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THE CANADIAN BLUEFIN TUNA FISHERY

by

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Abstract

A summary of catch and effort data from the 1980 Canadian bluefin tuna fishery is presented and trends from 1974 to 1980 are examined. A decrease in annual mean weight was observed in 1980; however it is unclear whether this represents a reversal in the trend of increasing annual mean weight observed in recent years. Analysis of CPUE data showed a declining trend from 1975 to 1979, but indicated a slight increase in 1980. A decrease in logbook coverage and deterioration in the quality of data reported make the observed increase suspect. Recent population analyses have indicated a declining resource base for the Canadian fishery and stock abundance estimates show a high correlation with the Canadian CPUE trends. The Canadian fishery is unlikely to improve until recruitment of the relatively abundant 1973 year-class occurs. If the age structure of the fishery does not change, this may not occur for five to ten years.

Résumé

Ce document contient un résumé des données sur les prises et l'effort de la campagne de pêche canadienne du thon rouge en 1980, ainsi qu'un examen des tendances de 1974 à 1980. Le poids moyen annuel a diminué en 1980; on ne peut toutefois être certain qu'il s'agit d'un revirement de la tendance de ces dernières années vers une augmentation de poids moyen annuel. Les PUE diminuent de 1975 à 1979 et augmentent légérement en 1980. Cette augmentation peut être mise en doute car la proportion de pêcheurs qui ont soumis des journaux de bord et la qualité des données statistiques ont diminué. De récentes analyses de population indiquent une diminution de la ressource accessible aux Canadiens, et les estimations d'effectif de stock démontrent une étroite corrélation avec les tendances des PUE canadiennes. Il est peu probable que la pêche canadienne s'améliore tant que la classe d'âge relativement abondante de 1973 ne sera pas recrutée. Si la structure par âge des prises ne change pas, il faudra peut-être attendre de cinq à dix ans.

The 1980 Fishery

A summary of catch and effort data from the 1980 Canadian Atlantic bluefin tuna fishery appears in Table 1. Total catch data were provided by Statistics Branch. Mean weights were calculated from port sampling data. Logbook coverage estimates were based on number of fish reported in logbooks compared to the total catch figures provided by Statistics Branch. Effort estimates were calculated from effort reported in the logbooks adjusted by the estimated logbook coverage. Numbers of licenses issued were obtained from Area Managers' reports.

The 1980 catch levels are compared to those for the period 1974-79 in Table 2. There was an increase in 1980 compared to the previous year in all areas except Newfoundland waters and the St. Georges Bay, N.S. area. The total catch in the St. Georges Bay area fell to less than 50% of the 1979 value; however this was only the second season of significant effort in this area and similar variations, usually due to variability in local abundance of forage species and/or in local hydrographic conditions, have been experienced in all areas. The St. Margaret's Bay trap catch of 129 bluefin is substantially below levels prior to 1979.

Annual mean weights from 1974-80 are shown by area in Table 3. Mean weight decreased in all areas in 1980 compared to previous years except in New Brunswick; however the 1980 mean weight for New Brunswick was lower than the 1978 maximum observed. The substantial decrease in Nova Scotia was likely a result of the poor late-season run of bluefin in St. Georges Bay where the heaviest fish have been taken in recent years. Market reports indicated that, in general, all Canadian-caught bluefin were much leaner in 1980 than usual and this may partially explain the decreases in mean weight observed; however sightings and, in some cases, catches of much smaller bluefin were reported, especially in St. Margaret's Bay. Size composition of the 1980 catch is shown in Table 4. It is possible this may indicate a reversal of the trend of steadily increasing annual mean weight observed in Canadian waters in recent years.

Approximately 750 bluefin licenses were issued in 1980. Licensing in this fishery had been frozen at approximately 250 licenses between 1975 and 1978. Changes in the licensing policy in 1979 resulted in approximately 450 licenses issued in that year. It was estimated that approximately two-thirds of the 1980 licensees were active participants in the fishery, at least to some extent; however logbooks were received for only 256 vessels. The logbooks submitted covered approximately 70% of the catch. Prior to 1979, logbook coverage had always been above 95%. Logbook coverage was estimated to be 75% in 1979 and the further decrease in coverage and increase in new participants in 1980 was accompanied by a substantial decrease in the quality of information reported in logbooks and an increase in the effort needed to process them. Any further decline in reporting standards could seriously affect assessment capabilities.

CPUE Analysis

Hurley et al. (1981) examined catch per unit effort trends from this fishery in several areas in the Gulf of St. Lawrence. A CPUE adjustment was calculated to compensate for increasing experience of the fishermen. They reported a strong correlation between adjusted CPUE data from 1975-79 from this fishery and stock abundance estimates derived by a recent Virtual Population Analysis conducted by Parrack (1980). The VPA has since been repeated using a more complete catch database (Parrack 1981). The comparison was repeated using the new VPA stock abundance estimates and including the 1980 Canadian logbook data. As in the previous comparison, only the 11+ year-class abundance estimates were used. Catch per ten days on fishing grounds was selected as the most reliable CPUE index available as a result of the poor quality of the 1980 hours on fishing grounds data. Comparisons were made using both the two-stock hypothesis western Atlantic stock abundance estimates and the one-stock hypothesis total Atlantic stock abundance estimates. Comparable results were obtained using the new 1975-79 abundance estimates, under both stock hypotheses, and lower but still significant correlations were found when the 1980 values were included (Table 5). The lower probabilities could well reflect declining reporting standards in 1980. It is worth noting that the adjusted CPUE data indicate a slight increase in P.E.I. waters and in the entire Gulf of St. Lawrence in 1980 (Fig. 1).

At the 1981 Atlantic Bluefin Tuna Advisory Committee meeting, the fisheries and industry representatives unanimously proposed that "keg gear" be introduced into the fishery. While acceptance of this gear type will likely have several beneficial effects on the fishery, i.e. better quality, greater efficiency and reduction of illegal gear use, it will also have a serious effect upon monitoring this fishery. If this proposal is accepted, then a comparative study must be made in order to continue the use of this CPUE series.

VPA Estimate of Stock Abundance

Several observations can be drawn from the VPA by Parrack (1981). Estimated stock abundance trends from 1960-1980 have been partitioned into several age categories (Fig. 2). Only abundance estimates for the western Atlantic stock are presented here.

Age 1 abundance has decreased gradually from 0.6 million fish in 1960 to 0.2 million in 1973. The 1973 year-class was exceptionally strong and the 1974 and 1975 year-classes were above average in size, but subsequent year-classes dropped to previous low levels.

Juvenile abundance (age 1-5) showed the same decreasing pattern from 1960-73, declining from 2.3 million fish in 1960 to 0.6 million in 1973. Abundance rose to early 1960 levels as the strong 1973, 1974 and 1975 year-classes appeared but is now returning to low levels as these year-classes recruit into the adult age category.

The abundance of the age 11+ year-classes (those year-classes taken in Canadian waters in recent years - see Fig. 2) increased slightly from 0.25 million fish in 1960 to 0.4 million in 1973 but has declined since and reached 0.1 million in 1980. Abundance will continue to decline until the 1973 year-class recruits into this age category.

The estimated age composition of bluefin tuna in Canadian Atlantic waters, based upon the otoliths of 1137 bluefin collected from 1975 to 1979 and analyzed at St. Andrews, is shown in Fig. 3. For comparison, the 1980 western Atlantic stock age composition estimated by VPA (Parrack 1981) is shown in Fig. 4. If the recent age composition of the Canadian fishery is related to age-specific migration patterns, then bluefin abundance in Canadian waters will not increase significantly for five to ten years. However, the catches off Wedgeport, N. S., and St. Margaret's Bay were characterized by medium-sized "jumpers" until the early- to mid-1950's. Individuals of the 1973 year-class would have attained a size of approximately 70-100 kg in 1980 and several bluefin in this size range were taken in St. Margaret's Bay last year (see Table 4).

Tiews (1978) examined the size composition of bluefin tuna taken off the Norwegian west coast and central North Sea from 1956 to 1973. He observed that, prior to 1963, there were two groups of fish of different size compositions, of which the older group migrated into the North Sea after a few weeks stay on the Norwegian coast. But in 1973 and subsequently, the younger group did not appear on the Norwegian coast and consequently the older group did not move into the North Sea. It is perhaps premature to speculate, but it will be interesting to observe what effect the reappearance of the 1973 year-class will have upon the migration patterns of older year-classes in Canadian waters when the 1973 year-class does appear.

The 1974 ICCAT recommendation stated that "parties ... take the necessary measures to limit the fishing mortality of bluefin tuna to recent levels." In compliance with this recommendation, Canada adopted regulations in 1975 which essentially fixed effort levels. However, the policy changes of 1979 removed the effort limitations and a formal quota in terms of number of fish was adopted. While the annual mean weight of bluefin taken in Canadian waters continued to increase each year, this manner of quota control was definitely advantageous to Canadian fishermen. The annual mean weight in Canadian waters decreased in 1980 and while it is impossible to determine yet whether this is a reversal of the trend, this trend will definitely reverse when the 1973 year-class recruits into the Canadian fishery.

Obviously the longer term continuation of the Gulf of St. Lawrence bluefin tuna fishery depends on future recruitment of younger and smaller fish. The difference between a Canadian quota in terms of numbers, rather than weight, will therefore become more critical in terms of the yield to the Canadian commercial fishery. It will be necessary to indicate the differential effect of quotas set by limiting numbers or weight to "recent levels" and/or instituting a quota regime determined more conventionally by translating acceptable F values into estimated removals from stocks of known age distribution, so that management proposals to ICCAT achieve resource stabilization.

References

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Tiews, K. 1978. On the disappearance of bluefin tuna in the North Sea and its ecological implications for herring and mackerel. Rapp. P.-v. Reun. Cons. int. Explor. Mer 172: 301-309.

Table 1. 1980 Canadian Atlantic bluefin tuna catch and effort summary.

Gear	Area	No. of fish	Total wt. (mt)	Mean wt. (kg)	Logbook coverage based on catch (%)	Effort (no. of days)	No. of licenses issued	No. of logbooks submitted
Rod & reel	Nfld.	-	-	-	-	-	9	-
	N.S.	50	20.6	396	48	688	168	24
	N.B.	118	47.3	412	68	565	151	22
	Que.	90	36.1	401	82	668	46	30
	P.E.I.	389	155.0	400	78	4605	376	180
		647	259.0	401	70	6526	750	256
Trap		129	46.6	360				
Other			18.1					
Total			323.7					

Table 2. Canadian Atlantic bluefin tuna catch by area (number of fish)* 1974-80.

	1974	1975	1976	1977	1978	1979	1980	1974-79
Nfld.	30	33	6	5	2	1	0	13
N.S.**	22	10	0	13	17	111	50	29
P.E.I.	1048	343	650	448	437	317	389	541
N.B.	93	148	180	196	35	55	118	118
Que.	6	6	26	95	11	20	90	27
Rod & Reel	1199	540	862	757	502	504	647	727
Trap	865	452	474	948	530	72	129	557
Total	2064	992	1336	1705	1032	576	776	1284
Total weight (mt)	665	350	514	674	429	245	324	

*Purse seine not included.

** Shift in areas of N.S. catch from Atlantic coast and Gulf coast during 1976-77.

Table 3. Annual mean weight by area of bluefin tuna taken in Canadian Atlantic waters.

	1974		1975		1976		1977		1978		1979		1980	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Nfld.	294	30	314	33	305	6	299	5	294	2	420	1	-	-
N.S.	351	25	380	9	-	-	437	9	459	17	493	111	396	24
P.E.I.	338	903	388	339	395	650	394	440	406	437	406	317	400	424
N.B.	-	-	392	119	402	165	397	183	421	35	396	55	412	79
Que.	-	-	-	-	407	22	398	22	407	11	404	20	401	74
Trap	297	841	319	442	332	455	388	918	418	530	424	72	360	124

A - mean weight (kg)

B - sample size (number of fish)

Table 4. Size composition (round weight per mille by 10 kg unit) of bluefin tuna captured in five localities along the Canadian Atlantic coast in 1980.

Class	P.E.I.		N.B.		Que.		N.S.				Total	
	Rod & reel		Rod & reel		Rod & reel		Rod & reel		Trap			
kg	n	o/oo	n	o/oo	n	o/oo	n	o/oo	n	o/oo	n	o/oo
80									2	16	2	3
90									3	24	3	4
100												
110									2	16	2	3
120									2	16	2	3
130									5	40	5	7
140												
150									1	8	1	1
160									4	32	4	6
170									1	8	1	1
180									1	8	1	1
190									2	16	2	3
200												
210	1	2									1	1
220	1	2									1	1
230	1	2							4	32	5	7
240												
250	1	2							1	8	2	3
260	1	2	1	13					2	16	4	6
270	4	9					1	42	2	16	7	10
280	2	5									2	3
290	4	9	1	13	1	13					6	8
300	5	12			1	13					6	8
310	12	28			1	13			3	24	16	22
320	5	12			3	41	1	42	3	24	12	17
330	17	40	2	25	2	27	2	83	2	16	25	34
340	24	57	2	25	3	41	1	42	1	8	31	43
350	14	33	2	25	5	68	1	42	5	40	27	37
360	21	50	5	63	3	41	2	83	1	8	32	44
370	32	76	4	51	3	41	2	83	4	32	45	62
380	26	61	6	76	5	68			10	81	47	65
390	36	85	7	89	6	81	1	42	5	40	55	76
400	28	66	7	89	4	54	3	125	5	40	47	65
410	35	83	4	51	7	95	2	83	5	40	53	73
420	30	71	7	89	5	68	4	167	7	57	53	73
430	25	59	8	101	14	189			8	65	55	76
440	19	45	8	101	4	54	1	42	5	40	37	51
450	22	52	4	51	2	27			4	32	32	44
460	16	38	3	38	1	13			3	24	23	32
470	17	40	4	51	2	27			2	16	25	34
480	12	28	2	25	2	27			6	49	22	30
490	5	12	1	13			2	83	1	8	9	12
500	2	5					1	42	1	8	4	6
510	4	9							4	32	8	11
520									2	16	2	3
530	1	2							1	8	2	3
540	1	2	1	13					1	8	3	4
550									1	8	1	1
560									1	8	1	1
570												
580												
590									1	8	1	1
Total	424	999	79	1002	74	1001	24	1001	124	996	725	999
Mean weight (kg)	399.6		412.2		401.1		396.1		359.9		394.2	

Size class 80 kg = 80.0-89.9

Table 5. r-values for adjusted CPUE vs, VPA estimated western Atlantic stock abundance of 11+ year-classes.

	1975-79	1975-80
Gulf of St. Lawrence	.9771	.8905
P.E.I.	.9575	.9178
Chaleur Bay*	.9153 (.9870)	.8181 (.9412)

r-values for adjusted CPUE vs. VPA estimated total Atlantic stock abundance of 11+ year-classes.

	1975-79	1975-80
Gulf of St. Lawrence	.9728	.8949
P.E.I.	.9574	.9212
Chaleur Bay*	.9171 (.9741)	.8275 (.9352)

*value in brackets calculated by dropping the 1978 point - exceptionally low catch in Chaleur Bay in that year.

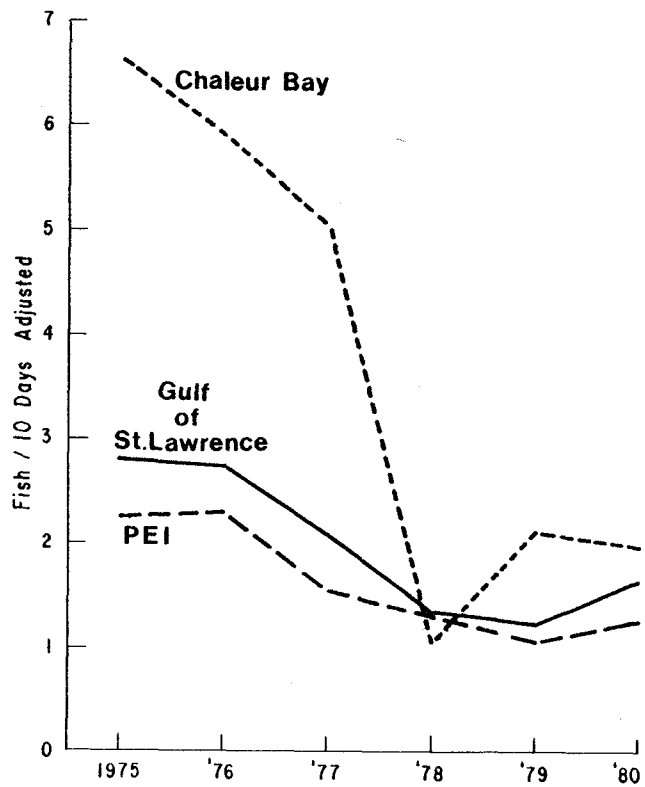


Fig. 1. Catch per unit effort trends (mean number of fish landed per 10 days on fishing grounds adjusted for bluefin tuna rod-and-reel fishery.

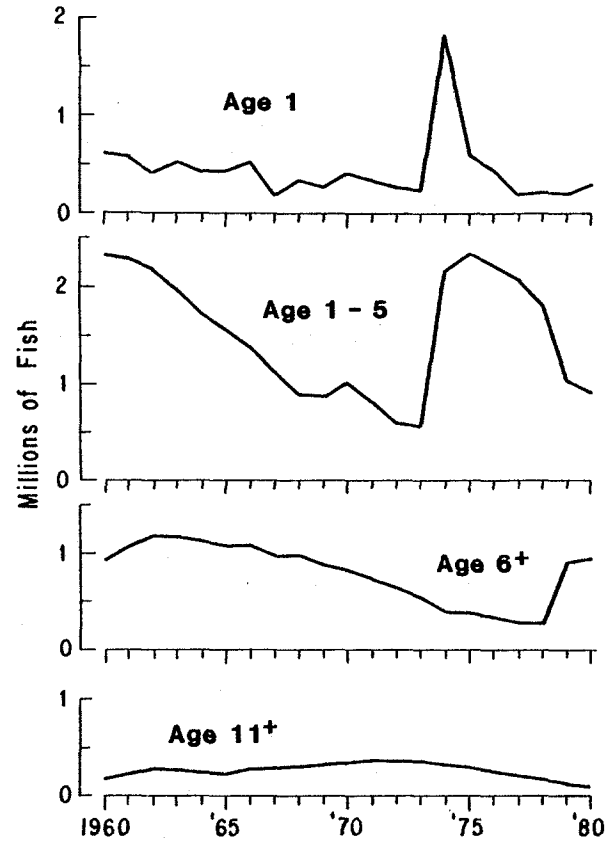


Fig. 2. Abundance trends of Atlantic bluefin tuna (western Atlantic stock) calculated by VPA by Parrack (1981).

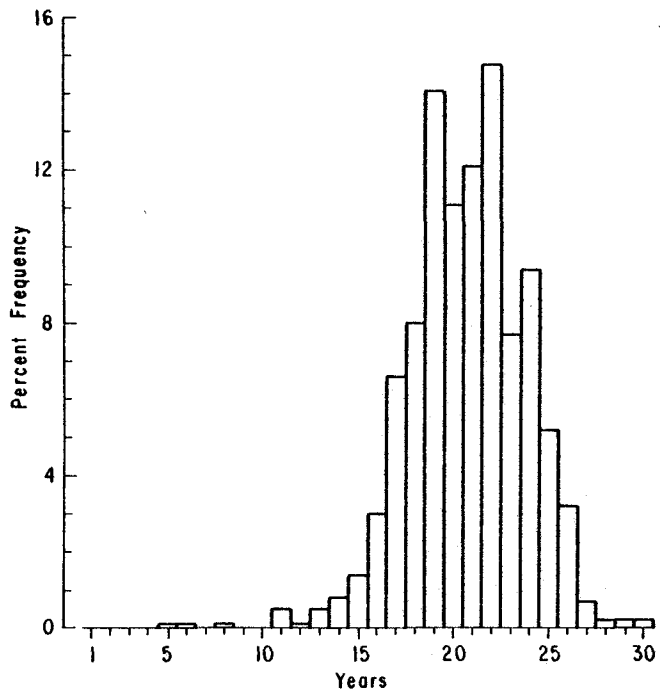
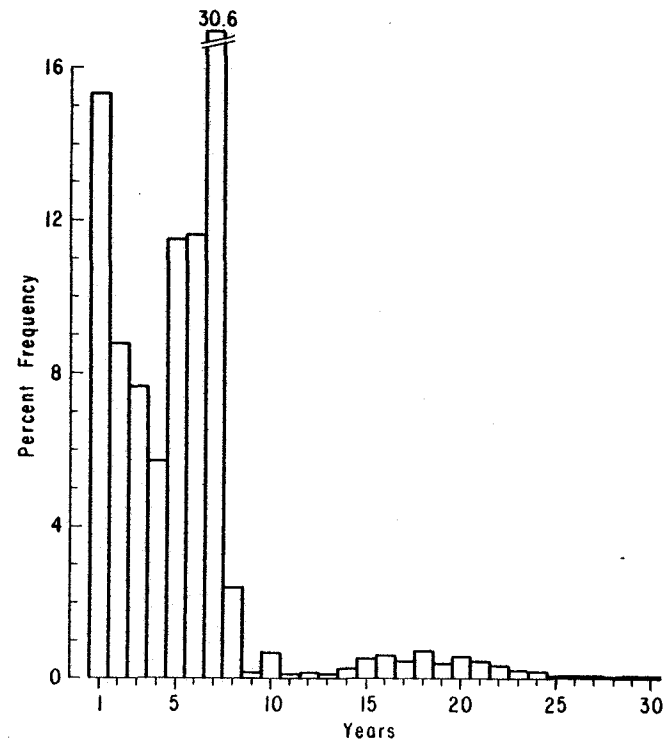


Fig. 3. Age composition of Atlantic bluefin tuna in Canadian waters estimated by analysis of otoliths collected from 1975-79.



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