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STANDARDIZED CATCH RATES FOR LARGE BLUEFIN TUNA, *THUNNUS THYNNUS*, FROM THE U.S. PELAGIC LONGLINE FISHERY IN THE GULF OF MEXICO AND OFF THE FLORIDA EAST COAST

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SUMMARY

Indices of abundance of large bluefin tuna from the pelagic longline fishery in the Gulf of Mexico and off the east coast of Florida were derived from a selected subset of 21 vessels which consistently caught bluefin tuna between 1987 and 1996.

RÉSUMÉ

Les indices d'abondance du grand thon rouge de l'Atlantique provenant de la pêcherie pélagique palangrière dans le Golfe du Mexique et au large de la Côte Est de Floride sont issus d'un sous-jeu sélectionné de 21 bateaux qui ont pris de manière uniforme du thon rouge entre 1987 et 1996.

RESUMEN

Se derivaron índices de abundancia de atún rojo grande de un subconjunto seleccionado de 21 barcos de la pesquería de palangre pelágico en el Golfo de México y la Costa Este de Florida, que capturaron atún rojo de forma consistente entre 1987 y 1996.

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Introduction

This paper is an update of the work by Cramer and Scott (1996) which provided a standardized CPUE for bluefin tuna in the Gulf of Mexico (GOM) and off the Florida east coast (FEC) for possible use by the SCRS in its stock assessments.

Large bluefin tuna are caught in the GOM and off the FEC as bycatch by longline vessels fishing for other species of tuna or for swordfish. Although bluefin are considered to be bycatch in this fishery, examination of the data, in previous studies, indicated that some vessels have consistently catch bluefin. The same 21 vessels were used in the update as were used in the 1996 analysis.

Materials and Methods

U.S. Atlantic fishing vessels which land swordfish have been required to provide daily records of effort and catch since October 1986. Ten complete years of data (1987 to 1996) are now available (1996 data are preliminary). Since swordfish landings are made by a variety of gear types over a wide geographical area, it was necessary to exclude effort not relevant to catch of bluefin. This was accomplished by defining a subset of times and areas and vessels where bluefin are most likely to be caught.

Earlier studies indicate that catch of large bluefin is primarily reported by longline vessels in the GOM and the FEC between January first and the end of May. Therefor these analyses are restricted to those areas and times. Vessels, selected for analysis, reported catching bluefin in at least 5 years (from 1987 to 1995).

Analyses

The indices of abundance were estimated using the delta-lognormal approach described by Lo *et.al.* (1992) in which the log-transformed positive catch rates (without any constant added) and the proportion of observations (days fishing) for which there was a positive catch were modeled separately to produce an index as:

$$\hat{I}=\hat{C}*\hat{S}=[\Psi_C e^{\beta_C}][\Psi_S e^{\beta_S}-1],$$

where $\hat{I}$ represents the estimated annual index value, $\hat{C}$, the annual standardized positive catch rate, and $\hat{S}$ the annual standardized proportion of days fished for which there was success in catching bluefin. Following Lo *et.al.* (1992), a value of 1 was added to the observed S values to permit inclusion of 0 values in modeling the log-transformed observations. In the above equation, β_c and β_s, represent the log-scale, standardized GLM estimates of marginal mean (LSMEAN) CPUE and proportion of days fished on which bluefin were caught, and Ψ_c and Ψ_s, the log-transformation bias adjustments for β_c and β_s, respectively. Variance in $\hat{I}$ was estimated via the delta method (Seber 1982). The appropriate equations for estimating this variance and calculating the log-transformation bias adjustment terms are provided in Lo *et.al.* (1992) and are not repeated herein.

Variables Investigated

As in the earlier analysis, bluefin caught included fish both reported kept and discarded. This was done to decrease the possible effects of U.S. regulatory changes which restricted longline landing of bluefin tuna during open season to two fish per trip from 1987 to 1991 and one fish per trip in 1992. Effective Dec. 31, 1991, in addition to the 1 bluefin per trip restriction, vessels were required to have at least 1,134 kg (2500 lbs) of other species on board before a landing a bluefin. Effective Apr. 16, 1994, vessels were required to have 1500 lbs of other species on board between January and the end of April and 3500 lbs of other species on board from May through December. At this time the N-S line was moved from 36 to 34 deg latitude.

Variables included in the analyses and thought to influence catch of bluefin were year (yr), area (zone), bluefin fishing open or closed (season), before or during spawning (spawn), vessel (id), depth (depth), and hooks per mile (hpm).

Four zones were defined based on nominal catch distributions. Bluefin catch rates were consistently lower off the coast of Florida and in the southern Gulf of Mexico than in the northwestern Gulf of Mexico or North of the Bahamas (Figure 1).

Season closure dates vary considerably between years (Table 1) with very early (February) closures in 1989 and 1990 and late (April) closures in 1991 and 1992, a later (May) closure in 1993, and no closures in 1994 and 1996. Lower reported catch rates after season closure may be due to under reporting of discarded bluefin and/or to a change in effort.

Spawning is considered to occur each year during May. The variable spawn identifies the records as occurring before or after May 15.

Results and Discussion

The models developed using the Lo method in the previous paper (Cramer and Scott, 1996) were used with the updated data and additional year (1996) of data. The basic trends did not change.

Lo Models:

Positive sets:
ln(bftcr) = t boat spawn hpm boat*hpm

Proportion Positive:
ln(ppos+1) = t boat spawn season zone boat*hpm boat*depth zone*depth zone*hpm

Variable descriptions:

dependent variables:

bftcr = bluefin tuna catch rate (bluefin/1000 hooks)
ppos = proportion of sets catching bluefin tuna
bft = bluefin tuna caught

class variables:
yr = year
id = vessel
spawn = before or during spawning
season = fishing season for bluefin tuna open or closed
zone = area

continuous variables:

depth = depth of hooks
hpm = hooks per mile

References Cited

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Table 1: Date of season closure in years 1987 to 1995.

YEAR	CLOSURE DATE
1987	MARCH 22
1988	MARCH 15
1989	FEBRUARY 18
1990	FEBRUARY 27
1991	APRIL 8
1992	APRIL 10
1993	MAY 4
1994	no closure
1995	no closure