

REVIEW OF THE MONITORING SYSTEM OF BLUEFIN TUNA IN THE WESTERN ATLANTIC

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SUMMARY

The major regulations for Atlantic bluefin tuna were reviewed and the effectiveness of data collected from the current monitoring fisheries for the western Atlantic bluefin was discussed. The data collection system of some of the fisheries was pointed out to be improved, especially in the collection of fishing effort data, so that they might serve in stock assessment.

In order to effectively estimate the relative abundance of the spawning stock in the western Atlantic Ocean, monitoring fishing by purely scientific longline research vessels in the Gulf of Mexico was proposed.

RESUME

Le présent document passe en revue les principales réglementations portant sur le thon rouge de l'Atlantique et examine le degré d'efficacité du recueil de données sur les pêcheries de thon rouge ouest-atlantique qui font actuellement l'objet d'un contrôle. Une amélioration du système de recueil de statistiques, le rendant plus utile du point de vue de l'évaluation des stocks, est signalée pour certaines pêcheries, en particulier en ce qui concerne les données sur l'effort.

Une pêche à des fins de contrôle, effectuée à la palangre dans le golfe du Mexique exclusivement par des navires de recherche, est proposée en vue d'évaluer de façon efficace l'abondance relative du stock reproducteur dans l'Atlantique ouest.

RESUMEN

Se examinan las regulaciones más importantes que afectan al atún rojo del Atlántico y se trata sobre la eficacia de la recogida de datos en las pesquerías de atún rojo en el Atlántico Oeste que están siendo actualmente controladas. Se señala que debe mejorar el sistema de recogida de estos datos en algunas de estas pesquerías, especialmente los de esfuerzo, que han de servir para evaluar la población.

Con el fin de hacer una estimación eficaz de la abundancia relativa de la población reproductora en el Atlántico Oeste, se propone que barcos palangreros de investigación pesquen en el Golfo de México con fines puramente científicos.

Bluefin tuna stock in the Atlantic is utilized by many countries and thus its abundance trend attracts much attention. International Commission for the Conservation of Atlantic Tunas (ICCAT) has been conducting various studies and implementing overall regulations for the management of the stock. In some waters, various fishing regulations are implemented through consultations among the countries concerned.

The major regulations for Atlantic bluefin tuna in chronological order are as follows:

- 1975: (1) In order to maintain the stock at a certain level, regulations limiting the catching of small fish less than 6.4 kg and freezing the fishing effort for bluefin tuna below the level maintained for the past several years went into effect.
- (2) A voluntary fishing restriction for spawning stock in the Mediterranean Sea was implemented by the Japanese longliners.
- 1979: Restrictions on the catch in number by Japanese longliners operating in the U.S. 200 miles zone in the Gulf of Mexico was implemented through Japan-U.S. bilateral consultation.
- 1982: (1) U.S. submitted a paper which suggested the extreme degradation of bluefin tuna stock in the western Atlantic (by cohort analysis) at the ICCAT annual meeting in 1981 (Tenerife). Based on the paper, a recommendation was adopted which in principle prohibited the fishing of bluefin tuna in the western Atlantic except the catch for the purpose of monitoring the stock for two years starting in 1982.
- Catch quota for the monitoring purpose for three countries, Canada U.S. and Japan was discussed in Miami in February 1982 and it was decided that the total catch be limited to 1,160 MT and that 250 MT be allotted to Canada, 605 MT to U.S. and 305 MT to Japan. This was implemented in the same year.
- (2) At the same time, they put a complete fishing ban on bluefin tuna in the Gulf of Mexico based on the recommendation that no direct fishing of the spawning stock in the Gulf of Mexico be made in 1982 and 1983.
- 1983: (1) At the 1982 ICCAT annual meeting (Madeira), some errors were identified in the U.S. paper on the stock assessment which laid a basis for the recommendation made in 1981. In addition, there was a substantial discrepancy in the judgement of the assessment of the western Atlantic stock between U.S. and Japanese scientists and no conclusion was drawn at the Standing Committee on Research and Statistics of ICCAT (SCRS). As the result, the catch

quota was adjusted to 573 MT for Canada, 1,387 MT for U.S. and 700 MT for Japan within the total catch limit of 2,660 MT. This went into effect in 1983.

- (2) In the same year, a restriction was introduced to limit the catch of small fish less than 120 cm below 15% of the total catch weight.
- 1984: (1) The Preparatory Bluefin Tuna Meeting was held in Trapani on Sicily island in May, 1983 and the workshop on bluefin tuna was held in Shimizu and Tsukuba (Japan) in August 1983. It was confirmed at the workshop that cohort analysis was the most effective method for the stock assessment of bluefin tuna. However, it was recognized that a careful review of many hypotheses and parameters was required to draw a right conclusion. Fourteen such items were selected as major items to review and the work was allotted to the countries concerned (Anon, 1984).
- (2) At the annual meeting in fall 1983, a report on the stock assessment of the western Atlantic bluefin tuna based on CPUE was submitted by U.S. and that based on cohort analysis was submitted by Japan. However, SCRS arrived at a conclusion that additional advice on the management could not be made on the ground that it was difficult to make a correct stock assessment unless the above problems were resolved.
- (3) Under such circumstances, the restrictions for bluefin tuna in the western Atlantic in 1983 was maintained for 1984. With regard to the restriction measures, it was agreed that a reasonable method be continued to be studied.
- 1985: (1) The stock condition of bluefin tuna was studied at the data meeting of bluefin tuna in Miami in May 1984 and also at the meeting of the Working Group on Bluefin Tuna held in Dartmouth, Canada from the end of September till the beginning of October. Although the accuracy of the data and the assessment method was much argued, it was estimated from cohort analysis and Y/R analysis that the equilibrium yield expected from 350 thousand age 1 recruitment was around 6,000 MT under the hypothesis that $M=0.18$ and that the fishing pattern of 1981 or 1982 be followed. However it was agreed that since the fishing in 1960s had decreased the stock size, it was better to have a conservative fishing in order to expedite the recovery of the stock. At the Fourth Special Meeting held in Las Palmas from October to November, it was decided that the existing regulation be extended for another year since no consensus was reached at SCRS on the reasonable level of catch of bluefin tuna in the western Atlantic.

- (2) Thus the regulation of 1984 was continued to be implemented for 1985 and the same catch quotas for monitoring were applied for the three countries.

As is obvious from the above review of the development, in spite of the various differences in the opinions among the scientists on the stock assessment of bluefin tuna in the western Atlantic, fishing has practically been banned since 1982 based on the assessment by a U.S. scientist that the stock condition deteriorated extremely in recent years. However as the fishing ban prevents the acquisition of all the data necessary for the stock assessment, the catch quotas for scientific monitoring were allotted, as compensation, to U.S., Canada and Japan which have engaged in the fishing of bluefin tuna in the western Atlantic.

Table 1 shows the bluefin tuna catch by fishing type by U.S., Canada and Japan in the western Atlantic in recent years. The figures in TASK 1 of Table 1 are the weight statistics reported from each country to the ICCAT secretariat. The estimated catch means the catch in weight obtained by multiplying the catch in number recorded on ICCAT bluefin tuna data base by the average weight calculated from the size composition of the catch. Thus the two sets of figures do not necessarily conform each other. However in some fisheries, the discrepancy between the two sets of figures is fairly large, which seems to be caused by the low accuracy of either catch statistics or size statistics of catch and, in some cases, by simple mistakes during the process of calculation. It is therefore necessary to study the cause and to make every effort to improve the collection of statistics.

The most important method to estimate the relative abundance from the monitoring catch may be to compare the yearly CPUE by age group. Therefore the accurate estimation of the length (or weight) data is a prerequisite to say nothing of the accurate grasp of the catch and fishing effort of the monitoring fishery by time and area. Furthermore, these data should be comparable with the long-term data obtained in the past.

Table 2 shows the status of the collection of the above-mentioned basic statistics for the fisheries now being conducted for the monitoring purpose. In the statistics of some fisheries, the time division of the catch statistics is year or the fishing effort statistics is lacking. It is virtually impossible to analyze the abundance trend from such statistics. In some fisheries the fishing gear was improved, which caused inconsistency in the CPUE data. It is necessary to have a comprehensive review of the effectiveness of the monitoring fishery at SCRS taking the above factors into consideration.

The life-span of bluefin tuna is extremely long and the migrating waters differ according to the different stage of the growth: that is, the western Atlantic bluefin tuna is assumed to spawn in the Gulf of Mexico, spend their young life off the east coast of North America and to be dispersed to the offshore waters as they grow. Although some ambiguity still remains as to the interchange with the eastern Atlantic stock, the result of the study obtained to date (Calaprice, 1985 MS) indicates that the degree of intermingling is small. Older fish return to the coastal waters again and they migrate to the Gulf of Mexico where they spawn from April to June. In order to monitor the bluefin tuna stock having such characteristics, the following factors must be taken into consideration.

- (1) Recruitment level of young fish (age 1 to 3): To estimate the abundance in each year as the recruitment of bluefin tuna is known to fluctuate substantially by year.
- (2) Stock level of Medium-sized fish (age 4 to 7): To predict the abundance to be added to the spawning group in near future.
- (3) Spawning stock level (over age 8): To estimate the relative size of the existing spawning stock.

Considerable number of young fish are caught by the sport fishery along the coast of North America in summer. Therefore the information obtained from this fishery is considered to be extremely important in judging the recruitment level. However, the fishing effort statistics of the sport fishery is lacking. Therefore, it is strongly desired that more effort be made to improve the measures to gather the data and to obtain the CPUE series in future.

Medium-sized fish is mainly caught by the Japanese longliners operating in the north western Atlantic in winter. The catch in number and the fishing effort (number of hooks) of the fishery have been reported since 1956 and the size data has been also provided since 1970. Thus the long-term CPUE series obtained from the fishery may prove to be useful information for monitoring the relative abundance of the medium-sized fish.

Large fish (adult fish) is caught by various fisheries along the coast of U.S. and Canada. The fishing effort data of the U.S. fishery has not been collected except for purse seine. In addition, although the long-term CPUE series of Canadian rod and reel fishery has been collected, the change in the gear efficiency after 1981 is said to have caused the loss of continuity in the data. The Japanese longliners operated in the Gulf of Mexico targetting at the spawning stock from 1973 to 1981, but they stopped operation since 1982. Therefore besides improving the data collection from the existing monitoring fisheries, some kind of monitoring in the Gulf of Mexico

where spawning stock gathers intensively should be considered as a mean to effectively estimate the relative abundance of large fish. One of the possibilities would be to conduct monitoring in the area in spring using purely scientific longline research vessels (unhampered by nationality and yet internationally managed).

The monitoring of bluefin tuna in the western Atlantic has been briefly reviewed in the above. The result of the population analysis currently being conducted are based upon many hypotheses and the underlying theory is too simple to explain the complex fluctuation of the abundance. It is therefore necessary to always compare the result of the analysis with the information obtained from the real fisheries and to confirm its validity. The monitoring fishery which was adopted in compensation for the commercial fishery which is substantially banned at present, must be designed to provide useful information for the above purposes and to gather very accurate data for future analyses.

In addition, tagging could be a very useful mean to further study the migration, growth and the mortality rate of the Atlantic bluefin tuna. The monitoring fishery should be utilized for such research activity as well. For that purpose, it is desired to release a large number of the small fish. It is also worthwhile to study the utilization of sport fishery or purse seine fishery which is more suited for catching very vital small fish.

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Table 1 Catches of Bluefin Tuna in the Western Atlantic,
by U.S., Canada and Japan

U.S.

YEAR	GEAR	Estimated catch				TASK1
		'84 Miami tape	'85 ICCAT tape			
		MT	%	MT	%	MT
1979	PS	1425.0	100	1344.7	94	1425
	UNCL	37.5	121	33.3	107	31
	HARP	140.9	99	138.4	97	143
	HAND	452.9	99	451.2	99	457
	RR	115.7 ¹⁾	41	269.1	94	285
TOTAL		2172.0	93	2236.9	96	2341
1980	LL	12.0	120	14.4	144	10
	PS	485.0 ²⁾	64	758.1	100	758
	UNCL	-	-	-	-	1
	HARP	102.1	100	102.1	100	102
	HAND	378.4	106	372.4	104	358
RR	147.4	53	245.6	89	276	
TOTAL		1124.9	75	1492.6	99	1505
1981	LL	26.1	31	82.1	99	83
	PS	661.1	82	787.8	98	805
	UNCL	4.3	108	4.3	108	4
	HARP	109.7	101	108.7	100	109
	HAND	286.4	100	284.9	100	285
RR	159.4 ³⁾	65	284.3	117	244	
TOTAL		1247.0	82	1552.1	101	1530
1982	HARP	86.8	109	85.9	107	80
	HAND	152.0	113	152.0	113	134
	LL	16.7	25	32.5	48	68
	PS	203.9	101	231.6	115	202
	UNCL	339.7	170	334.5	167	200 ³⁾
TOTAL		799.1	117	836.5	122	685
1983	LL			80.2	70	114
	PS			213.4	56	384
	HARP			163.6	103	159
	HAND			404.4	122	332
	RR			484.9	120	405
TOTAL			1346.5	97	1394	

1) likely caused by inadequate raising rates for small and large fish.
2) small fish is not included.
3) described as RR catch in Task I.

Table 2 Status of data collection of existing monitoring fisheries for western Atlantic bluefin tuna

Country	Gear	Catch ¹⁾ (Time/Area)	Fishing effort	Availability of CPUE series	Size data ²⁾ (Time/Area)	Comment	Effectiveness for monitoring
U.S.	Harp	WT(Year/5x10)	None	None	(Mon/Atlantic)	Fishing effort is lacking. Monthly catch is required.	
	Hand	WT(Year/5x10)	None	None	(Mon/Atlantic)		
	PS	WT(Quart/5x5)	None	None	Mon/Atlantic)		
	LL	WT(Year/5x10)	None	None	(Mon/Atlantic)		
	RR or Sport	WT(Year/ ₁₀ x10)	Dock side survey has been made since 1975.	Preliminary analysis was made (SCRS/83/62).	(Mon/Atlantic)	Dock side survey data are not recorded in ICCAT data file.	
Canada	Trap	WT(Mon/1x1)	Days fished			Yearly catch fluctuation is large.	
	Hand (RR)	No.fish(Mon/1x1)	Days fished	CPUE series was analysed (Dartmouth Meeting).	(Mon/ICCAT Area)	Consistency of CPUE was lost in 1981 due to in- itiation of tended lines.	Effective
Japan	LL	No.fish(Mon/5x5)	No. hooks	CPUE series of Gulf of Mexico and selected area were analysed (Dartmouth Meeting).	(Quar/5x10)	Fishery in G. of Mexico terminated in 1981.	Effective

WT: Catch in weight, No.fish: Catch in number of fish.

1) Quoted from the most recent year available: 1981 for U.S. and Canada; 1982 for Japan (See Data Record Vol.25).

2) Quoted from the most recent year available: 1983 for U.S. and Canada; 1982 for Japan (See Data Record Vol.25).

Table 1 Continued

YEAR	GEAR	Estimated catch		TASKI
		'84 Miami tape	'85 ICCAT tape	
1979	TRAP	31.1	31.1	31
	RR	214.0	215.6	214
	TOTAL	245.1	246.9	245
1980	TRAP	47.1	44.9	47
	UNCL	17.1	19.6	18
	RR	259.1	257.2	259
TOTAL	323.3	321.7	324	
1981	PS	105.4	97.8	105
	TRAP	40.9	43.2	41
	RR	279.2	278.0	279
TOTAL	425.5	419.0	425	
1982	TRAP	68.1	68.1	68
	HAND	223.7	223.7	213
	UNCL			10
TOTAL	291.8	291.8	100	
Japan				
YEAR	GEAR	Estimated catch		TASKI
		'84 Miami tape	'85 ICCAT tape	
1979	LL	3207	3207	3621
	LL	4541	4541	3936
	LL	4047	4047	3771
1982	LL	-	181 ^{b)}	292

4) tentative size data were used.