

## Summary of Fisheries Indicators in 2004

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**Abstract :** Various fisheries indicators were examined to overview the current situation of SBT stock. Indices suggested stock of middle to high age-groups as stable or in a recovery trend, though many indices indicated low recruitments of at least 1999 cohort and possibly 2000 cohort. Considering the acoustic indices from Recruitment Monitoring Program suggest continuous low recruitment four years in sequence, the further careful monitoring of recruitments and serious consideration on impacts of potential low recruitments to stock management should be need with a high priority. Indices on parental stock are hard to interpret and no specific judgment was made.

**要約 :** ミナミマグロ資源現況を概観するために、各種漁業資源指数を検討した。指標からは中高齢魚資源が安定または回復傾向にあることがみられたが、多くの指標は少なくとも 1999 年級、場合によっては 2000 年級の加入が悪いことを示した。加入量モニタリング音響指数が 4 年間続けて加入が低いことを示唆していることを考えると、今後さらに慎重に加入動向をモニターすること、加入の悪化が資源管理にどのような影響を及ぼすかを鋭意検討することの 2 点が重要である。親魚資源指標は解釈が難しく、これといった判断は行わなかった。

The 2001 Scientific Committee selected a set of fisheries indicators to overview the SBT stock status. Those indicators were revised and used in 2002 and 2003 to examine whether some unexpected changes of stock status requiring full stock assessment were occurring. Also, the 3<sup>rd</sup> Meeting of Management Procedure Workshop held in April 2004 agreed to utilize every year's review of fisheries indicators to monitor whether stock stays within an expected range of Operating Model. Although a full stock assessment and mechanical update of Operating Models are expected in 2004, we consider it useful to continue an examination of fisheries indicators. This document summarizes results of updated indicators including standardized Japanese longline CPUE and our overall interpretations. It should be noted that some indicators exchanged in 2002 and 2003 were not available in this year, maybe partly due to lack of formal agreement.

## 1. Japanese longline CPUE:

### Nominal CPUE

Fig. 1 shows nominal CPUE of Japanese longline operations including those by joint-venture vessels by age-groups. The most recent year's data almost exclusively rely on the data collected through the RTMP that covers only SBT targeting vessels. When all the other vessels' data become available in the following year, the CPUE of the most recent year tends to drop slightly. However, those differences have decreased gradually according to years, and almost no

difference is found in 2001 and 2002. The RTMP covers more than 95% of efforts in SBT distributing areas in recent years.

Nominal CPUE of middle age groups, i.e. age 5-11, maintained increasing trend until 2003, while CPUE of age 3 and 4 showed substantial drop in 2003 after staying at more or less consistent level for last ten years. Caution is need for an interpretation of age 3 and age 4 CPUE in 1995 and 1996 because of direct impact of non-retention of fish smaller than 25 kg occurred in these years.

Fig. 1-2 and 1-3 show nominal CPUE of Japanese longline by cohort by age. Fig. 1-2 shows a comparison of nominal CPUE among different cohorts and Fig. 1-3 compares reduction rate by cohorts by plotting semi-logarithm scale. Overall levels of CPUE by cohort are higher for cohort recruited after 1990. The 1986-1990 cohorts showed more drastic decline than the other cohorts, probably due to targeting towards small fish in the early 1990s caused by depleted stock status of cohorts recruited pre1986 and less structured management schemes at that time. Those cohorts recruited 1990 and after show much slower decline rate, suggesting a reduced level of exploitation rates for these cohorts. Peak CPUE also shifts to age 5 for the cohorts 1990 and after. Those seem to indicate steady recovery of stock size and better management for the cohorts recruited after 1990, the year when a substantial reduction of TAC was occurred.

Fig.1-2 indicates strong correlation among those three age groups. Now, substantial drop of CPUE in 1999 and 2000 cohorts can be observed to the level of early to middle 1980s' cohorts who experienced heavy exploitation before recruiting to longline catch.

Fig. 1-4 shows size frequencies of nominal CPUE obtained from RTMP. Recent five years data are shown for comparison. Substantial reduction of fish under 115cm was detected in 2003. Now, fish under 120cm almost disappear from catch in Area 4 and 7, e.g. Australian coast. Decline of small size fish is much less distinct in Area 9, off Cape area. Those fish showing a substantial reduction correspond to the same cohort that the acoustic monitoring survey detected a drastic decline of recruitment level in 2000.

#### Standardized CPUE

Two GLM standardized CPUE indices of w0.5 (B-ratio proxy) and w0.8 (Geostat proxy) were updated using the same agreed method as described in Takahashi et al. (2001). This year's data exchange and preparation are explained in Tsuji et al. (2004). Results are shown in Fig. 1-5. Estimates of CPUE indices for 2003 (the most recent year) were based on RTMP data only not on logbook, and thus should be examined with caution (Takahashi et al. 2001). These estimates may be changed when logbook data is available the next year. The w0.5 and w0.8 series calculated for the 2002 SAG meeting, virtually same as the ones used in the 2001 stock assessment, are also included in Fig. 1-5 for comparison. Data revision in 2004 (Anon. 2004) caused differences in w0.5 and w0.8 series between 2002 and 2004. The magnitude of the differences depends on age classes and years. There are substantial differences found in trends especially for age classes, 5 and 12.

Updated w0.5 and w0.8 indices for age 3 increase from 1997 to 1999, decline in 2000, and then

moderately increase again until 2002. The indices for age 4 increase from 1997 to 2002. Both indices for 3 and 4 age classes drop substantially in 2003 to the level of mid-1980s or lower. The CPUE indices for age 5 show decreasing trends from 1996 to 1998, and then remain constant until 2000. The CPUE for age 6&7 show short-term decreases and increases during 1995-2000. Trends of CPUE for age 8-11 are gradually increasing from 1996 to 2000. The CPUE indices for age 12+ remain almost the same level from 1996 to 2000. For all age classes of 5, 6&7, 8-11, and 12+, the indices increase from 2000 to 2002, and then decline in 2003 to levels, which are still higher than (5, 6&7, 12+) or similar to (8-11) the 2000 levels.

In summary, the w0.5 and w0.8 CPUE series of all age classes show increase trends from 2000 to 2002 and declines in 2003. The extent of the declines in 2003 should be interpreted with caution because data source of CPUE calculation is different in the most recent year. This decline of CPUE in 2003 common to all age groups is not observed for nominal CPUE nor ST windows series below.

Another type of standardized CPUE, “Spatial-temporal(ST) window”, was also updated using the same method as described in Takahashi et al. (2002). Data preparation for the update this year is explained in Tsuji et al. (2004). Results are shown in Fig. 1-6, where the results for 2001 assessment are also included for comparison. Trends of the past and updated indices (normalized to the average) were very similar. The updated “ST window” increases from 2000 to 2002, and then declines in 2003, but the level of index in 2003 is still higher than the one in 2000.

## **2. Australia surface fishery:**

Fig. 2-1 and 2-2 show changes of catch per efforts and age composition of Australia surface catches. Although an interpretation of catch per efforts of surface fisheries is troublesome, both catch per shot and catch per searching hours stayed at relatively low level during the last three seasons. The proportion of age 3 fish increased in 2002 and declined again in 2003. Other than that, no strong signal was observed in age composition of surface catches.

Fig. 2-3 shows tentative estimates of F-value for surface fisheries based on conventional tag-recapture (Takahashi et al. 2004). Except 2002 with extremely low recovery, F trend shows roughly consistent pattern with catch per effort of surface fisheries shown in Fig. 2-1.

## **3. Recruitments:**

### Acoustic survey:

Acoustic survey of the Recruitment Monitoring Program is aimed to monitor changes in relative abundances of age 1 fish migrating through the survey area in the southwestern coast of Australia. Fig. 3-1 shows the results of survey shown in 2003 (Itoh and Nishida, 2003). This index represents the age 1 fish within the survey area standardized with 15 days' survey period.

The index shows a drastic decline since 2000 and stays at very low level in 2002 with a slight upturn from 2001 level, then becomes non-estimatable level because of lack of records identified as SBT with a certain estimated biomass with sonar. No field activities were made in 2003/2004 season.

As reported in the previous year, the cohort showing a drastic decline in 2000 is now available to longline fisheries and showing substantially low CPUE. If the recruitment trend detected by acoustic survey reflects the real situation, we expect four years' low recruitments to come in sequence. This can cause devastating impacts on SBT stock. The lack of age 4 fish from Japanese longline catch is a great concern, especially since the same sign was detected with the other independent indices.

#### **4. Indonesian Catch (Spawning ground fishery) :**

Fig. 4-1 shows changes of Indonesian SBT catch both in number and weight as well as catches by two age groups, age 8-16 and age 17 and older. Those are estimated by combining age frequency of catch provided from CSIRO with estimation catch in number obtained by dividing catch weight by average body weight derived from size composition of catch.

A substantial increase of catch in 2001/2002 season was mainly derived by large increase of younger age classes. Then, catches were drastically declined in 2002/2003 season without changing age composition pattern from 2001/2002. No information available to judge whether this decline reflected changes in fish abundance or changes in fishing practices. Continuing decline of the older portion of spawning stock and potentially low give some concerns.

#### **5. Overall Conclusion:**

Indicators examined generally support a view of stable recovery trend for middle to high age groups and suggest a success of management in reducing fishing mortality at least by longline fisheries except Indonesian fishery. However, many indicators examined suggested low recruitments of at least 1999 cohort and possible of 2000 cohort. Considering the acoustic indices from Recruitment Monitoring Program suggest continuous low recruitment four years in sequence, the further careful monitoring of recruitments and serious consideration on impacts of potential low recruitments to stock management should be need with a high priority. Stock status of spawners is difficult to assess: No adequate information available to interpret drastic decline of Indonesian catch and no warnings were detected from longline CPUE. Though signs do not suggest an urgent need to abandon the direction toward Management by decision rules, there is a need to keep a close watch on those warning signs.

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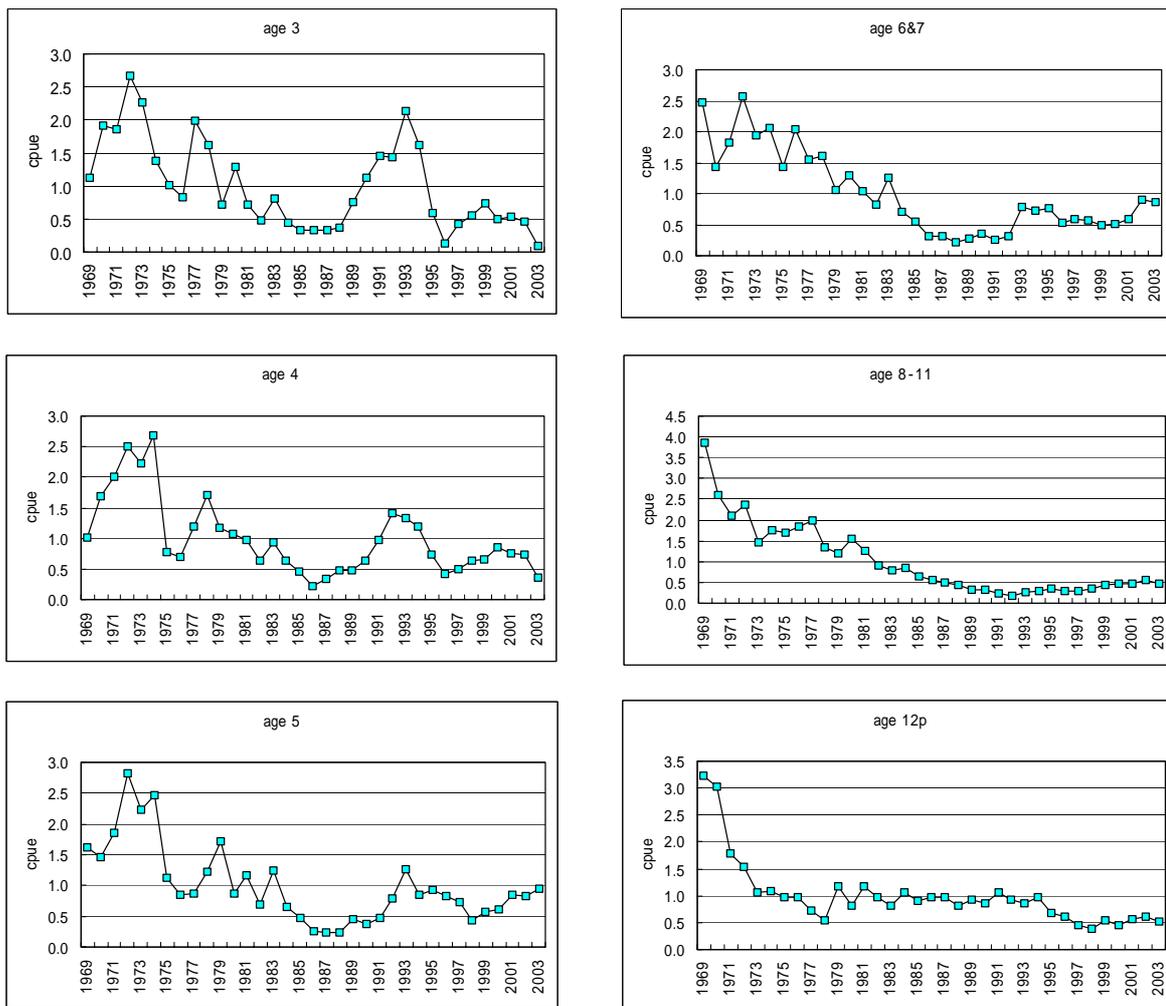


Figure 1-1. Nominal CPUE of Japanese longline by age groups.

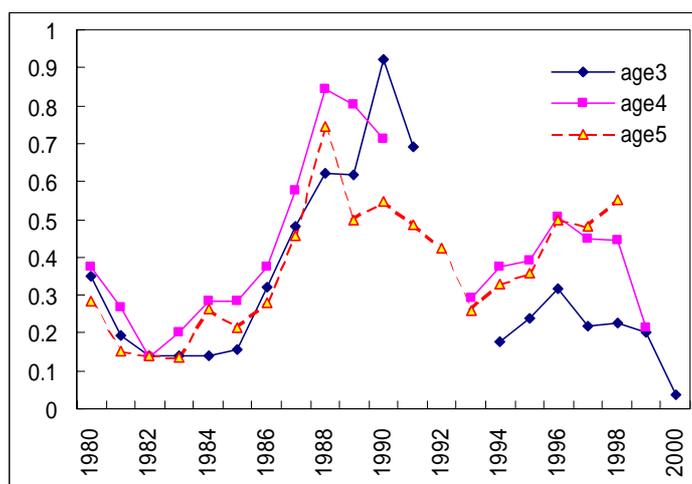


Figure 1-2. Nominal CPUE by cohorts for age 3, 4, and 5.

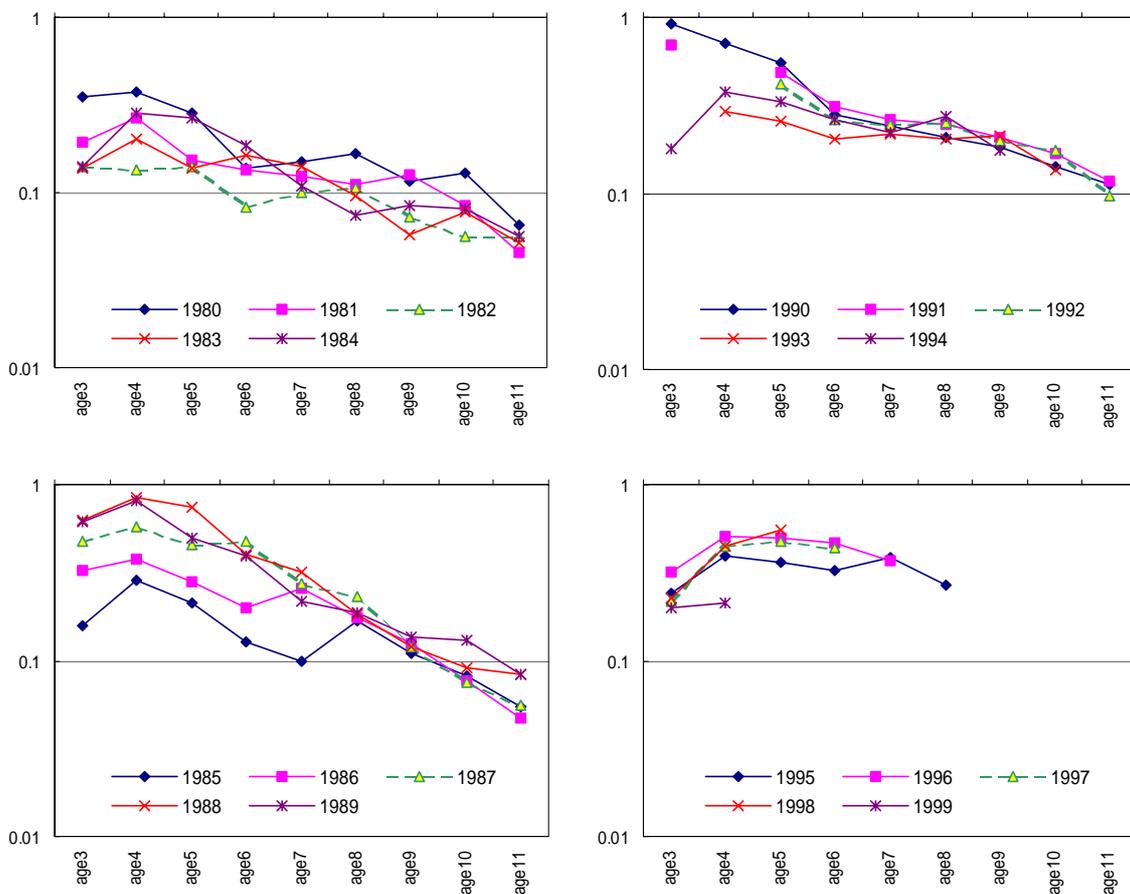
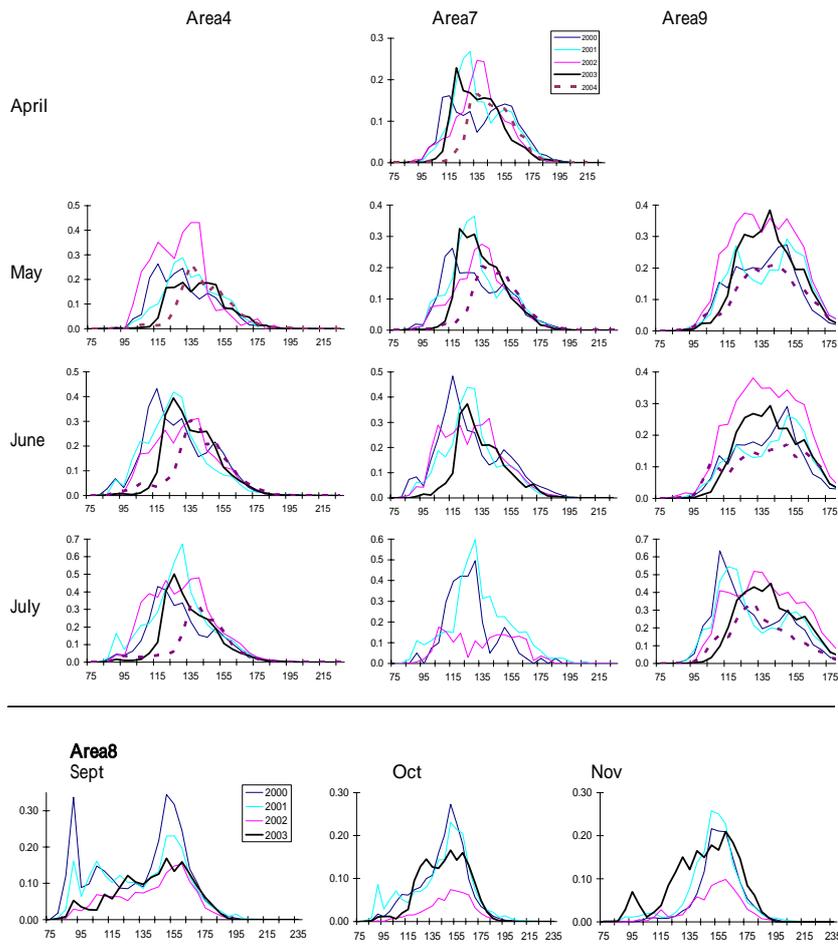
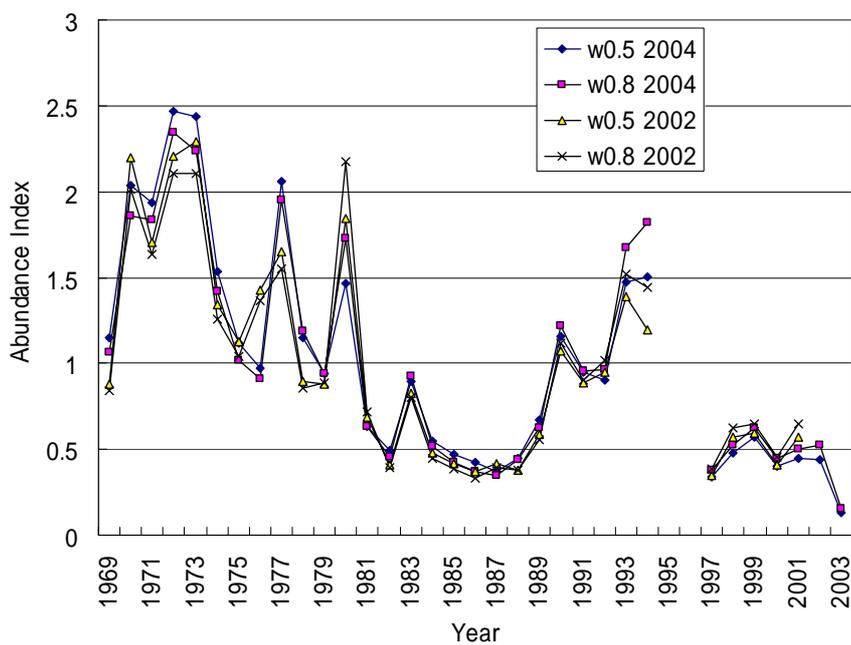


Figure 1-3. Nominal CPUE by cohorts in log-scale.



**Figure 1-4.** Size composition of nominal CPUE of RTMP data for recent five years by month and areas.

(a) Age 3



(b) Age 4

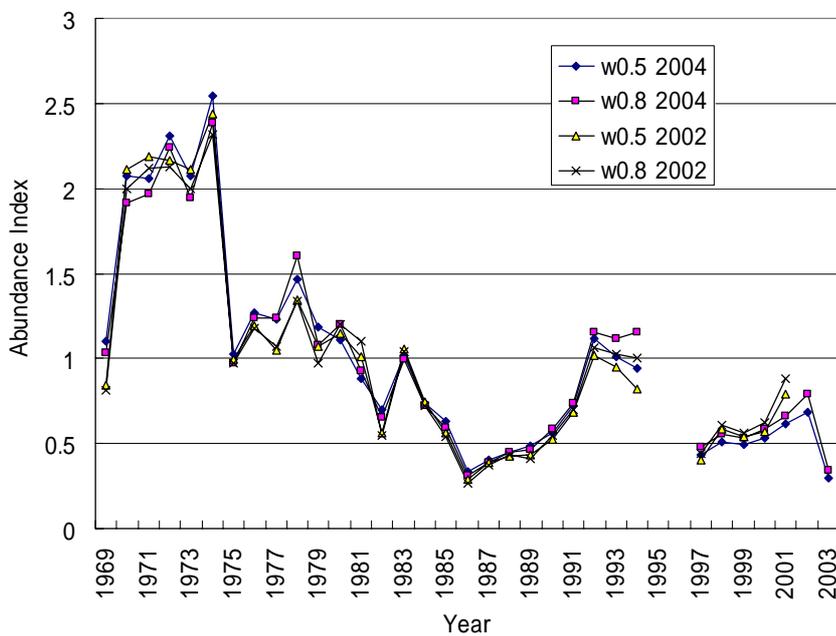
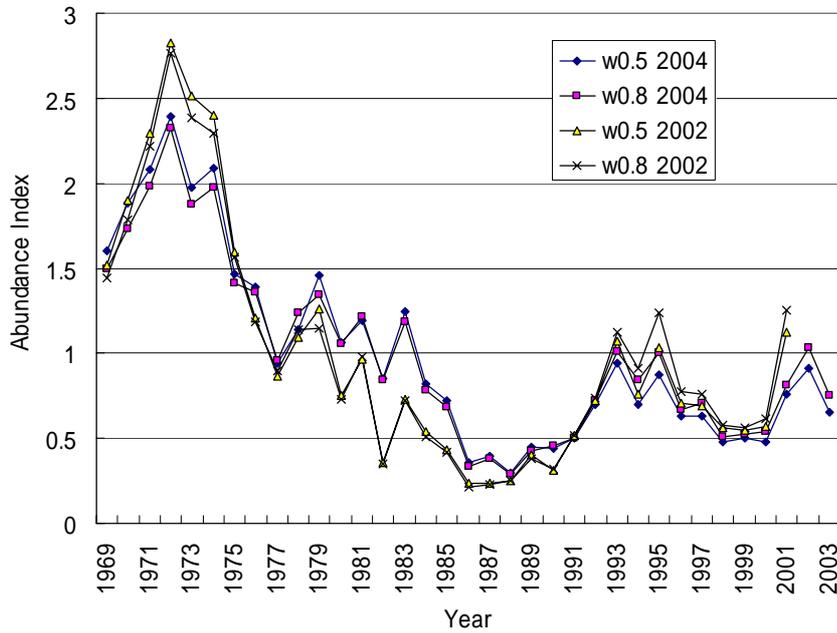


Fig. 1-5. Trends of normalized w0.5 (B-ratio proxy) and w0.8 (Geostat proxy) abundance indices, estimated from 2002 and 2004 data.

(c) Age 5



(d) Age 6&7

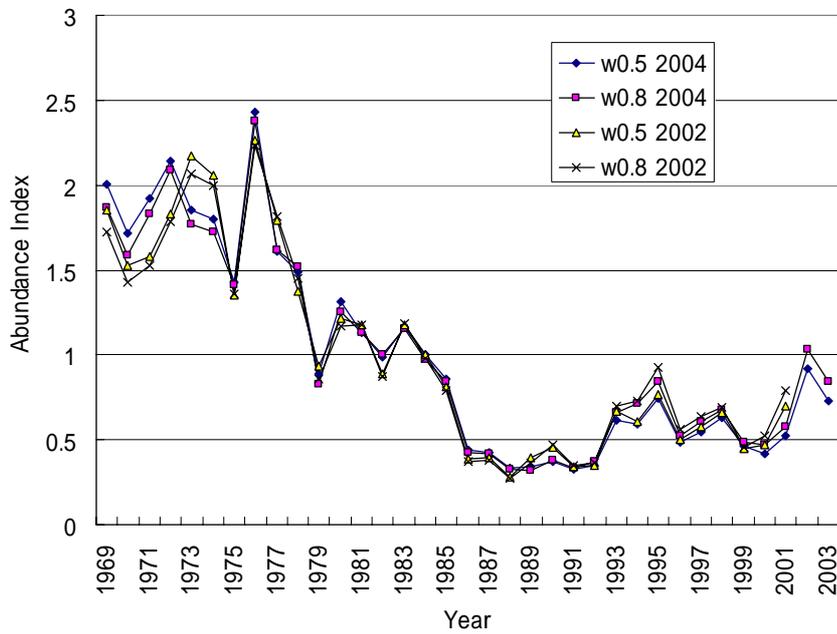
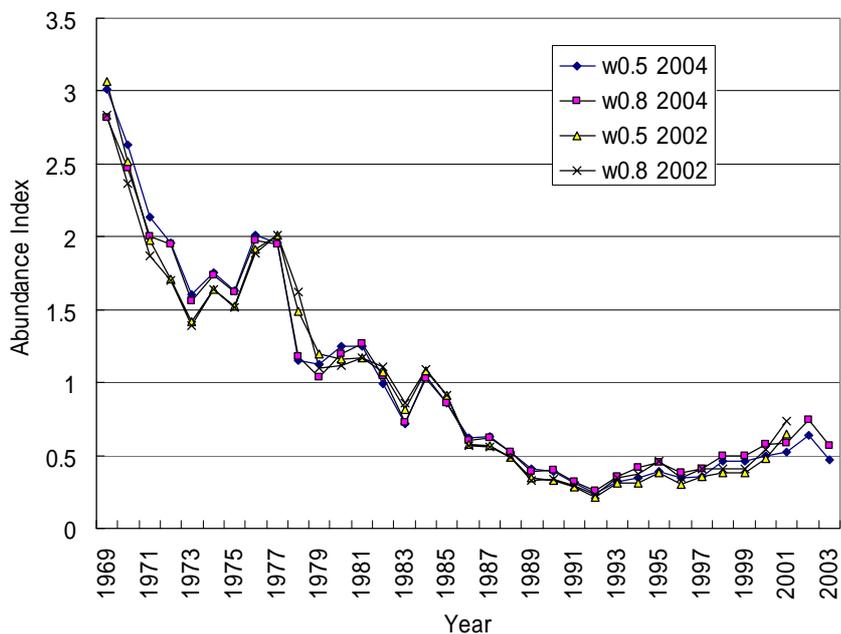


Fig. 1-5. Trends of normalized w0.5 (B-ratio proxy) and w0.8 (Geostat proxy) abundance indices, estimated from 2002 and 2004 data. (cont'd)

(e) Age 8-11



(f) Age 12+

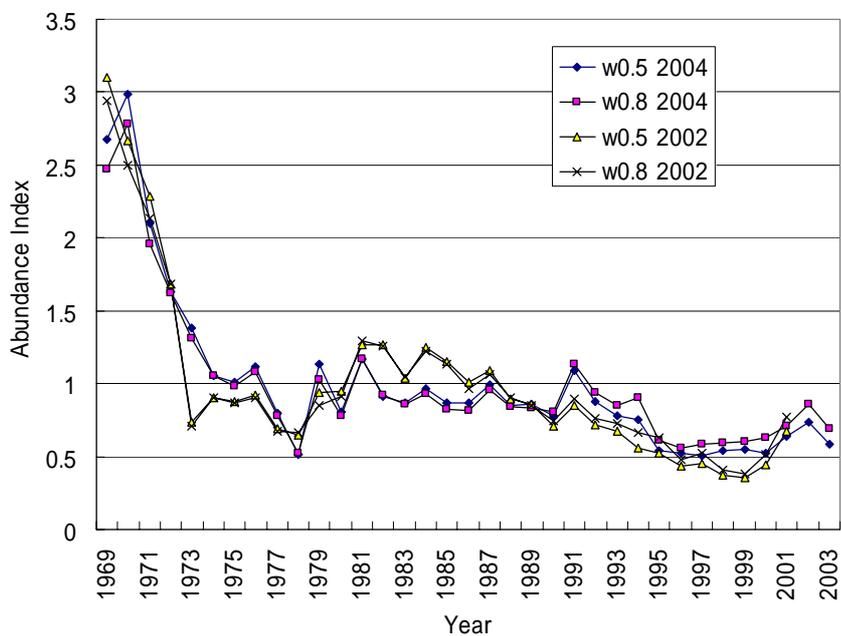


Fig. 1-5. Trends of normalized w0.5 (B-ratio proxy) and w0.8 (Geostat proxy) abundance indices, estimated from 2002 and 2004 data. (cont'd)

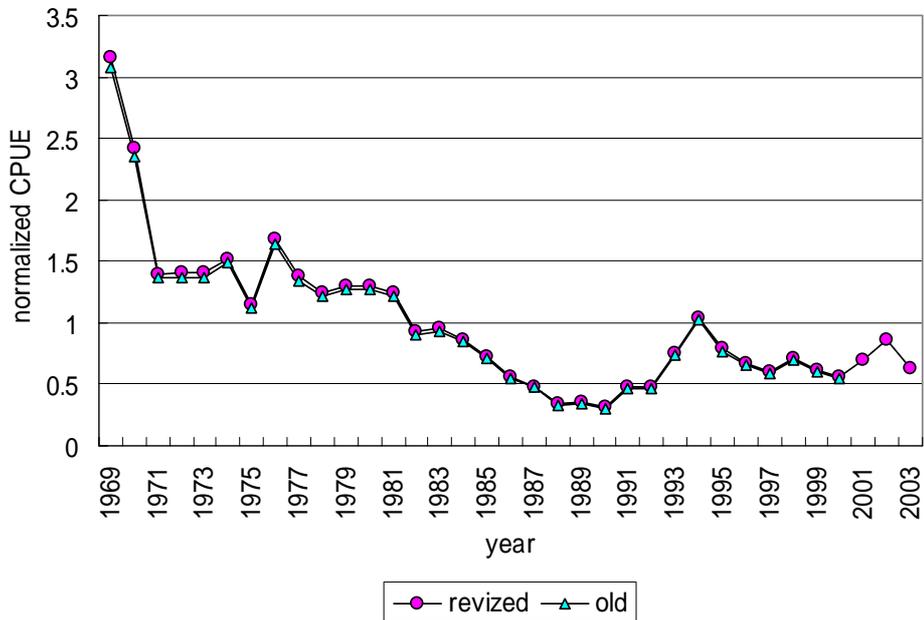


Fig. 1-6. Trends of normalized "ST Window" indices.

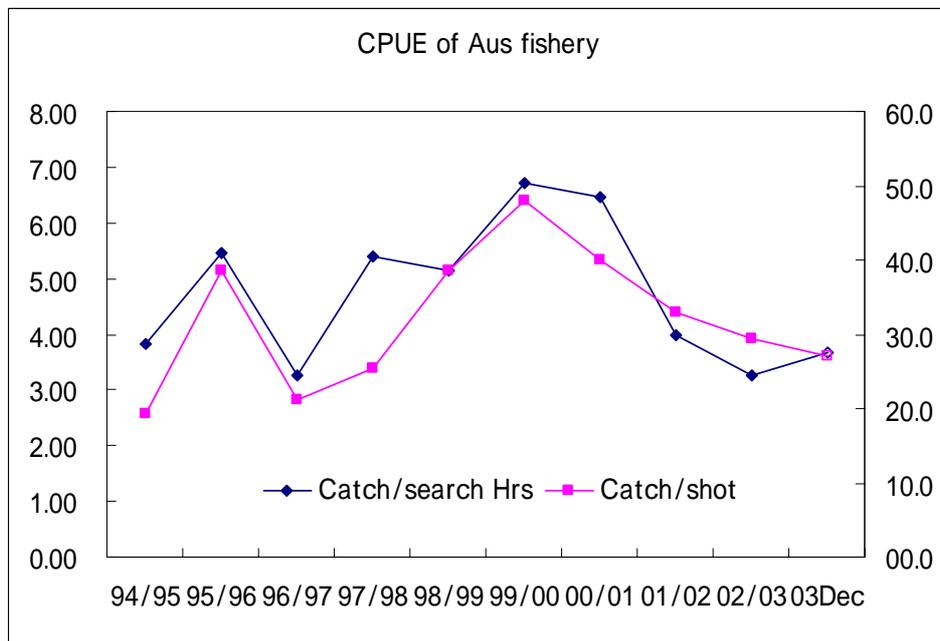


Fig. 2-1 Catch by efforts for Australia surface fishery.

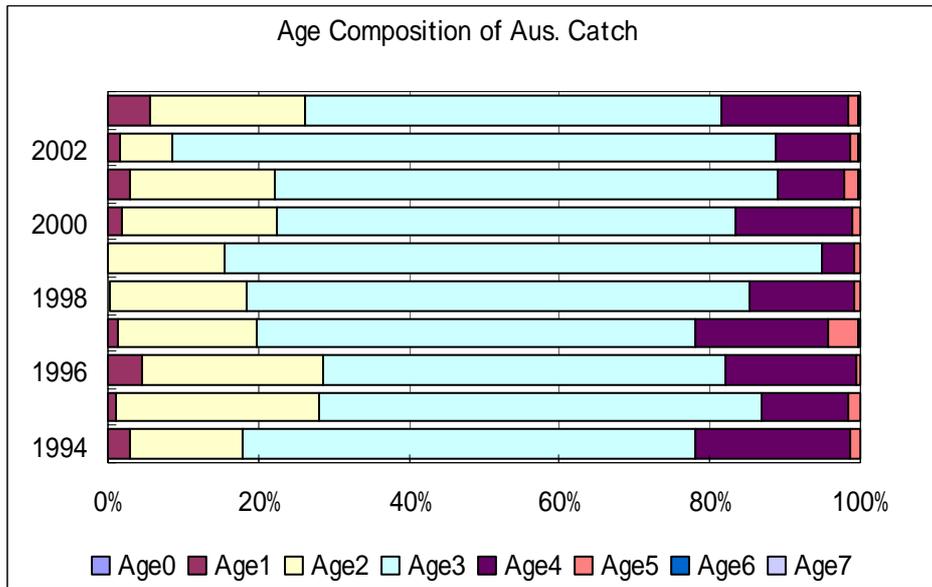


Fig. 2-2 Changes in age composition of Australia surface catches.

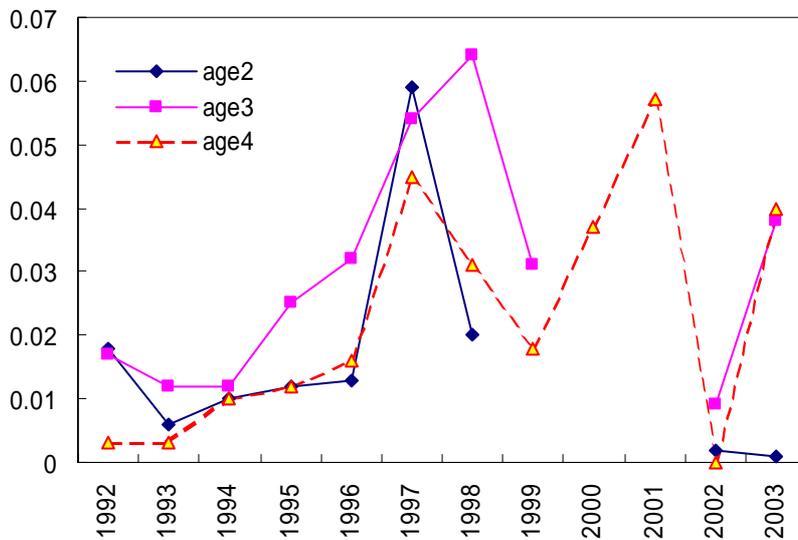


Fig. 2-3 Tentative F-estimates of surface fisheries based on conventional tag-recapture.

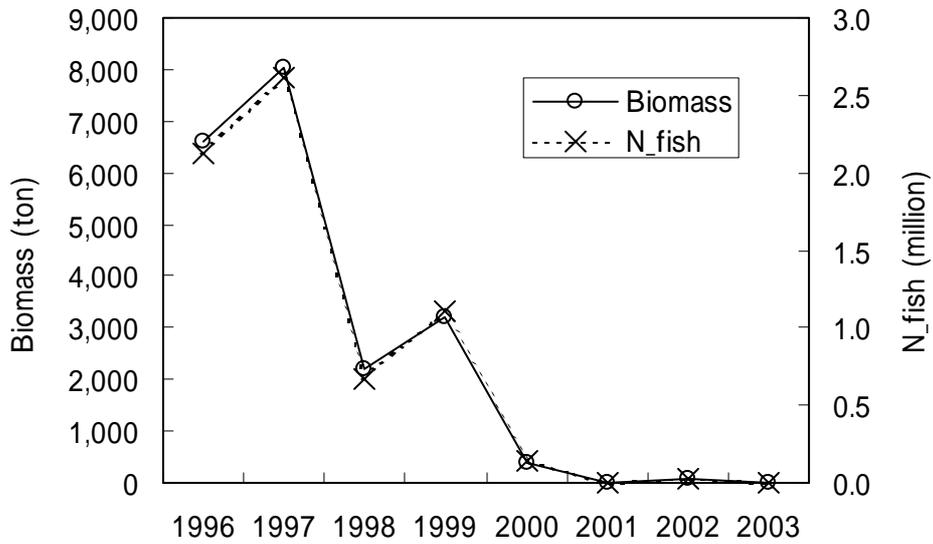


Fig. 3-1. Trends of acoustic index of age 1 SBT in the Western Australia (revised).

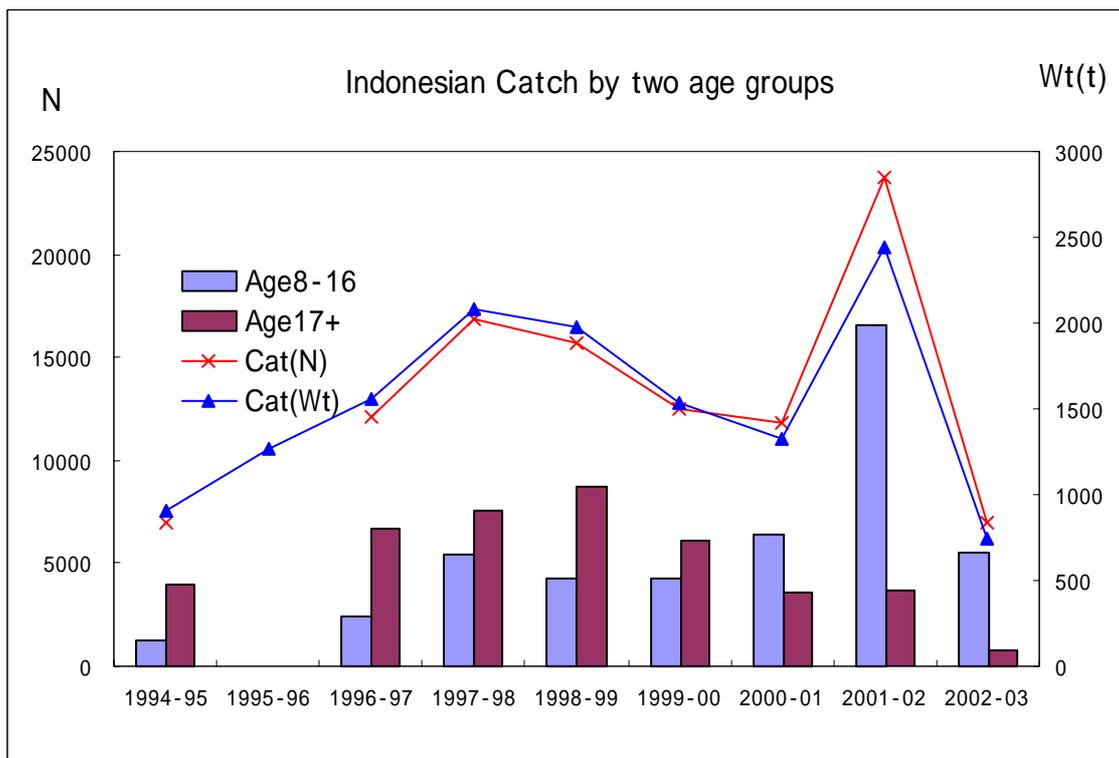


Fig. 4-1. Trends of Indonesian catches with proportion of two age groups occurrences.