WP 12

Memorandum of longline CPUE for yellowfin tuna

by Z. Suzuki prepared for discussion
in the WPYRG, June 1992, Honolulu

1. How the longline CPUE is being standardized

   1) Honma method (Honma 1974)
   2) GLM (e.g., Punsly and Nakano 1992).....Fig. 1 and Table 1.

   * Honma method is less statistically robust but applicable to statistically unmatched data set

   * GLM is statistically robust with estimates for confidence limit and easy to put additional factors but involves difficulty how to deal with zero catch.

   * For both methods, estimation of improvement of gear efficieny is not easy.

2. Gap in CPUE trend observed from purse seine and longline fisheries

   Eastern Pacific.....Fig. 2 and 3

   Eastern Atlantic.....Fig. 4

   What about western and central Pacific ? .....Fig. 5
   (Case of the Western Indian Ocean (Fig. 6) looks alike but different from the western and central Pacific as for rate of decline in the longline CPUE.)

3. Possible hypotheses on the observed gap

   Example taken from IPTP report (1992);

   1) only a part of population - which is independent of the abundance of the earlier population - is available to the longline fishery (Fonteneau 1987)

   2) an increased productivity of the stock

   3) an extremely large population (high natural mortality)

   4) a biassed measure of fishing effort (Au 1986)

4. Some suggestions for further study of the longline CPUE

   1) Analysis of mixing for fish taken by the longline and purse seine fisheries (tag recovery rates from the

two fisheries, sonic and conventional tagging to bigger yellowfin caught by the longline etc.)

2) Effect of environmental conditions (e.g., change in thermocline depth, El Nino events)

3) Analysis of detailed data with respect to strategic changes of longline operations (e.g., congestion in the operations, change in taget species, effect of by-catch species)

5. References

Au, D. 1986: Interpretation of longline hook rates. ICCAT, CVSP, 25, p. 377-385

Fonteneau, A. 1987: Competition between tuna fisheries, A critical review based on Atlantic examples. IPTP Collective Volume of Working Documents, p. 195-213.

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Suzuki, Z. 1991a: Trends in catch, fishing effort, catch rate and length data for the Japanese longline fishery in the Atlantic Ocean, 1955-1989. ICCAT WS on the stock assessment of the west Atlantic yellowfin tuna (#3), 8 pp.

Suzuki, Z. 1991b: A brief review of interaction between purse seine and longline of yellowfin tuna Thunnus albacares, in the western and central Pacific Ocean. FAO expert consultation on interactions of Pacific tuna fisheries (TIC/91/R#8), 24pp.

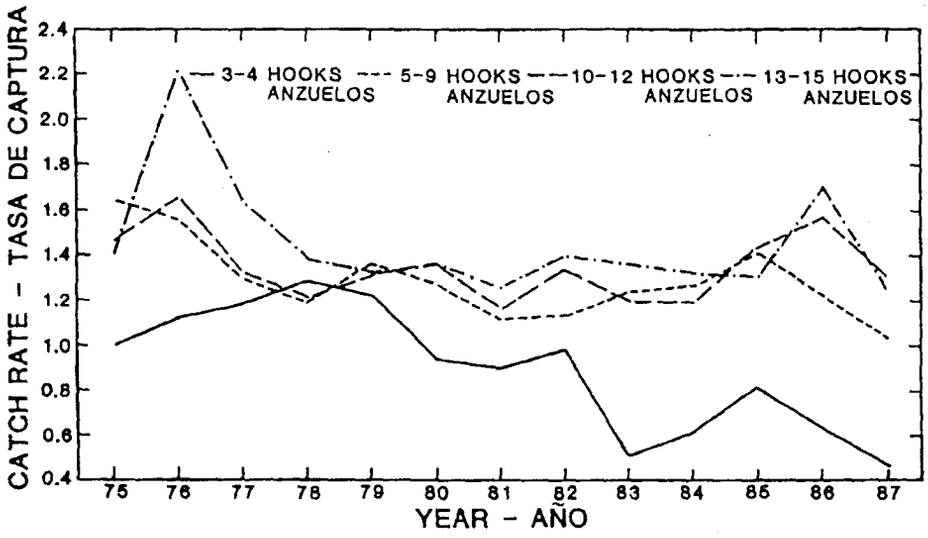

FIGURE 4a. Yellowfin hook rates for four depths of longlines in the EPO. All values are relative to 3-4 hooks per basket in 1975.

FIGURA 4a. Tasas de captura de aleta amarilla correspondientes a cuatro profundidades de palangre en el OPO. Los valores son relativos a 3-4 anzuelos por canasta en 1975.

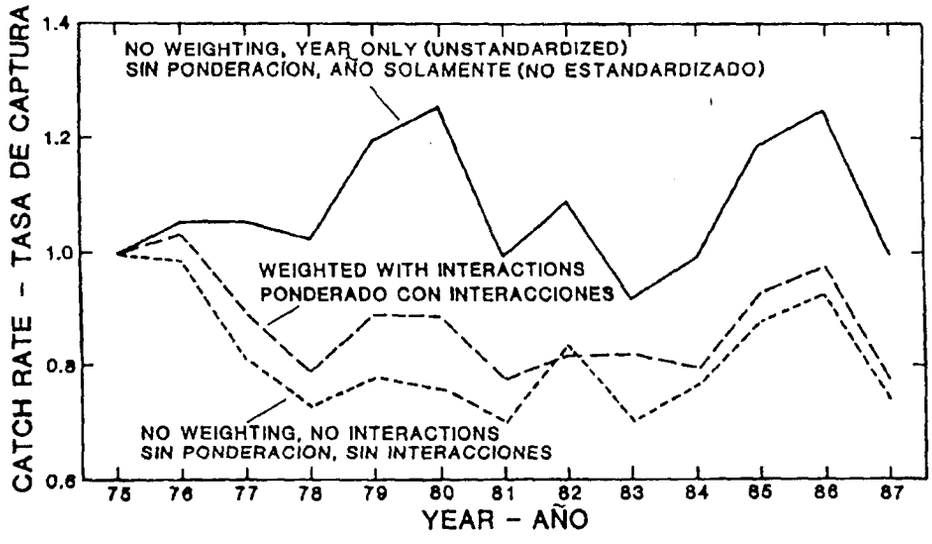

FIGURE 4b. Comparison of annual trends in yellowfin hook rates in the EPO for three different standardizing and weighting schemes. All values are relative to those of 1975.

FIGURA 4b. Comparación de tendencias anuales en las tasas de captura de aleta amarilla en el OPO correspondientes a tres esquemas distintos de estandardización y ponderación. Los valores son relativos a aquellos de 1975.

PUNSLY AND NAKANO (1992)

TABLE 1. Analysis of variance of logarithms of yellowfin hook rates, full model. Depth, area, and season, despite having sums of squares close to zero, are included in the model because their effects, plus the effects of their interactions, are significant.

TABLA . Análisis de varianza de logaritmos de tasas de captura de aleta amarilla, modelo completo. Se incluyen en el modelo profundidad, área, y temporada, a pesar de que tienen sumas de cuadrados cercanas a cero, porque sus efectos, más los efectos de sus interacciones, son significativos.

Source Fuente	Degrees of freedom Grados de libertad	Sum of squares Suma de cuadrados	Mean square Cuadrado medio	*F* value Valor *F*	Probability Probabilidad
Year – Año	12	3.65	0.30	0.29	0.9909
Depth – Profundidad	3	>0.00	>0.00	0.00	>0.9999
Area	6	>0.00	>0.00	0.00	>0.9999
Season – Temporada	5	>0.00	>0.00	0.00	>0.9999
Year × depth Año × profundidad	34	85.05	2.50	2.40	0.0001
Year × area Año × área	72	433.52	6.02	5.78	0.0001
Year × season Año × temporada	48	152.36	3.17	3.05	0.0001
Depth × area Profundidad × área	17	32.81	1.93	1.85	0.0174
Depth × season Profundidad × temporada	12	26.16	2.18	2.09	0.0143
Area × season Area × temporada	24	146.24	6.09	5.85	0.0001
Year × depth × area Año × profundidad × área	118	515.14	4.37	4.19	0.0001
Year × depth × season Año × profundidad × temporada	117	402.91	3.44	3.31	0.0001
Year × area × season Año × área × temporada	256	2597.29	10.15	9.74	0.0001
Depth × area × season Profundidad × area × temporada	62	146.38	2.93	2.81	0.0001
Residual	37549	39115.12	1.04		

NAKANO AND BAYLIFF (1992)

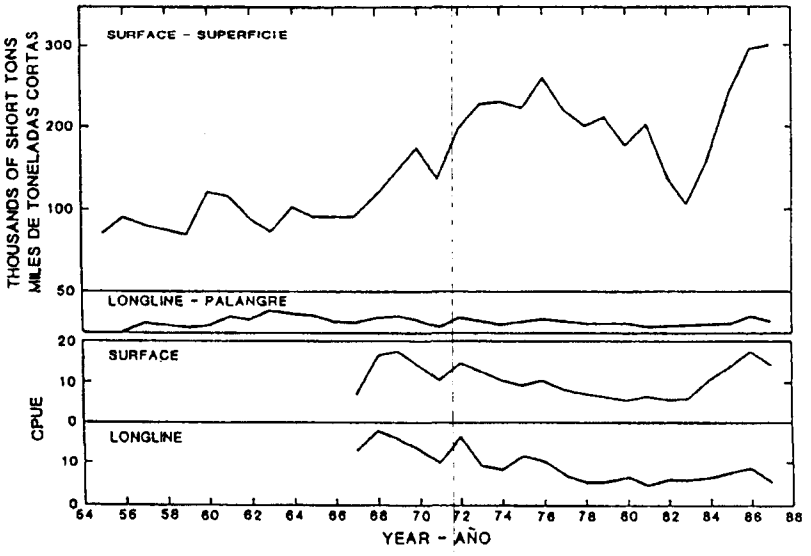

FIGURE 2. Catches (top two panels) and CPUEs (bottom two panels) for yellowfin in the EPO. The CPUE data for the surface fishery are expressed as catch per day by Class-6 vessels, and those for the longline fishery are expressed as catch per 73,800 hooks.

FIGURA . Capturas (dos recuadros superiores) y CPUE (dos recuadros inferiores) de aleta amarilla en el OPO. Se expresan los datos de CPUE correspondientes a la pesquería de superficie como captura por día por barcos de la Clase 6, y los de la pesquería palangrera como captura por 73,800 anzuelos.

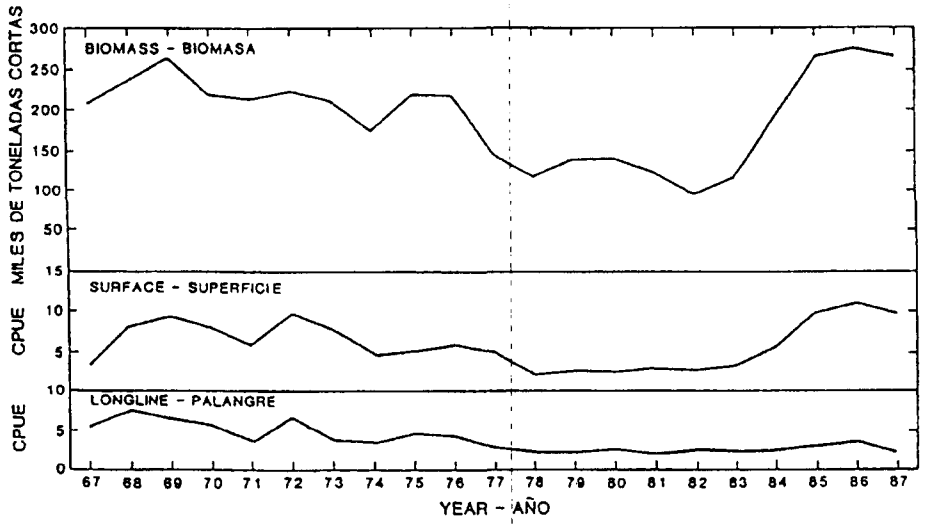

FIGURE 3. CPUEs of large yellowfin by surface and longline gear, compared to biomass estimates of large yellowfin in the EPO. The CPUE data for the surface fishery are expressed as catch per day by Class-6 vessels, and those for the longline fishery are expressed as catch per 30,550 hooks.

FIGURA . CPUE de aletas amarillas grandes por arte de superficie y palangre, comparadas con estimaciones de la biomasa de aletas amarillas grandes en el OPO. Se expresan los datos de CPUE correspondientes a la pesquería de superficie como captura por día por barcos de la Clase 6, y los de la pesquería palangrera como captura por 30,550 anzuelos.

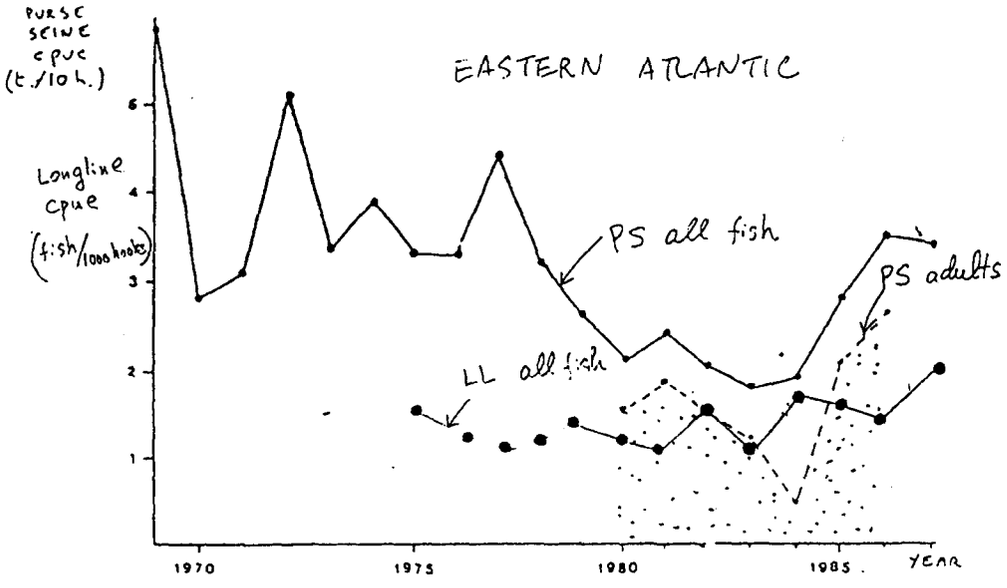

Figure 4. Index of abundance for the eastern Atlantic yellowfin stock (all fishes and adults). PS and LL data from Fonteneau (1988) and Suzuki (1991a).

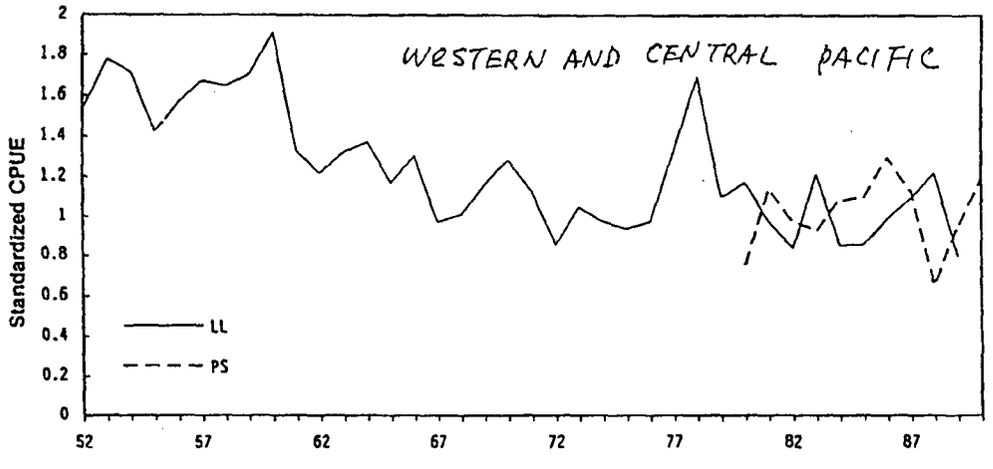

Fig. 5. Trends of longline and purse seine CPUE in the western and central Pacific Suzuki (1991b) and Tsuji (Pers. comm.)

① Compare CPUE for different oceans.

② Try to better quantify LL effort on YF, eg. no. hooks sampling YF habitat.

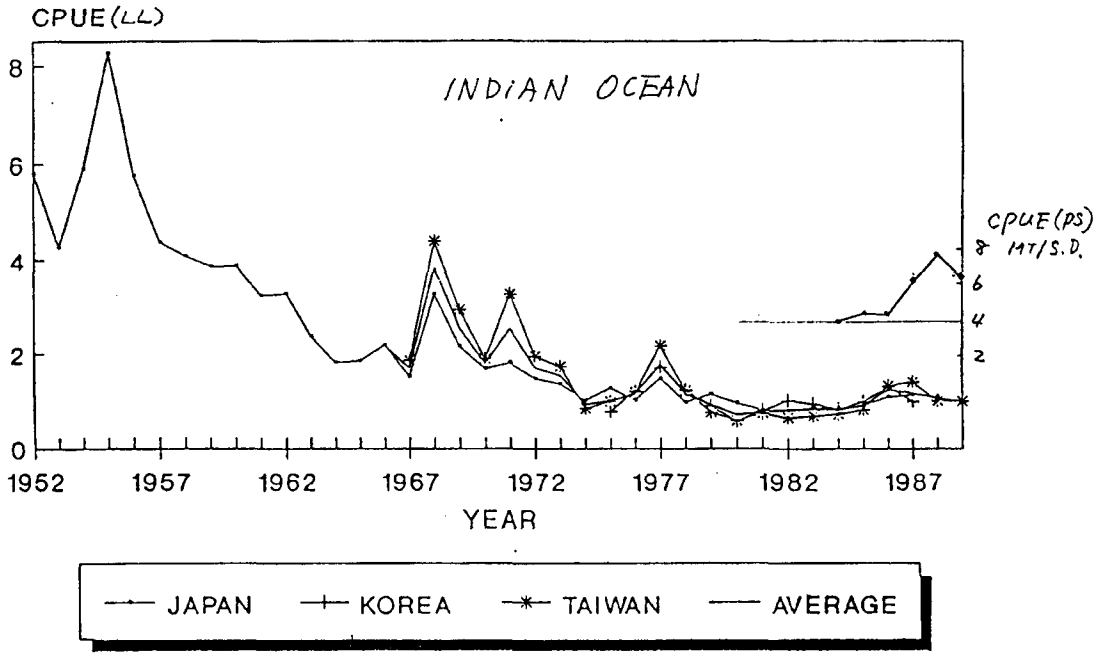

Figure 6: Standardized longline CPUE on yellowfin using Honma's method (Japan, Korea and Taiwan), 1967-89 and the General Linear Model (all fleets), 1975-89 (TWS/91/05) IPTP (1992)