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Notes on the standardized swordfish CPUE of tuna longline fisheries (Japan and Taiwan) in WPB6 (1980-2006 and 1992-2006)

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CONTENTS

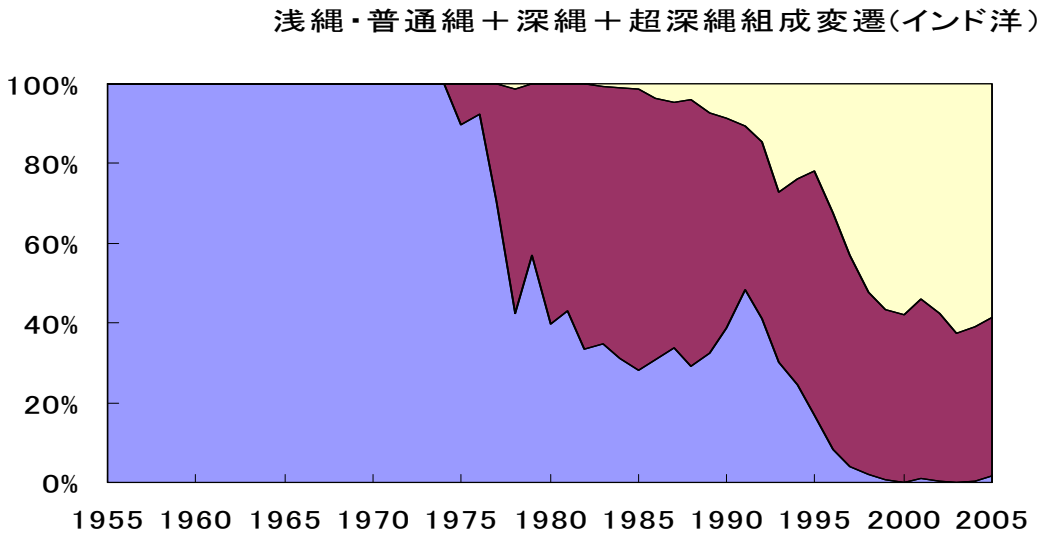
We realized that the above issues were important when we worked on the SWO STD LL CPUE (Japan and Taiwan). Thus we made special notes to explain further for our discussion.

1. Periods analyzed

We made two periods for the STD CPUE and ASPIC analyses. The reasons to establish for these two periods are as follow:

1980-2006

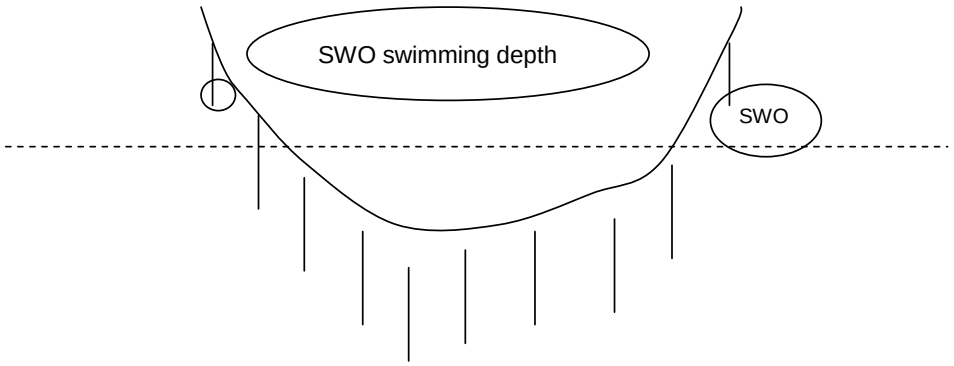
From the last assessment in 2006 it was recognized that there are three regimes regarding NHBF (number of hooks between floats) in the Japanese LL (Fig.1).



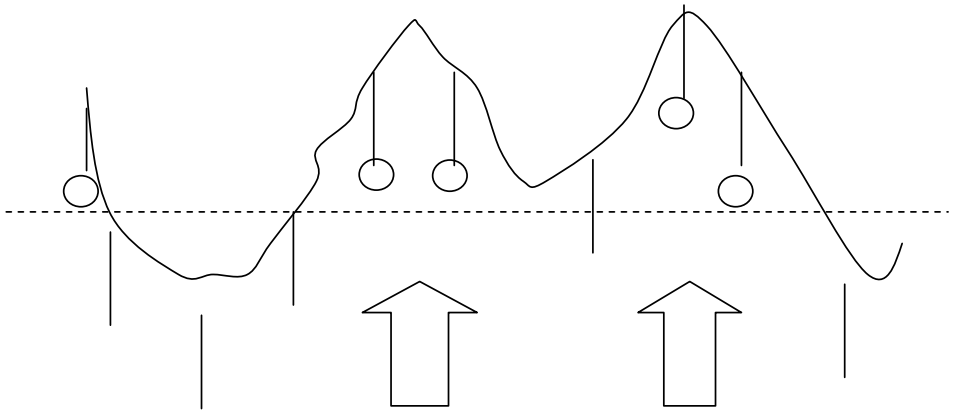
Blue (left): shallow and regular LL (NHBF <= 9)
Red (middle): deep and light LL (10<=NHBF<= 14)
yellow (right) : ultra deep LL (15<= NHBF)

In the Japanese LL SWO is mainly caught in the shallow waters as bycatch by the regular LL. It is likely that hooks of regular LL are easily affected by the shear current which makes more hooks to the shallower waters which will make the overestimated CPUE than those by deep and ultra deep LL. This is because more SWO are caught by the hooks blown up to shallower waters, while this effect is less in the deep and ultra deep LL as they are deployed in the deeper waters. Thus to reduce such biases we used the data after 1980 when there are more compositions of deep and ultra deep LL (for details see Fig.2).

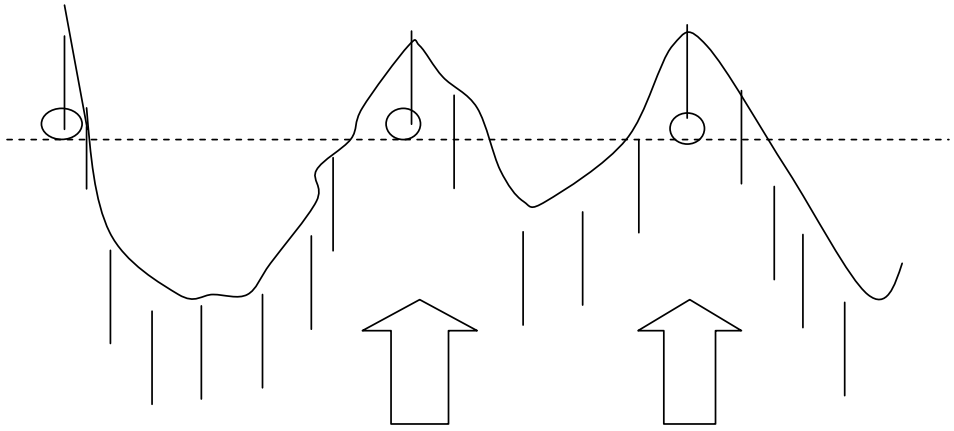
Another reason to select the data after 1980 is as follows. As the shear currents and ocean fronts are important ENV factor affecting SWO habitats. Such information are available after 1980 (for details refer to other paper submitted to WPB by Nishida et al, 2008). This is another reason to analyze the data after 1980.



At the normal catenary conditions of the normal or deep LL : nominal CPUE=2/10=0.2



When the catenary LL shape is disturbed by the under water current which upraised LL gear up to the shallower waters where SWO inhabits. In this case nominal CPUE becomes CPUE=5/10=0.5 which overestimate 2.5 times higher CPUE than the situation when the catenary shape is kept (above case).



In case of the ultra deep LL: nominal CPUE 3/18=0.17 (less unbiased)

Fig 2 The schematic diagram showing why the nominal CPUE is overestimated before 1990 when

Why 1992-2006

To reduce biases caused by the shear current further we attempt one more period after 1990 when the composition of the regular LL is much less than in previous decades. In fact in the last assessments this period (1990-2004) produced better results.

As observed from the last sections on the comparison of CPUE there are unexplainable strong discontinuity before and after 1992 (Fig. 2), we use the 1992-2006 instead of 1990-2006.

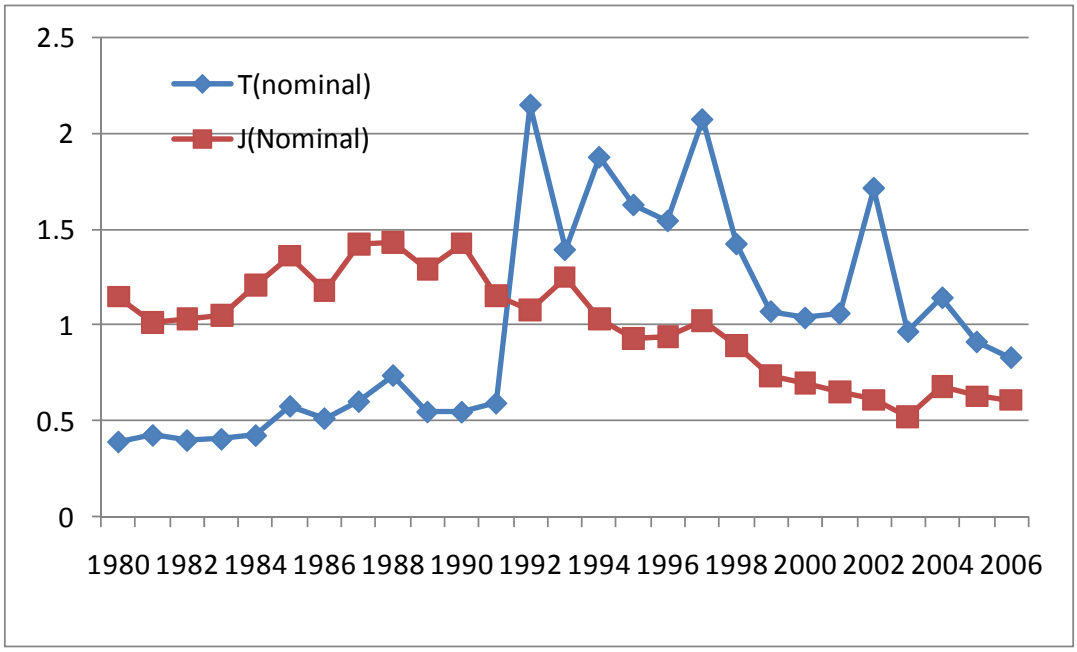


Fig. 3 Uexplainable large gap before and after 1992.

2. Comparison of CPUE

(All CPUE are scaled as average CPUE=1)

<table>
<tr><td colspan="2">JAPAN (case 1)
(Wang model)</td><td colspan="2">Japan (case 3)
(Semba model)</td><td>Taiwan
Case 1</td><td>Taiwan
Case 2</td><td>Taiwan
Case 3</td><td>Taiwan
Case 4</td></tr>
<tr><td colspan="4">Full ENV data</td><td colspan="2">Original (Less) ENV</td><td>Full ENV</td></tr>
<tr><td colspan="4">Coarse scale (5x5/ mo)</td><td colspan="2">Corse & fine
(5x5/MO & fine scale)</td><td>Fine scale</td></tr>
<tr><td colspan="4"></td><td colspan="2"></td><td></td></tr>
<tr><td>(1980-2006)</td><td>(1992-2006)</td><td>(1980-2006)</td><td>(1992-2006)</td><td>(1980-2006)</td><td>(1990-2006)</td><td colspan="2">(1995-2006)</td></tr>
<tr><td colspan="8"></td></tr>
</table>

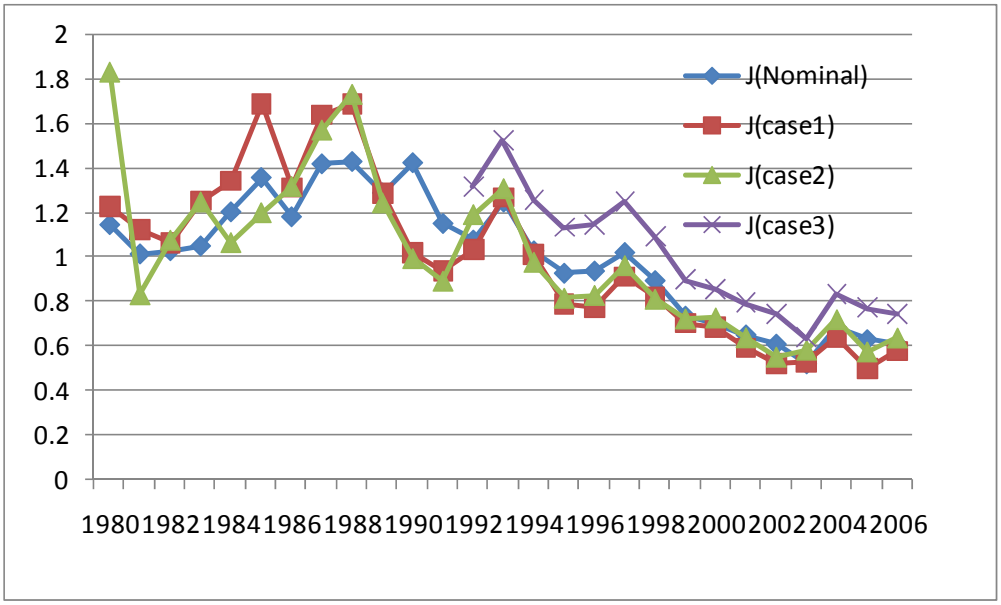
Note

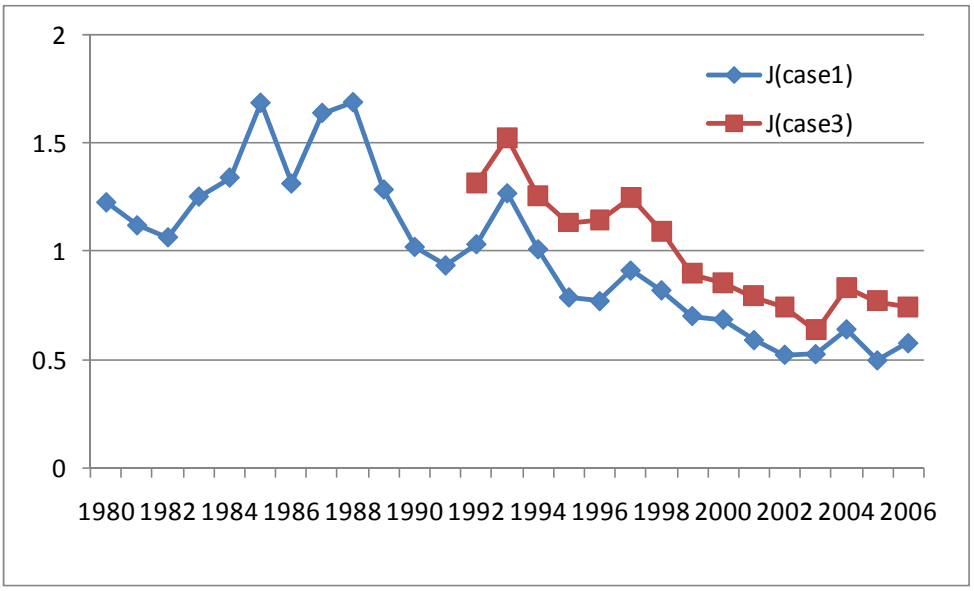
- Japan case 2 (Semba model with Y*Q was not used)
- Wang model means that all the GLM independent variables are same as those of Taiwan GLM by Wang.

● Comparison of STD CPUE among Japan CPUE

Adjustment of targeting : no of hooks between floats (NHBF)

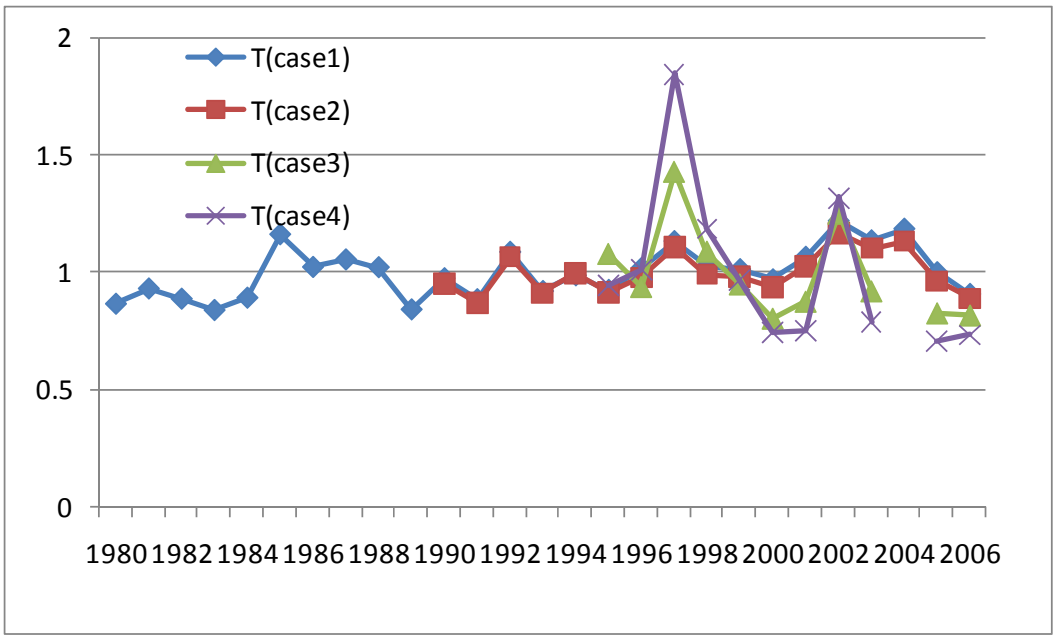
J(case1) : 1980 -2006(Wang type)
J(case 2): 1980-2006 (Semba type)
J(case 3): 1992-2006 (Wang type)

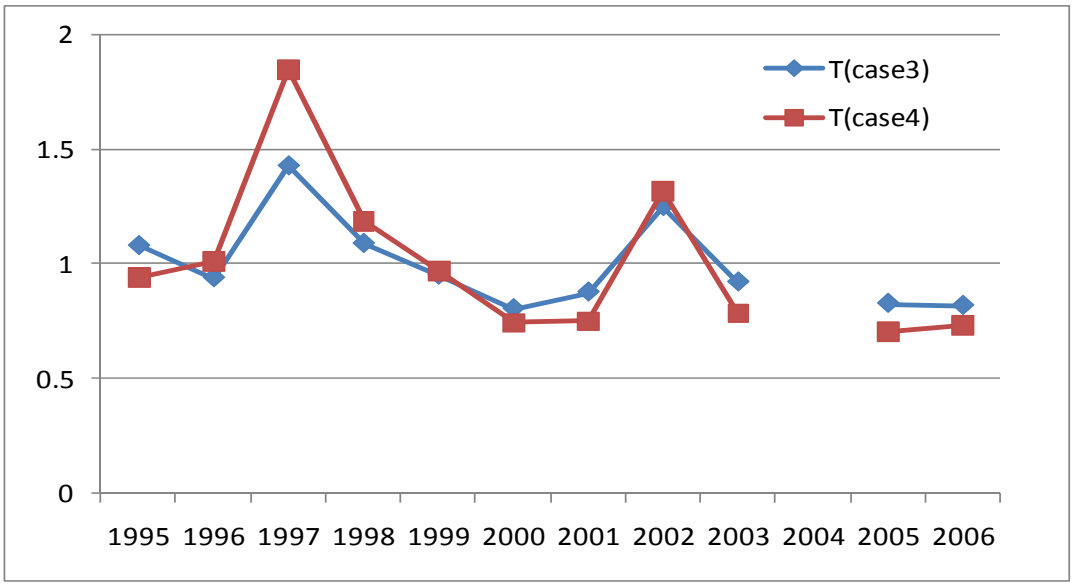




- **Comparison of STD CPUE among Taiwan CPUE**

T(case 1): 1980-2006 adjustment of targeting (species compositions+ NHBF)
T(case 2): 1990-2006 adjustment of targeting (species compositions+ NHBF)
T(case 3): 1995-2006 adjustment of targeting (NHBF)target (NHBF) with less ENV factors
T(case 4): 1995-2006 adjustment of targeting (NHBF)target (NHBF) with full ENV factors

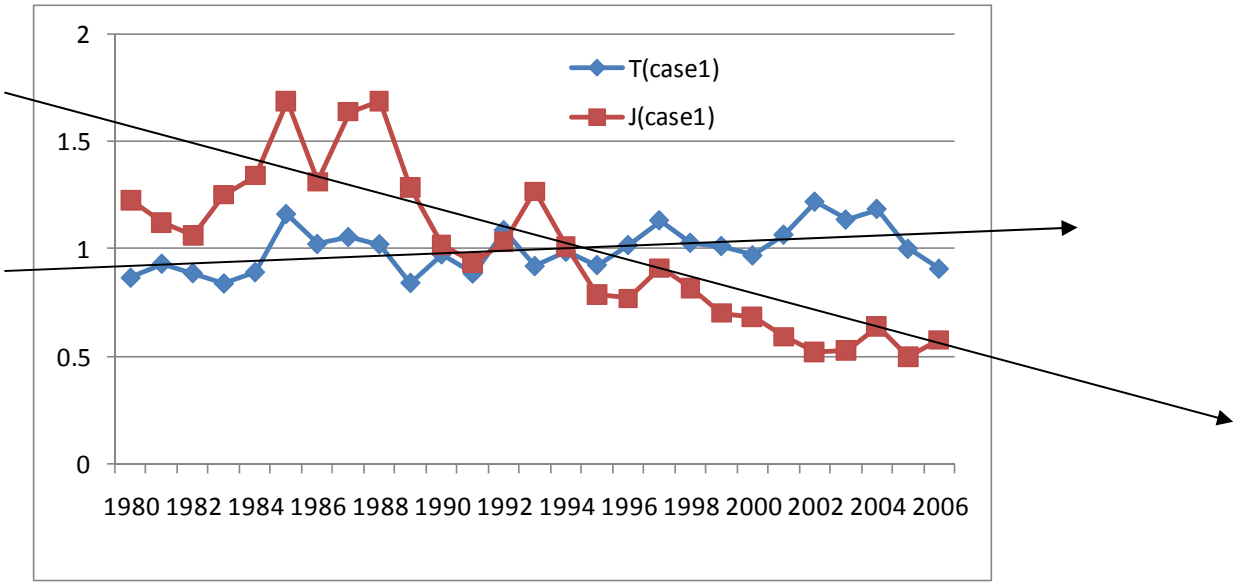




- **Comparison between Japan and Taiwan**

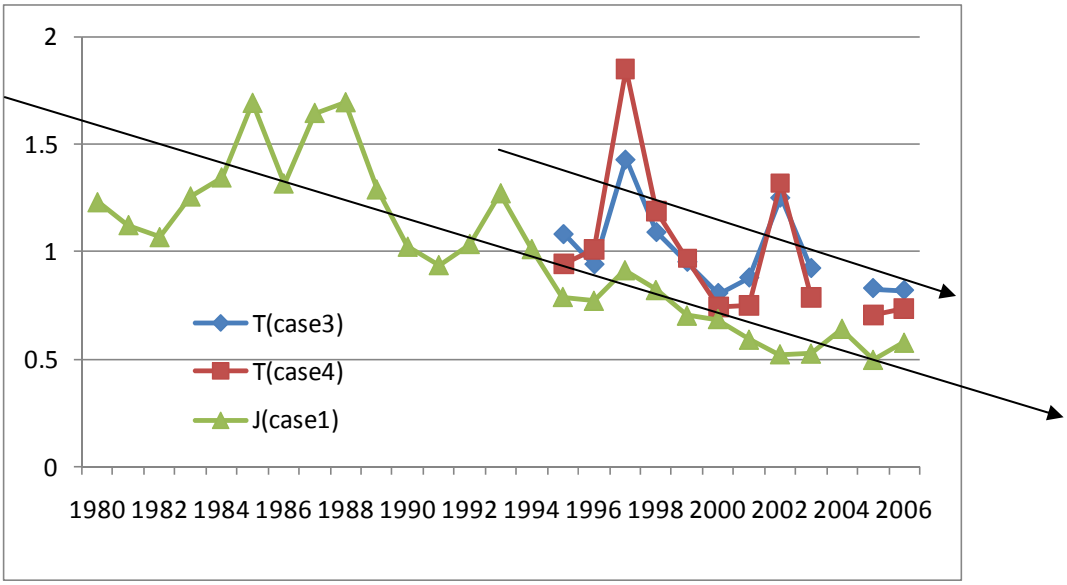
1980-2006

Typical discrepancies in recent years if we use the species comp. & NHBF

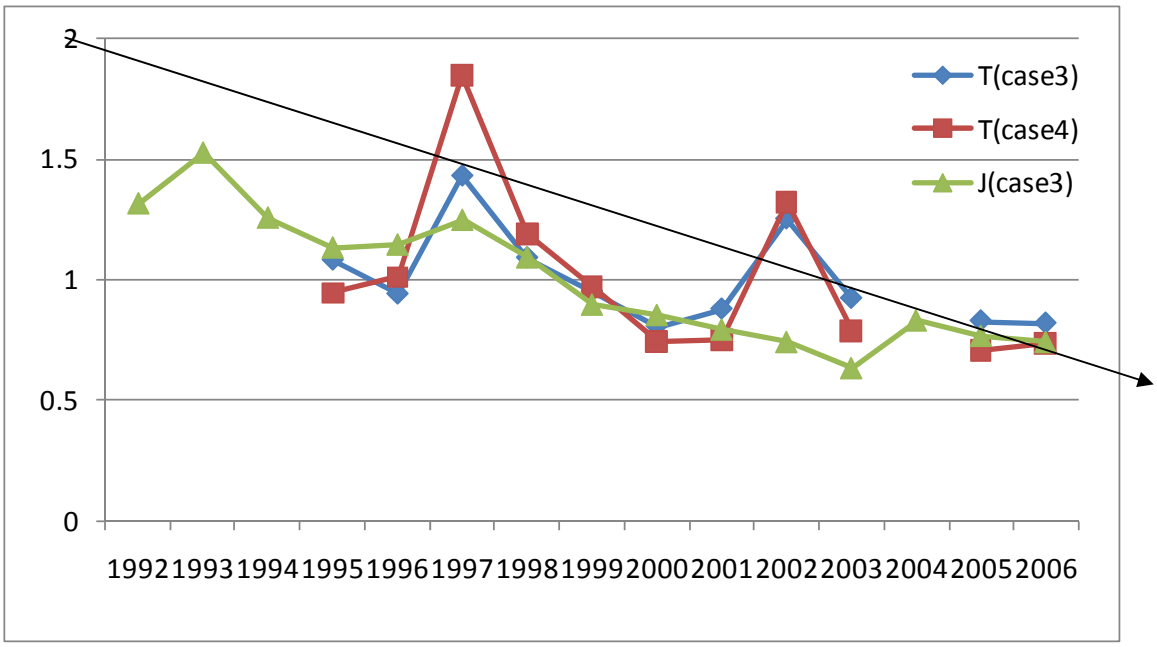


Same situation has been observed in YFT & BET STD CPUE.

If only NHBF (Taiwan) after 1995 is used, both trends became similar



1992-2006



Trends became much similar.

3. YR interaction terms in the GLM

Hinton and Maunder (2003) (information paper submitted to this WPB6) suggested that when we attempt to standardize the annual STD CPUE we should not include the YR interaction terms except YR*AREA. This is because there are biases caused by YR* interaction terms.

However we wonder if we can abandon even some of YR* interaction are very significant. Some approach may be applicable to overcome this dilemma?

4. ENV Factors affecting nominal CPUE

JAPAN (case 1) (Wang model)		Japan (case 3) (Semba model)				Taiwan Case 1		Taiwan Case 2		Taiwan Case 3		Taiwan Case 4	
Full ENV data						Less ENV						Full ENV	
Coarse scale (5x5/ mo)						Corse & fine (5x5/MO & fine scale)				Fine scale			
(1980-2006)		(1992-2006)		(1980-2006)		(1992-2006)		(1980-2006)		(1990-2006)		(1995-2006)			
YR	57	Yr	45	S*Q	59	Q*NA	40	T*S	537	T*S	904	T*S	2069	T	395
TD*NA	49	TD*NA	40	Q	55	TD*NA	35	T	536	T	900	T	2053	SC*NA	327
S*Q	48	S*Q	29	Q*NA	48	S*NA	34	S	488	S	852	S	2027	Y	236
Q	45	Q*NA	29	S*NA	33	T*NA	30	S*NA	461	Q	398	S*NA	1122	A	227
T*NA	42	T*Q	29	TD*NA	30	NA	30	A	412	S*Q	377	A	1068	T*SC	220

Y is year,
q is quarter,
NA is area,
G is gear,
SC is Sheer current,
AM is its amplitude which affect the depth of the gear,
TG is temperature gradient (degree/100km) (at the 5m depth),
TD is Thermocline depth (m),
T is temperature at (xx) m depth (xx=15, 75, 95, 105 and 135),
S is salinity at (xx) m depth (xx=15, 75, 95, 105 and 135),
IOI is Indian Ocean Index,
SG is salinity gradient (degree/100km) (at the 5m depth),
m1 and m2 is line material.

- In general ENV factors are very important as they are primary factors affecting nominal CPUE.
- Corse scale : TD, T and S are major factors
- We need to investigate the ecological reasons why salinity affect SWO habitats.
- Fine scale: SC, T, S are major ENV factors. More ENV factors affect.
- Ocean fronts seems be no significant
- Corse scale may mask the SC affect as it average out the fine structure

5. Line materials of longline

Okamoto et al (2006) suggested that YFT nominal CPUE are affected by materials of LL line (traditional vs. recent nylon). However we could not see the significances for this time. Following are discussion on this issue quoted from both Japan & Taiwan STD CPUE papers

Japan

Nylon mono-filament has been used since around 1992 in JLL in the Indian Ocean (Okamoto et al. 2004). As this material is lighter than the traditional material which had been used, we expected that these factors were significant in the preliminary analysis. However, the line material was not significant for both main line and branch line. This may be improved by the analysis using fine-scale catch data.

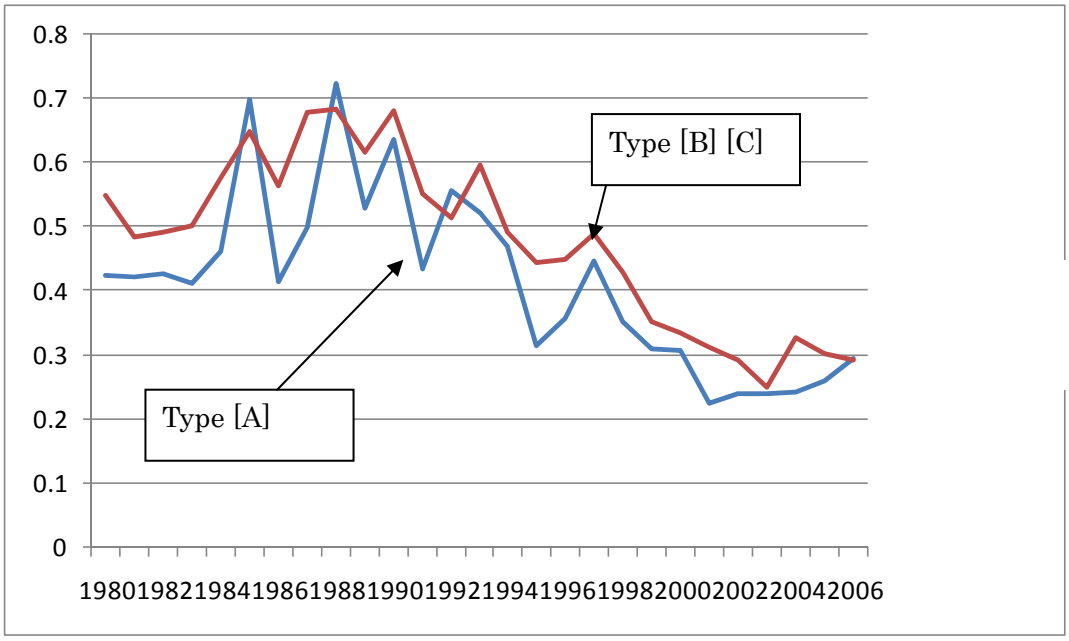
Taiwan

For fishing gear operation, the materials of fishing gear might be used as an additional effect for fishing gear operation. Based on the information from Taiwanese observer program, most of fishermen use nylon (nylon mono or nylon twist) as the material for branch line and some use wires as the materials. At this stage, however, the information related to materials for lines were insufficient for CPUE analyses of Taiwanese longline fishery.

6. Nominal CPUE

During we worked on the CPUE STD, we stared to discuss about the definition of the nominal CPUE. Taking chances during the recent IOTC tagging meetings from the end of June to the beginning of July, we asked a few outstanding tuna stock assessments experts. Surprisingly there are a few different opinions. In summary it seems to be three definitions including our views as below:

[A] Total catch/total effort (in one year). It is the real NOMINAL, but it is easily affected by outliers.
[B] : Annual average NOMINAL CPUE accumulating average CPUE of smaller strata by season and area. This is good to compare with STD CPUE as both are computed same structure. Some experts suggested to used this especially when we compare with STD CPUE.
[C] [B] with area weighting. This is further closer in the way to evaluate STD CPUE in case the area weighting are applied. Some expert suggested to use this type.



As a conclusion, we may be able to use any types which depend on the objectives, i.e., if we want to compare STD CPUE with the raw nominal CPUE we will use [A], while if we want compare with the annual average nominal CPUE we use [B] or [C] as they are computed in the dame way for the STD CPUE.