Committee on Resources

Witness Testimony

Testimony of
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Wildlife, and Oceans
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Background

Since 1993, we have worked in collaboration with commercial spotter pilots on an aerial survey to assess the relative abundance, distribution, and environmental biology of giant bluefin tuna in New England waters. This work was initiated in 1993 when then East Coast Tuna Association (ECTA) asked the New England Aquarium (NEAq) to examine the feasibility of direct photographic assessment of bluefin schools in the New England region. Because bluefin tuna schools frequently travel and feed at the surface in this region, spotter pilots are able to photograph schools for enumeration and document school locations and their search tracks. The 1993 pilot study was funded in part by the ECTA, who provided funds toward purchase of cameras, by the National Marine Fisheries Service, and by the New England Aquarium. The results of the 1993 feasibility study have been published in Lutcavage and Kraus (1995, Attachment 1). Since 1994, our aerial survey research program has been funded entirely by the National Marine Fisheries Service and the NEAq, with voluntary participation by spotter pilots who donate survey time.

A full discussion of data collection, spotter activities, and results of the 1994 survey were presented in Lutcavage et al. (unpublished final report to the NMFS, February, 1995). Briefly, in 1994 we developed a data acquisition system that allowed us to track spotter pilot effort, document schools, and derive counts of surface bluefin. Sightings per unit effort (SPUE) analyses quantified spotter search effort and indicated trends in movements, regional abundance, and bluefin surfacing behavior, by day and by geographic regions of 10 min squares of latitude by longitude. An algorithm was developed that allowed us to "filter" summed daily bluefin counts by swimming speed and school size to establish minimum daily counts based on criteria that reduced the likelihood of redundant counts.

The New England Aquarium's aerial survey research initiative is the first multi-year study to examine the population and environmental biology of giant bluefin tuna on one of their most important seasonal foraging grounds. The use of spotter surveys and direct photographic assessment of bluefin tuna has had very little precedent. In 1990, the Australian CSIRO fisheries group began an aerial survey program to examine recruitment of juvenile Southern bluefin to the South Australian Bight (Chen and Polacheck, 1994). The CSIRO survey incorporates two commercial spotter pilots who independently estimate bluefin size class and tonnage while flying dedicated transects, but does not include photo documentation. In the 1950's and 1970's, the NMFS conducted aerial surveys for giant bluefin in the Bahamas and in the New England region (e.g. Rivas, 1978; Partridge et al., 1983), but these surveys did not lead to a long-term aerial assessment program.

Much has been learned from three years of New England bluefin surveys, which we reported on at the Lake Arrowhead 47th Annual Tuna Conference (Lutcavage et al., 1996, Attachment 2) and from a recent aerial survey of giant bluefin on the Bahama Banks (Lutcavage et al., 1995). We are working toward the establishment of a long-term database that can be used by resource managers to make informed biological assessments. Another objective of our survey is to examine the interrelationships of bluefin with their environment. Oceanic fronts, temperature, tide, and local abundance of prey may affect the distribution and relative abundance of giant bluefin in this region. For example, in New England bluefin distributions shift annually. These shifts may be related to changes in migration patterns and environment factors. Changes may also be closely tied to population dynamics of prey populations, which include herring, mackeral, sand

lance and squid, among others (Chase, 1995).

The positions of bluefin schools photographed by spotter pilots are plotted on daily satellite sea surface temperature (SST) charts obtained through AVHRR remote sensing. Photos also provide information on schooling behavior, associations with other marine life, and the spatial structure of bluefin schools. Through our collaboration with Drs. Don Olson and colleagues of the Un. of Miami's Physical Oceanography department, we are examining bluefin migration and aggregation size in relation to ocean fronts and other environmental features (Olson et al., 1996, Attachment 3). Giant bluefin tuna have perhaps the most strongly polarized schooling behavior of any pelagic fish. Working from photographs, we are examining bluefin school structure, polarity, and packing density to learn more about how these large predators forage, interact within schools, and travel on the New England feeding ground (O'Dell and Lutcavage, in prep). This season we will collaborate with Dr. Richard Brill, of the School of Ocean and Earth Science, Un. of Hawaii, and Bradford Chase and Greg Skommel of the Mass. Div. of Fisheries, to track the horizontal and vertical movements of giant bluefin in the study region. This information is vital to the interpretation and analysis of aerial survey sightings data.

In 1994, the National Marine Fisheries Service conducted a pilot project to determine whether line transect methodology currently used for terrestrial and air-breathing marine animals is adequate for bluefin tuna. In 1995, sightability curves required by transect methodology were determined (Hoggard, 1995). At the present time we and the NMFS are independently examining results of the spotter and line transect surveys. We hope that the results of our combined efforts can be integrated in order to develop meaningful alternative direct assessments for bluefin tuna that are fishery- independent measures of abundance.

Since 1992, the New England Aquarium has been developing applied methods for the capture, transport, maintenance and physiological sampling of live bluefin tuna. Throughout this period NEAq has worked closely with environmental, commercial, recreational and government groups utilizing and managing this important marine resource. To date, the focus of this program has been to develop methods of maintaining study animals in captivity in order to provide researchers with year-round access.

In 1995 this program refocused its efforts on three primary areas: 1. An assessment of the reproductive biology of bluefin tuna 2. Examination of the levels of delayed mortalities in bluefin caught and released in hook and line fisheries. 3. An assessment of the feasibility of commercial tuna aquaculture in the United States. All three areas were chosen specifically because they address issues that the fishing community, fisheries managers, and environmentalists have identified as areas critical to the development of sustainable utilization of existing bluefin stocks. In 1996, funding for this program was terminated, and continued work in these areas is contingent upon the acquisition of further funding. Detailed explanations of the program are included in Attachment 4.

The need for alternative, fishery-independent population assessments and studies concerning the environmental and reproductive biology of bluefin have been identified as vital gaps in knowledge necessary for wise management and conservation of bluefin (cited in the National Academy of Science's 1993 independent review of bluefin tuna research). The New England Aquarium's Bluefin Tuna Research and Conservation Program is proactive in its effort to work collaboratively with members of the research, conservation, fishing, and bluefin management communities in order to close some of these gaps.

Literature Cited

Chase, B. C. 1995. The diet of bluefin tuna (*Thunnus thynnus*) off the coast of Massachusetts. Mass. Div. of Fisheries, Cat Cove Marine Laboratory, Salem, MA. unpub. report., June, 1995. (*manuscript in preparation*).

Chen, S. and T. Polacheck. 1994. Data analysis of the aerial surveys (1991-1994) for juvenile Southern bluefin tuna in the Great Australian Bight. unpub. report, CSIRO SBFWS/94/7.

Hoggard, W. 1995. Summary of bluefin tuna line transect aerial surveys in New England waters. unpub. report. NMFS, Pascagoula Laboratory, PO Drawer 1207, Pascagoula, MS

Lutcavage, M., Goldstein, J., and S. Kraus. 1996. Distribution, relative abundance and behavior of giant bluefin tuna in New England waters, 1993-1995. Abstract. Proceedings of the 47th Annual Tuna Conference, Lake Arrowhead, California, May 20-23, 1996. SWFSC, NMFS, NOAA, La Jolla, CA.

Lutcavage, M. and S. Kraus. 1995. The feasibility of direct photographic assessment of giant bluefin tuna, *Thunnus thynnus*, in New England waters. Fishery Bulletin 93:495-503.
Lutcavage, M., Kraus, S., and W. Hoggard. 1995. Progress report on the 1995 Bahama Banks Bluefin tuna aerial survey. Int. Comm. Conserv. Atlantic Tunas Coll. Vol. Sci. SCRS document 95/85, October, 1995. (*Manuscript submitted to Fishery Bulletin*)
O'Dell, K.E., and M. Lutcavage. Schooling behavior of the North Atlantic giant bluefin tuna (*Thunnus thynnus*). Manuscript in preparation.
Olson, D.B., Humston, R., Podesta, G., Samuels, G., and M. Lutcavage. 1996. Bluefin tuna distributions and migration relative to oceanic fronts in New England waters, 1993-1995. Abstract. Proceedings of the 47th Annual Tuna Conference, Lake Arrowhead, California, May 20-23, 1996. SWFSC, NMFS, NOAA, La Jolla, CA.

Partridge, B.L., Johansson, J., and J. Kalish. 1983. The structure of schools of giant bluefin tuna in Cape Cod Bay. Environmental Biol. of Fishes 9:253-262.
Rivas, L. R. 1978. Aerial surveys leading to 1974-1976 estimates of the numbers of spawning giant bluefin tuna (*Thunnus thynnus*) migrating past the western Bahamas. Int. Comm. Conserv. Atlantic Tunas Coll. Vol. Sci. paper 7, pp. 301-312.

Recommendations

1. Bluefin tuna research should be coordinated out of a single National Marine Fisheries office.
2. All bluefin tuna research conducted or contracted by the National Marine Fisheries should be dependent upon peer review by expert scientists outside of the United States (e.g. Canada, Australia, Japan).
3. That the NMFS hold a workshop to present and discuss the results of the NMFS Twin Otter transect and NEAq spotter pilot surveys.
4. In order to gather samples of reproductively mature individuals, consistent yearly longline cruises are needed that target spawning aggregations in the Gulf of Mexico.
5. Initiate a long-term domestic broodstock holding program.
6. Conduct replicated experiments designed to estimate mortalities of released fish caught using all current fishing methods.

List of Attachments 1. Lutcavage, M. and S. Kraus. 1995. The feasibility of direct photographic assessment of giant bluefin tuna, *Thunnus thynnus*, in New England waters. Fishery Bulletin 93:495-503.
2. Lutcavage, M., Goldstein, J., and S. Kraus. 1996. Distribution, relative abundance and behavior of giant bluefin tuna in New England waters, 1993-1995. Abstract. Proceedings of the 47th Annual Tuna Conference, Lake Arrowhead, California, May 20-23, 1996. SWFSC, NMFS, NOAA, La Jolla, CA.
3. Olson, D.B., Humston, R., Podesta, G., Samuels, G., and M. Lutcavage. 1996. Bluefin tuna distributions and migration relative to oceanic fronts in New England waters, 1993-1995. Abstract. Proceedings of the 47th Annual Tuna Conference, Lake Arrowhead, California, May 20-23, 1996. SWFSC, NMFS, NOAA, La Jolla, CA.
4. Belle, S. Bluefin tuna project overview. (Reproductive biology and husbandry).

Summary of Submitted Testimony

An overview of the New England Aquarium's research program on the population, environmental, reproductive biology, and aquaculture of bluefin tuna is presented. Attachments include supplemental information including publications, abstracts of scientific presentations, and more detailed description of the reproductive biology and aquaculture studies.

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