is not uncommon for captains to give out false information such as telling an untrue story of being near a large school of fish, when in fact the captain may be in a completely different location. This often happens with less-experienced captains and/or those captains who want to “mess with” others. This attitude may stem from a prior negative fishing experience, or just the opportunity to fool others.

Fish On!

It is common knowledge among fishermen that you will hook a fish when you least expect it. You can sit and watch the baits all day, but the minute you take your eyes off the rod you will hook up. Both Penn and Shimano create their reels with a “clicker” option. When the fish hits the bait and starts taking line, the reel will create this loud clicking noise as the fish runs. This clicking noise is more often referred to as “screaming” and will snatch even the deepest of sleepers out of the deepest of naps. Once the reel starts screaming, the boat suddenly comes alive with activity. The captain immediately pushes ahead on the throttle trying to set the hook in the bluefin’s mouth while at the same time trying to distance himself from the fish. The crew right away tends to the rod, which is still in its rod holder. He must be focused and prepared to quickly bring in line if the bluefin stops running, prevent the bluefin from tangling in the

other lines, and monitor the drag so the bluefin doesn't pull the line too quickly off the reel and tangle it, causing a "backlash." The angler jumps into the fighting chair and readies his harness, which is tied directly to the chair itself. As soon as the angler is set the crew pulls the rod out of the rod holder, reel still screaming, and places it in the holder on the fighting chair. The angler then hooks himself straight to the rod and the fight is on.

The primary role of the angler is to bring the bluefin to the boat as quickly as possible without breaking it off the line. The angler must be always conscious of the bluefin's movements. The fighting chair is mounted on a swivel and can be turned to face the fish. If the fish is moving more towards one direction or the other, the angler must call out to the crew to swivel the chair. If the fish rests even for a moment, the angler must bring in as much line as possible. Many times the bluefin will turn and swim directly towards the boat. When this happens the angler must furiously reel to prevent any slack in the line, which may cause the hook to fall out of the fish's mouth. If, alternatively, the bluefin has a burst of energy and starts taking line off the reel, the angler must put the right amount of pressure on the reel to stop this run. If only a little pressure is needed, the angler's thumb or hand, applied directly to the reel, will slow down the fish. Occasionally the angler must increase the drag on the reel. This is dangerous and many times the angler will just let the fish run and tire itself out; too much drag and the line may break. The angler must also use proper big-game fishing techniques.

Having the correct fighting form is more essential than overall strength. Rather than pumping the rod with your arm, as you would if fishing for something small, the

angler pumps with his legs and back. The angler starts from a sitting position in the fighting chair. Keeping his back and legs straight he quickly leans forward, nearly creating a 90-degree angle with the deck of the boat. As he leans forward he quickly reels in the line in the slack that he just created. Bending his knees slightly, he leans backwards, pulling with his back and pushing with his legs, to bring himself back to the sitting position. From here he repeats leaning forward and reeling, and leaning back (Photo 8).



Photo 8: An angler battling a bluefin (photo courtesy of Dr. Barbara Block).

The angler keeps his left hand on the face of the reel at all times, between it and his body. This positioning is partly to help control the rod, but mostly for safety; if the line parts or the bluefin spits the hook, the incredible tension placed on the rod by the bluefin will be lost and rod will come flying back towards the angler. Many fishermen tell stories of having the rod snap back and hit them in the face, or see the same thing happen to others, giving them what is known as an “AFCO tattoo,” imprinting the shape of the rod on their face.

While the angler is fighting the bluefin, the captain has turned around and is now running the boat's controls while facing the stern. The captain must be able to operate the boat while keeping the bluefin away from the edge of the rail. The captain maneuvers the boat so as to keep ahead of the bluefin at all times. He must be able to accelerate, decelerate, and turn the boat without hesitation, based on the behavior of the bluefin. If boats are nearby he must get on the radio and warn them to steer clear for fear that they might accidentally (or, occasionally, intentionally) run over the line.

As soon as the crew hands over the rod to the angler he must reel in the other lines and bring up the planars as quickly as possible. The longer the other lines remain in the water, the better the chance that they could tangle and the angler could lose the fish. Once this task is complete the crew constantly monitors the angler and the line. Bluefin are very powerful and can change direction and speed in the blink of an eye. The crew must always rotate the fighting chair so the angler faces the fish. Optimally there will be someone on the boat whose job is solely to "man the chair," but if not then the crew must do this job himself. The crew is also required to make sure the line doesn't touch the rail of the boat; any chaffing and the line may part under such intense strain. He does this by donning heavy gloves and pushing the line out away from the rail should it near the boat.

If the angler is fishing with a wind-on leader then he can reel the bluefin in until it nearly reaches the boat. However, if the leader is attached with a snap swivel, the swivel is too large to fit through the rod guides. Therefore when the angler has brought the fish in as far as the start of leader, the crew (who takes on the new nickname of "wireman") steps in and pulls the fish the rest of the way in hand-over-hand, known as "wiring" the fish. As soon as the wireman has a grasp on the leader, the angler backs off the drag. If

the fish were to break free of the wireman's grasp, allowing it to run while slowly increasing the drag reduces the chance of breaking off the fish (Photo 9).



Photo 9: The crew wiring the fish (photo courtesy of Dr. Barbara Block).

This is a very dangerous point in the fight. The wireman must have a solid enough grip on the leader to be able to pull the bluefin up. However, too tight of a grip may result in him being pulled over the rail if the bluefin takes off. Therefore it is very important that the wireman be aware of the bluefin and its actions at all times. If it starts to swim away then the wireman must quickly unwrap his hand before being pulled over the rail.

Once the wireman has brought the bluefin to the surface, he “walks it” along the stern to the tuna door. Both the captain and the crew must make an important decision at this point. If the bluefin is obviously over the 73” CFL legal commercial limit, then it can be gaffed or harpooned (preferably in the head so to minimize the amount of damage done to the flesh) and then tailwrapped. If the bluefin is obviously smaller than the 73” CFL legal commercial limit and is going to be released, then the line must be cut above

the hook. On the other hand, if the bluefin is too close to 73" CFL to visually distinguish as legal or not, it still needs to be brought onboard and measured. This must be done the least intrusive way possible to minimize injury to the bluefin. This is accomplished by gaffing the bluefin in the lower jaw (where very few blood vessels are located). Once this is done the bluefin is pulled in through the tuna door and quickly measured. If, after all this effort, the bluefin is too small then the line is cut, the tuna is turned around and guided head-first back out the tuna door. If, however, the bluefin ends up measuring over 73" CFL then the captain, crew and angler breathe a sign of relief.

Preparing the Bluefin

If the bluefin is identified as being of legal size prior to being brought on deck, most fishermen will bleed it while it is still in the water. This reduces the amount of blood on deck, which leads not only to blood being tracked all over the boat, but an increasingly slippery deck. If the bluefin is identified as being of legal size after having been brought on deck it is either bled directly on the deck or is secured with a rope and pushed back out the tuna door, only to be bled in the near future.

Methods of bleeding and gutting, or "cleaning" a bluefin vary slightly from captain to captain. Bluefin are bled from a variety of different locations on the fish, including the tail, below the "chin," and behind the pectoral fin. Some fishermen may choose to use one or all of these methods depending on how familiar they are with that method of bleeding the fish. Once any combination of cuts are made and the bluefin has "bled out," it is brought on board (if it isn't already there).

If the bluefin is small and measures close too 73” CFL then NMFS requires it to be landed with the head on. This allows the dealer to verify that the bluefin is of legal length. A bluefin that is significantly larger than 73” CFL can, be landed with its head removed. Despite this, nearly all of the charter boat fishermen land their bluefin with the head on.

If the fishermen aren’t going to remove the bluefin’s head, the crew must clean the fish through the removal of the upward-facing gill plate. If not, the crew can remove the entire head and entrails at once. Once the body cavity of the bluefin is empty it must be packed full of ice. The objective is to reduce the tuna’s core body temperature as much as possible so the meat doesn’t spoil. After filling the body cavity with ice the bluefin is either wrapped in a tarp or placed in an insulated, zippered “tuna bag” and the captain heads for home. While the captain is taking the boat back to the dock the job of the crew is to wash the deck and clean the gear with soapy water. Once clean, the gear is stowed and the rods are returned to the cabin.

The Dealer

The captain is responsible for contacting a buyer and having an ice-filled truck meet the boat at the dock. Most captains have a prior relationship with a dealer and will sell all of their bluefin to the same dealer. However, if a fisherman feels that he was treated unfairly, the dealer didn’t get the best possible price for his fish, or he could have more financial success elsewhere, the fisherman will change dealers. Only six dealers were located in Carteret County last year, two of which reside in Beaufort and Morehead City.

Any bluefin that is landed must be documented. A small tag with a unique tag number is inserted through the skin near the tail. The dealer records this number, along with the captain's permit number and length of the bluefin. Once the paperwork is complete, the drivers of the ice truck, the crew, the captain and any other available persons needed, grab the mat that the bluefin has been placed on and carry it to the truck. The bluefin is buried in the ice, and trucked directly to the dealer.

The bluefin is cleaned even more after it arrives at the dealer. The head, tail, fins, and any remaining entrails are removed, and if needed, the bluefin is bled further. A slice is taken out of the tail and examined under a flashlight for color and fat content to estimate the quality of the meat (Photo 10 and 11).



Photo 10 and 11: Cross-sectional cut from the bluefin's tail; Examining the fat content of the sample (photos courtesy of Jacquelyn Cornet)

Grades of "A" through "D" are given for each of the two categories, and an overall grade is assigned to the bluefin. A grade of "A" is assigned to a bluefin that has a high fat content and marble-colored flesh. A grade of "D" is assigned to a bluefin that has a low fat content and lean, red flesh. Once these grades are assigned, the dealer decides whether to sell the bluefin domestically or ship it to Japan. Usually, the highest-grade bluefin are sold to Japan while the lower-grade bluefin are sold domestically.

Once the destination of the bluefin has been determined, it is then submerged in a tank filled with a chilled seawater brine. After the bluefin's core body temperature is sufficiently low, it is removed from the tank, packed in dry ice, trucked to the airport and loaded on a plane bound for Tokyo's Tsukiji Central Wholesale market. It will arrive on the auction block the next day.

THE BLUEFIN TUNA FISHERMEN

Demographics

Fishermen traditionally live in the same town they fish from. This phenomenon holds true with the charter boat fishermen in Beaufort and Morehead City. Most of the fishermen live relatively close to the waterfront, either in Morehead City, Beaufort, Harker's Island or Atlantic Beach; some fishermen live in Greenville and Newport; and a very few live as far away as Raleigh or Durham. It is these fishermen that often have to rent a house or apartment, or own a second home in Beaufort or Morehead City they can inhabit on the weekends during commercial bluefin season.

Many reasons exist for living in close proximity to your boat. Primarily, fishermen do not look want to commute a long way to work. They already spend much of their time on the water and away from their families, and prefer to maximize the amount of time they have on land and minimize their travel costs. Additionally, the fishermen want to be able to get out on the water with little notice if a bite is happening or they discover that they are missing a good fishing opportunity. Most captains own their boat, as opposed to owning their boat but having someone else operate it. Since they are responsible for their boat, it benefits them to live near the boat. Another benefit of living in the same town in which you dock your boat is that the money you spend on expenses (ice, bait, food, fuel, maintenance, etc.) all get filtered back into your community. The business that the charters bring in and the expenditures the captains have all benefit the community in which they reside. In turn, people who are drawn to the community as a whole may book a charter. Both the individual fishermen and the community benefit from this symbiotic relationship.

History in the Fishery

The North Carolina recreational bluefin tuna fishery emerged in the mid-1990s near the port of Hatteras and existed there until 1997. Around this time fishermen in Hatteras began to see a decline in bluefin tuna in local waters while fishermen in Beaufort and Morehead City began to see an increase in bluefin tuna in local waters. Local charter captains began fishing for bluefin tuna in 1998. Most fishermen took advantage of this fishery from the start, but for those who didn't, it didn't take more than a year or two for them to become "hooked." The numbers of Beaufort and Morehead City charter fishermen has remained relatively constant since 1998, ranging between 18 and 25 boats.

The local charter boat captains have had many years of experience fishing the waters off North Carolina. Most have fifteen to twenty-five years under their belt, while a few have been charter fishing for thirty years or more. Crews have spent significantly less time charter fishing, most likely due to the age difference between captains and crew: captains tend to be older (in their thirties, forties, and fifties) while crew tend to be younger (in their teens, twenties and thirties).

Why They Do What They Do

The charter boat fishermen in Beaufort and Morehead City enjoy their jobs. They cite the thrill of hearing the reels go off, constantly meeting new people, and working outside and on the water as benefits of working on a charter boat. Despite this love for fishing, many captains rely other professions for additional income. Some hold shares in construction companies, some hold shares in condominiums, and some own their own

businesses. Only a very few captains rely on charter fishing as their sole source of income as it is not a very lucrative job.

To Charter or Not to Charter?

As bluefin begin to show up in the waters off North Carolina in November, the charter boat fishermen must make decisions on whether to charter or fish commercially. On one hand, a commercial bluefin charter will bring the captain a guaranteed \$800 to \$1400, and the crew a 10-20% tip. On the other hand, if the captain forgoes a charter to fish commercially he takes a gamble. If he does not catch a bluefin, he will have used up some of his bait supply and burned many gallons of fuel. This net loss will put him in the hole for the day. Even if he does catch a bluefin he is not guaranteed to turn a profit. If the bluefin is small, the quality of the meat is poor, and/or the market is flooded with fish, the captain will be lucky to receive a check that will cover his fuel and bait expenses. If the bluefin is large, has a high grade meat, and/or is one of few fish on the market, the chances of the captain receiving a much larger check increase greatly.

If the captain books a charter and the charter members catch a bluefin, normally the captain will try and promote releasing the fish. However, charter boats are allowed to keep one bluefin per day less than 73" CFL and one bluefin per year over 73" CFL under the angling permit rules. Usually when the charter members are first booking their charter over the phone, the captain will clarify his personal rules concerning keeping a bluefin. He may say that even though his permit allows him to keep one bluefin per day less than 73" CFL, the trip will be strictly catch-and-release. Conversely, he may allow the charter customers to keep their bluefin if it measures less than 73" CFL. Since the

captain (or the crew) is in possession of the permit, ownership of the fish technically belongs to the captain.

If the charter members land a bluefin over 73" CFL and the captain has already filled his quota of one bluefin this size per year, the charter members may not keep their bluefin. However, if the captain has not filled his quota, then the captain must make a choice. If he lets the charter members keep the bluefin then he will fill his angling quota, he won't be able to sell the bluefin, and the charter members will be able to photograph and consume the fish. Alternatively, if the captain forces the charter members to release the bluefin then he won't fill his angling quota, he won't be able to sell the bluefin, and the charter members won't be able to keep the fish. If the captain makes it clear ahead of time that if a legal sized bluefin is landed, charter members won't be able to keep the fish. The fish will go to the captain, and he will fill be able to sell it.

Each of these decisions has financial and personal implications. The captain must balance financial needs with the relationship he has with the charter members. If the charter members enjoy their trip then they are more likely to return and book more charters with the same captain in the future. Captains cherish the relationships they build with their charter members. They know that if they can form some manner of relationship with their charter members, the members will not only return in the future, but will refer the name of this captain to their friends. Good relationships result in good business.

People who book bluefin tuna charters do so for the thrill of battling a fish that can easily weigh 500 pounds and more. Most often, the actual act of fighting the fish draws the customers in. Some people take this desire a step further and kill the fish. If

this is done, then they are able to take pictures of these giants for bragging rights. Having a picture taken of you standing next to a fish that weighs over twice your weight and is longer than you are tall will bring a sense of pride and accomplishment to any fisherman, demonstrating that you battled this giant and defeated it. Finally, some charter members desire to kill and keep a bluefin for its meat. Prized in Japan for its fat content, a plate of prize bluefin sashimi in an upscale Japanese restaurant will cost the consumer upwards of \$75. Charter members who keep their bluefin can stock their freezer for months and dine on this delicacy as easily if it were steak or chicken.

For the most part, if a captain has the option to book a bluefin charter for any given day, he will do so. He will not pass up the opportunity for a guaranteed sum of money just to take a chance at possibly making a greater sum of money. This thought process was especially true this year, as catch rates were lower than in years past for unknown reasons.

Communication and Relationships

Communication is an essential skill for fishermen. Effective communication with customers can mean the difference between not booking a charter and booking annual charters with the same group. Captains and crew must be friendly, respectful, and pleasant to a charter group. If they are these things, these groups may return. In addition to spending more money, the charter group will “spread the word” about the enjoyable charter they booked, inadvertently advertising the captain’s services. If the captain and crew provide a good experience, relationships between fishermen and charter groups may

form. When this happens, the fishermen know that it will attract the charter group to return for future trips.

Captains and crew tend to have healthy relationships built on trust: the crew trusts the captain to find the fish and the captain trusts the crew to make sure that operations run smoothly. They tend to joke around with each other, either to alleviate the drudgery and disappointment of a fishless day, or to communicate their excitement over catching a bluefin. Often the captain and crew will take on the same moods – if one is happy then the other is happy, and vice versa.

Over the years, a crew may work for more than one captain on the waterfront. Crew change captains if they are looking for a change of pace and scenery. Some captains tend to work longer hours or fish harder; if a crew is not interested in that type of environment then he may ask to change boats. This normally does not result in hurt feelings or tension among the captain and crew.

Captains mostly converse with other captains. Whether on the dock, on a boat, or leaning on the window of someone's truck, captains can be seen primarily talking with other captains. This may have to do with the roles that the captains play – they are more aware of where the bluefin are located and the success or failure of the other boats. Most captains are friendly with each other, although occasionally arguments do break out. Usually these arguments will entail the occasional bad-mouthing over the radio and jeers at the dock. Rarely ever do they escalate to violence, although physical altercations do occasionally occur.

Similarly, crew mostly converse with other crew. Crew are more familiar with the gear that they use and the success of their boat than the gear used by and success of

other boats. This does not mean that captains and crews avoid communication between themselves; in fact, many crews have worked for multiple captains along the waterfront and still hold strong relationships with them. However, it is more common to see crews conversing with crews and captains conversing with captains.

These conversations often concern the success or failure of the fishermen at finding the bluefin. If their luck has been good, they will recount stories of catching bluefin. If their luck has been poor, however, they will try and determine the cause of such bad luck. The weather is always a topic of discussion, including what it was like that day, what the forecaster claims it will be in the next few days, and often how the forecaster was wrong. Weather plays a significant role in the success of fishermen in general; especially in the winter in North Carolina, weather determines whether or not you leave the dock. “If the wind blows from the East, the fish bite the least; if the wind blows from the West, the fish bite the best.” “It’s gotta be damn-near life-threatening to get a fish.”

These conversation layouts reflect the social hierarchy of the waterfront. Captains are more knowledgeable of the fishery and have been involved for a longer period of time than the crew. Therefore, they appear to have more in common than with the crews. Crews have similar experiences and knowledge, and tend to have more in common with the captains.

Decision Making

Throughout the fishing day, captains and crew are continually making decisions. Their primary objective is to make the correct combination of decisions that will result in

them not only locating bluefin but hooking up, landing, and getting the best price for their fish. These decisions are strongly based on, and influenced by, a wide variety of oceanographic, biological, ecological, economic and social factors.

Fishermen, make their living in the same waters day after day, year after year, have a unique knowledge of the oceanography of the local waters. They are familiar with the bottom topography, the current flow, and normal temperature and salinity breaks that affect productivity and fish aggregation. This information is gained through nautical charts and communication with others. Fishermen must have a strong knowledge of the biology of bluefin tuna to be able to locate them, including familiarity with preferred water temperature, and daily and seasonal movements. This knowledge may be gained from literature on bluefin tuna, the fishermen's instincts, or from the experiences the fishermen has had fishing for bluefin tuna. Similarly, the fishermen must be aware of the role of the bluefin in the ecosystem; how does it interact with its marine environment and the organisms within? Economic factors come into play more heavily after the bluefin is caught. Specifically, how the bluefin is cleaned and packed in ice helps increase the quality of the meat. Ideally, fishermen would like to catch bluefin when it is most economically-profitable to them, either during Japanese holidays or when the market supply is low. However, these aspects are often out of the fishermen's control. Arguably the most important knowledge the fishermen must have is social knowledge. Fishermen act individually but acknowledge the role that they play as a community. Trust, camaraderie, working together, relaying information, and providing advice all shape the relationships fishermen have with each other and ultimately play a role in their fishing success or failure.

Some decisions by the captain and crew are made based on instinct, feeling, or “a hunch.” This reasoning shouldn’t be overlooked and ignored; it happens quite often and for no apparent “tangible” reason. If a given speed or direction isn’t working to produce hook-ups the captain may slightly increase or decrease the boat’s speed, or change the boat’s direction. If a given bait doesn’t seem to be producing any bluefin then the crew will often let the line out or bring it in a little ways. He may change the depth at which they are fishing the planars. He may reel in the bait, check it and let it out again. He may change the bait, the lure, or both; any excuse to change something, hopefully finding the “correct” combination.

SOCIOECONOMIC FACTORS IN THE BLUEFIN TUNA FISHERY

Bluefin Economics

One of the most profitable fish in the sea, bluefin tuna can fetch significant dockside and market prices. In 1991, a Japanese importer paid a then-record price of \$68,503 for a single bluefin tuna.⁷⁶ Ten years later, the most expensive fish ever sold appeared on the Tsukiji floor: a 445-pound bluefin tuna auctioned for \$173,853.⁷⁷ This record still stands today.

Market prices are significantly higher than dockside prices. The first market day after a closure usually brings higher prices than other market days. A closed fishery means that no bluefin are being shipped to Japan; supply will be low and the demand will be high, driving the market up. Also, Friday markets usually bring the highest prices of the week. This happens because of the increased restaurant business (and therefore increased demand) on the weekends.

Exchange rates also affect the price fishermen receive for their bluefin. Japanese yen-to-dollar conversions fluctuate daily. During the open commercial fishing days in December and January the exchange rate ranged from 102.68 (December 31) to 105.59 (December 14) yen/dollar;⁷⁸ however dealer reports report exchange rates as high as 106.22 for the same time period. Historical exchange rates can be seen in the figure below (Figure 7):⁷⁹

⁷⁶ National Academy of Sciences. National Research Council. *An Assessment of Atlantic Bluefin Tuna*. Washington D.C., National Academy Press, 1994.

⁷⁷ World Records of Sushi. <http://homepage3.nifty.com/marvy/eng/records.htm>. Accessed April 1, 2005.

⁷⁸ Online Exchange Rates. <http://www.x-rates.com>. Accessed March 21, 2005.

⁷⁹ NMFS. "Pre-Draft of the Highly Migratory Species Fishery Management Plan Including the 2005 Stock Assessment and Fishery Evaluation (SAFE) Report for Atlantic Highly Migratory Species." Washington D.C., February 2005.

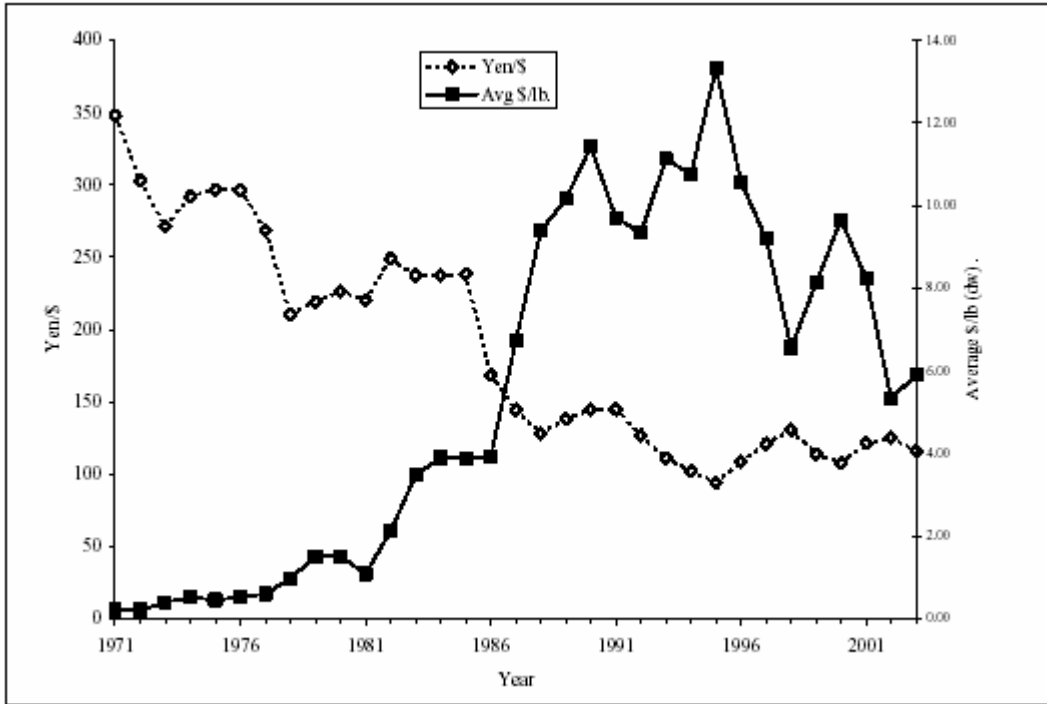


Figure 7: Average annual Yen/\$ Exchange Rate and Average U.S. Bluefin Tuna Ex-Vessel \$/lb (dw) for all gears: 1971-2003.

The weighted average price per pound for bluefin tuna landed this year with Kashiko Exports in Beaufort ranged from \$8.86 to \$11.81, with most bluefin falling in the \$9-\$10 range. Average price per pound for bluefin tuna landed this year with J&B Enterprises in Beaufort ranged from \$6 to \$24, with most bluefin falling in the \$12 to \$15 range. Differences in bluefin prices between buyers may be attributed to the care and preparation the buyer puts into preparing the fish for shipment, how many fish the buyer is purchasing, and when the buyer ships the bluefin to market. For instance, one dealer held onto some bluefin caught during the last day of the commercial season in December. They shipped them to market 3 days after the season ended, and as a result, were some of only a very few fish being auctioned off. By taking advantage of the supply-and-demand of the bluefin market, these buyers were able to secure a price of approximately \$24 per

pound for their fish, whereas average prices three days earlier had been only \$12 to \$13 per pound.

While this may seem like a significant amount of money at first glance, various players each have a hand in the pie. Japanese Expenses and the dealer's commission are usually near 15 percent and 5 percent of the total sales price, respectively. Domestic handling charges include a dock charge, box, airfreight, and transportation to the airport and range from approximately \$3 to \$5 per pound.

Direct Expenses

Only three local tackle shops cater towards fishermen targeting bluefin tuna: Captain Joe Schutes, Henry's Tackle and Outer Banks Outfitters. Of these three establishments, most fishermen look towards Joe Schute when purchasing gear. While Joe's prices may be slightly more expensive than competing tackle shops, many fishermen cite Joe's status as a fisherman and his willingness to customize gear to the fishermen's preference, as primary reasons they purchase gear from his shop. Due to the small number of shops stocking bluefin gear, fishermen are limited in their choice of gear and the price range of gear.

When purchasing gear for bluefin fishing, a responsible fisherman will buy more gear than he may need for a single trip. It is better to pay more and buy more than you need than to be caught short-handed on the water. Fishermen have to "spend it [money] to make it [money], and if they don't have it [the gear] then won't catch it [the fish]." On average, tackle shops see fishermen spend \$800 to \$1,000 per person per season on gear,

including baits, lures, fluorocarbon, planars and other “expendable” items. Purchases such as rods and reels are (hopefully) not purchased more than once or twice.

Direct expenses on “consumable” gear (gear that is used and needs to be replaced after each use) include all of the necessary lines (backing, fluoro, spiderwire, topshot, leaders), lures, bait, hooks, miscellaneous items (swivels, crimp sleeves, rubber bands), and fuel. Bait and fuel are consumed every trip and need to be purchased often; lines, lures, hooks, and miscellaneous items are not consumed every trip and may only need to be purchased once per season. Average annual costs for expenses for local charterboat fishermen can be seen in the chart below (Figure 8):

Expenses	Average Range of Annual Costs
Mate fees	\$12,000 - \$15,000
Phone	\$2,000 - \$3,000
Supplies	\$2,000 - \$4,000
Property	\$1,000 - \$3,000
Tournament Fees	\$1,000 - \$3,000
Ice	\$800 - \$1,200
Advertising	\$5,000 - \$7,000
Auto	\$800 - \$1,200
Credit card fees	\$700 - \$1,000
Dockage	\$3,000 - \$4,000
Charter expenses	\$3,000 - \$5,000
Boat insurance	\$4,000 - \$6,000
Licenses	\$1,500 - \$2,500
Fuel and maintenance	\$50,000 - \$70,000
TOTAL	\$86,800 - \$125,900

Figure 8: Approximate average range of annual expenses for local charterboat fishermen

As the participants in the North Carolina winter bluefin fishery have increased each year since its inception, local tackle shops have seen a corresponding increase in gear purchases each year. Some fishermen will come in multiple times in one week, spending \$100 to \$200 to supply themselves with enough gear for only a few days

fishing. Other fishermen will come in and spend \$600 to \$1,000 to supply them with enough gear for most of the season.

In general, the fishermen who run boats for corporations or who are not fiscally responsible for the boats they use tend to spend more money on gear than privately-owned boats. If the fishermen are not paying out-of-pocket for expenses then they are less conservative spenders. Additionally, the charter fleet is more likely to spend more money on gear than strictly-commercial fishing operations, due mainly to the sheer numbers of trips they offer.

Currently the only fees required to enter the fishery are the purchase of a federal bluefin tuna permit (\$22) and a state commercial (\$200 for in-state residents, \$800 for out-of-state residents) fishing license. In addition, a commercial fisherman must have a vessel registration (\$1-\$6 per foot).

Charter Prices

The price of bluefin charter trips varies between the boats in the fleet. Many captains do not advertise these prices on their websites and advise interested parties that pricing is seasonal and they should call for more information. However, the bluefin charter rates that are made available range from \$800 to \$1400 with most captains charging \$1000 or \$1100 per trip. Typical crew tip is 10 to 20 percent of the charter price, averaging 15 percent. Based on these figures crew members receive tips ranging from \$80 to \$280; an average crew tip ranges between \$150 and \$220. Nonetheless, often if the crew appeals the to the charter group, his tip may exceed 20 percent.

Local Economic Benefit

Beaufort and Morehead City benefit from the local winter bluefin tuna fishery through the increased tourism sectors of charter boat fees, food and drink consumption, hotels and lodging, and other retail costs. Additionally, the community profits from increased fuel sales, house/room rentals, and restaurant business. In turn, these purchases further stimulate the economy by generating additional expenditures by local restaurants and hotels from tips and fees. Since many charter groups travel to the area from out of state, economic impacts at the state level are similar to at the local level.

The local community also benefits from advertising in fishing magazines, television shows, fishing-related websites and even scientific journal articles. Both the winter bluefin tuna fishery itself and the TAG research program are good advertisements for Beaufort and Morehead City. Furthermore, the fishery draws famous fishermen to the area, such as Tred Barta and Dennis Braid, who have made appearances in the area for several years filming television episodes and testing new gear types.

Summary

Fishery managers are authorized to investigate the economic importance of fishery resources so as to minimize the adverse economic impacts of fishery management on fishing communities.⁸⁰ If NMFS' task of managing the U.S. bluefin tuna fishery wasn't complicated enough, the emergence of this winter fishery makes their task even more difficult. It is difficult to estimate the total number of fishermen and/or boats that commercially fish for bluefin tuna from Beaufort and Morehead City. Even though

⁸⁰ Magnuson-Stevens Fishery Conservation and Management Act.
<http://ipl.unm.edu/cwl/fedbook/magfish.html>. Accessed January 10, 2005.

dockage data exists, many fishermen use boats that are small enough to launch in the morning and haul out in the evening. These boats would not be counted with dock surveys. Adding to this complexity is the fact that fishermen from Maine to Florida travel to North Carolina each winter to participate in this fishery. Therefore, fishing pressure is not restricted to just local fleets.

On the local level, the community must recognize the needs of the anglers they wish to attract if they are to be successful in drawing them to the area. A study done during the heyday of the Hatteras bluefin fishery drew the following conclusions:

- Anglers reported spending an average of \$1,005 in the Hatteras area on their trips, or an average of \$558 per person per day; most of these expenditures were on charter fees, lodging and restaurant meals;⁸¹
- Overall, the population of bluefin tuna anglers in the Hatteras area spent \$3,635,654 locally and \$212,036 elsewhere in the state of North Carolina between January 15, 1997 and March 22, 1997;⁸²
- These expenditures resulted in a total output of \$4,627,108 and \$5,032,870 on the Hatteras-area economy and North Carolina economy, respectively;⁸³
- According to angler reports, charter boats in Hatteras had gross revenues of \$1,849,776 or about 58% of U.S. Atlantic totals reported by NMFS in 1994.⁸⁴

Similar studies must be done for the local Beaufort and Morehead City bluefin fishing community before the fishery can be most efficiently utilized. Understanding the

⁸¹ Bohnsack, B. L., Ditton, R.B., Stoll, J.R., Chen, R.J., Novak, R., and Smutko, L.S. The Economic Impacts of the Recreational Bluefin Tuna Fishery in Hatteras, North Carolina. *North American Journal of Fisheries Management*. 22:165-176 (2002).

⁸² Ibid.

⁸³ Ditton, R.B. and Bohnsack, B.L. A Social and Economic Study of the Winter Recreational Atlantic Bluefin Tuna Fishery in Hatteras, North Carolina. Report prepared for the American Sportfishing Association. 1998.

⁸⁴ Ibid.

market segment of anglers that visit Beaufort and Morehead City could help the local chamber of commerce and those in the fishing community to attract more bluefin tuna anglers in future years.

TAGGING HISTORY

Early Tagging

In 1952, a biologist named Howard Schuck and a salty fisherman-turned-scientist named Frank Mather stamped and numbered the hooks they used to catch bluefin tuna in Bimini. Once they succeeded in catching one of these giants, they released it by cutting the line above the hook and letting the bluefin swim away with the stamped hook still in its mouth. That bluefin was effectively “tagged,” along with many more at later dates. That Fall, Schuck received a call from the owner of a tuna trap in Nova Scotia who had landed one of Mather and Schuck’s bluefin. In his own words, he and Mather went “through the roof” with astonishment.⁸⁵

Two years later, Mather developed the idea of tagging bluefin with more-permanent floy tags to better determine how far these fish roam. A floy tag is sometimes referred to as a “spaghetti” tag due to its resemblance to a piece of uncooked spaghetti. Nine bluefin that had been tagged with a small hand-held tagging harpoon in the Bahamas in 1954 were later recaptured off the coast of Norway – a journey of over 6,000 miles.⁸⁶ Mather had just proved, for the first time, that bluefin traverse the Atlantic. Another bluefin tagged and recaptured in the same region made the trans-Atlantic crossing in only 50 days, averaging over 120 miles per day.⁸⁷

⁸⁵ Lutcavage, M. *Bluefin Spawning in Central North Atlantic?* Pelagic Fisheries Research Program Newsletter. 6(2): 1. April-June 2001.

⁸⁶ Whynott, D. “Giant Bluefin.” North Point Press. New York. 1995.

⁸⁷ Ibid.

Tag-A-Giant

The visionary studies of Mather and Schuck were the prototypes of modern tagging programs. Since then, scientists from the Hopkins Marine Station at Stanford University and the New England Aquarium have developed a method for tagging bluefin and tracking their migration patterns using surgically-implanted electronic tags.

During the early 1990s, NMFS recognized the need to obtain more detailed behavioral data about bluefin tuna, and therefore joined forces with Stanford's Dr. Barbara Block. Together they established a project focused on tagging bluefin tuna in the waters off North Carolina, with specific goals to assess spawning site fidelity, migrations between east and west regions, and the level of mixing that occurs during trans-Atlantic movements.⁸⁸ The Tag-A-Giant program (TAG) was born. Led by Block, the team tagged their first bluefin tuna in the waters off North Carolina in the winter of 1997. With the exception of the winter of 1998, TAG has returned each year to North Carolina to participate in the tagging program with the support of local fishermen.

Tagging Procedure

To allow for a larger number of these tagging surgeries to occur, the TAG team splits into two smaller teams. Each team includes a surgeon, a lip-hooker, and one or two taggers. Within the targeted fishing area, any participating boat can act as a "catch boat." Traditionally, TAG assigns two boats as "surgery boats." These boats provide a platform for tagging the bluefin; if there is a lull in the action, then the surgery boats will attempt

⁸⁸ Block, B.A., Dewar, H., Williams, T., Prince, E.D., Farwell, C., and Fudge, D. Archival Tagging of Atlantic Bluefin Tuna (*Thunnus thynnus*). *Marine Technology Society Journal*. 32(1): 37-46 (1998).

to catch bluefin themselves. However, these boats mostly receive bluefin transferred from the catch boats.

The procedure for tagging bluefin starts with the fishermen, who typically troll ballyhoo with skirted lures behind the boat. If a hooked bluefin is small and the angler uses the proper fighting technique, the contest may last only a few minutes. If the bluefin is large and strong - "hot" as the fishermen put it - the fight may last up to an hour. If the bluefin happens to be caught by a surgery boat, then it is brought directly to the stern.

A bluefin caught by any other boat must be transferred to a surgery boat. This transfer requires a tennis ball and someone with a good throwing arm. When a catch boat hooks a bluefin that it plans to transfer to TAG, the catch boat captain calls the surgery boat captain over the VHF or a mobile phone. The angler on the surgery boat buckles himself into the fighting chair and waits for the angler to finish battling the bluefin. The angler on the surgery boat will use a standard rod and reel, but instead of a bait at the end of the line he has a threaded tennis ball with a large snap swivel at the end of the line intersecting the ball. The person with the throwing arm, usually a crew member of the boat, pulls 50 to 75 yards of line off the reel and places it on the deck of the boat. He holds the tennis ball in his hand and awaits the captain's command to throw.

Once the original angler has successfully brought the bluefin to his boat, the captain of the surgery boat maneuvers close to the angling boat. The crew member on the surgery boat throws the tennis ball (with the line attached) to the other boat. Hopefully it is caught on the first try. If not, the crew member retrieves the ball, the captain re-positions the boat, and the ball is thrown again. Once the ball is caught by someone on the catch boat, the angler on the surgery boat must pay close attention to the

movement of both the surgery boat and the catch boat. He must leave enough slack in the line so as not to pull the ball out of the hands of the person on the catch boat, but not leave so much slack as to get it tangled in the propeller of either boat.

After the angler has brought the bluefin to his boat, the person on the catch boat who is holding the ball must attach the snap swivel (located below the tennis ball) to the snap swivel connecting the angler's fishing line to the leader (Photo 12).



Photo 12: Transferring a bluefin (photo courtesy of Dr. Barbara Block).

Once accomplished, both anglers on both boats are attached, for a moment, to the same fish - a precarious situation given that both anglers are applying pressure on one swivel connection. Immediately after the connection has been completed, the line coming from the catch boat must be cut *above* the swivel connection. At this point, the bluefin is no longer attached to the line of the catch boat but to the line of the angler on the surgery boat. At once, this angler must reel-in the slack created by the transfer and not let the hook slip from the bluefin's mouth. From here, the angler has very little line to reel in before the bluefin reaches the stern of the surgery boat.

Once transferred to a surgery boat, the bluefin is brought onboard through a “tuna door” located near the water line on the stern. The “lip hooker” leans out through this door and carefully gaffs the bluefin in the lower jaw, a process often hampered by rough water and swell. A securely-gaffed fish is pulled in through the tuna door and onto a large padded mat on the boat’s deck where a hose discharging saltwater is placed in its mouth, aerating the gills. A small towel soaked in seawater and protective artificial fish slime is placed over the bluefin’s eye to protect it (Photo 13).



Photo 13: A bluefin with its gills aerated and eye protected (photo courtesy of Eric Brazer, Jr.).

Team members first measure CFL and girth, which they later use to estimate the bluefin’s mass. They also assess general physical condition. Once these data are collected, the surgeon implants an archival tag in the belly cavity of the bluefin near the base of the anal fin. These tags are programmed to archive light level, water pressure, body temperature and ambient temperatures at pre-determined intervals. Internal software processes the light level and pressure data, making corrections for light

attenuation, and logs the estimated longitude and latitude of the bluefin's location.⁸⁹

These data can be retrieved only if the fish is landed and the tag is returned to the researchers (Photo 14).



Photo 14: A scientist implants an archival tag in a bluefin (Photo courtesy of Eric Brazer, Jr.)

While the surgery is being performed, the second tagger collects a small sample of skin or muscle. This specimen is used to determine the genetic characteristics of the population. After the sample is taken, if the bluefin measures longer than 85" CFL, the second tagger attaches a pop-up satellite archival tag (PSAT) into to the bluefin. These PSATs are larger tags than the archival ones. They are attached onto to the bluefin using a metal dart head which locates each PSAT in the musculature near the base of the second dorsal fin (Photo 15 and 16).

⁸⁹ Teo, S.L.H., Boustany, A., Blackwell, S., Walli, A., Weng, K.C., and Block, B. Movements and Temperature Preferences of Atlantic Bluefin Tuna (*Thunnus thynnus*) off North Carolina: A Comparison of Acoustic, Archival and Pop-Up Satellite Tags. Unpublished.



Photo 15 and 16: A scientist attaches a PSAT; the attached PSAT (photos courtesy of Eric Brazer, Jr.)

The tag monitors the geolocation (based on ambient light levels), and diving behavior of the bluefin. The tag releases at a preprogrammed point in time (usually 7-9 months) because of a corrosive linkage. It then floats to the surface and transmits its information to an ARGOS satellite, which uploads the data to a computer at a research lab.⁹⁰

In addition to the archival tag and PSATs, two small floy tags are attached to the dorsal side of the bluefin. These tags give information concerning their origin and a phone number to call if the bluefin is caught. Rewards are offered for the return of the tags: \$500 for a PSAT and \$1,000 for an archival tag as incentives for fishermen.

Finally, with the tagging procedure complete, the scientists lift the fish on its mat, turn it 180 degrees, and guide it head-first back out the tuna door.

⁹⁰ Block, B.A., Dewar, H., Farwell, C., and Prince, E.D. A New Satellite Technology for Tracking the Movements of Atlantic Bluefin Tuna. *Proceedings of the National Academy of Sciences of the United States of America*. 95: 9384-9389 (1998).

Tagging Results

The total number of North Atlantic bluefin tagged with electronic tags from the Stanford TAG program as of January 28, 2005 is 900. After leaving the tagging site, many of these bluefin went on to travel thousands of miles. In 1996 and 1997, multiple bluefin were tagged off the coast of Cape Hatteras, North Carolina; these fish traveled 1,670 nautical miles (1,922 statute miles), and were recaptured 90 days later in the Mediterranean Sea. In 1999, one bluefin tagged off the coast of North Carolina migrated to the Flemish Cap, east of Newfoundland. From there it was tracked through the Strait of Gibraltar in the Spring of 2000. After returning to the Flemish Cap, the bluefin remained there through the Summer and fall of 2000, traveled to the Bahamas for the winter, and quickly migrated across the Atlantic again where it was caught by a French purse seiner in June 2001. This bluefin's path can be seen in the figure below (Figure 9):⁹¹

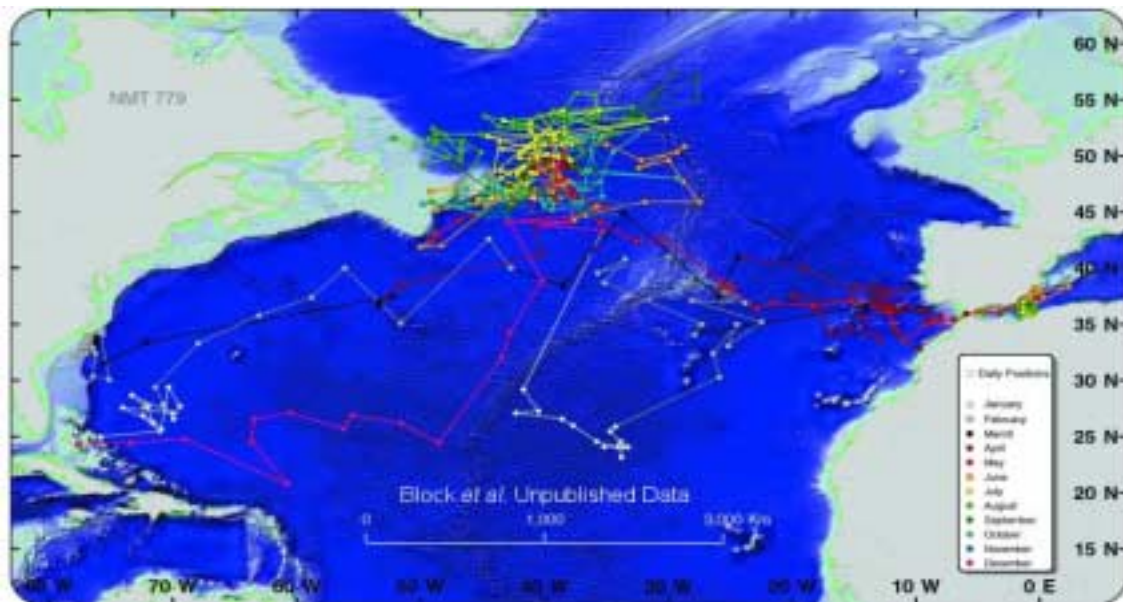


Figure 9: Trans-Atlantic migration of a bluefin tuna (Image courtesy of Dr. Barbara Block)

⁹¹ Tuna Research and Convention Center. Stanford University.
<http://www.tunaresearch.org/tagagiant2003.html>. Accessed October 25, 2004.

TAG deployed 201 archival tags between 2002 and 2003. Of these, 21 were recovered, more than one-third of which were recaptured east of the 45 degree management line.⁹² So far these tagging experiments have revealed the following general information on bluefin tuna movements:

1. Bluefin tuna tagged in North Carolina waters most often move into New England waters and back to North Carolina in the first year post tagging;
2. Some bluefin tuna released in North Carolina and Massachusetts show directed movements to the Gulf of Mexico and Bahamas spawning grounds;
3. Bluefin tuna tagged off of North Carolina move to the Mediterranean spawning grounds in the eastern spawning season. We believe these fish are returning to their natal spawning site;
4. Bluefin tuna that visit the Gulf of Mexico spawning ground (western fish) can move into the eastern Atlantic and become vulnerable to fisheries there;
5. Bluefin tuna that go to the Gulf of Mexico from North Carolina or New England, thus far tend to be very large fish. These fish on average measured over 85 to 95 inches in curved fork length (375 to 500 lbs);
6. It is possible but not certain that some fish are breeding in spring months in the South Atlantic Bight.⁹³

Policy Implications of Tagging Studies

Since the initial discovery of these trans-Atlantic migrations, scientists have teamed up with commercial and recreational fishers in New England and North Carolina to tag an ever-increasing number of bluefin. In the last decade, scientists have discovered a mixing of the two stocks substantial enough ($\geq 30\%$)⁹⁴ to cast serious doubt on the

⁹² NMFS. "Pre-Draft of the Highly Migratory Species Fishery Management Plan Including the 2005 Stock Assessment and Fishery Evaluation (SAFE) Report for Atlantic Highly Migratory Species." Washington D.C., February 2005.

⁹³ Tag-A-Giant Newsletter. Tuna Research and Convention Center. Stanford University. January 2005.

⁹⁴ Proceedings from the Second Symposium on Fisheries, Oceanography and Society, Woods Hole, MA, 8/27-29, 2001.

current “two stock” theory of management. At present, the western Atlantic quota is set by ICCAT at 2,500 mt and the fishermen are restricted by minimum size limits for capture and commercial sale, permits, closed fishing days, individual daily quotas, category quotas, gear restrictions, no directed fishing pressure on spawning stock, and reporting requirements. The eastern Atlantic quota, on the other hand, is set at 29,160 mt, nearly 12 times greater than the western quota. These fishermen are restricted only by a small minimum size requirement (no fish kept < 14 kg) and a time closure for purse seining.⁹⁵ With such a substantial percentage of the stocks mixing, such discrepancies in regulations theoretically result in bluefin being conserved in the western Atlantic but have the chance of being caught in the eastern Atlantic. This issue is on the topic of many fishermen minds: “Why are we letting fish go that can be caught in the Mediterranean?”

At a Workshop on Bluefin Mixing in Madrid in September of 2001, the Standing Committee on Research and Statistics considered their most recent evidence of bluefin mixing in the Atlantic. After five days of discussion, the SCRS stated the position that “it is likely that the distribution of fish from the two known spawning areas overlaps, at least for part of the year, for a large proportion of the Atlantic Ocean, and that the current boundary does not depict the present understanding of the biological distribution and biological stock structure.”⁹⁶ This announcement was followed with a recommendation that “assessment models be developed that permit accommodating more biological realism and which provide for greater flexibility for managers to select effective and

⁹⁵ ICCAT. Executive Summary of Bluefin Tuna Status Report; 10/03. www.iccat.es. Accessed October 1, 2004.

⁹⁶ ICCAT. Resolution 01-09: Regarding the SCRS Mixing Report on Atlantic Bluefin Tuna; www.iccat.es. Accessed October 1, 2004.

efficient conservation programs and management units for bluefin tuna of western and eastern origin.”⁹⁷ At the conclusion of this meeting, ICCAT formally resolved that “contracting parties, in cooperation with their National Scientists and the SCRS, should endeavor to conduct scientific research throughout the Atlantic Ocean and Mediterranean Sea that will contribute to the better understanding of Atlantic bluefin tuna movement patterns. As recommended by the SCRS, research should include archival tagging of fish of all sizes, larval and spawning studies, and genetic and microconstituent analyses.”⁹⁸

At the 2002 ICCAT meeting in Bilbao, the SCRS presented to the Commission even more evidence of Atlantic bluefin mixing. At the end of this meeting, ICCAT recommended, among other things, that the Working Group, including scientists and managers, shall be established to “evaluate all available biological information relevant to the issue of stock structure and mixing, and to develop operational options for implementing alternative approaches for managing mixed populations of Atlantic bluefin tuna including but not limited to those developed by SCRS.”⁹⁹

This Working Group met in 2003 and again in 2004. In response to the recommendations from these meetings, the Committee is currently developing a revised proposal for initiating a coordinated Bluefin Tuna Research Program between the eastern and western Atlantic. This proposal will address priority research and data needs for providing scientific advice to ICCAT related to revised management procedures.

⁹⁷ Ibid.

⁹⁸ Ibid.

⁹⁹ ICCAT. Resolution 02-11: Recommendation by ICCAT to Establish a Working Group to Develop Integrated and Coordinated Atlantic Bluefin Tuna Management Strategies. www.iccat.es. Accessed October 1, 2004.

PERCEPTIONS OF SCIENCE AND MANAGEMENT

Local Bluefin Science

In 2005, TAG returned to Morehead City for the seventh year to conduct their research. TAG has forged a strong bond with local fishermen over the years, and the fishermen hold a generally positive opinion of the program and the scientists. TAG is subjected to the rigorous lifestyle of the fishermen for the month of January, including leaving the dock before sunrise, dealing with inclement weather conditions and below-freezing temperatures, battling the winter seas day after day, and not returning to the dock until the afternoon or early evening. While fishermen may generally perceive scientists as landlubbers who can't handle life on the water, the TAG team members are seasoned pros. They know their way around the boats, aren't troubled with seasickness, and are familiar with how the captains run their operations. Since there is often a significant amount of downtime during the fishing day, including travel to and from the fishing area, team members pass the time by chatting with the captain and crew members. Conversations range from more serious talk about TAG research to lighthearted talk about social events and sports.

Despite the friendly dialogue between the team members and the fishermen, the team allows the captain to make decisions concerning the fishing. While most captains are open to suggestions by the team, it is the captain who ultimately decides where to fish. TAG plays almost no role in the catching of the fish; the captain uses his knowledge and skill to find the fish, the angler uses his/her knowledge and skill to bring in the fish, and the crew member uses his knowledge and skill to wire the fish. Once the bluefin is

on deck, however, TAG takes over. Team members occasionally disagree with the captain or crew, but these differences are most often slight and quickly resolved.

TAG makes every effort to promote the fishermen's role in this research. This concept is particularly apparent in their annual newsletter highlighting the previous year's accomplishments, wherein TAG writes that "North Carolina vessels, in particular, have been instrumental in placing tags on the bluefin tuna off Morehead City and Hatteras, North Carolina. Fishermen play a key role in our team deploying and retrieving tags."¹⁰⁰ Each year TAG provides the fishermen with this newsletter, including tagged bluefin that have been recovered and general conclusions that can be drawn from their research. Additionally, this newsletter provides visual descriptions of the movements and behaviors of some of the bluefin the fishermen have helped tag. The fishermen can see where the fish have traveled after being tagged on their boats.

To encourage participation in their research, TAG provides incentives to the fishermen. These incentives are an effective means to foster relationships between the fishermen and the scientists. TAG holds a transfer competition among the charter boats each year. The captains and crew of the top three boats that transfer the most bluefin each receive coveted Helly Hanson jackets. These trophies are embroidered with "Tag-A-Giant," the year, and an image of a bluefin on the back. While nearly all fishermen receive a hat, only a few are lucky enough to earn a jacket, which provides bragging rights at the dock, as it is a status symbol among the fishermen.

Furthermore, after a catch boat transfers a bluefin to a surgery boat, TAG tosses a gift bag to every angler. Within this gift bag is a TAG hat, a newsletter, a length of leader material (to replace theirs that was cut), the lure on which they caught the fish,

¹⁰⁰ Tag-A-Giant Newsletter. Tuna Research and Convention Center. Stanford University. January 2005.

and, occasionally a second lure. Another incentive provided by TAG is the naming of captains and boats on the TAG website and daily tagging log. Seeing their names and the name of their boats on the website gives fishermen a sense of satisfaction, and tangible proof that they are playing a pivotal role in this extremely important research.

Additionally, captains emphasize on their own websites their participation with TAG and, if applicable, their standings in the transfer competition. This bolstering of credentials theoretically makes these captains more likely to increase their business; people who book charters are more likely to do so with a reputable captain who is known for his ability to fish rather than someone with no qualifications.

TAG has formed both professional and personal relationships with the local fishermen. When the team showed up for their first day of tagging on January 5 2005, they also brought with them small Christmas gifts for some of the captains. Some captains returned the favor with shirts and visors depicting their boats' name and image. This reciprocation is evident throughout the tagging season. Each night, the individual members of the team sit down to eat and drink with captains, crew and their families, visiting researchers, friends, and volunteers. This year, the dinners were cooked by the wife of one of the captains. They share fish stories, pictures, and even home-movies.

Overall, the fishermen appear to see TAG as a positive program, saying that they are impressed with the amount and quality of data collected, the tagging procedure, and the general attitude of the team. The fishermen recognize that there is a lack of accurate data behind the current management, but acknowledge that TAG is working to improve that and enjoy the opportunity to participate in this data collection.

Local Bluefin Management

Many fishermen favor requiring mandatory use of heavy tackle and/or prohibition of light tackle. Local charterboat fishermen have noted an increase in the number of light-tackle recreational fishermen in the last few years. These risk-takers forgo the standard heavy gear for the challenge of landing a giant bluefin on incredibly light gear. Light tackle fishing stresses the fish considerably more than heavy tackle fishing. Also, charter fishermen say that often the bluefin will spool the angler, or the fight will last an excessively long time. If the bluefin spools the angler it will be trailing hundreds of yards of line from its mouth as it swims along. According to the charter fishermen, this will slow the bluefin down, require it to spend more energy swimming and feeding, cause it to become separated from its school, and will eventually kill it. Charter fishermen remark that if minimum standards on tackle are put into place, this unnecessary and unintentional bluefin killing will stop.

Most fishermen question the “emergency” NMFS rulings that allow 2 bluefin to be landed in the general category in the New England summer bluefin fishery. This rule is enacted in New England when the general category quota is at a low level and fishermen are catching many fish. Frustrated with being able to catch so many fish but not be able to keep them, New England fishermen lobby their state representatives and NMFS for the opportunity to take more of an advantage of the resource. They are often successful in their attempts. Local fishermen feel that when this happens, the New England fishermen have an unfair advantage – “why do New Englanders get a large quota *and* get to land two bluefin when we have only a small quota and can only land one?”

Many times fishermen will call NMFS seeking information on quotas and landings. They are often directed to the NMFS website (which doesn't have detailed information) or they are told that the information is "unavailable" or that NMFS "is unable to divulge anything."

Some fishermen oppose a limited entry system because they believe that they should not be restricted in accessing this "public resource." In lieu of limited entry, some fishermen favor gear and other restrictions. However, a small number of fishermen favor a limited entry system, citing the increasing number of boats participating in the fishery each year. Those that support the former ruling say that NMFS shouldn't prevent people from fishing if they want to fish, but that NMFS should enact restrictions on the fishermen. Regulate the fishing, not the fishermen. Those that support the latter ruling say that the ever-increasing number of boats presents a problem with increased capacity and also brings up a safety issue. Regulate the fishermen in addition to the fishing.

RECOMMENDATIONS FOR POLICY AND MANAGEMENT

Many biological characteristics of fish stocks impact the effectiveness of management measures including the fecundity and spawning potential of the population; variability in population size and recruitment; interactions with other species; the geographic range and migration patterns of the stock; the normal life span of the fish; and role of the species in the local ecosystem.

The previous issues are indicative of how difficult it is to manage a resource. However, it is not the stock that is managed but rather the fishermen themselves. Managers do not regulate bluefin tuna; they regulate the fishermen who harvest them. Characteristics of fishermen that impact the effectiveness of management include choosing short-term necessity over long-term sustainability, harvesting the resource using the most efficient means possible, and competition among resource users.

NMFS must consider many biological, economic and social factors when determining how to manage this fishery, including:

- the development of a relatively new fishery in a new location
- the decline of the traditional bluefin tuna fishery
- a fishery more economically-efficient than the traditional one
- fishermen who have not historically participated in this fishery
- defining “commercial” and “recreational” operations
- an overfished species
- a highly migratory species
- an easily accessible species
- an economically valuable, and thus highly political species

Knowing this, and prior to formulating policy recommendations, managers must first identify and define their objectives. It is essential that they determine the ultimate goal of the policy in question. Often these objectives are in the form of conservation, allocation and efficiency. All three play a vital role in fisheries management.

Objectives

Three main objectives for fisheries policy include conservation, allocation, and efficiency: how many fish can be harvested, who should be able to harvest them, and what is the most efficient way of doing so. While managers may focus on a single objective, attributes of each must be considered in the decision-making process.

Conservation

Conservation of the resource is always an underlying priority when determining fisheries allocations. NMFS must determine, to the best extent possible, the maximum sustainable yield (MSY) of the resource and develop an appropriate (and enforceable) Total Allowable Catch (TAC). Individual actions based upon self-interest cannot assure adequate conservation. Therefore, it is essential that an acceptable harvest arrangement, along with implementation and enforcement requirements, be determined.

In the local winter bluefin tuna fishery, conservation is an important issue that must be considered. Recent bluefin tuna population estimates show a 90 percent decline in spawning stock biomass since the 1960s. With the current western Atlantic allocation of approximately 2,500 mt, there is only a 50% chance that this level of fishing pressure will allow the stock to rebuild to a level of MSY in twenty years.¹⁰¹ Additionally, tagging studies have shown that some bluefin released in North Carolina show directed movements to the Gulf of Mexico and Bahamas spawning grounds. While conservation is an important issue to address in any fishery, it is vital that NMFS considers the state of

¹⁰¹ ICCAT. Report of the SCRS. 1998. Website unavailable.

this dwindling stock and the potential effects on spawning when attempting to manage the fishery.

Allocation

When determining fisheries allocations, NMFS is faced with deciding who should receive a share of the resource and how large that share should be. Traditionally these decisions are based on historical catch rates while occasionally they are based on potential catch rates of the fishery. There are four primary ways to allocate scarce resources: the open-access approach; a rule of equal opportunity (through a lottery, a first-come-first-served principle, or a same-for-everyone allocation); the political approach or priority ranking; and the market device (the resource is distributed to those who are willing to pay the most for it).¹⁰² Allocation issues are moot in an open-access fishery because fishermen determine their own allocation based on how competitive they are. A rule of equal opportunity gives each fisherman the same shot at the same amount of quota, regardless of their experience in the fishery. Priority ranking, on the other hand, determines that greater allocations go to those who “deserve it more than others,” for instance, fishermen who have a historical stake in the fishery. Finally, market mechanisms determine allocation shares based on how much fishermen are willing to pay to utilize the resource.

Currently, the local commercial bluefin tuna fishery only occurs if New England fishermen do not reach their quota for the angling and general category. These quotas are area-dependant; the fishery is shut down when the quota is filled, regardless of where

¹⁰² National Research Council. *Sharing the Fish: Toward a National Policy on Individual Fishing Quotas*. Washington D.C., National Academy Press. 1999.

the fish are caught. Traditionally, this has occurred while bluefin are still located in New England waters, prior to their migration past North Carolina. NMFS allocates the bluefin quota among gear types and sectors. NMFS must decide if the quota system should be changed from an east-coast-wide quota with gear and sector allocations to true, directed regional allocations, including allocation by region, by state, by county, by port, or by individual participants (as individual transferable quotas, or ITQs). If regional allocations are the answer that NMFS is looking for, they must decide how to determine the appropriate TAC for each quota, on what qualifications to base the TAC, and how do best deal with in-season transferability. Additionally, since the local bluefin tuna fishery is composed of recreational as well as commercial fishermen, NMFS must address whether or not to change recreational allocations.

Efficiency

An efficient fishery is one where maximum net community benefits are achieved through an optimal arrangement of harvest levels and fishing methods. The Magnuson-Stevens Act requires that “conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.”¹⁰³ In any market, the efficiency of the outcome depends on the costs associated with establishing the relevant contracts for trading the product or service and monitoring, policing and enforcing, usually through the courts, the contracts.¹⁰⁴ Despite this, efficiency is not synonymous

¹⁰³ Magnuson-Stevens Fishery Conservation and Management Act.
<http://ipl.unm.edu/cwl/fedbook/magfish.html>. Accessed January 10, 2005.

¹⁰⁴ Fisheries Western Australia. *Use of Market Mechanisms for the Allocations of Commercial Fishing Access Entitlements in Western Australia*. Economics Consulting Services Pty Ltd. 1998.

with sustainability. For instance, if it is possible to harvest all the fish and put the money into another investment and earn a higher rate of return on that investment than you would've earned by leaving some of the fish in the fishery, then that's precisely what you'll do.¹⁰⁵

Due to market and fish conditions, bluefin tuna harvested off North Carolina in the winter months tend to draw higher prices at auction than bluefin tuna harvested in New England waters during the summer months. As required by the MSFCMA, NMFS must use this knowledge to determine appropriate quotas for bluefin tuna. Additionally, there is the issue of matching fishing effort with the availability of the species. Currently the only fees required to enter the fishery are the purchase of a federal bluefin tuna permit (\$22) and a state commercial fishing license (\$200 for in-state residents, \$800 for out-of-state residents). In addition, a commercial fisherman must have a vessel registration (\$1-\$6 per foot). Due to the inexpensive nature of the permits, many fishermen become involved with the fishery. Even to the untrained eye, it is quite evident that there are too many boats chasing too few fish. NMFS must decide if it is appropriate to limit the number of permits available, and if so, how to go about doing it the most efficient way possible.

Alternatives for Management

Four types of techniques are used to control the level of harvest in a fishery: input controls, output controls, fees and taxes, and technical measures. Input controls attempt to limit catch indirectly through limits on the amount of labor or capital that can be

¹⁰⁵ Krall, Lisi. *An Ecologically Economic Perspective on Microeconomics and Fisheries Conservation*. American Fisheries Society. 2005.

applied to a fishery; that is, they do not directly control the amount of catch. These measures include restrictions on gear, vessels, or participants in the fishery. Gear restrictions include limits on the type, amount, or use of certain gears. Vessel restrictions include limits on the design, length, or engine horsepower. Participant restrictions include some form of licensing or permission to enter a fishery.

The second type of fishery management tool is output controls. These measures attempt to limit catch through the number or weight of fish that can be harvested; that is, they directly control the number or amount of fish landed. Output controls include a TAC for an entire fleet or fishery, or trip limits and individual vessel/fishing quotas for individual vessels, owners or operators.

Fees and taxes make up another tool fisheries managers use to control the level or harvest. Fees are often associated with licenses and can be based on vessel and gear configuration, catch, or past participation in the fishery. Economic theory suggests that appropriately designed fees and taxes can lead to socially optimal levels of resource utilization, however the level of knowledge required to design optimal taxes or fees is difficult to achieve.¹⁰⁶ As a result, controlling resource use strictly with taxes and fees has resulted in limited success. Most fishery-related taxes are assessed on the value of the fish landed.

Technical measures are a fourth tool used by fisheries managers. These actions include limits on fish size and sex, and area limits. Restrictions on fish size may include minimum and maximum length requirements or slot limits. Area/time restrictions

¹⁰⁶ National Research Council. *Sharing the Fish: Toward a National Policy on Individual Fishing Quotas*. Washington D.C., National Academy Press. 1999.

include limits on where people can fish and at what times they can fish, and involve seasons or area/time closures.

The local charter fishermen all use similar gears and have similar boats and engine types. However, the boats and gear employed by bluefin fishermen in general range from small center consoles with outboard motors and anglers using light tackle, to large Carolina Sportfishermen with twin diesels and heavy tackle. Regulating gear, boat and engine types would not greatly impact the Beaufort and Morehead City charter fleet (depending on how the rule was written) but would stand to limit the participants in the fishery. An additional participant restriction would be the decrease in availability and/or increase in price of the permits required to fish for bluefin tuna. Of all the input controls in this fishery, permit restrictions would affect all fishermen regardless of gear used.

Some form of output control will probably be the most effective means to managing this fishery. Currently, NMFS attempts to manage the bluefin tuna fishery with a TAC for each user category and trip limits. Due to the low levels of the stock, it is not foreseeable that these TACs will be removed. If NMFS were to make the switch from category quotas to ITQs, these quotas would have to be further divided among the participants; something difficult but not to be ruled out as a management technique.

As was previously mentioned, permit fees are currently very low and appear to have no effect on limiting fishery participation. At present, between Japanese expenses, dealer commissions and domestic handling charges, fishermen are only receiving approximately half of their total sales price. For instance, one bluefin tuna sold for a total sale of \$3789; however after subtracting \$568 for Japanese expenses, \$189 for commission, and \$1005 for handling, the fisherman's total return was only \$2026.

Therefore, additional taxes on bluefin will most likely be met with strong opposition from the fishermen.

Existing management calls for a minimum size limit of 73” CFL on bluefin tuna. Presently, controversy exists over whether a 73-inch fish has spawned. If this is not the case, NMFS must consider the effects of removing individual fish from a small population before they have had a chance to reproduce. Maximum size limits have elsewhere proved effective in helping sustain a species’ population. However a rule such as this would be met by opposition from fishermen who are attempting to land the “500+ lb giant bluefin” they have read so much about. Seasonal closures occur in this fishery in the form of closed fishing days. These are employed to lengthen the season and prevent a flooding of the market and subsequent low dock prices. Currently NMFS proposes restricted fishing days for all Friday, Saturday and Sundays from November 18, 2005 through January 31, 2006; “this is intended to extend the general category fishery into the late season for the southern Atlantic region.”¹⁰⁷ Limits on fish sex are not a realistic option in the bluefin tuna fishery since sexual dimorphism is not apparent. Finally, since the bluefin are concentrated around such a small geographic location, determining area closures would present a problem and would most likely be met with opposition from fishermen.

Summary

It isn’t unusual for disputes to emerge among scientists and fishermen over the abundance of fish stocks, even when scientists are highly confident in their stock assessments. This occurs partly because scientists and fishermen pay attention to and

¹⁰⁷ Federal Register. Vol. 70, No. 55. 50 CFR part 635. March 23, 2005.

experience different types of information: scientists base their models on large-scale characteristics of entire fish stocks, such as fish population recruitment, mortality and population size over the species' entire range; fishermen pay attention to small-scale characteristics of fish populations and select fishing areas to maximize catch or net revenue per unit effort.¹⁰⁸

It is imperative that NMFS work with the fishermen to institute the most effective and efficient regulations. NMFS needs to use a combination of input controls, output controls, fees and taxes, and technical measures to best manage this fishery. No single technique will work on its own. Some techniques, such as taxes, closed fishing areas and fish sex limits are either impossible to employ or will be met with stiff opposition. Other techniques, such as quota allocation, minimum size limits, and gear regulation will be met with less opposition. NMFS must update their regulatory measures to keep up with this ever-changing fishery and choose the most appropriate actions based on an objective of conservation, allocation and/or efficiency.

¹⁰⁸ National Research Council. *Sharing the Fish: Toward a National Policy on Individual Fishing Quotas*. Washington D.C., National Academy Press. 1999.

CONCLUSION

When revising the management structure for the bluefin tuna fishery, NMFS must determine whether their main objective is conservation, allocation, or efficiency. Despite the fact that attributes of each objective must be considered in the decision-making process, managers must pay special attention to conservation. The current allocation of approximately 2,500 mt to the western Atlantic projects only a 50% chance that this level of fishing pressure will allow the stock to rebuild to a level of MSY in twenty years.¹⁰⁹ Allocation is another sensitive issue in that the North Carolina winter bluefin fishery is developing in the place of a historical, traditional fishery in New England. North Carolina fishermen only receive a commercial bluefin allocation if the New England fishermen fail to catch their quota. ICCAT and NMFS must focus on equity and balance traditional fishing rights with opportunistic ones. Finally, the bottom line in the bluefin fishery is that there are too many boats chasing too few fish. ICCAT and NMFS must match the optimal arrangement of harvest levels with the optimal arrangement of fishing methods to produce the maximum net community benefits and increase the efficiency of the fishery.

North Carolina has taken many steps towards establishing a commercial quota for a local winter fishery. Forming a non-profit organization and going right to NMFS, the fishermen have petitioned for, and are slowly gaining, the respect, clout and the quota that they demand. Even though the WBA has neither authority nor responsibility in the management of a North Carolina winter bluefin tuna fishery, it is a driving force in establishing management procedures and bringing about change in the fishery management process.

¹⁰⁹ ICCAT. Report of the SCRS. 1998. Website unavailable.

In conclusion, the US bluefin tuna fishery is a dynamic system that is continuously evolving. The bluefin tuna, the fishermen that hunt them, and the policies that manage the fishery, are all part of a complex network of biological, ecological, social, economic, and political factors. Secondly, NMFS is currently faced with a complicated, multifaceted domestic situation: how do they balance a traditional, yet declining New England fishery with an up-coming, more profitable North Carolina fishery, all the while knowing that the bluefin is overfished and overfishing continues to occur? Finally, the Beaufort and Morehead City charter fleet is a prime example of local organization, the role that fishermen can play in research, and the effects that stakeholder involvement can have on fisheries management. The only way to successfully utilize this winter bluefin fishery is to manage both the fish and the fishers the most effective way possible. I hope that my work with the local bluefin tuna fishermen of Beaufort and Morehead City can contribute to this process.

ACRONYMS

ATCA	Atlantic Tunas Convention Act
BSD	Bluefin Statistical Document
CFL	Curved Fork Length
CITES	Convention on International Trade in Endangered Species
EEZ	Exclusive Economic Zone
FCA	Fishery Conservation Amendments
FCMA	Fishery Conservation and Management Act
FMP	Fishery Management Plan
HMS	Highly Migratory Species
ICCAT	International Commission for the Conservation of Atlantic Tunas
IGFA	International Game Fish Association
ITQ	Individual Transferable Quota
kg	Kilogram
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSY	Maximum Sustainable Yield
mt	Metric Ton
NCDMF	North Carolina Division of Marine Fisheries
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OY	Optimum Yield
PFCFL	Pectoral Fin Curved Fork Length
PSAT	Pop-Up Satellite Archival Tag
SAFE	Stock Assessment and Fishery Evaluation
SCRS	Standing Committee Research and Statistics
SDEIS	Supplemental Draft Environmental Impact Statement
SFA	Sustainable Fisheries Act
SSB	Spawning Stock Biomass
TAC	Total Allowable Catch
TAG	Tag-A-Giant
WBA	Winter Bluefin Association

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