Comparison among various recruitment indices

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Summary: Various recruitment indicators are compared to OM estimates of recruitment on cohort basis. Indices from Western Australia tend to exaggerate low recruitments but reflect OM fluctuation pattern well. Indices from Great Australian Bight seem to be less sensitive to abundance fluctuations. Global nominal CPUE of Japanese longline reflect OM fluctuation patterns quite well. General observation indicates that the OM estimates for recent recruitment are reasonable.

要約：各種加入指数と OM の加入推定値を年級群ベースで比較した。WA の指標は低加入を強調する傾向にあるが、OM の変動をよく反映している。GAB での指標は資源量変動に鈍感なようである。日本のはえ縄の海域全体のノミナル CPUE は OM 変動パターンをよく反映している。全体的な観察から、OM による最近の加入推定は妥当と思われる。

Objectives:

The ninth Scientific Committee held in September 2004 noted that both stock assessment and fisheries indicators indicated markedly low recruitment in one or more of 1991-2001 cohorts. The Scientific Committee decided to review a full set of recruitment indicators at 2005 SC to determine whether immediate TAC reduction would be required, and if so how much to be reduced.

The Special Management Procedure Technical Meeting developed four additional recruitment scenarios to be examined. It was planned that the 2005 SC would examine these five recruitment scenarios at the 2005 SC in the light of updated recruitment indicators and develop weighting among them to be used as a basis to determine the need and level of immediate TAC reduction. This document tries to provide some basis for judgment about relative plausibility among five recruitment scenarios.

Methods:

Various recruitment indicators are plotted with OM estimates after standardized with a certain period where both data available. All the figures in this document are cohort base.

Three questions were addressed: a) credibility of OM estimates of 2000 and 2001 recruitments, b) recruitment trend after 2001 cohorts, and c) what is the most reliable recruitment indicator for the future monitoring.

Fig. 1A shows OM estimates of five recruitment scenarios and 1B corresponds to recruitment to longline fisheries at age 4 after removal by surface catch. Here, age 4 population is calculated by extracting surface catch and corresponding natural mortality from OM recruitment estimates.

In many cases, reference OM estimates are used to judge credibility of various indicators. Since OM estimates incorporate all information available, they are considered to be most reliable at least for historical part, even though estimates and all indicators are mutually linked. In general, OM estimates of recruitment trend are quite robust to most of model assumptions.

Comparison with reference OM:

Fig. 2 shows comparison of indices obtained from Western Australia and Great Australian Bight GAB). Indices obtained from the same area tend to give similar pattern. All of indices from the Western Australia show concomitant patterns of ups and downs, though they tend to exaggerate low abundance like the case of 1999 cohort.

All the indices from GAB were assumed to represent age 3 abundance. Indices from GAB give more stable pattern than expected from OM, in the other words less sensitive to low recruitments. Among three indices examined, surface catch per search hours reflect general fluctuation pattern of OM reasonably well. Aerial index occasionally gives contradictory signals from OM. Due to lack of observations on 2000 and 2001 cohorts, it is not possible to assess the sensitivity of this index to low recruitments.

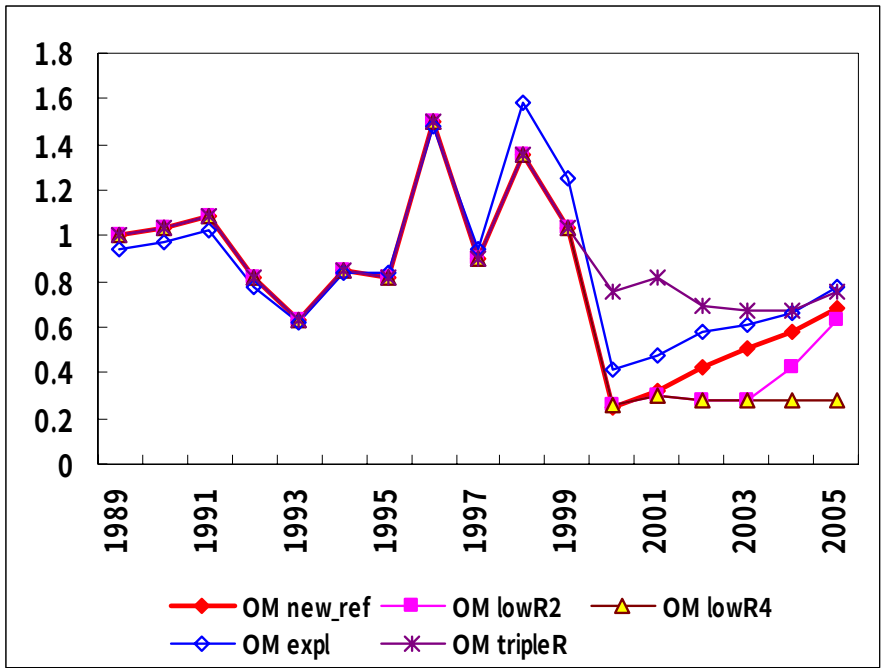
Fig. 3 shows comparison between OM estimates of age 4 and various Japanese longline CPUEs. Global nominal CPUE for age 5 shows fluctuation patterns of OM almost exactly. Global CPUE for age 3 and age 4 becomes less reflective but still shows good consistency with OM pattern. CPUE by Areas seems to carry more noises. Especially Area 8 seems to react hyper-sensitively to high abundance of juvenile, which may suggest changes in distribution pattern according to stock level. In any case, global CPUE seems to be reliable indicators of overall cohort strengths.

Comparison with five recruitment scenarios:

Fig. 4 and 5 shows comparison of various indicators with five recruitment scenarios of OM. Table 1 summarize qualitative judgment of cohort strength with various recruitment indicators. In this case, some indicators that are not able to quantified, such as length composition of catch, are also included.

Most indicators denote the 2000 cohort as the lowest, many with markedly low status. Based on this, we consider the OM estimated level for 2000 and 2001 cohorts is reasonable and reliable. Also, many indicators suggest that 2002 cohort is stronger than 2000 and 2001 cohorts and that 2001 cohort is slightly stronger than 2000 cohort. Western Australia indices indicate 2004 cohort higher than 2000-2002 cohorts. These information give a general support to recruitment estimates by reference OM.

A) Recruitment



B) Age 4 after removal of surface harvest

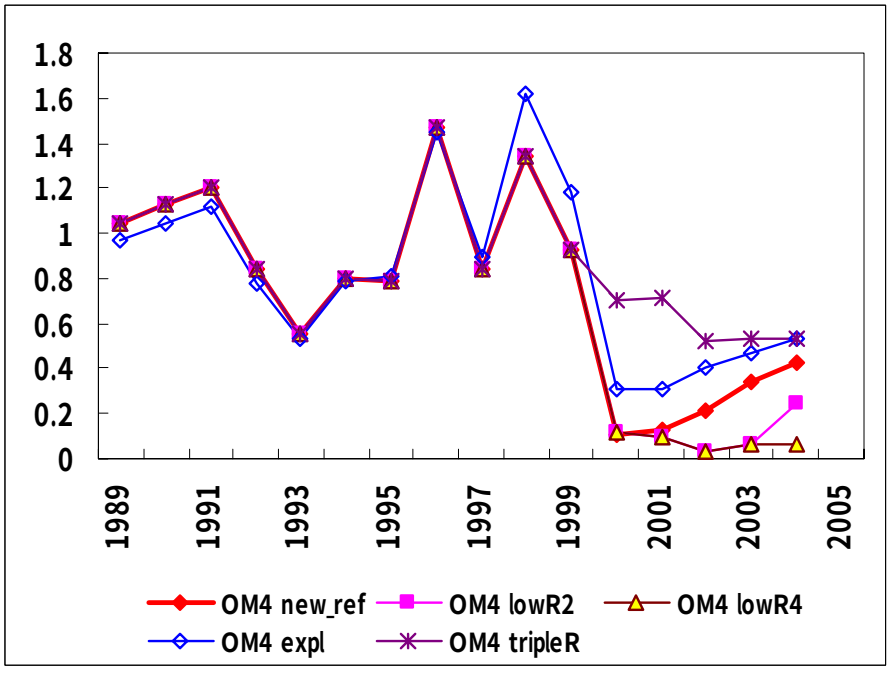
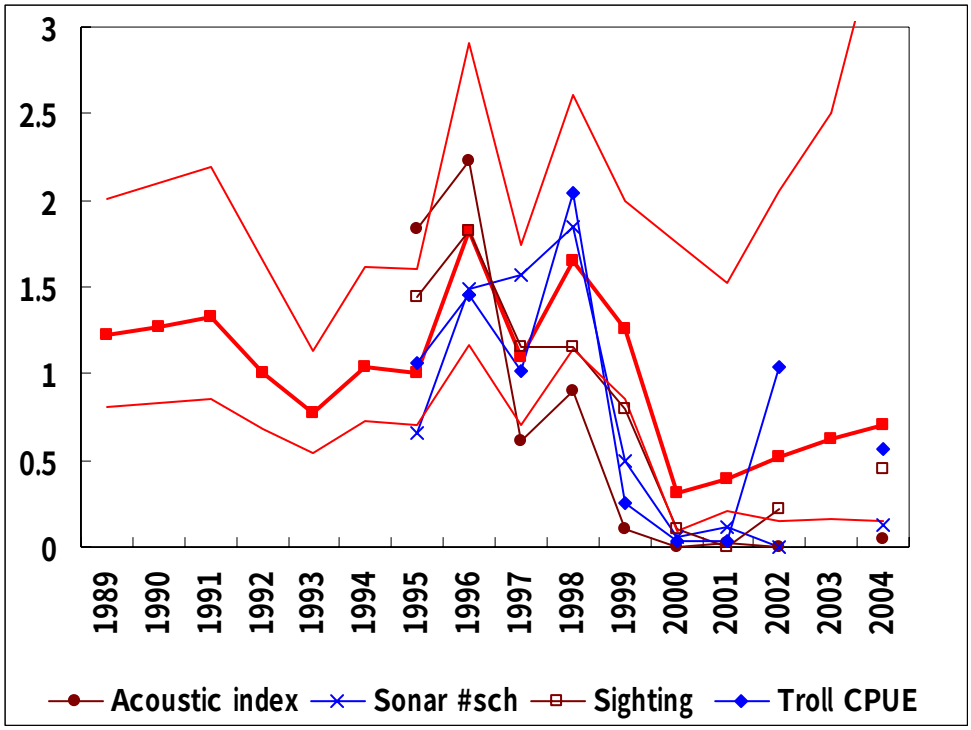


Fig. 1. Trajectories of five recruitment scenarios.

A) Indices obtained from Western Australia



B) Indices obtained from Great Australian Bight

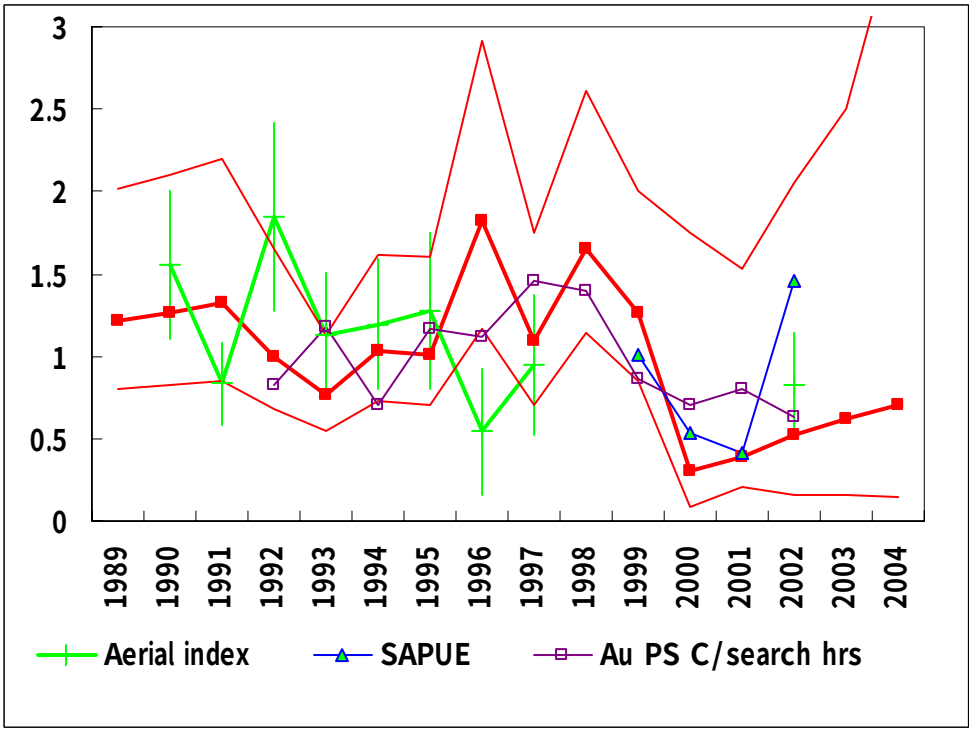
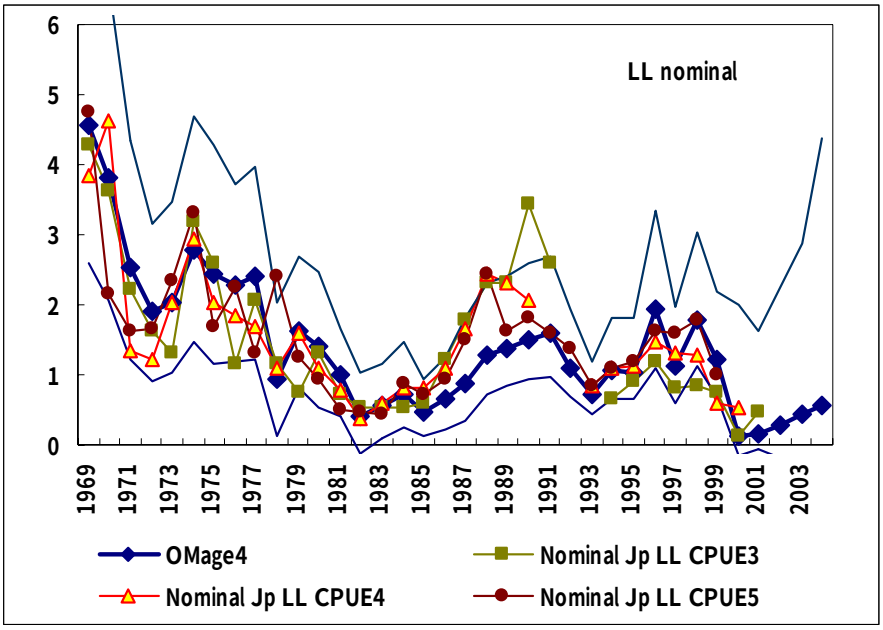


Fig. 2. Comparison of Recruitment Monitoring Indices with OM estimates.

A) Global nominal CPUE



B) Nominal CPUE in Area 7 (off Tasmania)

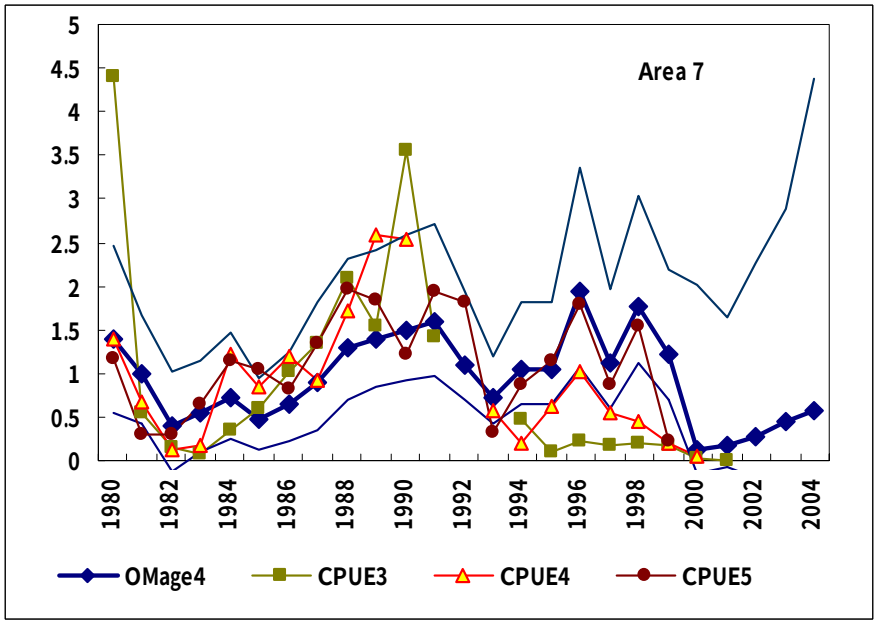
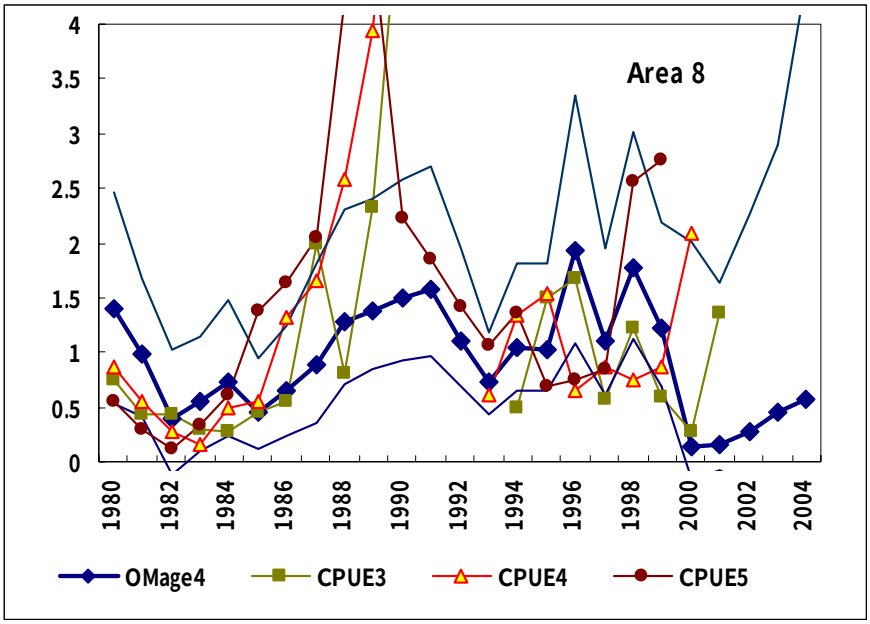


Fig. 3 Comparison of Japanese longline CPUE with OM estimates of age 4.

C) Nominal CPUE of Area 8 (mid Indian Ocean)



D) Nominal CPUE of Area 9 (off Cape)

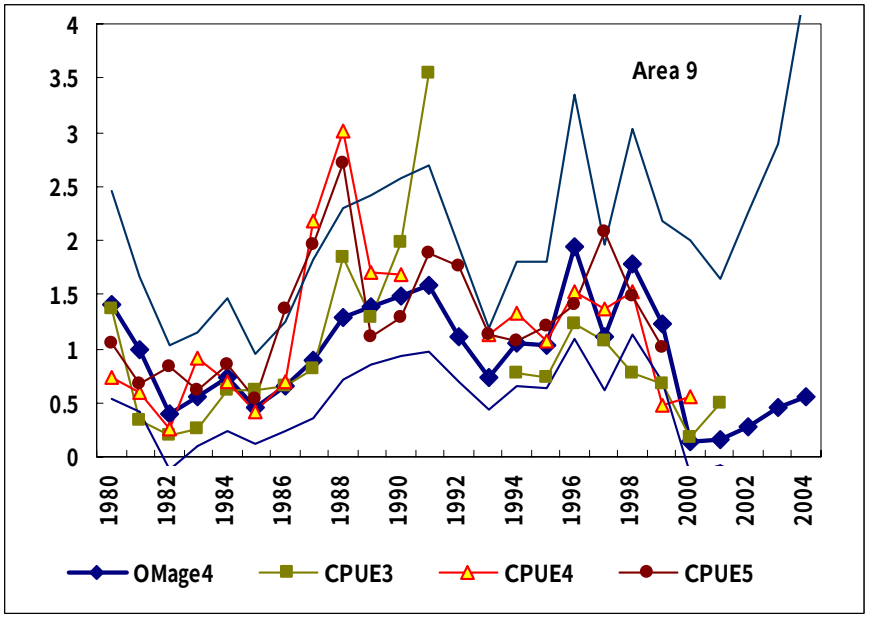
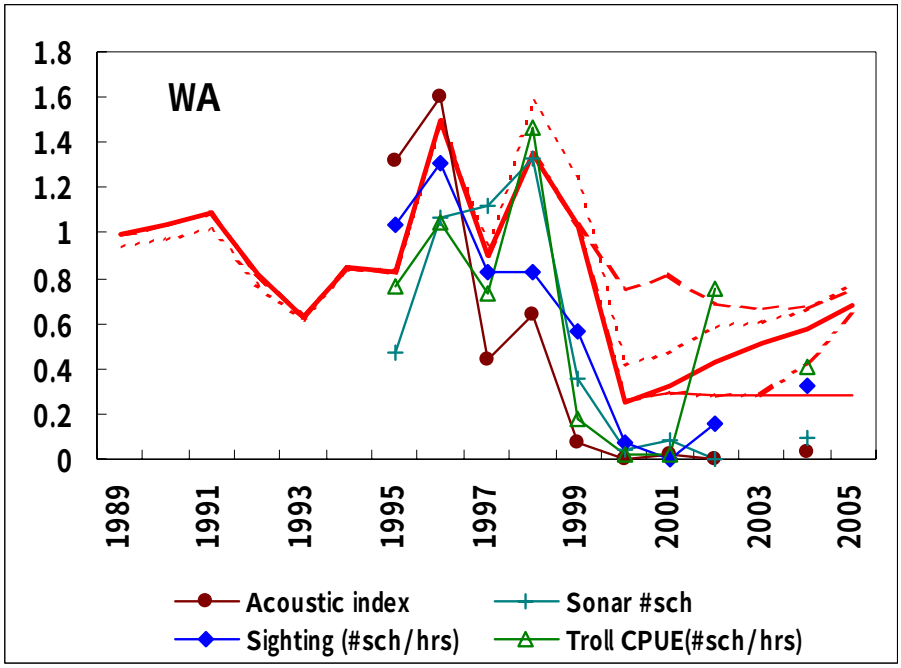


Fig. 3 Comparison of Japanese longline CPUE with OM estimates of age 4. (cont.)

A) Indices obtained from Western Australia



B) Indices obtained from Great Australian Bight.

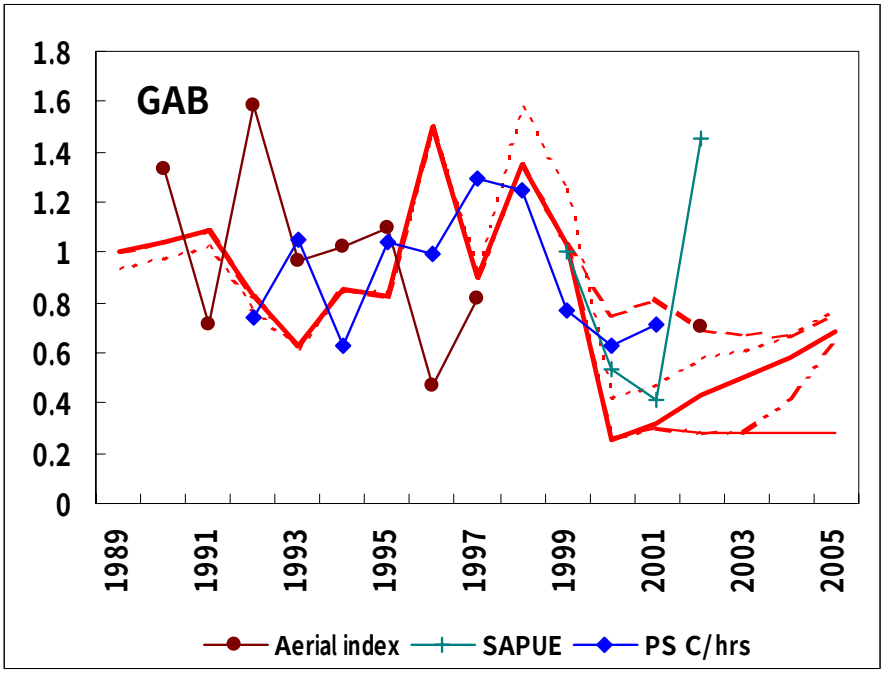


Fig. 4. Comparison of Recruitment Monitoring Indices with five recruitment scenarios of OM estimates.

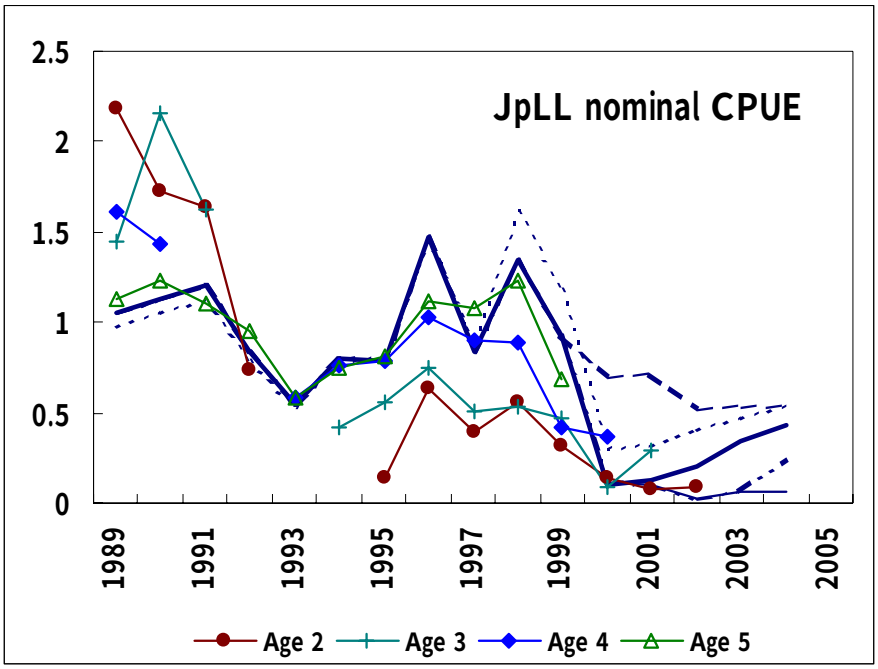


Fig. 5 Comparison of Japanese longline global nominal CPUE with five recruitment scenarios of OM estimates of age 4.

Table 1. Qualitative indication of cohort strengths obtained from various recruitment indicators.

Cohort Year	1998	1999	2000	2001	2002	2003	2004
Western Australia							
Acoustic index	M	L	EL	EL	EL	-	L
Sonar schools #	H	ML	EL	L	EL	-	L
Troll CPUE	H	L	EL	EL	M	-	ML
Sighting	M	ML	L	EL	L	-	ML
Great Australian Bight							
Aerial index	-	-	-	-	ML	-	-
SAPUE	-	M	L	L	H	-	-
PS CPUE	H	M	M	M	-	-	-
Japanese LL CPUE							
Nominal age 3	L	L	EL	L	-	-	-
Nominal age 4	M	L	L	-	-	-	-
Nominal age 5	M	ML	-	-	-	-	-
RTMP_Area 4	MH	L	EL	ML	ML	-	-
RTMP_Area 7	ML	L	EL	L	L	-	-
RTMP_Area 8	MH	L	L	M	M	-	-
RTMP_Area 9	M	L	L	M	M	-	-
Longline size composition							
NZ JV	M	L	EL	EL	-	-	-
NZ domestic	H	ML	EL	L	-	-	-
Taiwan	M	H	M or H?	M	M	-	-