

VARIABILITY IN SURFACE CATCHES OF ATLANTIC YELLOWFIN AND BIGEYE TUNAS--  
ITS RELATION TO MEASUREMENT OF EFFECTS OF REGULATIONS

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ABSTRACT

Any attempt to measure benefits from regulation of surface fisheries for yellowfin and bigeye tunas in the Atlantic must take into account the variability in these fisheries. Yellowfin catches vary from 15 to 40 percent from one year to the next, and bigeye catches vary from 20 to 50 percent or more. The "signal" of any benefits of regulation, usually estimated to be on the order of 10 percent, will be very difficult to measure against this background "noise."

RESUME

Toute tentative d'évaluation des avantages à escompter de réglementations des pêcheries de surface d'albacore et de thon obèse dans l'Atlantique doit tenir compte du facteur de variabilité dans ces pêcheries. Les prises d'albacore varient de 15 à 40 % d'une année sur l'autre, et celles de thon obèse de 20 % à 50% ou plus. Les "signaux" révélateurs de tout avantage à escompter des réglementations, qui est généralement estimé être de l'ordre de 10%, seront très difficiles à dissocier de ces "bruits."

RESUMEN

Al intentar medir los beneficios que resultarían de las regulaciones sobre las pesquerías de superficie de rabil y patudo en el Atlántico, se debe tener en cuenta la variabilidad en estas pesquerías. Las capturas de rabil varían entre el 15 y el 40 por ciento de un año a otro, las capturas de patudo, varían entre el 20 y el 50 por ciento o más. La "señal" de que ha habido beneficio, generalmente estimado en un 10 por ciento, será muy difícil de medir a causa del "ruido" de fondo.

The ICCAT Working Group on Juvenile Tropical Tunas said in the report of its 1980 meeting in Brest "...it appears that the lower size limit of 3.2 kg may not yield potential benefits to the fisheries which could be readily distinguished from the typical inter-annual variations in apparent production." The Working Group did not quantify the inter-annual variations. This paper is a first attempt to do so.

Table 1 shows Atlantic surface catches of yellowfin and bigeye tunas from 1969 to 1982 from the ICCAT Statistical Bulletin. The catches vary considerably from one year to the next. Overall catches of yellowfin show a steady upward trend; this trend is principally due to

catches by purse seiners, which have been increasing at about 10 percent per year. Baitboat catches of yellowfin have decreased since the 1970s.

The trends in yellowfin catches are related to changes in fishing power of the purse seine and baitboat fleets, shown in the first two columns of Table 2. Purse seine fishing power increased at a rate of more than 12 percent per year during 1969-82; baitboat fishing power peaked in the late 1970s.

Catches of bigeye tuna are much more irregular, with a peak in the early 1970s and perhaps another in the late 1970s.

It should be kept in mind that the apparent fluctuations in these data reflect not only true fluctuations in the abundance of the species and in the catches, but also any fluctuations (and/or reductions in fluctuations) that may have been introduced in the process of turning raw estimates into "official" ICCAT statistics.

The last six columns of Table 2 show catches of yellowfin and bigeye adjusted for changes in fishing power by dividing the appropriate columns in Table 1 by the fishing power shown in the first two columns of Table 2, and may be considered a first approximation of catch per unit effort.

Absolute percentage change from one year to the next was calculated for each of the columns showing catch in Tables 1 and 2 [(1977 catch - 1976 catch)/1976 catch x 100, for example], and then the values of the mean percentage changes were calculated. The results are:

	Min.	Max.	Mean	S.D.
-- absolute percentage --				
Yellowfin unadjusted -				
Surface (Table 1 "a")	0	41	14	13
Purse seine (Table 1 "b")	2	56	17	17
Baitboat (Table 1 "c")	3	52	29	16
Yellowfin adjusted -				
Purse seine (Table 2 "c")	1	39	14	9
Baitboat (Table 2 "d")	1	70	38	21
Bigeye unadjusted -				
Surface (Table 1 "d")	1	55	23	16
Surface - north (Table 1 "e")	4	49	25	14
Purse seine - north (Table 1 "f")	0	400	100	127
Baitboat - north (Table 1 "g")	6	39	26	13
Surface - south (Table 1 "h")	10	93	44	30
Purse seine - south (Table 1 "j")	5	127	44	35
Baitboat - south (Table 1 "k")	0	100	46	31

	Min.	Max.	Mean	S.D.
	-- absolute percentage --			
Bigeye adjusted-				
Purse seine - north (Table 2 "e")	0	300	84	87
Baitboat - north (Table 2 "f")	1	65	23	18
Purse seine - south (Table 2 "g")	0	120	51	34
Baitboat - south (Table 2 "h")	0	143	33	40

"S.D." is the standard deviation, calculated in the usual manner. It should not be taken too seriously; the distribution of the absolute values is usually skewed toward the low end, and it may not even be mathematically valid to apply this criterion to values which originated as percentages. It does, however, give a rough idea of the variance in the series.

Some tentative conclusions can be drawn from these figures:

1. Adjusting for fishing power does not reduce variability; i.e., the variability in catches is probably not closely related to changes in fishing effort.
2. The variation in general for the adjusted and unadjusted yellowfin series is about 15 to 40 percent; the variation within a series is usually plus or minus about 10-20 percentage points around the mean.
3. The general variation for bigeye is larger, about 20-50 percent. The variation within a series is also larger, usually plus or minus about 15-40 percentage points around the mean. (Purse seine north not included.)
4. Variation in yellowfin is larger for baitboats; variation in bigeye is larger for purse seiners.

Attempts to measure benefits from regulations on Atlantic surface fisheries for yellowfin and bigeye tunas must take into account the considerable variability in the fisheries. Most estimates place the benefits from regulation on the order of 10 percent. It will be very difficult to measure systematic changes of this magnitude as a signal against the high background noise of variability in the fisheries.

Table 1 - Atlantic surface fishery catches of yellowfin and bigeye tunas, 1969 - 82

Year	thousand metric tons										
	a	b	c	d	e	f	g	h	j	k	
1969	61.0	45.1	15.9	10.6	8.6	.0	8.3	2.0	1.5	.5	
1970	43.4	33.9	9.4	11.2	9.6	.3	9.4	1.5	1.1	.5	
1971	43.0	32.6	10.4	13.0	10.4	.2	10.2	2.6	1.7	.8	
1972	60.6	47.8	12.8	10.3	7.3	.1	7.2	3.0	1.5	1.5	
1973	59.3	44.9	14.4	16.0	10.9	.1	10.8	5.1	2.7	2.4	
1974	72.7	53.4	19.4	20.8	14.7	.1	14.6	6.0	3.2	2.8	
1975	92.7	83.4	9.3	15.7	14.1	.4	13.7	1.5	.9	.7	
1976	99.0	86.2	12.8	11.5	8.6	.3	8.3	2.9	1.1	1.4	
1977	98.8	87.6	11.0	17.3	12.1	1.5	10.6	5.2	2.5	2.1	
1978	106.9	97.6	8.7	17.2	13.6	.7	12.9	3.6	2.1	1.4	
1979	105.6	91.7	12.8	13.5	9.5	.9	8.2	4.1	2.8	1.1	
1980	94.6	87.1	7.0	17.5	12.3	2.3	9.9	5.2	3.8	1.0	
1981	118.8	108.6	9.4	16.3	9.2	1.4	7.2	7.1	6.3	.7	
1982	109.1	99.6	9.1	14.7	8.4	3.0	5.3	6.4	6.0	.3	

Key:

- a - Eastern Atlantic surface yellowfin tuna
- b - Eastern Atlantic purse seine yellowfin tuna (included in "a")
- c - Eastern Atlantic baitboat yellowfin tuna (included in "a")
- d - Atlantic surface bigeye
- e - North Atlantic surface bigeye (included in "d")
- f - North Atlantic purse seine bigeye (included in "e")
- g - North Atlantic baitboat bigeye (included in "e")
- h - South Atlantic surface bigeye (included in "d")
- j - South Atlantic purse seine bigeye (included in "h")
- k - South Atlantic baitboat bigeye (included in "h")

Sources:

- 1969 - ICCAT Historical Statistical Bulletin, Vol. 2
- 1970 - ICCAT Statistical Bulletin, Vol. 11
- 1971 - ICCAT Statistical Bulletin, Vol. 12
- 1972-82 - ICCAT Statistical Bulletin, Vol. 13

Table 2 - Carrying capacity of the fleets, and Atlantic surface fishery catches of yellowfin and bigeye tunas adjusted for fishing power, 1969 - 82

Year	a	b	c	d	e	f	g	h
			-thousand	metric	tons			
1969	12.5	1.2	3.61	13.25	.00	7.08	.12	.42
1970	15.5	1.2	2.19	7.83	.02	7.83	.05	.42
1971	16.7	1.6	1.95	6.50	.01	6.37	.10	.50
1972	29.5	3.2	1.62	4.00	.00	2.25	.05	.47
1973	25.0	6.9	1.80	2.09	.00	1.57	.11	.35
1974	30.0	9.2	1.78	2.11	.00	1.59	.11	.30
1975	42.3	10.0	1.97	.93	.01	1.37	.02	.07
1976	36.7	8.1	2.35	1.58	.01	1.02	.03	.17
1977	39.5	11.8	2.22	.93	.04	.90	.06	.18
1978	52.2	13.4	1.87	.65	.01	.96	.04	.10
1979	47.3	12.0	1.94	1.07	.02	.68	.06	.09
1980	53.3	9.7	1.63	.72	.04	1.02	.07	.10
1981	58.9	8.7	1.84	1.08	.02	.83	.11	.08
1982	66.1	8.1	1.51	1.12	.05	.65	.09	.04

Key:

- a - Carrying capacity of eastern tropical purse seiners
- b - Carrying capacity of major eastern tropical baitboats
- c - Eastern Atlantic purse seine yellowfin tuna, adjusted (Table 1 "b"/Table 2 "a")
- d - Eastern Atlantic baitboat yellowfin tuna, adjusted (Table 1 "c"/Table 2 "b")
- e - North Atlantic purse seine bigeye tuna, adjusted (Table 1 "f"/Table 2 "a")
- f - North Atlantic baitboat bigeye tuna, adjusted (Table 1 "g"/Table 2 "b")
- g - South Atlantic purse seine bigeye tuna, adjusted (Table 1 "j"/Table 2 "a")
- h - South Atlantic baitboat bigeye tuna, adjusted (Table 1 "k"/Table 2 "b")

Source of "a" and "b":  
Miyake, P.M.

1984

Review of historical fleet sizes for major fisheries.  
Collective Volume of Scientific Papers, Vol. XX(2):  
514-517 (SCRS/83/27).