

## CATCH AND EFFORT IN THE CANADIAN INSHORE BLUEFIN TUNA FISHERY

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## SUMMARY

Canadian bluefin tuna landings in 1984 were the lowest since 1979 and nearly all were caught on tended-line gear in the Gulf of St. Lawrence. The mean size of fish landed has increased by 5 percent from 1983.

The Canadian inshore tuna log record data base from 1975 to 1984 has been re-analyzed and catch-per-unit-effort indices generated from the data. The effort data have been divided into two major time periods--that prior to 1981 and that including and after 1981. (1981 was the year of introduction of tended line gear.) Both of these time periods provide strong catch-effort relationships. Standardization was carried out to the mean of each series, respectively, and then a scaling factor of 53.25 percent suggested as a means of linking these two indices.

## RESUME

Les débarquements canadiens de thon rouge en 1984 ont été les plus faibles depuis 1979; presque toutes les prises avaient été effectuées à la ligne à main (ligne surveillée) dans le golfe du Saint-Laurent. La taille moyenne du poisson débarqué s'est accrue de 5 % depuis 1983.

La base de données provenant d'extraits de livres de bord de la pêche côtière canadienne de thonidés de 1975 à 1984 a été analysée de nouveau, et ces données ont permis de calculer des indices de CPUE. Les données d'effort ont été scindées en deux grandes périodes temporelles - avant l'année 1981, et depuis 1981 comprise - 1981 étant l'année où fut introduite la ligne à main (ligne surveillée). Ces séries signalent toutes deux une

étroite relation prise-effort. La standardisation s'est effectuée à la moyenne de chaque série respectivement, puis un facteur d'échelonnement de 53,25 % fut suggéré comme moyen d'associer ces deux indices.

## RESUMEN

Los desembarques canadienses de atún rojo en 1984 registraron la cifra más baja desde 1979 y la mayor parte de la captura se obtuvo con el arte de "tended-line" en el Golfo de St. Lawrence. La talla media de los peces capturados ha aumentado un 5% desde 1983.

La base canadiense de datos de cuadernos de pesca de bajura correspondiente al período 1975-1984, fue analizada de nuevo y a partir de estos datos se obtuvieron índices de captura por unidad de esfuerzo. Los datos de esfuerzo se han dividido en dos períodos principales: antes de 1981 y 1981 y años posteriores. El año 1981 fue el de la introducción del arte de "tended line". Ambos períodos facilitan importantes relaciones entre captura y esfuerzo. La normalización se hizo a la media de cada serie respectivamente y se sugirió un factor de escala de 53.25% como medio de enlazar estos dos índices.

## CATCH PER UNIT EFFORT

### INTRODUCTION

Atlantic bluefin tuna (*Thunnus thynnus*, L.) are presently harvested in Canadian waters by three major gear types: tended line, rod and reel, and trap net. The Canadian fishery exploits large bluefin tuna (ie. fish over 120 kg.) which migrate north for summer feeding. The fishery takes place on the continental shelf off Nova Scotia (N.S.) and Newfoundland and in the waters of the southern Gulf of St. Lawrence.

Over the last decade important shifts in the gear mix have occurred. The major shifts have been from a purse seine fishery off New England to a successful commercial trap net fishery in the mid to late 1970's in St. Margaret's Bay, N.S.; to the present commercial tended line fishery in the Gulf of St. Lawrence. A relatively stable sport rod and reel fishery along the coast of Nova Scotia and in the Gulf of St. Lawrence has persisted throughout this period. Canadian large fish landings have remained relatively constant over the past decade averaging about 400 tonnes per year (Table 1). The proportion of the total west Atlantic bluefin tuna landings by Canada has varied considerably over this time, the major catches have been made by Japan and the U.S.A.

### CATCH

Canadian landings in 1984 were again under strict quota control with options available to re-allocate surplus local quota from regions of low catch to regions having more successful fisheries. The total landings in 1984 were 590 fish (Table 2) weighing 264.2 tonnes (Table 3) down from 1008 fish and 439.3 tonnes in 1983. This was the lowest catch since 1979; the landings to date for 1985 (as of 25/Sept/85) are down by nearly 20% of the catch at the same time in 1984. The average weight of bluefin tuna in the 1984 P.E.I. catch was 457.5 kg. This is up 5% (24 kg) over that of 1983 (433.4 kg), continuing a long term trend recorded since 1965 (Fig. 1).

The distribution of landings since the early 1970's (Table 2) indicates that the overall distribution of bluefin tuna has changed. The areas presently sustaining the Canadian fishery are P.E.I., St. Georges Bay (N.S.) and Baie de Chaleur, New Brunswick, all in the southern Gulf of St. Lawrence.

The St. Margaret's Bay (N.S.) and Newfoundland fisheries have all but collapsed in the last five to ten years. This drop in catch may be interpreted as an indication of a change in migratory patterns, possibly due to environmental conditions. The St. Margaret's Bay trap fishery failed in 1984 yielding the lowest catch since ranching operations began. The 1985 trap fishery catch is slightly better although it is estimated that only 40 or less fish have been captured so far this year.

Compulsory submission of log records has been a license requirement since 1975. At this time measures were introduced to restrict fishing mortality in compliance with ICCAT advice. Log record coverage has varied over the years: 1980, 1981 and 1984 having only about 50% by numbers of fish caught (Fig. 2). The number of fishermen reporting 20 or more log days has increased substantially over the past three years (Fig 2). The degree of coverage of this fishery by log records is down considerably from the 95% reported by Hurley et al. (1979) for the period from 1975 to 1979. The decreasing trend in quality and coverage of log record information reported by Hurley and Iles (1981) has continued. The accuracy and/or representativeness of this coverage can not be ascertained.

The log records between 1980 and 1984 were not used to define fleet distribution, however, from interviews with vessel owners it appears that fishing distribution pattern for the P.E.I. fleet has not changed significantly from that reported for the 1975 to 1978 period (Hurley et al. 1979).

To standardize the quality of the log data, only vessels that reported at least 20 log days of fishing for the season were utilised. This arbitrary choice was based upon the assumption that fishermen recording 20 or more log days of effort are active tuna fishermen and conscientious about submitting completed log records. A limit of twenty submitted log days was chosen because in many areas the migratory bluefin are available to the inshore fishermen for only a portion of the season - a month was considered to have at least 20 'fishable' days.

The analysis of the log books from P.E.I. fishermen shows two distinct Catch Per Unit Effort (CPUE) trends. The data between 1975 and 1980 represents only rod and reel fishing operations - although there were both sport and commercial fishermen. This first data set indicates a decline in CPUE over the time period (Fig. 3). Tended line gear was first introduced to the fishery in 1981 and by 1982 an estimated 86% of tuna fishermen were using it. This second data set (1981 to 1984) shows a dramatic decline in the tended line CPUE. During this latter period the CPUE of the rod and reel fishery has stabilized. This index can not be assumed equivalent to the index prior to 1981, it must be assumed that only the more successful of the charter rod and reel fishermen have remained with this gear.

These two CPUE indices both indicate a decline in abundance. The rod and reel fishery (pre 1981) shows a slower rate of decline than the tended line gear probably because of its more mobile nature versus the passive tended line methods. The relationships of the smoothed data are:-

pre-1981 ROD and REEL  
CPUE = 7.66 - 0.09 YEAR ;    n = 6 , r = -0.97

post-1981 TENDED LINE  
 $CPUE = 17.86 - 0.20 \text{ YEAR} ; \quad n = 4 , r = -0.99$

where CPUE is the catch of fish per log day and YEAR is the year. These two series were linked by projecting the CPUE forward two years with the pre-1981 regression and back two years with the post-1981 regression. These four overlapping estimates were then averaged to obtain an adjustment factor of 53.25% for tended line gear. A series of abundance indices are provided (Table 4) - each indicates a serious decline in the stock of west Atlantic bluefin tuna. The standardized-smoothed-adjusted index is the only one providing data for the entire ten year period.

#### ACKNOWLEDGEMENTS

Linda Currie, Martina Poirier, and Isabel Forest coded, key punched and verified the log data for 1981 and 1984. Pre 1981 log data was obtained from computer files of the Scotia Fundy region of the Department of Fisheries and Oceans, St. Andrews.

#### REFERENCES

- Hurley, P.C.F., G.Black, C.Burnett, and T.D.Iles (1979) Preliminary analysis of catch and effort data for the Canadian bluefin tuna rod and reel fishery. ICCAT SCRS/79/113.
- Hurley, P.C.F. and T.D.Iles (1981) Changes in the bluefin tuna stock in the Gulf of St. Lawrence in 1980 and their implications. ICCAT SCRS/81/61.

TABLE 1. Landings of bluefin tuna from the the ICCAT area in thousands of tonnes.

YEAR	WEST ATLANTIC OCEAN		U.S.A.	JAPAN	OTHER	TOTAL	EAST ATLANTIC & MEDITERRANEAN	TOTAL
	CANADA small	large						
1970	1.2	0.5	3.0	0.1	0.3	5.7	10.4	16.1
1971	0.9	0.2	4.1	1.4	0.2	6.9	10.8	17.7
1972	0.3	0.2	3.1	0.3	0.1	4.1	11.3	15.4
1973	0.6	0.3	1.6	1.1	0.2	4.1	10.7	14.7
1974	0.1	0.7	1.6	0.9	0.2	3.5	18.2	21.7
1975	0.3	0.3	2.9	1.5	0.2	5.2	21.1	26.3
1976	0.3	0.5	1.9	2.9	0.4	6.0	22.3	28.3
1977	0.3	0.7	3.1	3.7	0.2	6.0	18.0	25.6
1978	0.2	0.4	1.9	3.1	0.3	5.9	14.6	20.5
1979	0.0	0.2	2.3	3.6	0.3	6.5	12.1	18.5
1980	0.0	0.4	1.5	3.9	0.1	5.9	13.0	18.9
1981	0.1	0.3	1.4	3.8	0.3	5.9	13.2	19.2
1982	0.0	0.3	0.6	0.3	0.2	1.4	21.2	22.6
1983	0.0	0.4	1.3	0.7	0.2	2.7	20.3	23.0
*								
1984	0.0	0.3	1.2	0.7	0.3	2.5	18.3	20.8

\* provisional nominal landings

TABLE 2. Landings of Atlantic bluefin tuna by numbers of fish from Canadian fisheries by province. The trap net fishery is from St. Margaret's Bay, Nova Scotia (N.S.); the N.S. catch is from the rest of the province. These statistics do not include the Canadian purse seine fishery off the New England coast.

YEAR::PROV	TRAP NET <sup>+</sup>	P.E.I.	N.B.	QUE.	N.S.	NFLD	TOTAL
1965	286	-	-	-	73	283	642
1966	306	-	-	-	30	388	724
1967	614	5	-	-	23	179	821
1968	356	13	-	-	53	<604>	<1026>
1969	680	31	-	-	12	<585>	<1308>
1970	458	99	-	-	15	418	990
1971	208	173(201)	-	-	9	76	466
1972	104	482	-	-	12	104(259)	702
1973	508	653	4	-	19	33	1217
1974	865	1048	93	6	22	30	2064
1975	452	343	148	6	-	33	982
1976	474	650	180	26	-	6	1336
1977	948	448	196	95	13	5	1705
1978	530	437	35	11	17	2	1032
1979	72	317	55	20	111	1	576
1980	129	389	118	90	50	1	777
1981	93	515	26	29	81	3	747
1982	157	392	53	43	61	7	713
1983	17	789	125	54	20	3	1008
1984*	8	384	78	17	100	3	590
AVERAGE	340	474	93	40	42	49	907
PERCENT	37	52	10	4	5	5	
1985**	44	133	47	11	3	3	241

\* provisional nominal landings

\*\* provisional nominal landings up to Sept 25 1985

+ 1965 to 1972 includes small portion of incidental longline catches

- no fishery

blank no data

(xxx) fish caught but not necessarily landed (usually associated with tagging program).

<xxx> estimated values

TABLE 3. Landings of Atlantic bluefin tuna by weight (tonnes) from Canadian fisheries by province. The trap net fishery is from St. Margaret's Bay, Nova Scotia (N.S.); the N.S. catch is from the rest of the province. These statistics do not include the Canadian purse seine fishery off the New England coast.

YEAR::PROV	TRAP NET <sup>+</sup>	P.E.I.	N.B.	QUE.	N.S.	NFLD	TOTAL
1965	81	-	-	-	10.4	<75.7>	<175.1>
1966	87	-	-	-	7.2	<103.8>	<198>
1967	174	1.4	-	-	6.2	47.9	229.7
1968	101	4.2	-	-	13.8	161.6	280.6
1969	193	10.0	-	-	3.2	156.6	362.8
1970	130	33.3	-	-	6.2	111.6	281.1
1971	59	64.3	-	-	3.0	<20.3>	<146.6>
1972	29	155.7	-	-	<4.6>	<27.8>	<217.1>
1973	144.4	221.0	<1.5>	-	6.1	9.9	<382.9>
1974	255.7	355.0	33.8	1.9	<7.1>	8.8	<662.3>
1975	144.0	133.5	57.3	2.1	-	10.4	347.3
1976	172.1	256.9	71.8	10.5	-	1.8	513.1
1977	367.9	178.2	77.9	37.9	5.4	1.5	668.8
1978	221.3	180.0	14.7	4.9	8.1	0.6	429.6
1979	30.6	128.6	21.8	8.1	54.7	0.4	244.2
1980	46.6	155.0	47.3	36.1	20.6	0.3	305.9
1981	40.7	219.2	10.9	11.6	36.4	0.9	319.7
1982	68.3	157.9	21.1	16.1	25.8	2.3	291.5
1983	6.6	341.7	52.4	22.1	8.9	1.0	439.3
1984*	2.7	174.5	33.3	7.3	45.4	1.1	264.2
AVERAGE	123.3	207.3	43.3	14.4	19.3	2.6	407.2
PERCENT	30	51	10	4	4	1	

\* provisional nominal landings

+ 1965 to 1972 includes small portion of incidental longline catches

- no fishery

blank no data

(xxx) fish caught but not necessarily landed (usually associated with tagging program).

<xxx> estimated values

Table 4. Four indices of bluefin tuna abundance from the west Atlantic. Rod and reel (R&R) and tended line (TL) are the only two gears utilized in these series. The rod and reel pre-1981 are not considered comparable to the rod and reel post 1981 - see text.

YEAR	RAW DATA		STANDARDIZED TO MEAN OF SERIES		SMOOTHED (running of 3)		STANDARDIZED SMOOTHED ADJUSTED *
	R&R	TL	R&R	TL	R&R	TL	
1975	0.090	-	1.015	-	(1.2 )	-	(1.2 )
1976	0.125	-	1.410	-	1.132	-	1.132
1977	0.086	-	0.970	-	1.124	-	1.124
1978	0.088	-	0.992	-	0.913	-	0.913
1979	0.069	-	0.778	-	0.868	-	0.868
1980	0.074	-	0.835	-	(0.8 )	-	(0.8 )
1981	-	0.214	-	1.344	-	(1.3 )	0.69
1982	0.058	0.194	0.829	1.218	-	1.128	0.60
1983	0.082	0.131	1.111	0.823	-	0.885	0.47
1984	0.070	0.098	1.000	0.615	-	(0.7 )	0.37

\* adjustment was made of the post 1981 tended line gear by using the regression slopes of the each series to bring the both to a common level at 1981. This was done by taking the mean of the 1979 to 1982 ratios (see text).

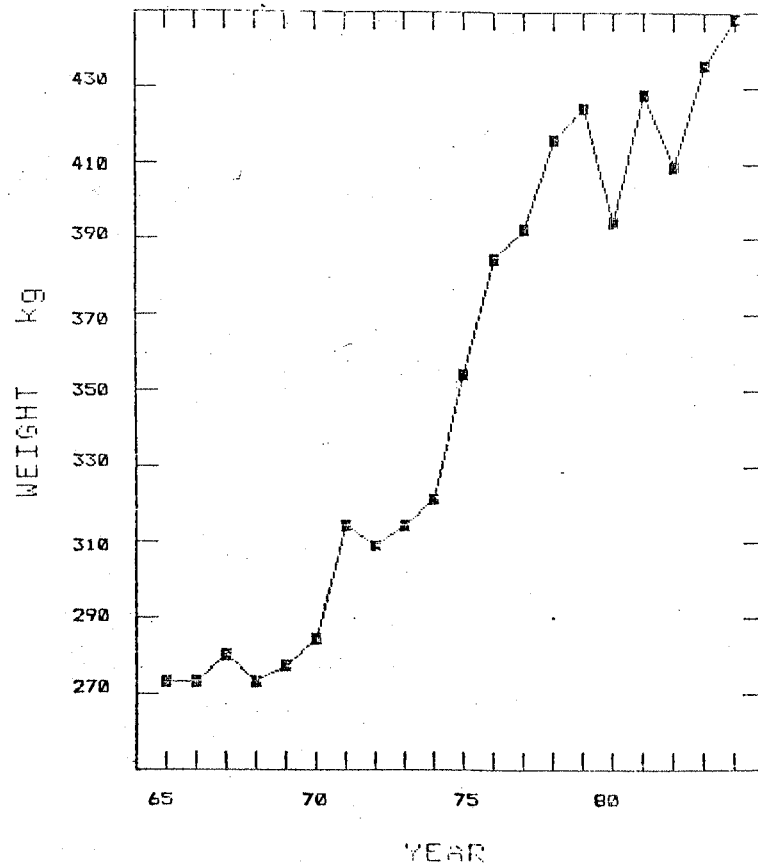


Figure 1. Mean weight (kg) of bluefin tuna landed in Canadian waters by the inshore fishery including the St. Margaret's Bay trap fishery.

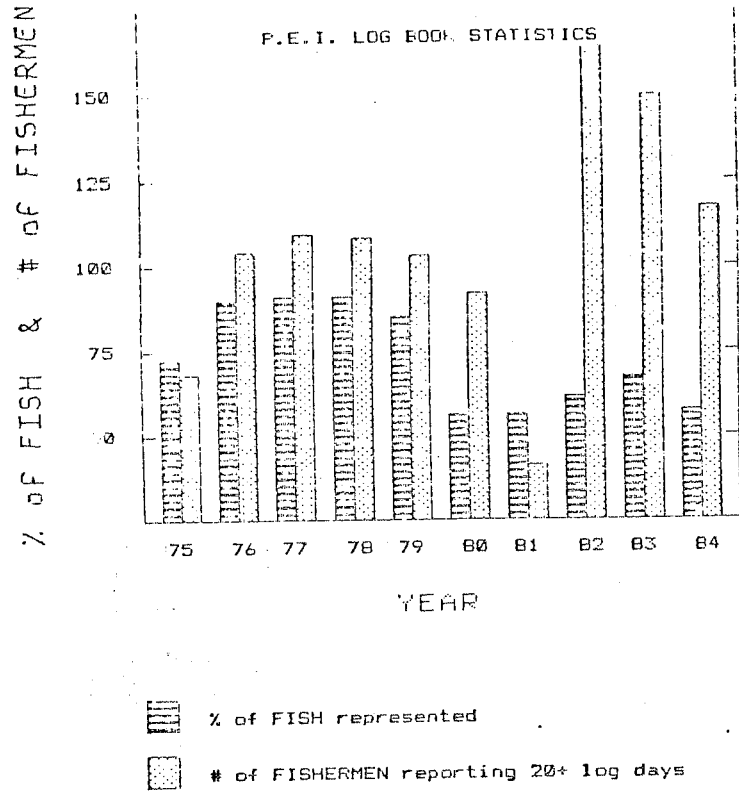


Figure 2. Statistics of the log books submitted by P.E.I. bluefin tuna fishermen.

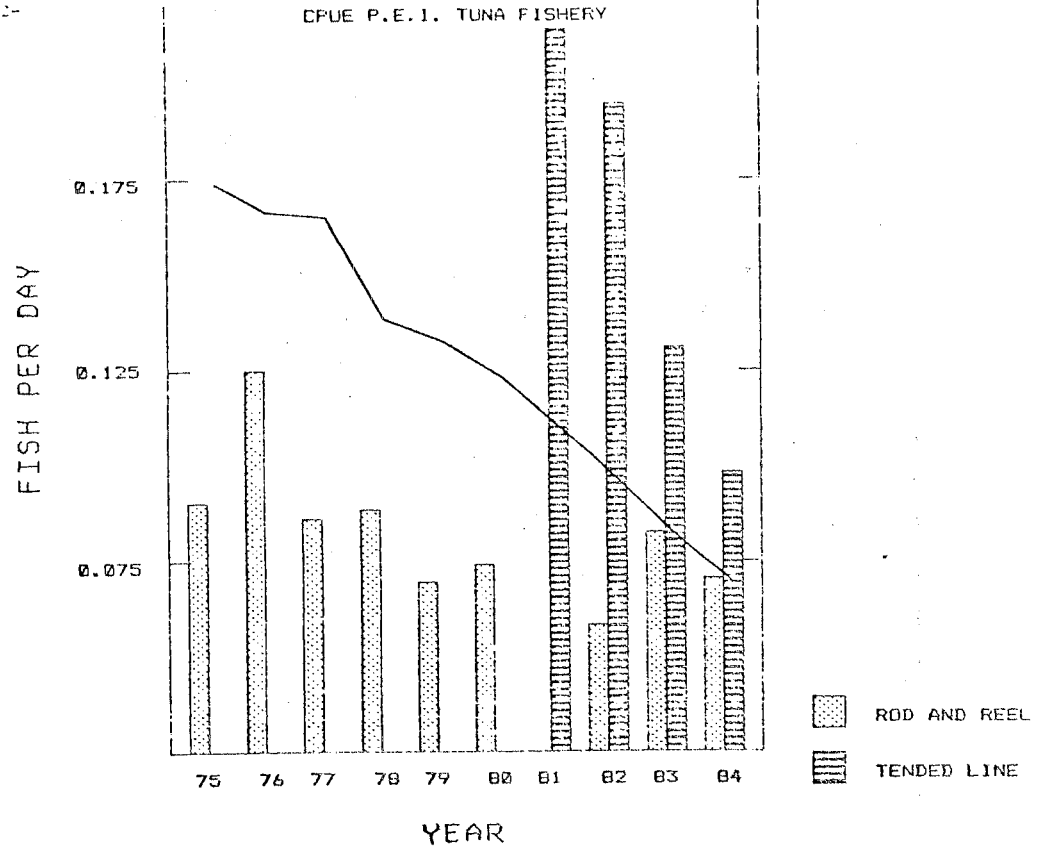


Figure 3. Catch per unit effort indices calculated from log books of bluefin tuna fishermen from P.E.I. The solid line represents the standardized smoothed adjusted CPUE index (see Table 4).