(7) *Pseudupeneus prayensis*

[1] Spawning season

The gonad analysis of *Pseudupeneus prayensis* caught in the second survey (stable period: October and November, 2000) and the third survey (upwelling period: July and August, 2001) confirmed that the period from July to November is the spawning season of this species. (See Chapter 5-2-2.) The median month of spawning of this species to be used for the stock analysis is set to September.

[2] Maturity

A fish at maturity stage III (i.e., although the ovary is developed well and spawn can be seen clearly, little transparent spawn can be recognized) or higher is considered to be mature. The proportion of the fish at maturity stage III or higher was examined within the length range by age calculated from the growth equation described later. As a result, 82 % of the one-year-olds and 100% of the two-year-olds were mature. Even if the catch in the mesh selectivity test was added, three-year-old and older fish (the total length of more than 305 mm) were not found. Only the maturity rate of these one-year-old and two-year-old fish will be used for the stock analysis.

[3] Sex ratio

The sex ratios of the yearling, one-year-old and two-year-old were 0%, 50% and 41%, respectively. The sex ratios of three-year-old and older fish (with 30cm TL or larger) are unknown because those fish was not caught through out all the surveys. Since the number of investigated yearling fish is only two, the reliability of the percentage could not be judged. The sex ratio of two-year-old varied depending on the survey. From the second through fourth survey the proportion of the female at age two was 24% (N=21). However, it was 60% (N=20) at the fifth survey. Though it is possible that the proportion of the female at age two is 50%, the values shown above will be used for the stock analysis.

[4] Growth

The fitting of normal distributions to the length composition of this species caught in the second survey (stable period: October and November, 2000) could not be conducted, but the analysis shown in the table below was obtained from the third survey (upwelling period: July and August, 2001).

Results obtained from the fitting of normal distributions to the length composition (the third survey)

Age	TL(cm)	SD	Nos.(%)
1	17.9	2.235	69.7
2	22.7	2.329	30.3

The following growth equation was obtained from the results above.

$$L_t = 460\{1 - e^{-0.1875(t+1.7105)}\}$$

L_t: Total length at the age of t (mm)

t: Age

On the other hand, the age determination results obtained from the otolith described in Chapter 5-2-2 were converted into absolute age (0.08 year was subtracted in the upwelling period and 0.17 year was added in the stable period), with September, the median month of the spawning, described above, being a starting point. Thus, usable data was arranged as shown below.

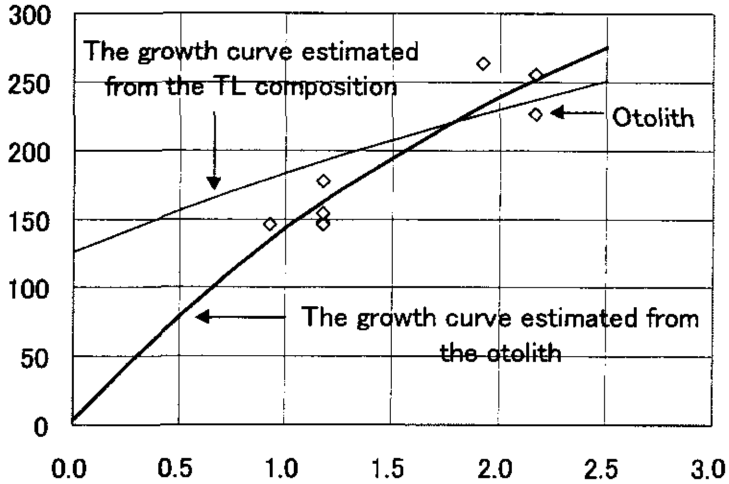
Absolute age and length (mm) organized from the reading of otolith

Age	TL	Age	TL
0.92	146	1.17	178
1.17	146	1.92	264
1.17	147	2.17	227
1.17	154	2.17	256

The growth equation estimated using the results above is shown below.

$L_t = 450\{1 - e^{-0.3750(t+0.0202)}\}$

The following figure shows the superposition of the growth curve estimated from the length composition and the age



determination results from the otolith.

The growth curve obtained from the length composition widely deviates from the otolith results, which is affected by the fact that t_0 of the growth equation is abnormally high. It is obvious that the growth curve obtained from the age of the otolith is reasonable. Consequently, the growth curve obtained from otolith will be used for the stock analysis.

[5] Natural mortality coefficient

According to Pauly's (1980) method, the natural mortality coefficient was assumed from the parameter of the growth equation and the average water temperature in the habitat, as in the case of the *Pagellus bellottii*. The natural mortality coefficient was calculated by changing the water temperature at intervals of 1°C within the range from 16 to 22°C, as in the case of the *Pagellus bellottii*. The natural mortality coefficient ranges between 0.65 and 0.75 and does not indicate wide fluctuations with the water temperature. Consequently, 0.70, a calculation value at the water temperature of 19°C, was assumed as the natural mortality coefficient.

[6] Current survival rate

The length composition of the catch in the second and third surveys was integrated in the same way as in the case of *Pagellus bellottii* and was converted into the age composition.

The results are as shown below.

Age	Ratio(%)
1	85.9
2	14.1

From this composition, assuming that the age at complete recruitment is one year old, the current survival rate was estimated in the same way as in the case of *Pagellus bellottii*. The current survival rate and exploitation rate are as shown below.

Age	Survival rate (%)	Exploitation rate (%)
1	16.4	51.2
2	16.4	51.2

[7] Estimation of stock number

The stock number was estimated in the same way as in the case of *Pagellus bellottii*. The average catch quantity for five years from 1997 through 2001 (Table 5-1-7-2), 348 tons, was used for this estimation. The median month of the fishing season is set to May, when the accumulated monthly catch quantity from the spawning month exceeds a half of the annual catch quantity.

The estimated stock number and stock biomass by age are as shown below.

Stock number and biomass by age

	Stock	
Age	Number (x1000)	Biomass (tom)
1	4,097	135
2	672	116
Total	4,770	251

As in the case of the *Sparus cseruleostictus*, the catch quantity of this species (348tons) is larger than the stock biomass (251tons). The reason is same as in the case of *S. caeruleostictus*. The stock biomass is the values at the point of the spawning month (September), while the median month of the fishing season is set to May, eight month after spawning.

[8] Stock assessment by SPR

The SPR was calculated in the same way as in the case of *Pagellus bellottii*. The results are shown below.

$SPR_{F=0}$ = 0.049 (kg)

SPR_{now} = 0.025 (kg)

%SPR = 51.6

The %SPR of this species is larger than 50, which is close to the value of *Pomadasys incisus*. In the case of this species, it is dangerous to judge that the stock is secure only from the %SPR value. Unlike *Pomadasys incisus*, this species is under a strong fishing pressure from the age of one, and a three-year-old or older individual has not been found in the catch. The %SPR is high because the natural mortality coefficient of this species of 0.70 is relatively high ($SPR_{F=0}$ is low because the survival rate at the virgin stock is low) and almost all of the one-year-old females, which are not subject to catch, become mature and spawn. The annual survival rate of 14.4% is not high enough for demersal fish. Like many other species, it is necessary to take some protective measures for *Pseudupeneus prayensis*.

(8) *Decapterus rhonchus*

[1] Spawning Seasons

Based on the gonad analysis of this species collected at the second survey (stable period: October to November 2000) and third survey (upwelling period: July to August 2001), we identified the fact that *Decapterus rhonchus* has spawning seasons at upwelling periods (see Chapter 5-2-2). Accordingly, we set July to the middle month of the spawning period for resource analysis.

[2] Maturity Rate

We regard female individuals of this species of maturity III (an ovary containing eggs has developed but transparent eggs have hardly been observed) or higher as matured individuals. We examined the rate of individuals at maturity III or higher in the range of lengths by age calculated with the growth formula described later. The results are that 30% of one-year-old individuals were at maturity III or higher. However, we could not gain data of two-year-old or older individuals of this species because all the individuals analyzed were one year old (total lengths: 187 to 274 mm). When we examined individuals whose length is 220 mm or longer, 75% or more of them were mature. From this, we estimate that two-year-old or older individuals are completely mature. Thus, our input data for resource analyses are that 30% of one-year-old individuals are mature and that all of the two-year-old or older individuals are mature.

[3] Sex Ratio

Sex ration of yearling individuals, one-year-old individuals, and two- to three-year individuals respectively accounted for 20%, 59%, and 50%. The number of yearling, one-year-old, two-year-old, and three-year-old or older individuals investigated accounted for 5, 32, 6, and 2, respectively. Since the sample of yearling and two-year-old individuals were limited, the data are poor in reliability. However, since a little more than a half (52%) of the one-year-old or older individuals were female, we adopted 50% for the resource analyses as the sex ratio throughout all ages of this species.

[4] Growth

We had no appropriate growth formula of this species until the end of the fourth survey. However, after reading ages of otoliths of the sample individuals collected at the fifth survey (upwelling period: July to August 2002), we obtained the following data to estimate a reasonable growth formula.

Absolute ages estimated by reading otoliths and lengths (cm)

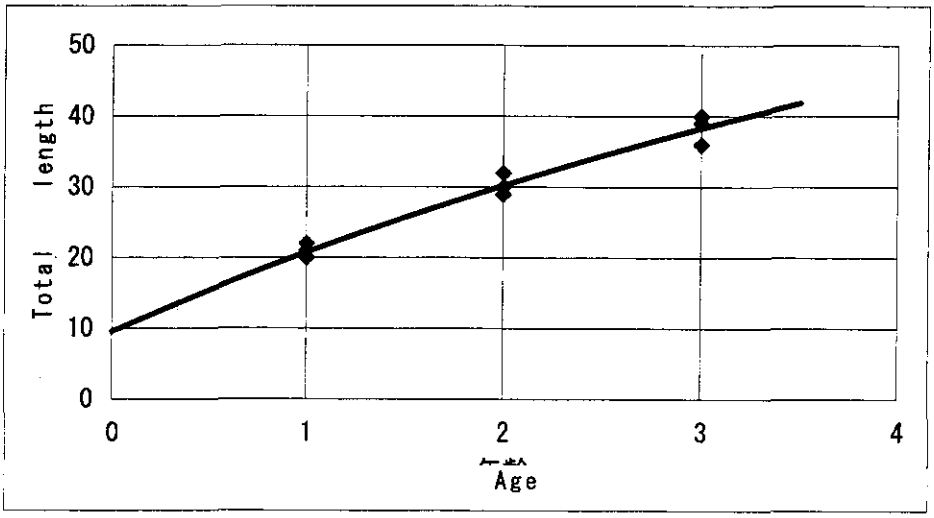
Age	Total length	Age	Total length
1.0	22	2.0	30
1.0	20	2.0	30
1.0	21	3.0	39
1.0	20	3.0	36
2.0	29	3.0	40
2.0	32		

From the above data, we obtained the following growth formula:

$$L_t = 844\{1 - e^{-0.1615(t+0.7459)}\}$$

L_t : Length (mm) at the age of t

t : Age



This growth formula was applied to our subsequent analyses.

[5] Natural Mortality Coefficient

According to Pauly's (1980) method, the natural mortality coefficient was assumed from the parameter of the growth equation and the average water temperature in the habitat, as in the case of the *Pagellus bellottii*. The natural mortality coefficient was calculated by changing the water temperature at intervals of 1°C within the range from 16 to 22°C, as in the case of the *Pagellus bellottii*. The natural mortality coefficient ranges between 0.31 and 0.36. The natural mortality coefficient does not indicate wide fluctuations with the water temperature. Consequently, 0.34, a calculation value at the water temperature of 19°C, was assumed as the natural mortality coefficient.

[6] Present Survival Rate

As we did in the case of *Pagellus bellottii*, we consolidated body length compositions of catches, which were obtained at the second and third surveys, and converted them into the age composition.

The result is as follows:

Age	Ratio(%)
0	74.3
1	22.6
2	0.0
3	0.1
4	2.9

Unlike the species we analyzed so far, the ratios of yearling individuals (less than one year old) and of one-year-old individuals of this species were extremely high. However, it is possible that the age composition of our catches of *Decapterus rhonchus* does not necessarily reflect the age composition in resources. *Decapterus rhonchus* is included in Carangidae, and should be referred to as a "semi-demersal" from the viewpoint of its behavior rather than a typical demersal species like Sparidae. It seems that a trawl net can catch young and small individuals at near the sea bottom. However, we estimate that the fishing operation with a midwater trawl net or purse-seine net at a zone shallower than the seabed is required to catch individuals grown to a certain level. (Main Japanese fishing of Carangidae also targets the midwater.) Our research also indicates that many large individuals, seemingly three years old or older (total length: about 40 cm), are observed (Table 5-2-5-1) at the market. When we add the age composition of catches at the market to our data, the number of old individuals (two-year-old or older) in the data is likely to be more than in the data obtained with a trawl net at our marine survey. As described earlier in Chapter 5-2-5(5), Monitoring technique, we will need a nation-wide data collection system in order to have a quantitative age composition of individuals (caught by Artisanal and semi-industrial fishing) at markets, which is impossible at present. Thus, since we used the data obtained so far in order to have subsequent analysis, older individuals are likely to be underestimated.

In the age composition listed earlier, the number of two- to four-year-old individuals was limited. So we put two-year-old or older individuals into one group for resource analysis, as indicated below.

Age	Ratio(%)
0	74.3
1	22.6
2+	3.1

From the age composition, we supposed that age at complete recruitment is one-year-old, and estimated present survival rates of individuals as we did in the case of *Pagellus bellottii*. However, we supposed that yearling individuals were recruited target for catches three months after spawning, namely in October. The present survival rate and exploitation rates are as follows:

Age	Survival rate (%)	Availability (%)	Exploitation rate (%)
0	25.7	93.8	60.5
1	13.5	100.0	71.8
2	13.5	100.0	71.8

However, the values of yearling individuals were obtained from individuals whose ages were within nine months ranging from three months old (recruitment) and not over one year old.

[7] Estimating Stock Numbers

We estimated stock numbers of *Decapterus rhonchus* in the same way as we did in the case of *Pagellus bellottii*. We used the annual average catch quantity of 2,950 tons during 1997 through 2001 (Table 5-1-7-2). We set the median month for fishing to January when the accumulated catch quantity from the spawning month (July) exceeds a half of the annual catch quantity.

We estimated stock number by ages and stock biomass as follows:

Stock Numbers by Ages and Stock Biomass

Age	Stock numbers (x1000)	Stock biomass (ton)
0	45,027	802
1	11,565	989
2	1,562	433
Total	58,154	2224

The stock biomass (2,224 tons) of *Decapterus rhonchus* is smaller than its catch quantity (2,950 tons). The reason is the same as the case of *S. caeruleostictus*.

[8] Stock assessment by SPR

The SPR was calculated in the same way as in the case of *Pagellus bellottii*. The results are shown below:

SPRF=0 = 0.086 (kg)

SPRnow = 0.008 (kg)

%SPR = 9.4

%SPR is lower than 10. If this value is correct, the stock condition of *Decapterus rhonchus* is quite deteriorating. However, as we described earlier, this analysis is likely to have underestimated the portion of two-year-old or older individuals in the age composition. If the portion of two-year-old or three-year-old individuals is larger than the portion used for this analysis, the survival rate will become higher than the survival rate obtained in this analysis. Accordingly, %SPR will become higher. Therefore, 9.4 of %SPR is the lowest value that we can imagine (lower limit), and the real value is expected to be a little higher.

Improving the monitoring system is an important subject in order to improve the analytical accuracy of *Decapterus rhonchus*.

(9) ***Galeoides decadactylus***

[1] Spawning season

The gonad analysis of *Galeoides decadactylus* caught in the second survey (stable period: October and November, 2000) and third survey (upwelling period: July and August, 2001) confirmed that the period from July to November is the spawning season of this species. (See Chapter 5-2-2/) Consequently, September is used for the stock analysis as the median month of the spawning of this species.

[2] Maturity

A fish at maturity stage III (i.e., although the ovary is developed well and spawn can be seen clearly, little transparent spawn can be recognized) or higher is considered to be mature. The proportion of the fish at maturity stage III or higher was examined within the length range by age calculated from the growth equation described later. As a result, it is considered that this species starts to be mature at the age of less than one. The maturity rate of the yearling fish was 17%, and 100% of the one-year-old and older fish was mature.

Note that yearling mature individuals are likely to spawn at a time close to and not over the age of one when almost one year has passed since the spawning. For example, a fish which is spawned in October may spawn in next September when it has not reached the age of one. For this reason, a fish which spawns before the age of one should be regarded and handled as a one-year-old in order to conduct the stock analysis.

The maturity rate of 100% at the age of one or older will be used for the stock analysis.

[3] Sex ratio

The sex ratio of yearling, one-year-old, two-year-old, and three-year-old is 35%, 17%, 37%, and 100%, respectively. The sex ratio at each age is unbalanced. The number of yearling, one-year-old, two-year-old, and three-year-old samples is 20, 59, 19, and 2, respectively. Females were found in large numbers in the second survey while males were caught in extremely large numbers in the third, fourth and fifth survey. To be more specific, the proportion of females to males in the second survey was 13:4 while that in the third, fourth and fifth survey was 6:34, 3:24 and 4:12, respectively. At the fifth survey, two hermaphroditic individuals (TL 286mm and 341mm) occurred. However the relationship between the unbalanced sex ratio and the hermaphroditism is not clear, it is possible that this species is protandrous. The values above will be used for the stock analysis.

[4] Growth

The fitting of normal distributions to the length composition of this species caught in the second survey (stable period: October and November, 2000) could not be conducted, but the result shown in the table below was obtained from third survey (upwelling period: July and August, 2001).

Results obtained from the fitting of normal distributions to the length composition (third survey)

Age	TL(cm)	S D	Nos.(%)
1	21.5	3.614	86.6
2	31.8	2.578	13.4

The following growth equation was obtained from the results above.

$$L_t = 705\{1 - e^{-0.2358(t+0.6219)}\}$$

L_t: Total length at the age of t (mm)

t: Age

On the other hand, the age determination results obtained from the otolith described in Chapter 5-2-2 was converted into an absolute age (0.08 year was subtracted in the upwelling period and 0.17 year was added in the stable period), with September, the median month of the spawning, described above, being a starting point. Thus, usable data was arranged as shown below.

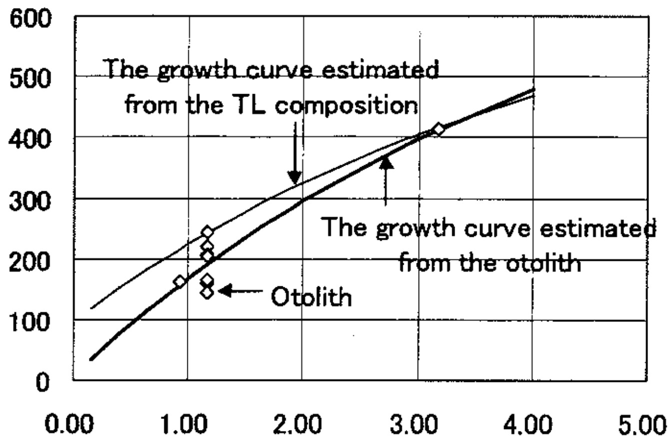
Absolute age and length (mm) organized from the reading of otolith

Age	TL	Age	TL
0.92	162	1.17	205
0.92	163	1.17	207
1.17	145	1.17	221
1.17	161	1.17	244
1.17	165	3.17	415
1.17	165		

The growth equation was estimated using the results above is shown below.

$$L_t = 801\{1 - e^{-0.2252(t+0.0407)}\}$$

The following figure shows the superposition of the growth curve estimated from the length composition and the age determination results from the otolith.



The growth curve obtained from the length composition passes the upper limit of the length of the one-year and two-year old fish and may be estimated excessively, compared to the otolith results. Naturally, the growth curve obtained from the otolith age agrees well with the otolith results.

The growth curve estimated from the otolith will be used for the stock analysis.

[5] Natural mortality coefficient

According to Pauly's (1980) method, the natural mortality coefficient was assumed from the parameter of the growth equation and the average water temperature in the habitat, as in the case of the *Pagellus bellottii*. The natural mortality coefficient was calculated by changing the water temperature at intervals of 1°C within the range from 16 to 22°C, as in the case of the *Pagellus bellottii*. The natural mortality coefficient ranges between 0.40 and 0.46. The natural mortality coefficient does not indicate wide fluctuations with the water temperature. Consequently, 0.43, a calculation value at the water temperature of 19°C, was assumed as the natural mortality coefficient.

[6] Current survival rate

The length composition of the catch in second and third surveys was integrated in the same way as in the case of *Pagellus bellottii* and was converted into the age composition.

The results are as shown below.

Age	Ratio(%)
0	10.1
1	85.2
2	4.3
3	0.4

For the reason described in "[2] Maturity", the following age composition, with the percentage of the yearling fish above added to that of the one-year-olds, will be used for the analysis.

Age	Ratio(%)
1	95.2
2	4.3
3	0.4

From this composition, assuming that the age at complete recruitment is one year old, the current survival rate was estimated in the same way as in the case of *Pagellus bellottii*.

The current survival rate and exploitation rate are as shown below.

Age	Survival rate (%)	Exploitation rate (%)
1	5.0	81.4
2	5.0	81.4
3	5.0	81.4

[7] Estimation of stock number

The stock number was estimated in the same way as in the case of *Pagellus bellottii*. The average catch quantity for five years from 1997 through 2001 (Table 5-1-7-2), 1534 tons, was used for this estimation. The median month of the fishing season is set to January, when the accumulated monthly catch quantity from the spawning month (September) reaches a half of the annual catch quantity.

The estimated stock number and stock biomass by age are as shown below.

Stock number and biomass by age

Age	Stock Number (x1000)	Biomass (ton)
1	15,297	743.4
2	758	207.8
3	38	25.5
Total	16,092	976.6

[8] Stock assessment by SPR

The SPR was calculated in the same way as in the case of *Pagellus bellottii*. The results are shown below.

$SPR_{F=0}$ = 0.361 (kg)

SPR_{now} = 0.015 (kg)

%SPR = 4.1

%SPR of this species is extremely low. Most of the stock is caught by fisheries at one-year-old and the portion which survive to two-year-old or older is very small. Since the maturity rate of one-year-old fish is 100%, which means that the fish starts to spawn at very early stage of life, the stock narrowly escapes a collapse. It is necessary to take some protective measures for this stock without delay.

(10) *Sepia officinalis*

[1] Spawning Period

We could not identify the spawning period of *Sepia officinalis* that we caught at the second (stable period: October to November 2000) and third (upwelling period: July to August 2001) surveys although we analyzed their gonad. However, we confirmed that *Sepia officinalis* has spawning periods in upwelling periods by their egg batches collected at our third survey. As is described later in the section of growth, multiple groups of spawning individuals are likely to exist. Thus we do not know spawning periods of *Sepia officinalis* other than upwelling periods.

[2] Maturity Rate

According to the analysis of the second survey (stable period: October to November 2000), the gonads of individuals collected were immature, and we could not identify their maturity rate. Similarly, since we could hardly catch female individuals at all at the third survey (upwelling period: July to August 2001), we could not identify their maturity rate. According to the Research Department of the Fisheries Agency of Japan (1989), 50% of *Sepia officinalis* in 12 to 14 cm mantle length is supposed to be matured. (The length of 100% maturity is unknown.) According to the growth formula described later, about one-year-old individuals have 12 cm of mantle length. Thus, we assumed that one-year-old individuals have 50% of maturity rate and that two-year-old or older individuals have 100% of maturity rate.

[3] Sex Ratio

We made a table of sex ratio shown below without discriminating spawning groups based on the growth formula described later. We caught a very few female individuals except for the second survey. We may estimate that the uneven distribution of female individuals in upwelling periods is attributable to the spawning migration to shallow sea, like golden cuttlefishes. However, this assumption cannot explain the uneven distribution in stable periods. We may dare to assume that male and female individuals have different living areas. We conducted the present survey at the depth of 20 m or more, mostly around 40 m. According to crew members of our survey vessel, most of the *S. officinalis* caught are males. Since large-scale trawlers are banned from fishing in zones shallower than 30 m and their fishing ground is in zones deeper than 50 m, we imagine that female individuals of *S. officinalis* dwell in shallow water although we have no scientific data to prove the hypothesis. Thus, we could not analyze the reason of the uneven distribution of the sex ratio. For the resource analyses, we consolidated the data collected during the surveys and applied the values obtained by ages. In other words, the values for one-year-old, two-year-old and three-year-old stand at 24%, 12% and 13% respectively.

Sex ratios by surveys in the range of mantle lengths

(female ratio: %)

Age (mantle length: mm)	2nd survey		3rd survey		4th survey		5th survey	
	Sex ratio	Number of samples	Sex ratio	Number of samples	Sex ratio	Number of samples	Sex ratio	Number of samples
One-year-old individual (less than 120 mm)	50	18	8	26	27	81	6	16
Two-year-old individual (121 to 214 mm)	27	26	0	41	4	50	35	23
Three-year-old individual (215 to 287 mm)	50	4	4	23	0	3	17	18

[4] Growth

We could fit the normal distributions to the mantle lengths composition (mm) of the catches that we caught at the second (stable period: October to November 2000), third (upwelling period: July to August 2001), and fourth (stable period: October to November 2001) surveys.

Result of fitting normal distributions to mantle length composition (mm)

Groups	2nd survey			3rd survey			4th survey		
	Mantle length	SD	Number of individuals (%)	Mantle length	SD	Number of individuals (%)	Mantle length	SD	Number of individuals (%)
1	78	0.964	47.6	74	1.145	13.5	79	1.352	32.8
2	129	1.521	25.8	121	1.460	18.9	138	2.060	42.5
3	172	1.696	26.7	177	1.268	30.7	197	2.064	15.9
4				215	1.047	24.8	244	2.261	5.1
5				254	1.000	6.1	285	2.162	3.7
6				288	0.993	6.0			

From this result, we estimate that groups 1 and 3 at the second survey, groups 1, 3, and 5 at the third survey, and groups 1, 3, and 5 at the fourth survey are the same spawning groups and that groups 2, 4, and 6 at the third survey and groups 2 and 4 at the fourth survey are another spawning groups. Accordingly, from the viewpoint of time elapse, we may explain that groups 1, 3, and 5 at the third survey (upwelling period: July to August 2001) grew to the mantle length of groups 1, 3, and 5 at the fourth survey (stable period: October to November 2001). Similarly, we may explain that groups 2 and 4 at the third survey grew to the mantle length of groups 2 and 4 at the fourth survey.

Meanwhile, we obtained the smallest individuals of *Sepia officinalis* with 26 mm in mantle length for mesh selectivity tests at the fourth survey. As described earlier, if the upwelling period is one of the spawning seasons of this species, we may imagine that individuals born in July to August grow to the aforementioned mantle length in October to November. When we adopt this hypothesis, we may estimate group 2 at the third survey is the result after an elapse of one year. Accordingly, we estimate that the age of individuals of group 1 is less than one year old. When we suppose that the age of group 1 is 0.5 year old, the absolute growth (mm) of the spawning groups of groups 1, 3, and 5 and groups 2, 4, and 6 can be arranged as follows:

Age	Groups 2, 4, 6 (3rd and 4th surveys)	Age	Groups 1, 3, 5 (3rd and 4th surveys)
1.00	121	0.50	74
1.25	138	0.75	79
2.00	215	1.50	177
2.25	244	1.75	197
3.00	288	2.50	254
		2.75	285

From this table, we can estimate that the individuals of *Sepia officinalis* consisted of two spawning groups. Based on the two spawning groups as listed in the above table for the third and fourth surveys, we estimated the following growth formulas.

Groups 1, 3 and 5: $L_t = 795\{1 - e^{-0.1562(t+0.0481)}\}$

Groups 2, 4, and 6: $L_t = 481\{1 - e^{-0.3238(t-0.1440)}\}$

L_t : Mantle length (mm) in time unit t

t : Time unit (year)

When these growth formulas are schematized, the curves of both spawning groups almost overlap until the age of three, having the identical growth rate. Accordingly, we may use either of the growth formulas. The groups have different spawning periods only. However, when we consider the maximum lengths of the formulas, the growth formula obtained from the data of groups 2, 4, and 6 (maximum length: 481 mm) seems more reasonable than the growth formula obtained from the data of groups 1, 3, and 5 (maximum length: 795 mm). Therefore, we decided to use the growth formula obtained from the data of groups 2, 4, and 6 for our subsequent analyses.

Since there is one spawning group in the upwelling period, another spawning group seem to spawn in around January judging from the supposition of the ages described above. Originally, ages should be decided from the age character. Although we examined shells of individuals, we could not read their ages. Thus, unit time in the above growth formulas is a supposition. Although we estimate the life expectancy of *Sepia officinalis* at about three years (to die at the age of about three), we need to compare the life expectancy of this species with the known life expectancy (one to two years) of Decapoda. If the above ages are lunar ages, the six groups at our third survey all fall into different spawning groups, alleging that *Sepia officinalis* has spawning periods throughout the year, which are quite unusual for the characteristics of a living creature. Thus, we may estimate the above unit time at year age. Since we cannot make further examinations at present, we should leave the unit time as a subject to be examined in the future.

In this way, when there are two or more spawning groups, we should deal with them independently in stock assessment. In other words, we should suppose that there are two species, namely the January spawning group (groups 1, 3, and 5) and the July spawning group (groups 2, 4, and 6). As is shown in Table 5-1-7-2, individuals of *Sepia officinalis* are caught throughout the year. In addition, our marine surveys caught individuals of both groups at different survey points. Thus, we estimate that the both spawning groups dwell in the same range of distributions and that, therefore, impacts on them by fisheries are also the same. Furthermore, when we consider the fact that the both spawning groups have the same growth pattern as we described earlier, their resource conditions seem not much different from each other. In this case, we may put these groups into one group to analyze their resource conditions.

Accordingly, we conveniently analyze this species as a single group that spawns in January.

[5] Natural Mortality Coefficient

According to Pauly's (1980) method, the natural mortality coefficient was assumed from the parameter of the growth equation and the average water temperature in the habitat, as in the case of the *Pagellus bellottii*. The natural mortality coefficient was calculated by changing the water temperature at intervals of 1°C within the range from 16 to 22°C, as in the case of the *Pagellus bellottii*. The natural mortality coefficient ranges between 0.58 and 0.67. The natural mortality coefficient does not indicate wide fluctuations with the water temperature. Consequently, 0.63, a calculation value at the water temperature of 19°C, was assumed as the natural mortality coefficient.

[6] Present Survival Rate

Based on the fitting of normal distributions to the mantle lengths composition at the third and fourth surveys, we took out groups 1, 3, and 5 and converted them into percentages. Weights of CPUE (catch quantity / one-hour towing) for the stable period and the upwelling period were multiplied to these percentage values and then converted into percentage values. The CPUE (average of the third and fifth surveys) for the upwelling period stood at 12.7 (kg/hour) while the CPUE (average of the second and fourth surveys) for the stable period stood at 19.5 (kg/hour).

Process of calculating the mantle length composition

	A	B	C (=A/ΣA)	D (=B/ΣB)	W1:12.7 E (=C×W1)	W2:19.5 F (=D×W2)	G (=E+F)	H (=G/ΣG)
	Number of individuals (%)		Percentage		Weighting			
Age	3rd	4th	3rd	4th	3rd	4th		
0	13.5	32.8	26.8	62.6	340.9	1220.6	1561.5	48.5
1	30.7	15.9	61.0	30.3	775.1	591.7	1366.8	42.4
2	6.1	3.7	12.1	7.1	154.0	137.7	291.7	9.1
Total	50.3	52.4	100.0	100.0	1270.0	1950.0	3220.0	100.0

The values in column H, obtained from the above formulas, indicate the age composition.

Age composition of *Sepia officinalis*

Age	Composition (%)
0	48.5
1	42.4
2	9.1

From this composition, we assumed that age at complete recruitment of this species is one-year-old. We estimated the present survival rate of *Sepia officinalis* in the same way as we did in the case of *Pagellus bellottii*. However, we estimated yearling individuals are recruited into target for catches in July, namely six months after spawning. The present survival rate, availability, and exploitation rate are as follows:

Age	Survival rate (%)	Availability (%)	Exploitation rate (%)
0	50.4	84.2	26.8
1	21.3	100.0	46.6
2	21.3	100.0	46.6

Note, however, that the values of yearling individuals are obtained from individuals within the six months after the recruitment (after six months from spawning) until becoming one year old.

[7] Estimating the Stock Number

We estimated the stock number of *Sepia officinalis* in the same way as we did in the case of *Pagellus bellottii*. We adopted the annual average catch quantity (3,033 tons) for 1997 through 2001 (Table 5-1-7-2) and set the median fishing month to July, when the accumulated catch quantity from the spawning month (January) exceeds a half of the annual catch quantity.

The stock number by ages and stock biomass are estimated as follows:

Stock number by ages and stock biomass

Age	Stock number (x1000)	Stock biomass (ton)
0	15,594	270
1	7,863	1236
3	1,678	1476
Total	25,135	2983

The catch quantity (3,033 tons) of *Sepia officinalis* also exceeds its stock biomass (2,983 tons). The reason is the same as the case of *S. caeruleostictus*.

[8] Stock Assessment in SPR

We calculated the SPR of *Sepia officinalis* in the same way as we did in the case of *Pagellus bellottii*. As we described earlier, although the maturity rate needs further examination, we assumed one-year-old or older individuals as 100% mature. The result is as follows:

$$SPR_{F=0} = 0.055 \text{ (kg)}$$
$$SPR_{now} = 0.021 \text{ (kg)}$$
$$\%SPR = 38.1$$

The %SPR is close to 40, indicating the resource is utilized effectively.

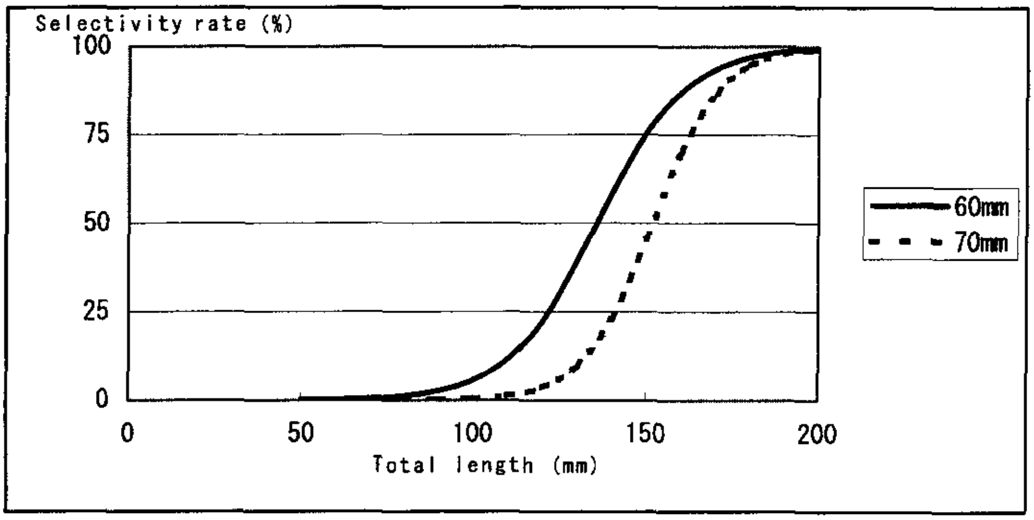
5-2-7 Forecasting Management Effects of Evaluation Target Species

We have forecasted effects of resource management based on the results of stock biomass of individual evaluation target species.

(1) Estimating a mesh selectivity curve (master curve)

The Government of Ghana supposes mesh size regulation (enlargement of mesh size) for Industrial fisheries as the major means of resource management in the future. In order to forecast quantitative effects of mesh size regulation, you need to know changes in selectivity rates when mesh sizes are changed.

This survey used two kinds of cod-end (60-mm and 70-mm) to hold mesh selectivity tests. The result (Table 5-2-3-1) allows us to depict selectivity curves of different mesh size. For example, *Pagellus bellottii* presents the following selective curve.



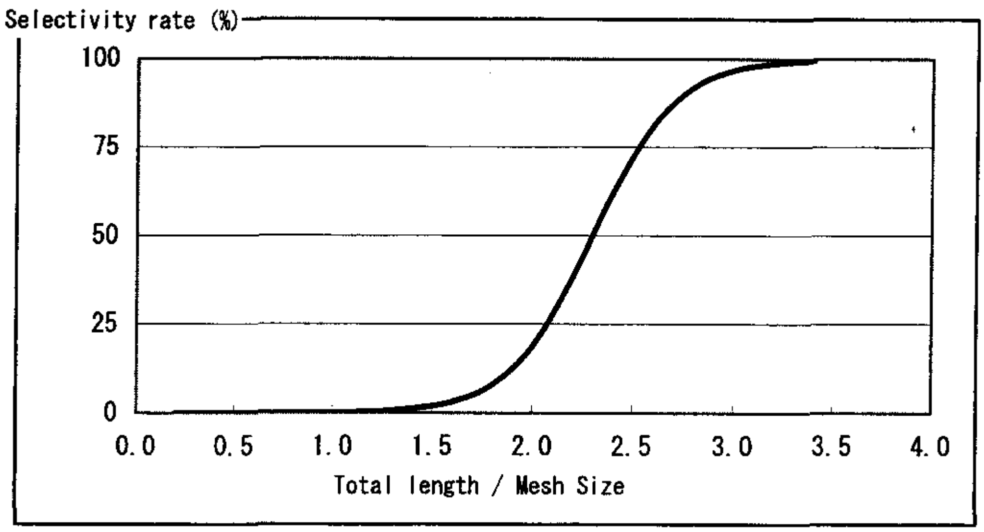
Mesh Selectivity Curve of *Pagellus bellottii*

Since these curves present only different selectivity rates for 60-mm and 70-mm mesh size they are not so good for practical use in the long run. For example, according to the "REVIEW OF AND RECOMMENDATIONS TO OPERATIONALISE MARINE FISHERIES POLICY AND MANAGEMENT PLAN FOR GHANA" (hereafter referred to as the "Review of Management Plan") of FMOC (2000), the government sets a long-term goal of changing the mesh size for trawl nets from 60 mm to 75 mm. Depending on the situation, the government may change the size from 75 mm to a larger size.

Accordingly, it will be desirable to prepare a general mesh selective curve (master curve) to estimate selectivity rates that correspond to whatever mesh size is selected within the practical range.

Usually, in a mesh selective curve, the total length is set to the horizontal coordinate while selectivity rates are plotted along the vertical coordinate. Therefore, one mesh size presents one selective curve. Meanwhile, the master curve has a horizontal coordinate in the ratios of total length divided by mesh size (total length / mesh size). By considering relative total length against mesh size, you can consolidate data of selectivity rates obtained from different mesh size (60 mm and 70 mm in this survey) and present one master curve that meet different mesh size.

Shown below is a master curve estimated for *Pagellus bellottii*.



Master curve of *Pagellus bellottii*

Master curve: S = $S=100/\{1+e^{-4.88(R-2.30)}\}$

S: Selectivity rate (%)

R: Total length (mm) / mesh size (mm)

The above example indicates 50% of selectivity rate when total length / mesh size at 2.30. In other words, 50% of selectivity rate indicates 138 mm of total length for 60 mm of mesh size (138/60 = 2.30); likewise, 161 mm of total length for 70 mm of mesh size (161/70 = 2.30); 184 mm of total length for 80 mm of mesh size (184/60 = 2.30). In this way, this curve allows you to calculate selectivity rates of arbitrary mesh size.

We have estimated nine master curves of evaluation target species except for the master curve of *Pseudotolithus senegalenis* (Chapter 5-2-2) whose data for selectivity rates could not be obtained. Our estimations are as follows:

Pagellus bellottii : $S=100/\{1+e^{-4.88(R-2.30)}\}$
Dentex canariensis : $S=100/\{1+e^{-6.70(R-2.32)}\}$
Sparus caeruleostictus : $S=100/\{1+e^{-5.44(R-1.98)}\}$
Brachydeuterus auritus : $S=100/\{1+e^{-5.39(R-1.98)}\}$
Pomadasys incisus : $S=100/\{1+e^{-4.32(R-2.21)}\}$
Pseudupeneus prayensis : $S=100/\{1+e^{-3.83(R-2.30)}\}$
Decapterus rhonchus : $S=100/\{1+e^{-2.70(R-2.54)}\}$
Galeoides decadactylus : $S=100/\{1+e^{-2.95(R-3.37)}\}$
Sepia officinalis : $S=100/\{1+e^{-28.6(R-0.878)}\}$

Figure 5-2-7-1 includes these master curves.

(2) Setting up Management Methods

The Review of Management Plan (FMOC, 2000) describes many short-term and long-term proposals for management methods of Industrial fisheries. These include mesh size regulation, setting up closed season for fishing, limit of tonnage of fishing boats, ban on import of fishing boats, and limit of fishing zones (expanding closed areas for fishing).

Among these methods, mesh size regulation and setting up closed season for fishing are direct and most effective to preserve fishery resources. For mesh size regulation, the Review of Management Plan describes that the mesh size of trawl nets should be enlarged to 75 mm from the current 60 mm. The plan also describes that three months from October through December should be closed to fishing for coming three years. If no remarkable effects are observed after the three years, then the government should halt Industrial trawl fishing fully until resources are restored.

This report classifies fisheries into two types of fisheries, namely Industrial fisheries and other fisheries (Artisanal and Semi-Industrial fisheries), where we have simulated eight patterns of management methods to forecast their effects in the future.

[1] To enlarge the mesh size to 70 mm in Industrial fisheries

[2] To enlarge the mesh size to 80 mm in Industrial fisheries

[3] To introduce a closed season for Industrial fisheries from October through December

[4] To enlarge the mesh size to 70 mm in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December

[5] To enlarge the mesh size to 80 mm in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December

[6] To introduce a closed period for all methods of fishing from October through December

[7] To enlarge the mesh size to equivalent to 70 mm for all methods of fishing

[8] To enlarge the mesh size to equivalent to 80 mm for all methods of fishing

The above [1] through [5] aims to restrict Industrial fisheries only and other methods of fishing are left as they are.

Concerning the mesh size for [1] and [2], changes in selectivity rate by age and month can be estimated from their master curve and growth formula. For example, the following tables list the selectivity rates of *Pagellus bellottii*.

Changes in Selectivity Rates of *Pagellus bellottii*
When the Mesh Size Is Set to 70 mm and 80 mm

	Age/Month	1	2	3	4	5	6	7	8	9	10	11	12
70mm	1	29	30	31	33	36	40	33	32	31	30	29	29
	2	76	81	84	87	90	92	44	49	55	61	66	72
	3	98	99	99	99	99	100	94	95	96	97	98	98
	4	100	100	100	100	100	100	100	100	100	100	100	100
	5	100	100	100	100	100	100	100	100	100	100	100	100

	Age/Month	1	2	3	4	5	6	7	8	9	10	11	12
80mm	1	10	10	11	11	12	14	14	13	12	12	11	11
	2	39	44	50	55	61	66	16	18	21	25	29	33
	3	90	92	93	94	95	96	71	75	79	83	85	88
	4	99	99	99	99	100	100	97	97	98	98	99	99
	5	100	100	100	100	100	100	100	100	100	100	100	100

These tables list changes in selectivity rates for 70 mm and 80 mm mesh size when we set selectivity rate by age and month to 100 based on the present mesh size (60 mm). For example, the value of one-year-old *Pagellus bellottii* in January is 29 for 70-mm mesh size (top left of the upper table). This indicates that the present selectivity rate will drop to 29% when the present mesh size (60 mm) is enlarged to 70 mm. Meanwhile, the selectivity rates of four- to five- year-old *Pagellus bellottii* are all set to 100 for 70 mm mesh size. Even when the mesh size is enlarged to 70 mm, the selectivity rates of four-year-old and older *Pagellus bellottii* remain the same. In other words, your catches of *Pagellus bellottii* will remain the same as they are.

Table 5-2-7-1 lists changes in selectivity rates of different species except for those of *P. senegalensis* whose data could not obtained.

As we describes in Chapter 5-1-7 (Fishing statistics), since catch quantity by other fisheries (Artisanal and Semi-industrial fisheries) accounts for a large portion of the evaluation target species caught by Ghana, controlling other fisheries, together with Industrial fisheries, will bring about a greater effect on resource conservation. This is why we have included simulations [6] through [8] in the table for reference. Simulations [7] and [8] are meant to enlarge mesh size to 70 mm and 80 mm for Industrial fisheries while selectivity rate of other fisheries are decreased to the same extent as Industrial fisheries. In other words, for the case of *P. bellottii* in simulation [7], you have to lower, by whatever means, the selectivity rates of one-year-old fish for January in other fisheries to 29% of current rate, which is the same change in selectivity rate in Industrial fisheries as listed in the above table. Fishing methods of other fisheries include trawl nets, bottom gill nets, long lines, and others. At present, we cannot specify which management method is effective to reduce the selectivity rate. This is one of the subjects that the Fishery Department of Ghana should challenge to conserve resources.

(3) Setting Unit Prices

Once resource management is enforced, fishing pressure lowers, leading to lowering catch quantity. However, when resources increase because of resource management, catch quantity will gradually increase. In other words, it will take years until resource management brings about increases in catch quantity. Decrease in catch quantity means decrease in revenues (value of gross landing) for fishermen. Even if the effect of resource management is great, it seems meaningless when fishermen cannot maintain their life due to decrease in revenues before re-enjoying increases in revenues.

Decrease in value of gross landing is not necessarily proportional to decrease in catch quantity. As we had a discussion on our fish price survey in Chapter 5-2-5(4), the unit price of large fishes tend to be higher than small fishes. For example, a 500g fish sells at a higher price than five 100g-fishes of the same kind. This means that, for example, even catch quantity decreases by 20% due to mesh size regulation or other means for concerning small fishes, value of gross landing will decrease by 10% only because small fishes account for the decrease in catch quantity.

Therefore, simulations have to forecast not only changes in catch quantity but also changes in value of gross landing. This is why we have estimated the unit price of individual evaluation target species by age and month based on the results reported in Chapter 5-2-5(4), Survey of Fish Prices.

More specifically, we have calculated unit prices of evaluation target species by calculating their average weights by age and month based on their growth formula and length-weight relation formula and then the relation formula between unit price and weight obtained in Chapter 5-2-5(4).

Table 5-2-7-2 lists their results.

(4) Future Forecast

We would like to explain forecast simulation by referring to an example of *Pagellus bellottii*.

First, divide annual catch quantity (average 7387 tons for the period from 1997 through 2001) into catch quantity of Industrial fisheries and that of other fisheries. According to the statistics of annual catch quantity (Table 2-7-2 of Data Book), the average catch quantity of Industrial fisheries (total of the "Industrial" and "Shrimpers" categories) from 1997 through 2001 stands at 750 tons. Meanwhile, the average catch quantity of other fisheries (total of the "Canoe" and "Inshore" categories) for the corresponding period stands at 6637 tons. Their ratios account for 10.2% and 89.8% respectively. Monthly catch quantity (Table 5-1-7-2) will be divided into Industrial fisheries and other fisheries at these ratios to obtain monthly catch quantity in different fishing methods.

Next, calculate weights of *Pagellus bellottii* by age and month based on its growth formula and length-weight relation formula, and then calculate the number of fishes caught by fishing method, month, and age by applying the age composition obtained in the process of estimating resource volumes. In other words, the catch quantity by fishing method and month, obtained in the earlier process, is converted into the number of fish catches, which are then subdivided into the numbers of fish catches by age. This process allows you to obtain the following data.

Present Numbers of Catches by Fishing Method, Month, and Age

Industrial

Number of fish catches (unit:1,000)

Month	1 year old	2 years old	3 years old	4 years old	5 years old	Total
1	151	450	116	30	8	756
2	212	629	163	42	11	1,057
3	90	267	69	18	5	448
4	161	478	124	32	8	802
5	139	413	107	28	7	693
6	74	219	57	15	4	368
7	356	1,058	274	71	18	1,777
8	129	383	99	26	7	644
9	78	231	60	15	4	389
10	126	374	97	25	6	629
11	230	683	177	46	12	1,148
12	239	708	183	47	12	1,190
Total	1,985	5,893	1,525	395	102	9,900

Others

Number of fish catches (unit:1,000)

Month	1 year old	2 years old	3 years old	4 years old	5 years old	Total
1	1,340	3,980	1,030	267	69	6,686
2	1,875	5,569	1,441	373	97	9,355
3	795	2,360	611	158	41	3,964
4	1,423	4,225	1,094	283	73	7,098
5	1,230	3,651	945	245	63	6,133
6	653	1,938	502	130	34	3,255
7	3,153	9,362	2,423	627	162	15,727
8	1,142	3,391	878	227	59	5,696
9	689	2,047	530	137	35	3,438
10	1,116	3,313	857	222	57	5,565
11	2,036	6,045	1,565	405	105	10,155
12	2,111	6,267	1,622	420	109	10,528
Total	17,561	52,146	13,496	3,493	904	87,601

The number of stock by age in the spawning month (July for *Pagellus bellottii*), which can be obtained from resource analysis, and the total number of fish catches in July, will allow you to calculate a fishing mortality coefficient (F) by age for July. The formulas are as follows:

$$C_{t7} = E_{t7} N_{t7}$$

$$E_{t7} = \frac{F_{t7}}{M/12 + F_{t7}} \left(1 - e^{-(M/12+F_{t7})}\right)$$

C_{t7}: Total number of t-year-old fish catches for July

E_{t7}: Exploitation rate of t-year-old fish for July

N_{t7}: Stock number of t-year-old fish for July

F_{t7}: Fishing mortality coefficient of t-year-old fish for July

M: Annual natural mortality coefficient (M/12 = monthly coefficient)

F_{t7} obtained from the above formulas, indicates a total of the fishing mortality coefficients of Industrial fisheries and those of other fisheries. Thus, F_{t7} can be divided into Industrial fisheries and other fisheries according to the ratios of the numbers of their catches. The following formula allows you to calculate the stock number for the *following month* (August) *of the spawning month.*

$$N_{t8} = N_{t7} e^{-(M/12 + F_{t7})}$$

When the stock number for August is obtained, you can calculate fishing mortality coefficient by age for August as you calculated for July.

In this way, you can calculate F by fishing method, month, and age for one year from the spawning month (July) through the subsequent 12th month (June) under the current fishing forms.

Present Fishing Mortality Coefficient by Fishing Method, Month, and Age

Industrial

Fishing mortality coefficient

Month	1 year old	2 years old	3 years old	4 years old	5 years old
1	0.0013	0.0093	0.0093	0.0093	0.0093
2	0.0019	0.0151	0.0151	0.0151	0.0151
3	0.0008	0.0074	0.0074	0.0074	0.0074
4	0.0015	0.0151	0.0151	0.0151	0.0151
5	0.0014	0.0156	0.0156	0.0156	0.0156
6	0.0008	0.0096	0.0096	0.0096	0.0096
7	0.0024	0.0118	0.0118	0.0118	0.0118
8	0.0009	0.0047	0.0047	0.0047	0.0047
9	0.0006	0.0031	0.0031	0.0031	0.0031
10	0.0009	0.0053	0.0053	0.0053	0.0053
11	0.0018	0.0107	0.0107	0.0107	0.0107
12	0.0019	0.0128	0.0128	0.0128	0.0128

Others

Fishing mortality coefficient

Month	1 year old	2 years old	3 years old	4 years old	5 years old
1	0.0113	0.0827	0.0827	0.0827	0.0827
2	0.0165	0.1340	0.1340	0.1340	0.1340
3	0.0073	0.0652	0.0652	0.0652	0.0652
4	0.0136	0.1338	0.1338	0.1338	0.1338
5	0.0122	0.1382	0.1382	0.1382	0.1382
6	0.0067	0.0853	0.0853	0.0853	0.0853
7	0.0210	0.1041	0.1041	0.1041	0.1041
8	0.0079	0.0420	0.0420	0.0420	0.0420
9	0.0050	0.0271	0.0271	0.0271	0.0271
10	0.0083	0.0469	0.0469	0.0469	0.0469
11	0.0158	0.0950	0.0950	0.0950	0.0950
12	0.0171	0.1136	0.1136	0.1136	0.1136

Changing selectivity rates by mesh size regulation or setting up a closed season for fishing is meant to change present F listed above.

For example, F of one-year-old fish of Industrial fisheries stands at 0.0013 for January. When the mesh size is changed to 70 mm, the selectivity rate falls to 29% of the current rate. Since F is proportional to the selectivity rate, F will fall to 0.00038 (0.0013 x 0.29). When the mesh size is set to 70 mm for Industrial fisheries, F by month and age will stand at as follow (F of other fisheries remain the same at present):

Fishing Mortality Coefficient by Month and Age for 70 mm Mesh Size

Industrial
Fishing mortality coefficient

Month	1 year old	2 years old	3 years old	4 years old	5 years old
1	0.0004	0.0071	0.0092	0.0093	0.0093
2	0.0006	0.0122	0.0150	0.0151	0.0151
3	0.0003	0.0062	0.0073	0.0074	0.0074
4	0.0005	0.0132	0.0150	0.0151	0.0151
5	0.0005	0.0141	0.0155	0.0156	0.0156
6	0.0003	0.0089	0.0096	0.0096	0.0096
7	0.0008	0.0052	0.0110	0.0117	0.0118
8	0.0003	0.0023	0.0045	0.0047	0.0047
9	0.0002	0.0017	0.0029	0.0031	0.0031
10	0.0003	0.0032	0.0051	0.0053	0.0053
11	0.0005	0.0071	0.0105	0.0107	0.0107
12	0.0006	0.0092	0.0126	0.0128	0.0128

Setting a closed season (October through December) for Industrial fisheries is equal to setting F for all ages during the period to 0. In this case, F by month and age for Industrial fisheries will be set to the following (F for other fisheries remain the same at present).

Fishing Mortality Coefficient by Month and Age for
a Period (October through December) Closed for Fishing

Industrial
Fishing mortality coefficient

Month	1 year old	2 years old	3 years old	4 years old	5 years old
1	0.0013	0.0093	0.0093	0.0093	0.0093
2	0.0019	0.0151	0.0151	0.0151	0.0151
3	0.0008	0.0074	0.0074	0.0074	0.0074
4	0.0015	0.0151	0.0151	0.0151	0.0151
5	0.0014	0.0156	0.0156	0.0156	0.0156
6	0.0008	0.0096	0.0096	0.0096	0.0096
7	0.0024	0.0118	0.0118	0.0118	0.0118
8	0.0009	0.0047	0.0047	0.0047	0.0047
9	0.0006	0.0031	0.0031	0.0031	0.0031
10	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.0000	0.0000	0.0000	0.0000	0.0000

In addition, when mesh size is set to 70 mm and when a closed season for Industrial fisheries (from October through December) is set, F are obtained by calculating F when the mesh size is set to 70 mm and then by setting F for October through December to 0.

Fishing Mortality Coefficient by Month and Age
for a Period (October through December) Closed for Fishing
and for 70 mm Mesh Size

Industrial

Fishing mortality coefficient

Month	1 year old	2 years old	3 years old	4 years old	5 years old
1	0.0004	0.0071	0.0092	0.0093	0.0093
2	0.0006	0.0122	0.0150	0.0151	0.0151
3	0.0003	0.0062	0.0073	0.0074	0.0074
4	0.0005	0.0132	0.0150	0.0151	0.0151
5	0.0005	0.0141	0.0155	0.0156	0.0156
6	0.0003	0.0089	0.0096	0.0096	0.0096
7	0.0008	0.0052	0.0110	0.0117	0.0118
8	0.0003	0.0023	0.0045	0.0047	0.0047
9	0.0002	0.0017	0.0029	0.0031	0.0031
10	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.0000	0.0000	0.0000	0.0000	0.0000

As shown in the above processes, forecast simulations are to calculate changes in the stock number, number of fish catches, and catch quantity.

To have accurate forecasts, you need to know reproduction relations (proportion of recruitment to adult fish volume). At present, however, no reproduction relations of species are unknown. Thus, we have assumed in our simulations that annual recruitments remain the same at present (fixed amount of recruitment). Estimating reproduction relations is very essential for accurate forecasting of resources and evaluating resources. It requires long-term resource surveys, which is a very subject for the Fisheries Department of Ghana to challenge.

If the amount of recruitment is fixed, the resource condition will be theoretically balanced after one generation when a certain control is introduced. Accordingly, further simulations above one generation do not make sense. Since the maximum age adopted in our simulations stands at seven years (*B. auritus* and *P. incisus*), we have calculated

Note: Since the relationships between adult and recruitment are unknown for evaluation target species, the numbers of recruit are assumed to be constant.

forecasts for seven years after a resource management program is introduced.

Table 5-2-7-3 lists changes in the stock number by species and changes in %SPR. In this case, we have assumed that the fishing pressure of *P. senegalensis*, whose selectivity curve could not be obtained, remains the same at present even when mesh size regulation is introduced. Accordingly, simulations Nos. 1, 2, 7, and 8, where mesh size regulation alone is introduced (no setting of a closed season for fishing), have the same stock number at present. These simulations also have the same catch quantity and values of gross landing at present, which are described later.

As represented by *P. bellottii* in Table 5-2-7-3 (1), many of the evaluation target species are caught in other fisheries (Artisanal and Semi-industrial fisheries), and Industrial fisheries accounts for a small portion of the catch quantity. Therefore, simulation Nos. 1 through 5, which aim to control Industrial fisheries only, do not bring about much increase in resources. Values of %SPR will also remain almost the same at present.

Most of *S. officinalis* is caught in Industrial fisheries. This is why a certain level of effects is observed even when only Industrial fisheries for *S. officinalis* is controlled. Next, we have examined mesh size regulation and setting up a closed season for fishing by comparing simulation No. 6 (setting up a closed season (October to December) for all methods of fishing), No. 7 (setting the mesh size to the size equivalent to 70 mm for all methods of fishing), and No. 8 (setting the mesh size to the size equivalent to 80 mm for all methods of fishing). As a result, we have found that mesh size regulation is more effective with species such as *P. bellottii, S. caeruleostictus, P. payensis, D. rhonchus*, and *G. decadactylus*. On the other hand, we have found that setting up a closed season for fishing is more effective with *S. officinalis*. The both control method are effective with other species such as *D. canariensis, B. auritus, and P. incisus* (the effect of mesh size regulation on *P. senegalensis* is unknown). From these results, we have concluded that mesh size regulation (or a control with the equivalent effect on small fishes to conserve) on all methods of fishing is more effective to conserve and increase resources.

Table 5-2-7-4 lists changes in catch quantity by different species while Figure 5-2-7-2 illustrates relative catch quantity (present catch quantity is set to 100).

For simulation Nos. 1 through 5, which control Industrial fisheries alone, catch quantity of all species, except for *S. officinalis,* in Industrial fisheries decreased while catch quantity in other fisheries increased. The total of fish catch volumes in all methods of fishing remains almost the same at present. In other words, the portion of resource fishes preserved by the introduction of Industrial fisheries control is caught by other fisheries. The total fish catch volume indicated little increase. In case of *S. officinalis,* of which Industrial fisheries catches much portion, since small cuttlefishes grown, escaped from catch due to mesh size regulation, are likely to be caught by Industrial fisheries, mesh size regulation on Industrial fisheries has brought about effects on catch quantity in Industrial fisheries. However, a closed season (October through December) for fishing is set up (simulation No. 3), catch volumes fall sharp because the catch quantity for the season account for over 30% of the annual catch quantity

For simulation Nos. 6 through 8, which introduces a uniform control into all methods of fishing, catch quantity, decreased in the first year, will recover to the original conditions in the second and third years, and since then catch quantity of most species are expected to increase. However, catch quantity of *B. auritus* and *P. incisus* do not recover to their original conditions even after seven years. This is because setting up a closed season (October trough December) for all methods of fishing and enlarging the mesh to the size equivalent to 70 mm and 80 mm are too strict in controlling these species. In other words, although resources increase, catching these species does not follow the increase. For *S. caeruleostictus* and *P. prayensis* (simulation Nos. 6 and 7), *D. rhonchus* (simulation No. 6), and *G. decadactylus* and *S. officinalis* (simulation Nos. 7 and 8), their catch quantity from the first year is likely to increase. This is because mesh size regulation or setting up a closed season for fishing has effects within the first year. *G. decadactylus* has the maximum management effect among species. When the mesh size is set to the size equivalent to 80mm in all methods of fishing (simulation No. 8), the catch volume seven years later will increase by over 60%. Among evaluation target species, the %SPR of *G. decadactylus* stands at 4.1, an extremely low value, indicating a highest degree of overfishing. Thus, it is urgent to introduce the resource management of *G. decadactylus* judging from forecasted changes in the catch quantity of *G. decadactylus*.

Table 5-2-7-5 lists changes in the value of gross landing by different species while Figure 5-2-7-3 illustrates relative values in the value of gross landing (when the present value of gross landing are set to 100).

As show in Table 5-2-7-5, data of one fishing method appear in four stages.

		Present state	1st year	2nd year	3rd year	4th year	5th year
Industrial	Value of gross landing	10,526	9,307	10,708	11,518	11,878	11,933
	Relative value	100.0	88.4	101.7	109.4	112.9	113.4
	Gap with present state	0	-1,219	182	992	1,353	1,408
	Accumulated gap	0	-1,219	-1,036	-44	1,308	2,716

The values are expressed in units of million cedis. The top stage indicates value of gross landing (value at the present state is expressed as 10526 million cedis). The second upper stage indicates relative values (when the value of the present gross landing is set to 100). For example, in the second upper stage, the value of gross landing for the first year stands at 9307 million cedis, accounting for 88.4% of the value of the present gross landing. The third upper stage indicates gaps between the value of the present gross landing and that of each year. The bottom stage indicates accumulations of the above gaps. For example, an accumulation of -1036 million cedis for until the second year is added to a gap of 992 million cedis for the third year, which totals -44 million cedis. When you start fisheries management, there are many cases where value of gross landing falls temporarily due to falls in catch quantity. When the accumulated gap turns plus, it means that the economic loss caused by the introduction of resource management is recovered (fourth year in the above example).

Note: It is assumed that the unit prices of fish do not vary depending on the change to some degree in catch quantity.

Changes in the values of gross landing tend to coincide with changes in catch quantity. However, when you compare relative values with those of the present state, increase in the values of gross landing is rather greater than the increases in catch quantity. This is because the portion of large fishes with higher unit prices increases in catches when you introduce mesh size regulation and/or when you set up a season closed to fishing. When checking values of gross landing, *G. decadactylus* seems to have the greatest effect of resource management when compared with those of the present state.

Table 5-2-7-6 and Table 5-2-7-7 respectively list changes in total catch quantity of all evaluation target species and changes in total values of gross landing. These tables contribute to comparisons of comprehensive effects by different management methods.

In the simulations other than No. 3 (setting up a closed season (October through December) for Industrial fisheries) and No. 6 (setting up a closed period (October through December) to all methods of fishing), total catch quantity in all methods of fishing increases over the present state by the seventh year since the introduction of fisheries management. Among these simulations, Nos. 1, 2, 4, and 5, which control only Industrial fisheries, have a fall in catch quantity in Industrial fisheries while other fisheries have increases in catch quantity. As a whole, catch quantity is expected to increase slightly over the present state. Nos. 7 and 8 (enlarging the mesh size to the size equivalent to 70 mm and 80 mm for all methods of fishing) forecast increases in catch quantity in Industrial fisheries and other fisheries.

When changes in the values of gross landing are checked, all of the simulations indicate an increase in total value of gross landing for all methods of fishing by the seventh year over the present state. This is because, as described earlier, portions of large fishes with higher unit prices increase in catches. However, value of gross landing for Industrial fisheries in simulations Nos. 1 through 5, which control Industrial fisheries alone, do not recover to the present state even after the seven years since fisheries management is introduced. Meanwhile, simulation Nos. 7 and 8, which carry out mesh size regulation on all methods of fishing, increase the value of gross landing for the seventh year by 10% and 20% over the present state, respectively. Industrial fisheries and other fisheries have different rates of increase in the value of gross landing. In simulation No. 8, the values of gross landing for the seventh year in Industrial fisheries increases by 12.4% over the present state while the values of gross receipt for the same year in other fisheries increases by 23.0% over the present state. This is because the composition ratio of species in the value of gross landing is different between Industrial fisheries and other fisheries as indicated in the table below.

Composition of Value of Gross Landing in Industrial fisheries
(Simulation No. 8)

Industrial	Present state	Ratio	7th year/Present state	7th year	Ratio
P. bellottii	10,526	(10.2)	1.38	14,537	(12.5)
D. canariensis	4,338	(4.2)	1.15	4,993	(4.3)
S. caeruleostictus	5,670	(5.5)	1.17	6,658	(5.7)
P. senegalensis	3,319	(3.2)	1.00	3,319	(2.9)
B. auritus	9,350	(9.0)	0.92	8,560	(7.4)
P. incisus	363	(0.4)	0.92	332	(0.3)
P. prayensis	2,870	(2.8)	1.07	3,080	(2.7)
D. rhonchus	4,740	(4.6)	1.51	7,138	(6.1)
G. decadactylus	279	(0.3)	2.05	571	(0.5)
S. officinalis	61,905	(59.9)	1.08	67,003	(57.7)
Total	103,361	(100.0)	1.12	116,192	(100.0)

Composition of Value of Gross Landing in Other Fisheries
(Simulation No.8)

Others	Present state	Ratio	7th year/Present state	7th year	Ratio
P. bellottii	93,134	(30.1)	1.38	128,627	(33.7)
D. canariensis	10,723	(3.5)	1.15	12,342	(3.2)
S. caeruleostictus	14,015	(4.5)	1.17	16,457	(4.3)
P. senegalensis	23,901	(7.7)	1.00	23,901	(6.3)
B. auritus	105,519	(34.0)	0.92	96,597	(25.3)
P. incisus	1,232	(0.4)	0.92	1,130	(0.3)
P. prayensis	2,568	(0.8)	1.07	2,756	(0.7)
D. rhonchus	29,036	(9.4)	1.51	43,721	(11.5)
G. decadactylus	24,315	(7.8)	2.05	49,850	(13.1)
S. officinalis	5,453	(1.8)	1.08	5,902	(1.5)
Total	309,897	(100.0)	1.23	381,283	(100.0)

As listed in the above tables, rates of increase in the value of gross landing of individual species are equal between Industrial fisheries and other fisheries. For example, the value of gross receipt of *P. bellottii* for the 7th year stands at 1.38 times more than the present state for Industrial fisheries and other fisheries. Likewise, that of *D. canariensis* stands at 1.15 times more than the present state for both fisheries. However, the rate of increase in the value of the seventh year gross landing of *S. officinalis*, which is a major species for Industrial fisheries, stands at 1.08 times more than the present state, a relatively low value. This is why the rate of increase in the total value of gross landing for Industrial fisheries is smaller than that of other fisheries.

When changes in the stock number, catch quantity, and value of gross landing are examined comprehensively, introducing uniform mesh size regulation on all methods of fishing (or a small fish preservation method having the equivalent effects) seems the most effective resource management.

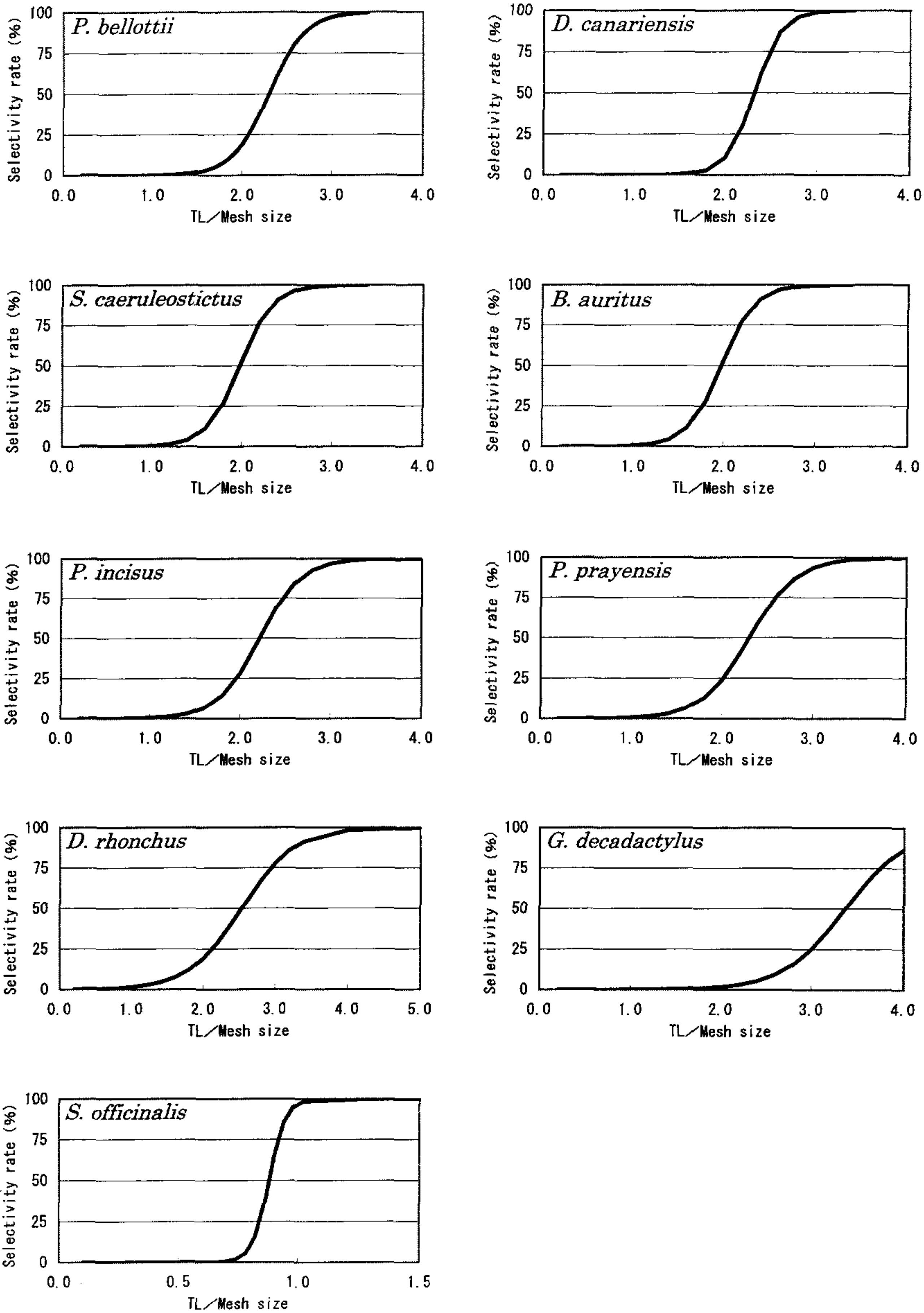
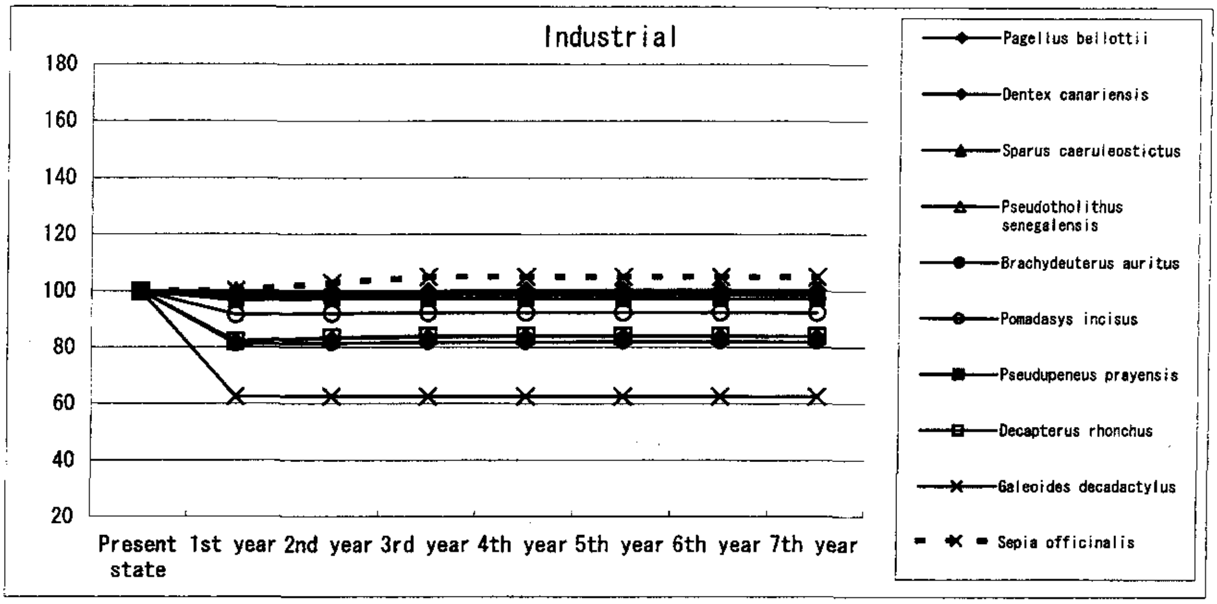
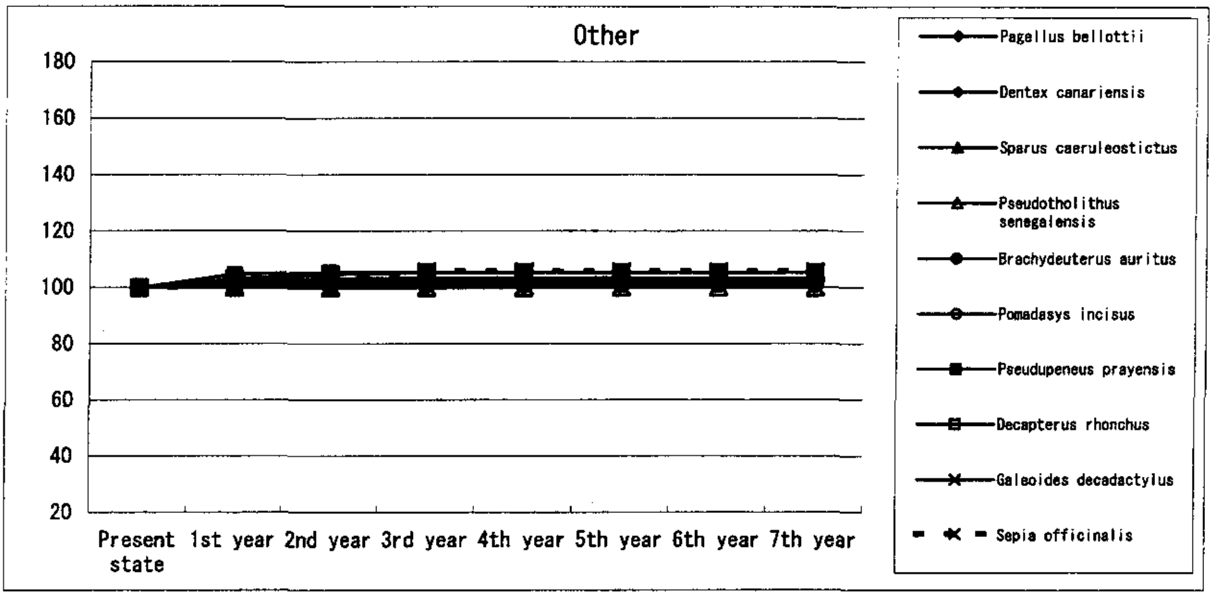


Fig. 5-2-7-1 Master curves of evaluation-target species.





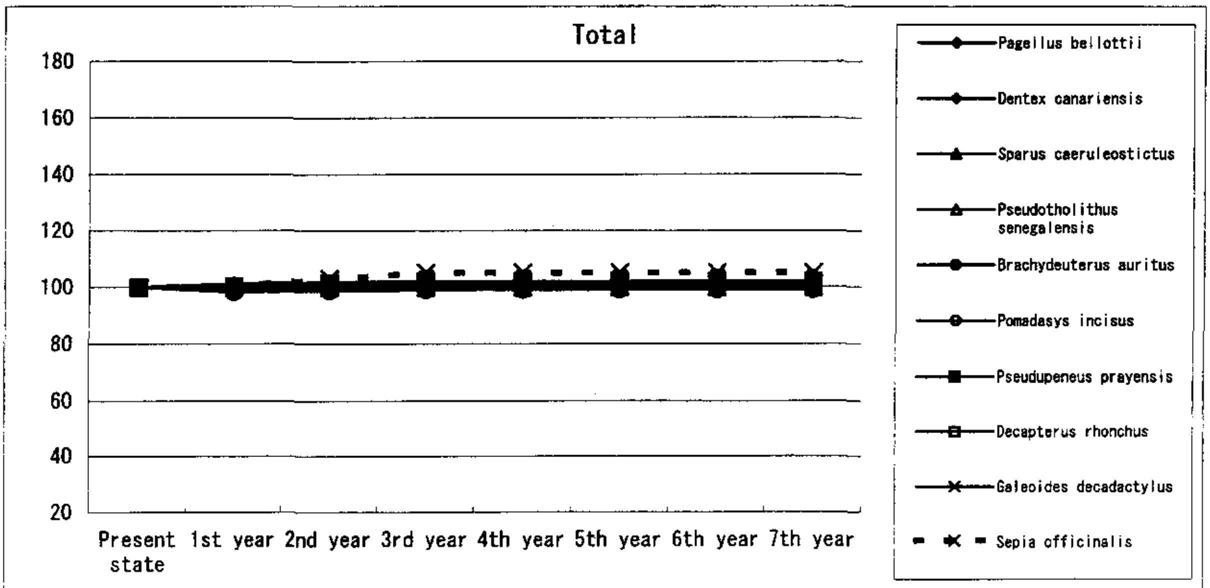
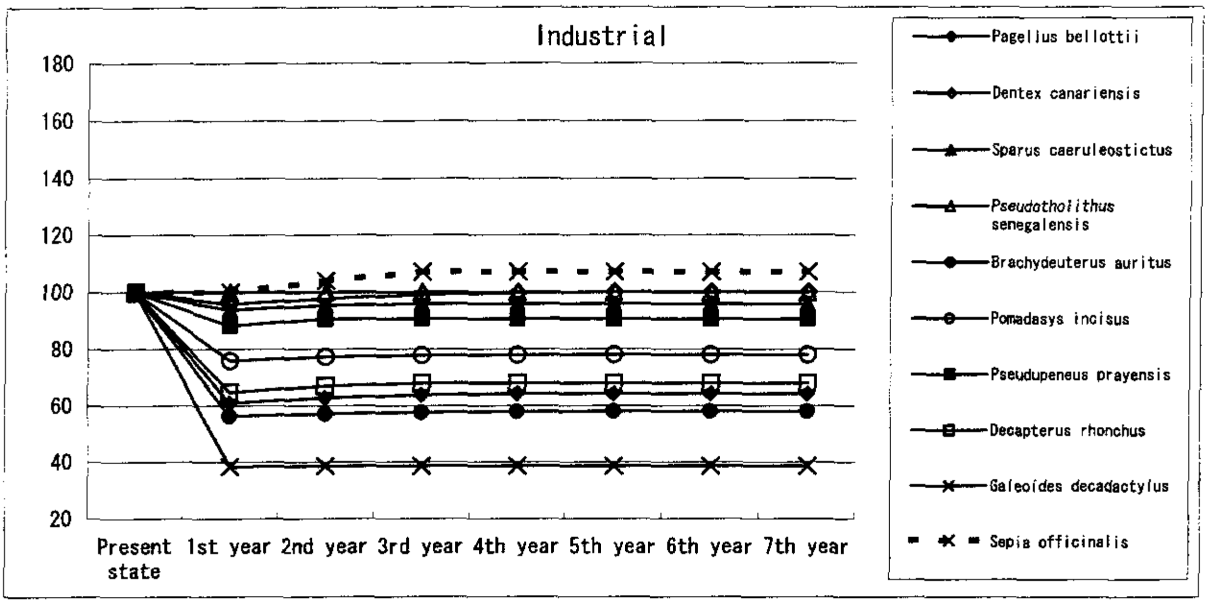
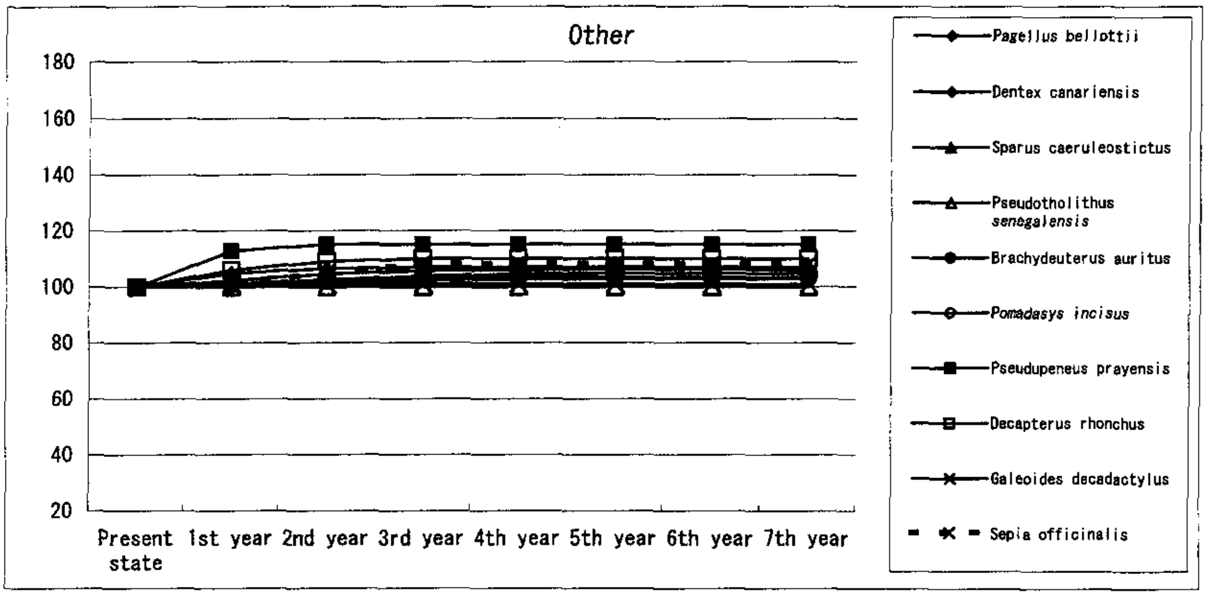


Fig. 5-2-7-2(1) Changes in the catch
(70mm mesh size regulation in Industrial fisheries)





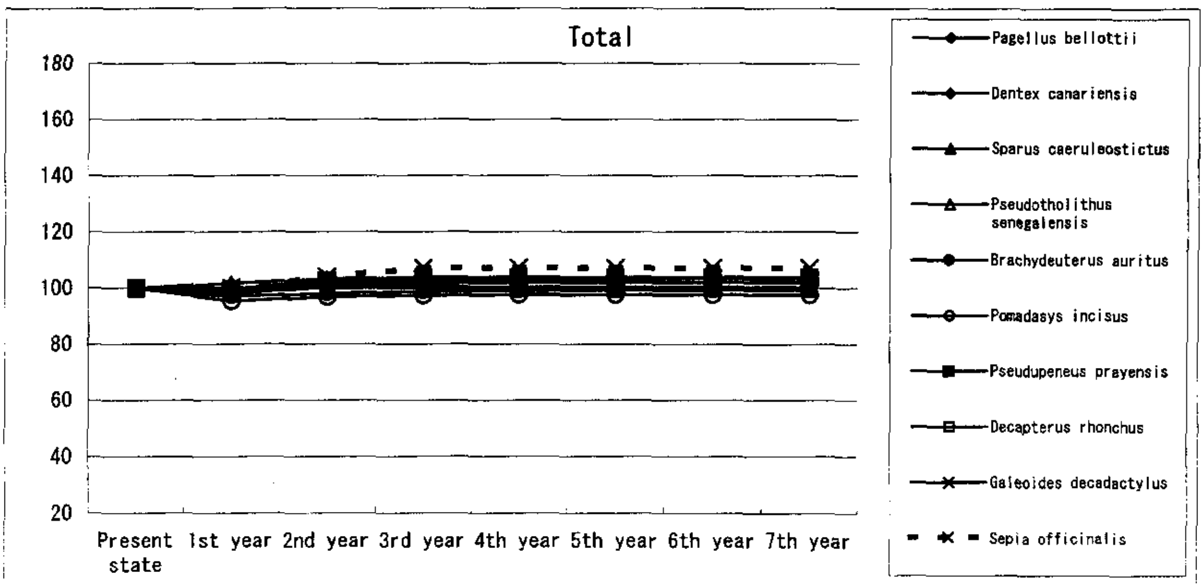
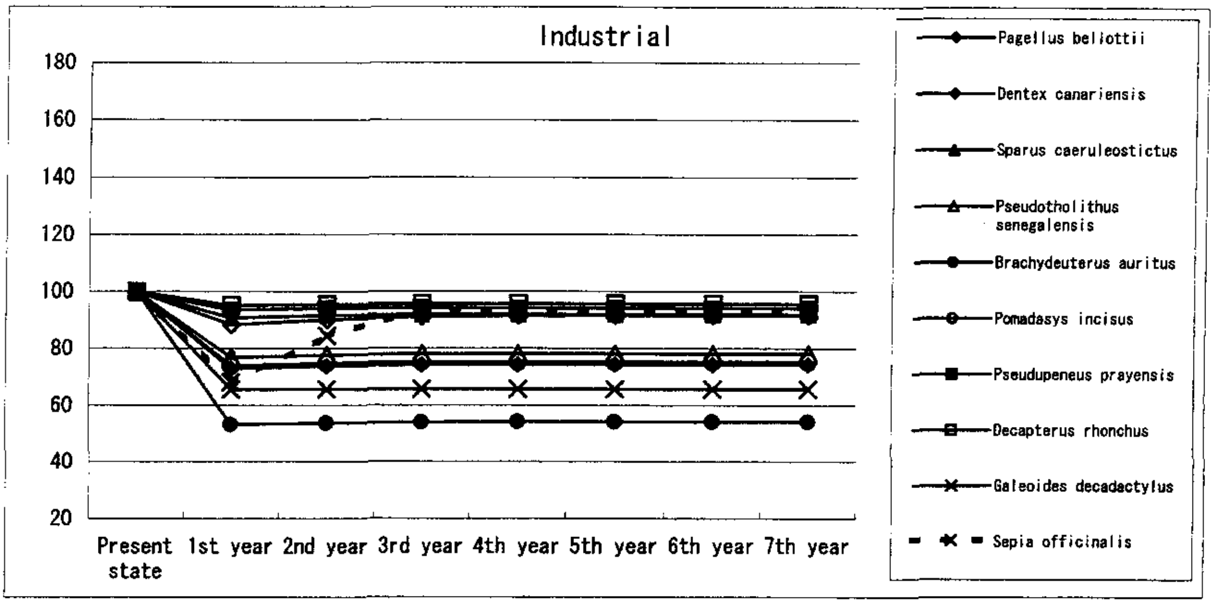
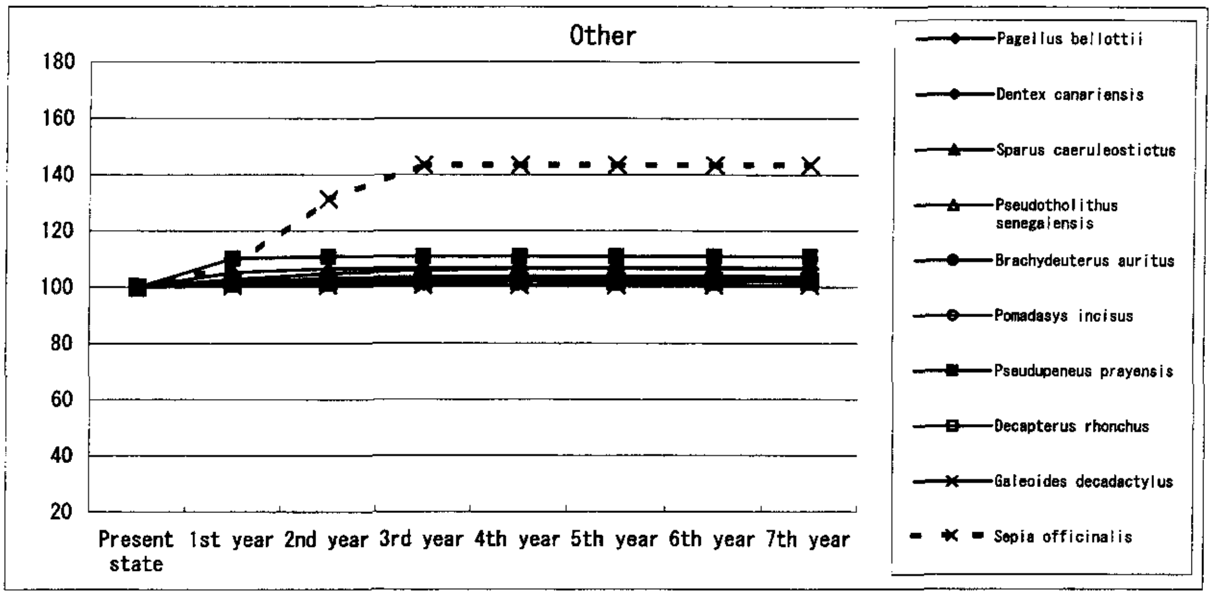


Fig. 5-2-7-2(2) Changes in the catch
(80mm mesh size regulation in Industrial fisheries)





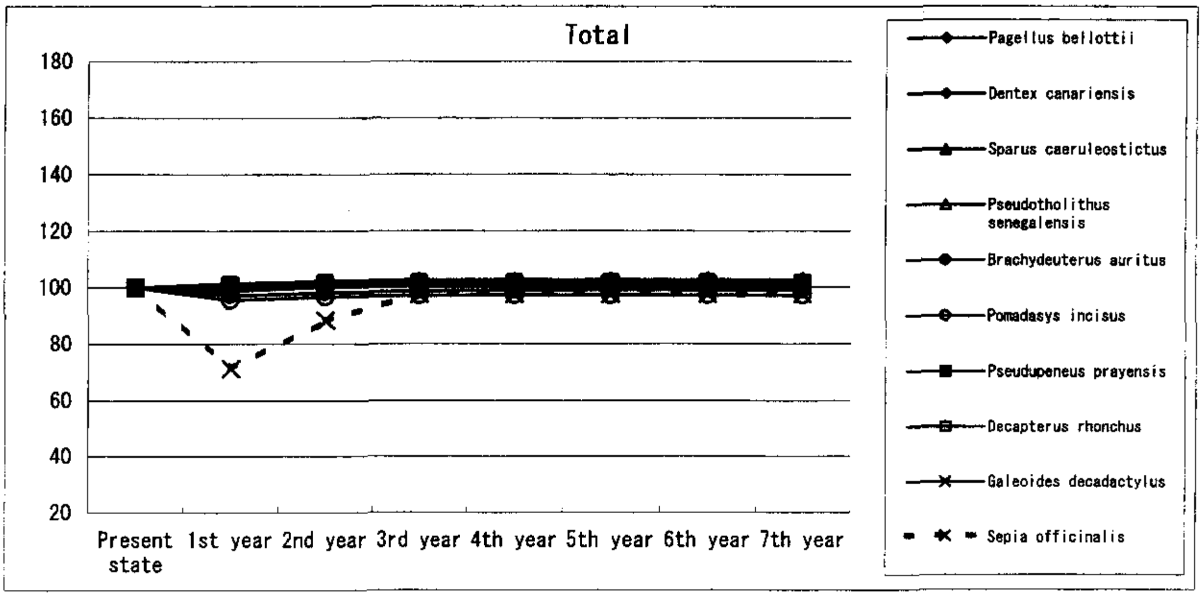


Fig. 5-2-7-2(3) Changes in the catch (to introduce a closed season for Industrial fisheries from October through December)

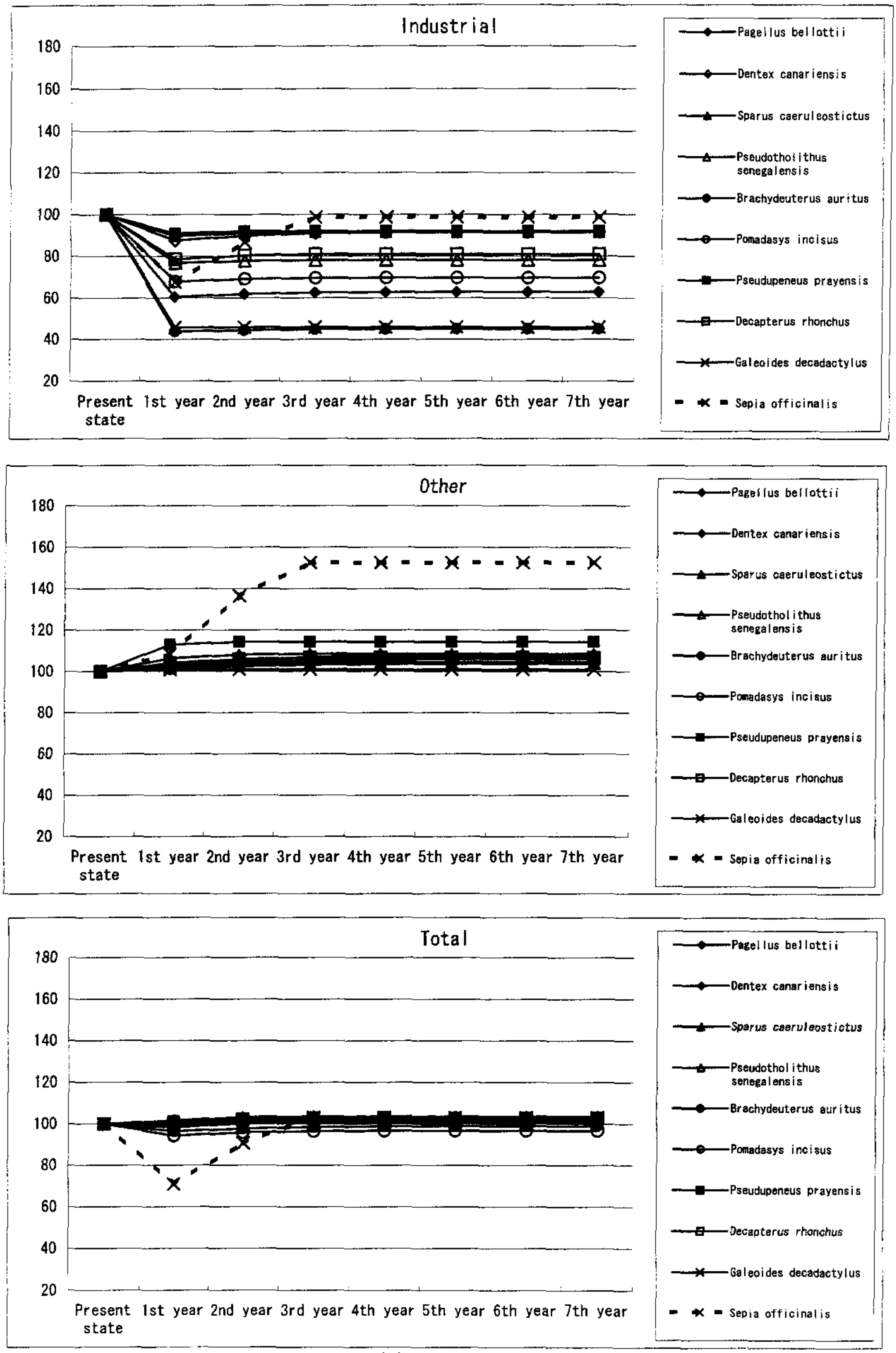


Fig. 5-2-7-2(4) Changes in the catch
(70mm mesh size regulation in Industrial fisheries and to introduce
a closed period for Industrial fisheries from October through December)

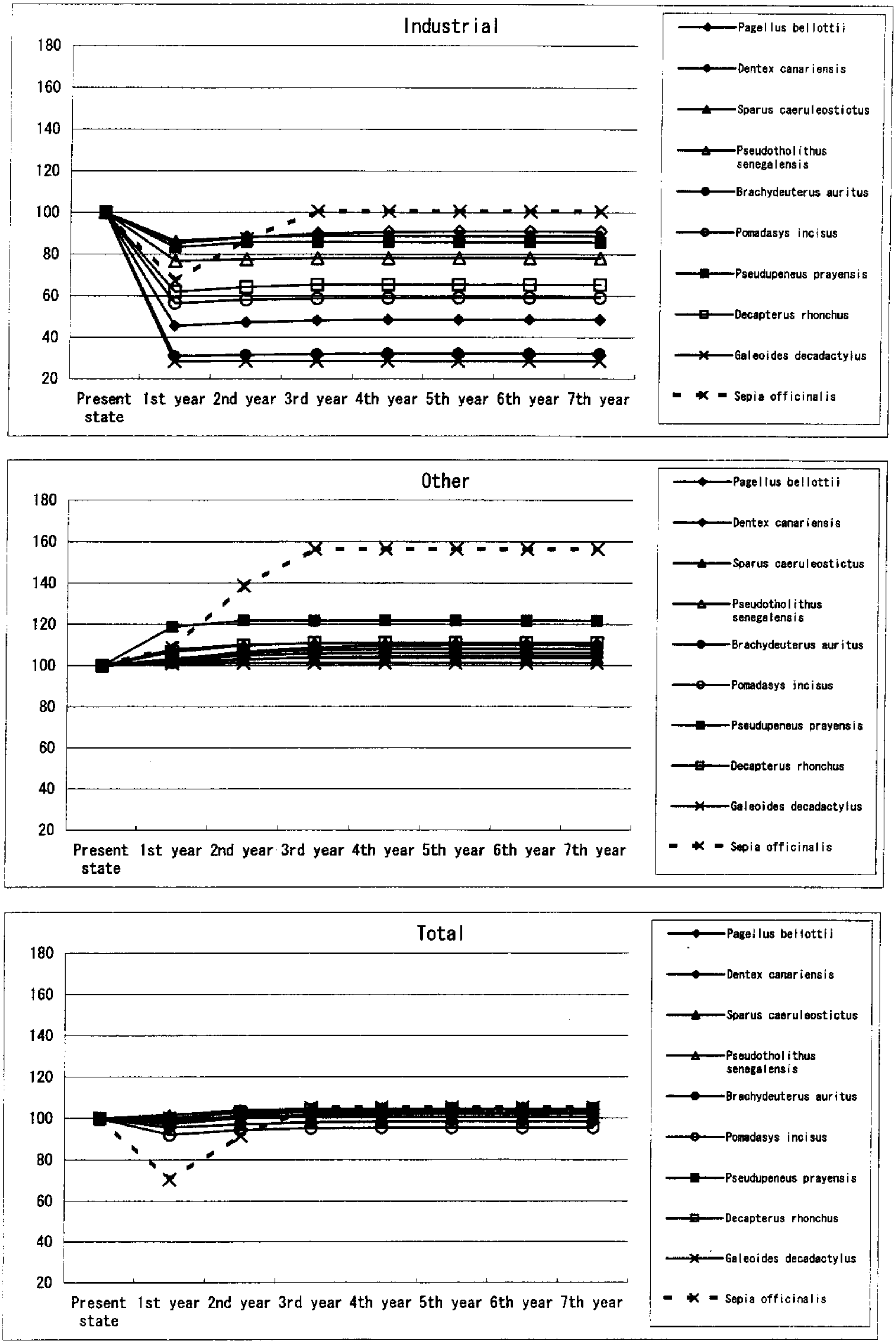


Fig. 5-2-7-2(5) Changes in the catch
(80mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

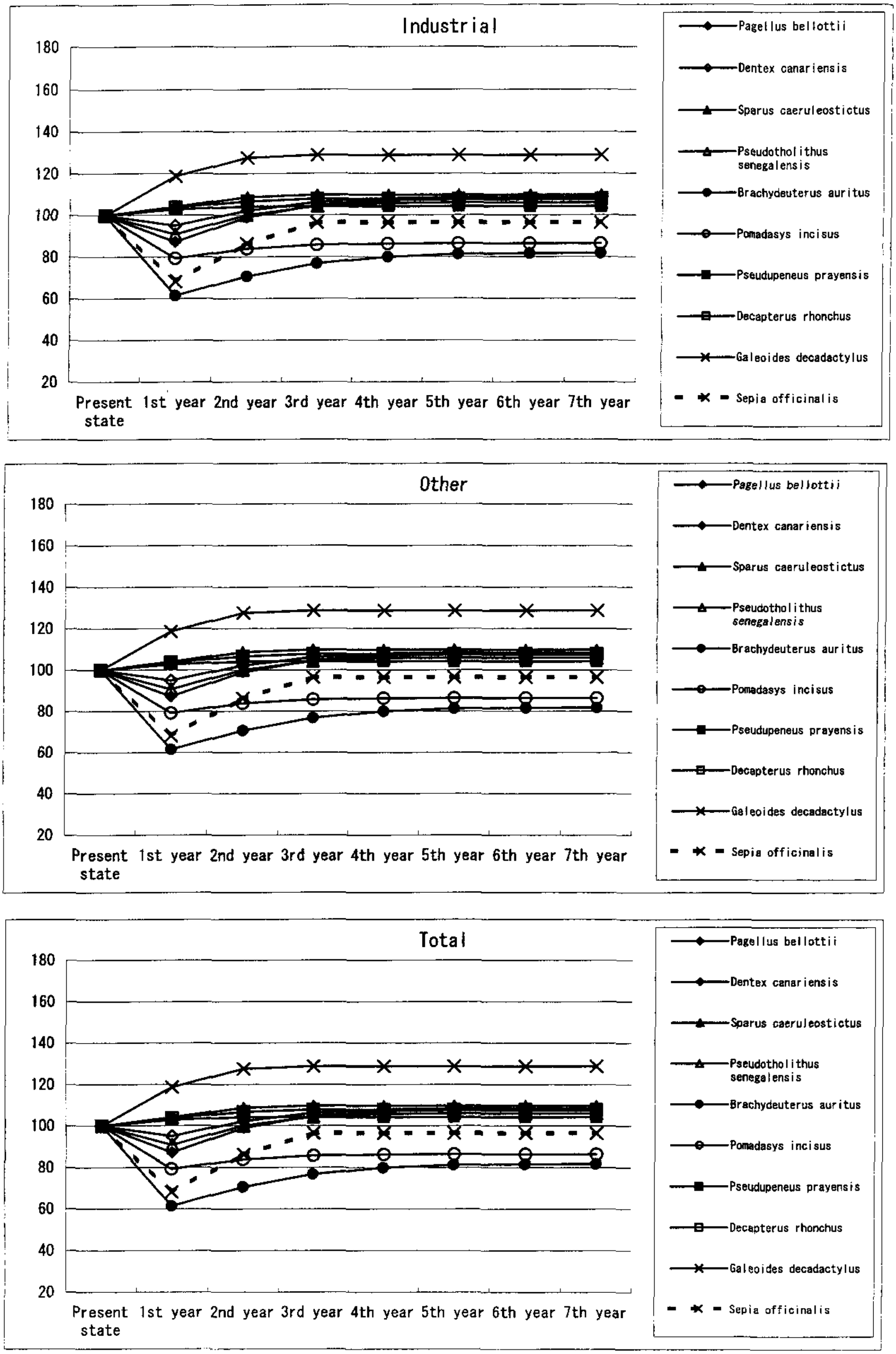
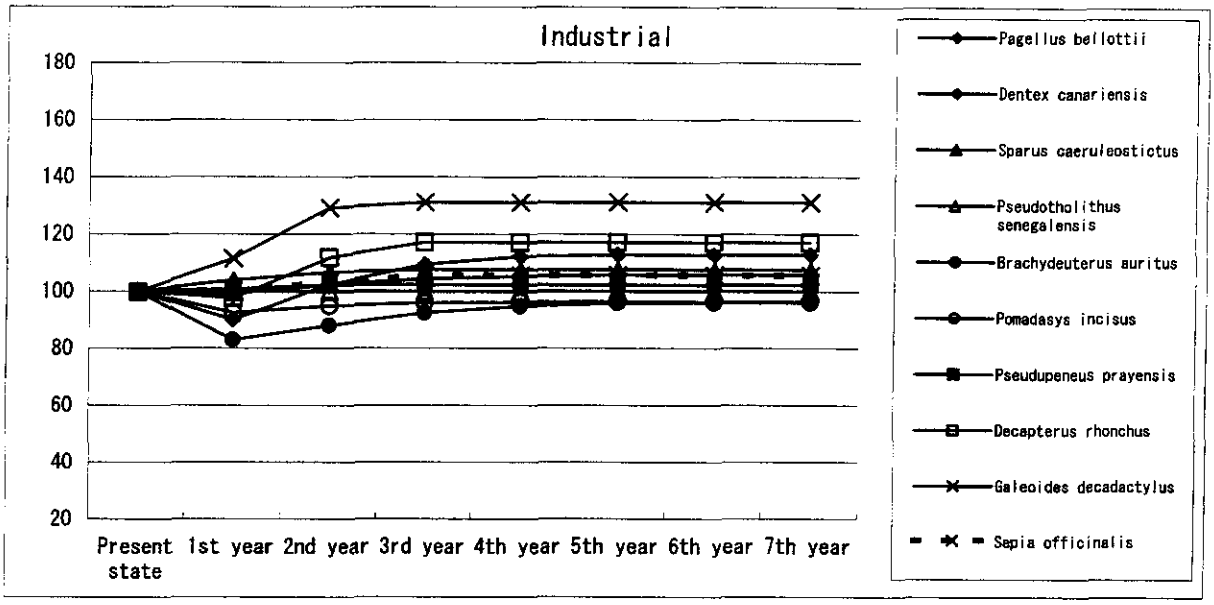
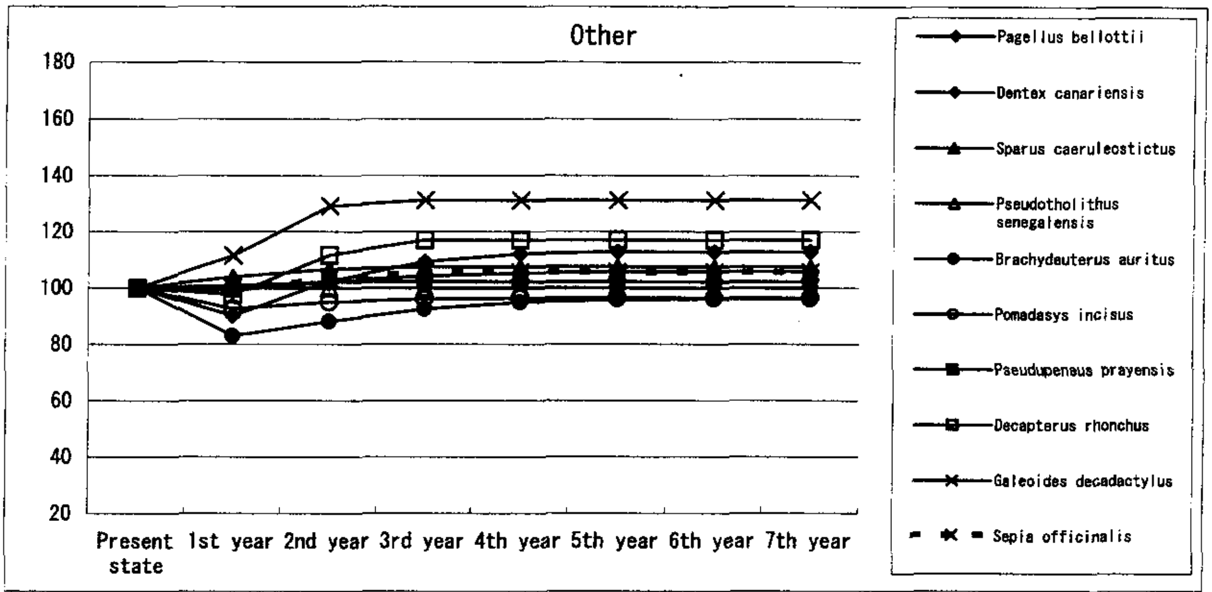


Fig. 5-2-7-2(6) Changes in the catch
(to introduce a closed period for all fisheries from October through December)





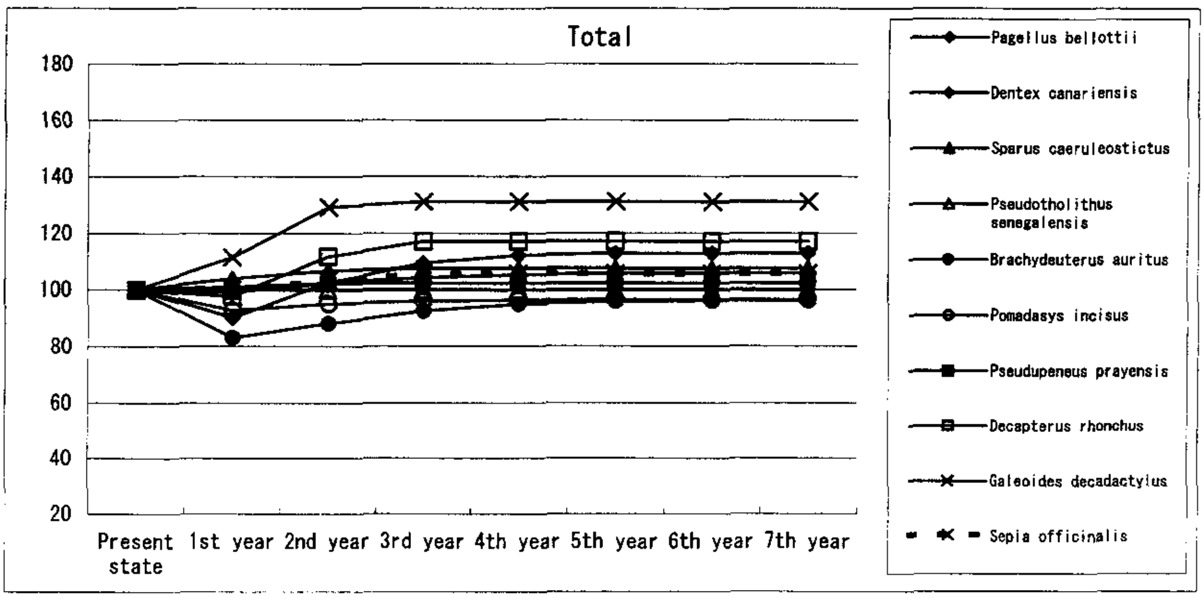


Fig. 5-2-7-2(7) Changes in the catch
(mesh size regulation to equivalent to 70 mm for all fisheries)

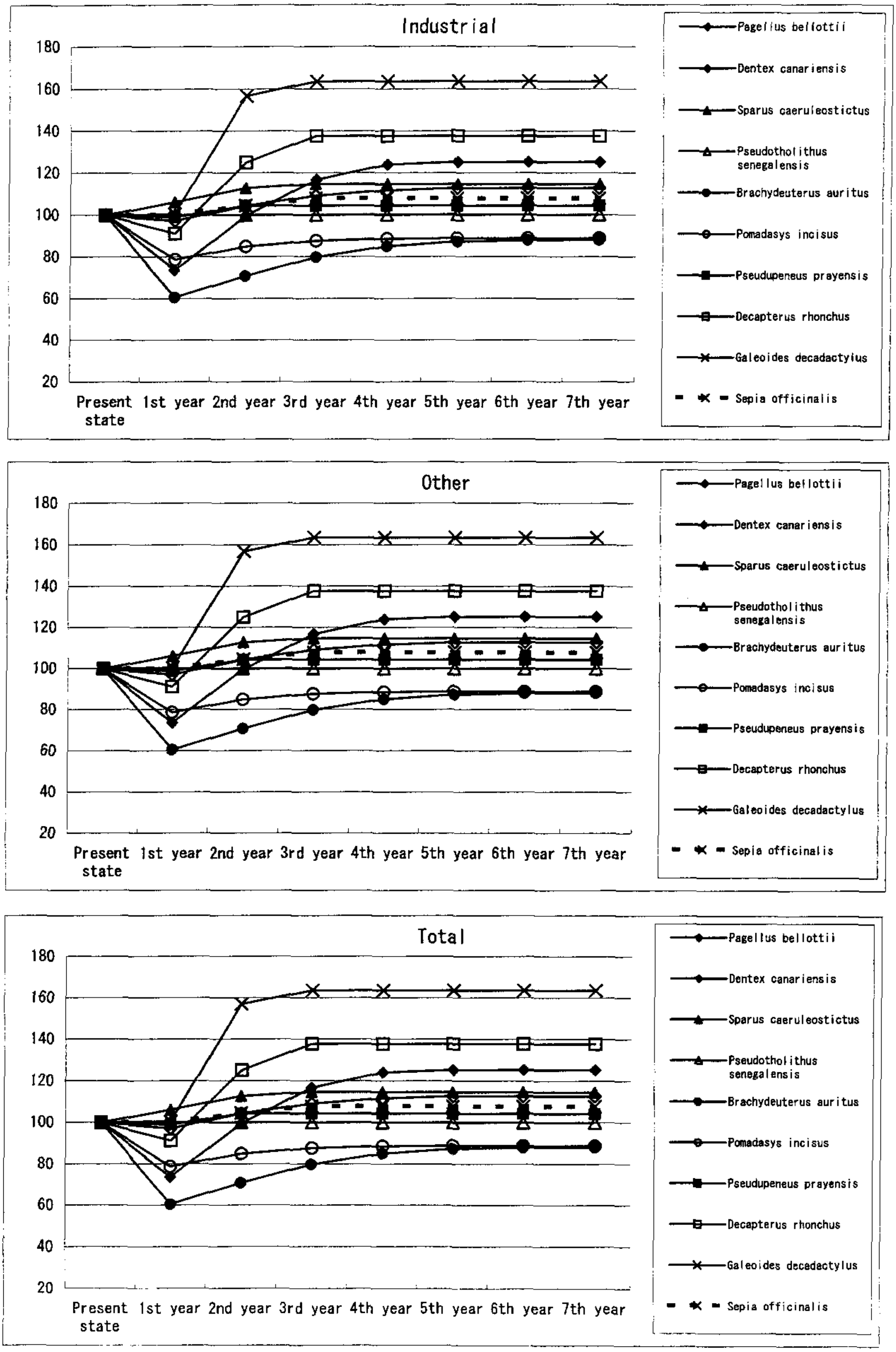
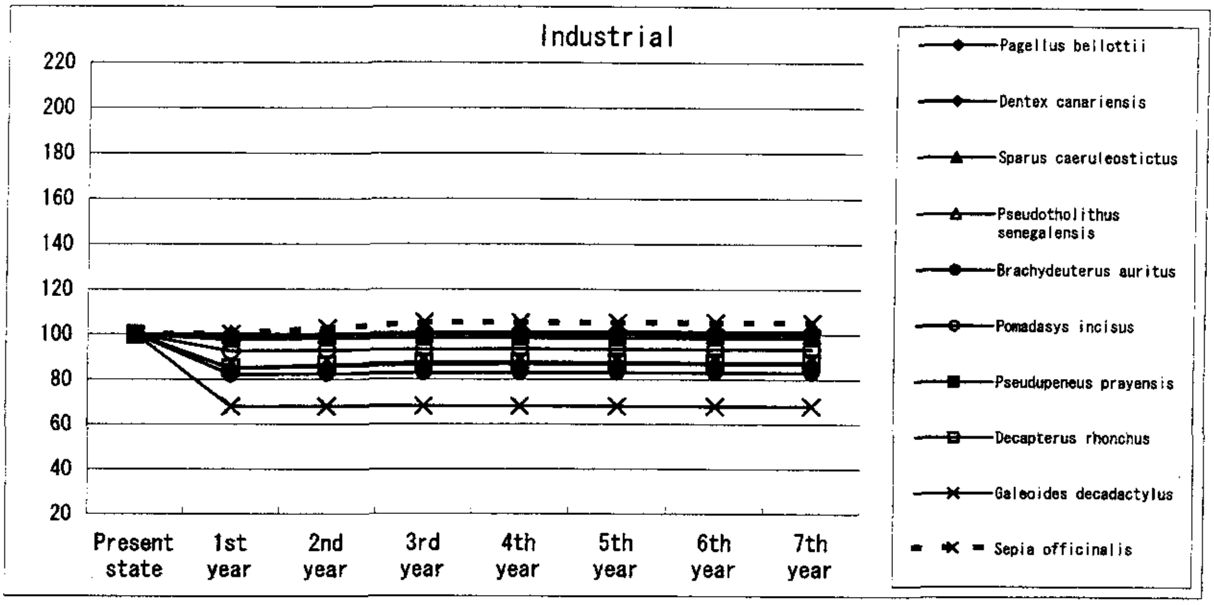
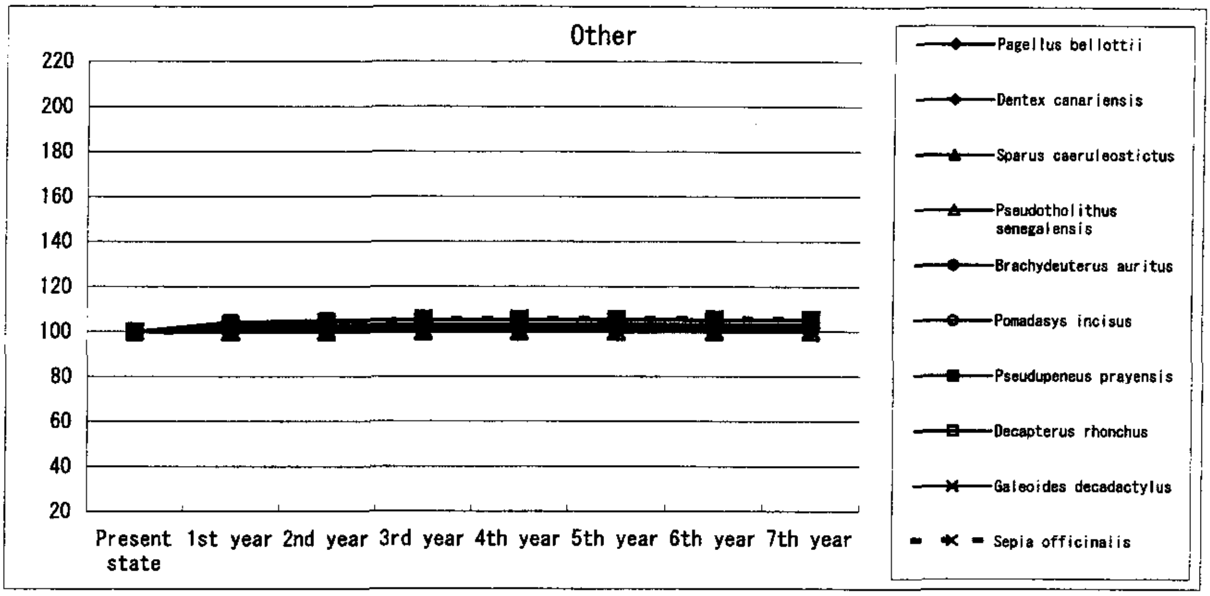


Fig. 5-2-7-2(8) Changes in the catch
(mesh size regulation to equivalent to 80 mm for all fisheries)





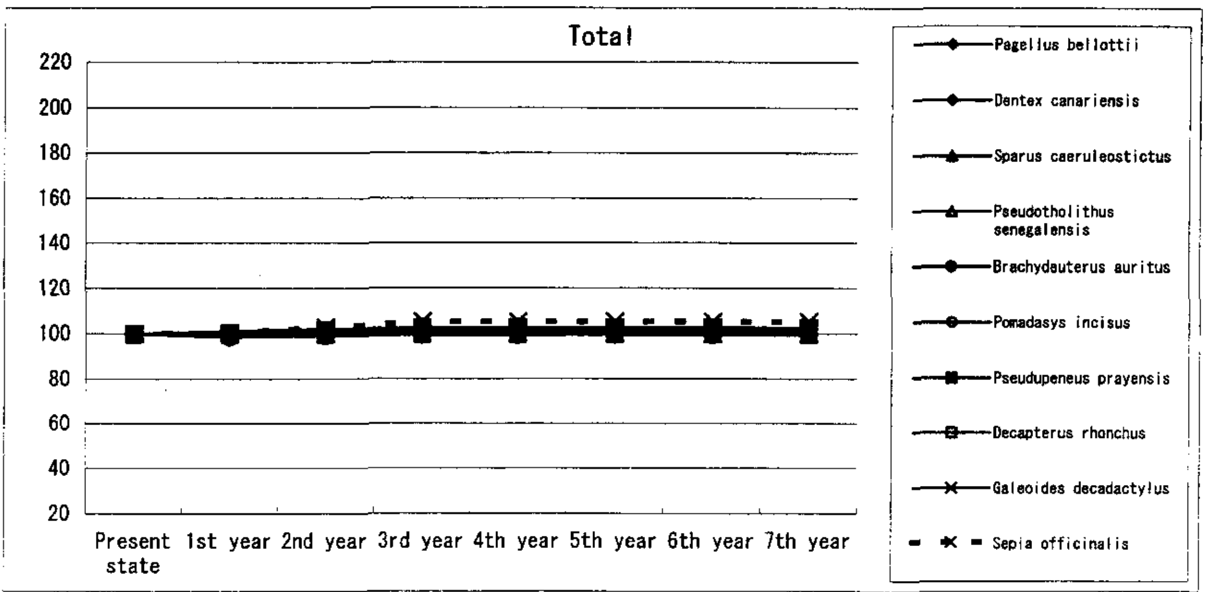
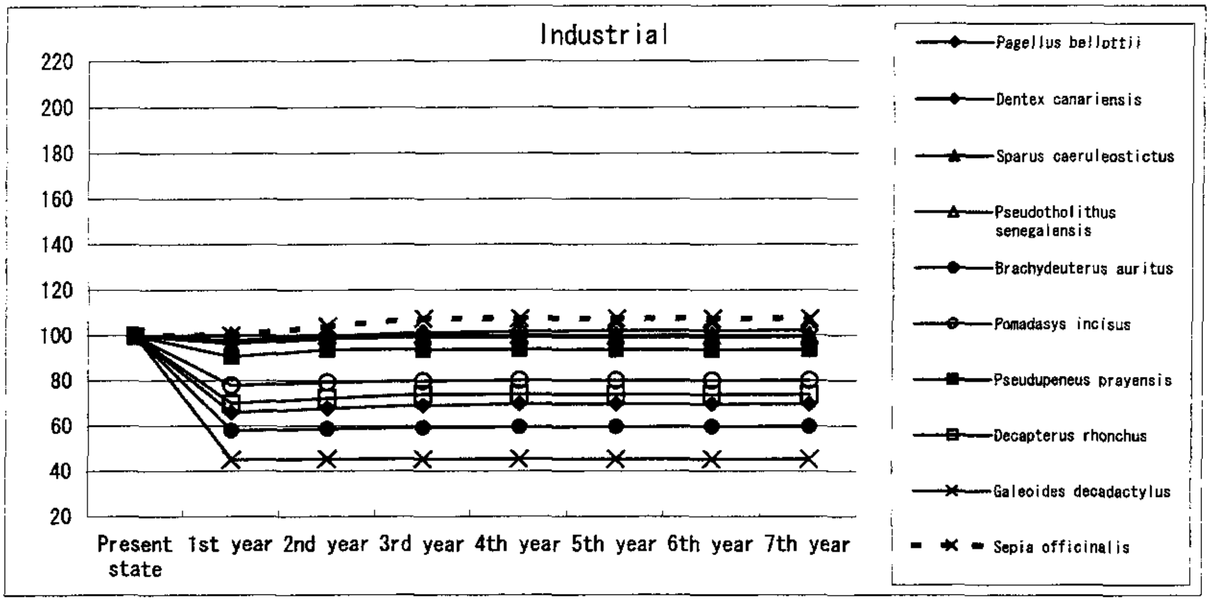
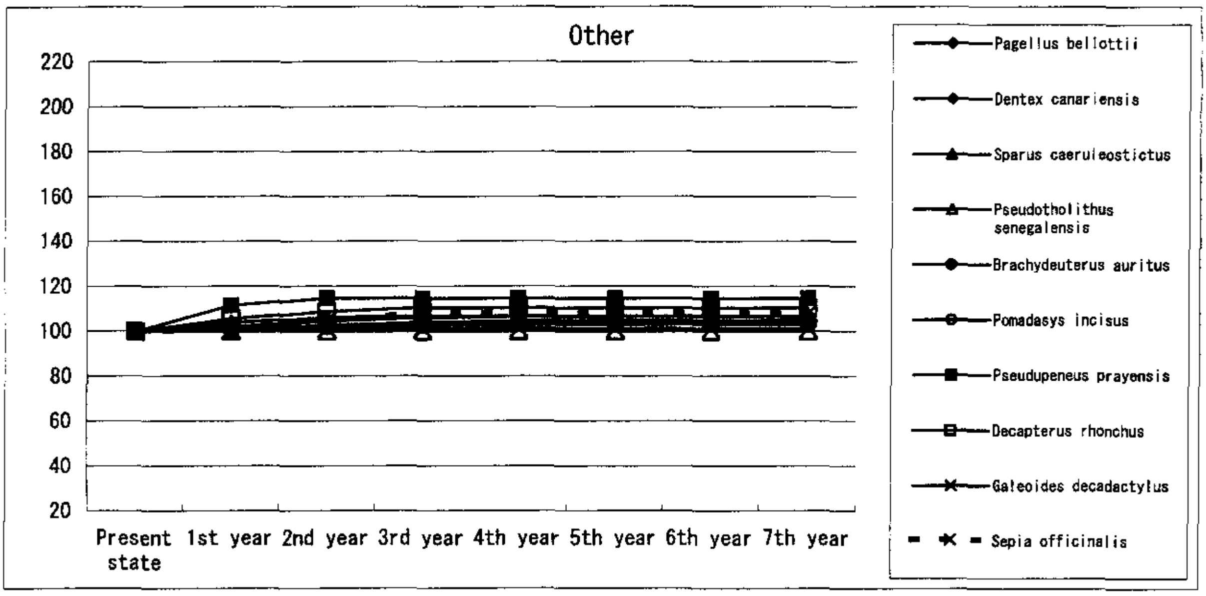


Fig. 5-2-7-3(1) Changes in value of gross landing (relative value)
(No.1 : 70mm mesh size regulation in Industrial fisheries)





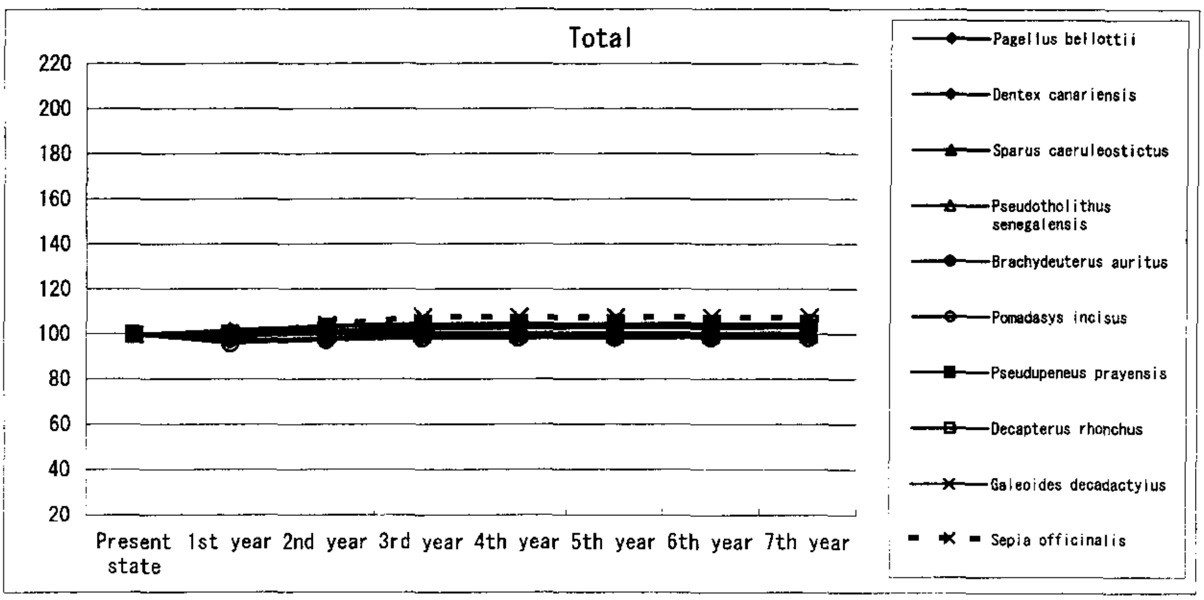
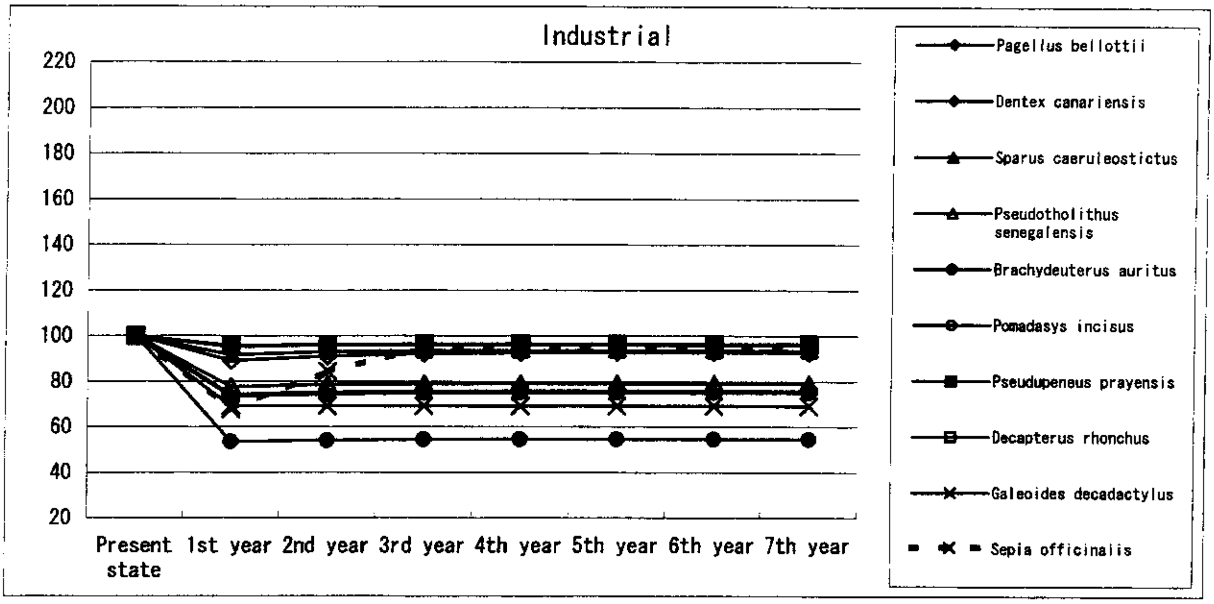
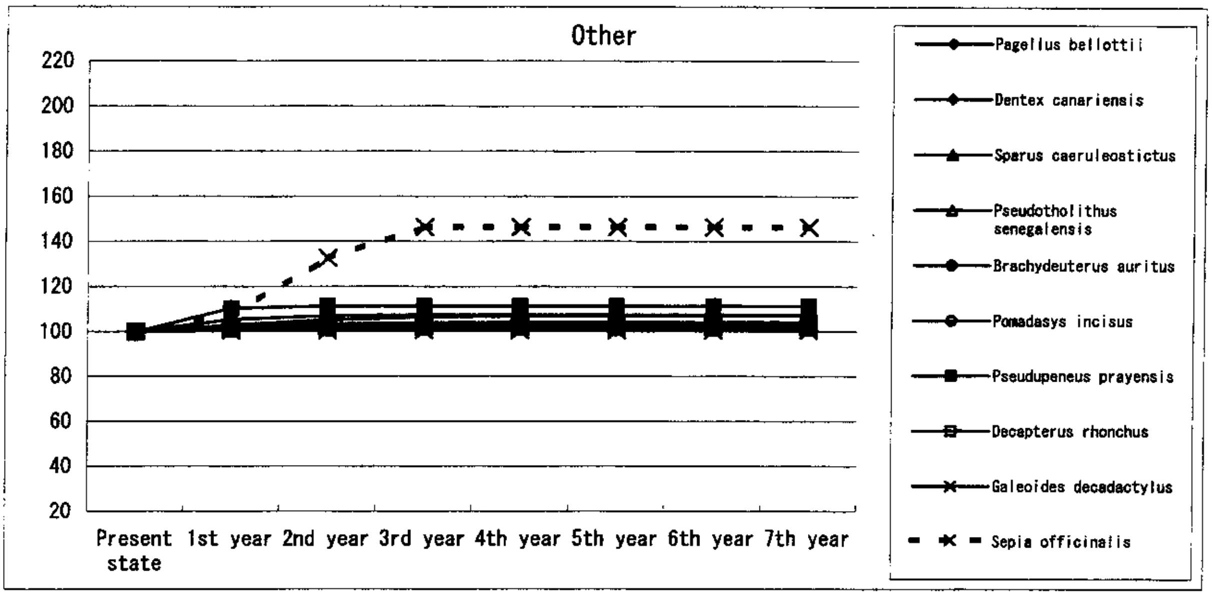


Fig. 5-2-7-3(2) Changes in value of gross landing (relative value)
(No.2 : 80mm mesh size regulation in Industrial fisheries)





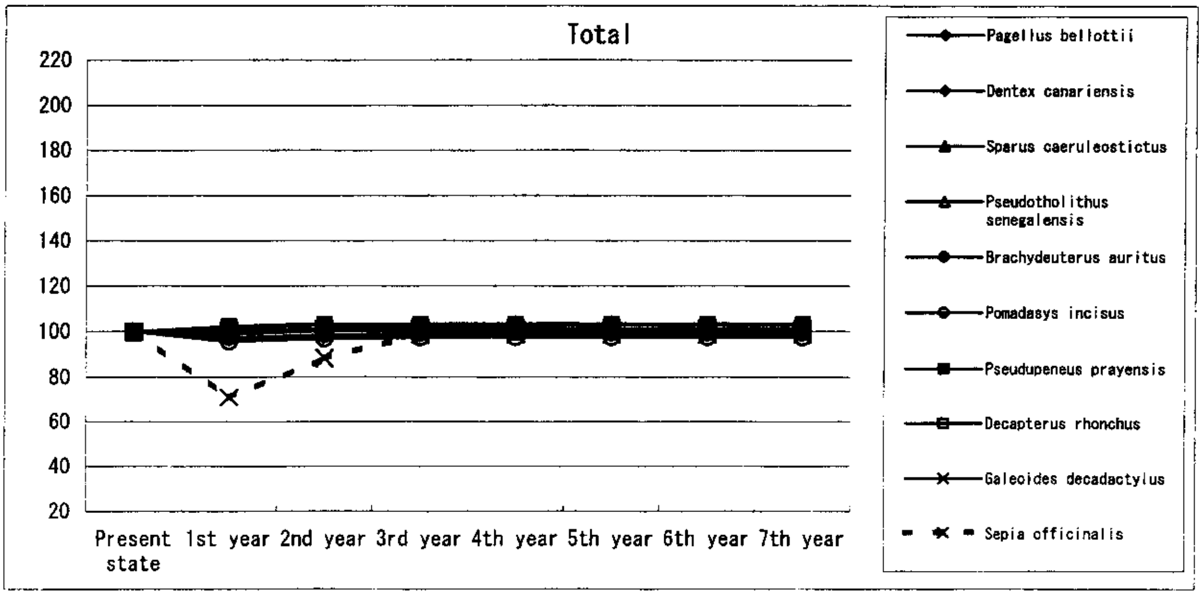


Fig. 5-2-7-3(3) Changes in value of gross landing (relative value)
(No.3 : to introduce a closed season for Industrial fisheries from October through December)

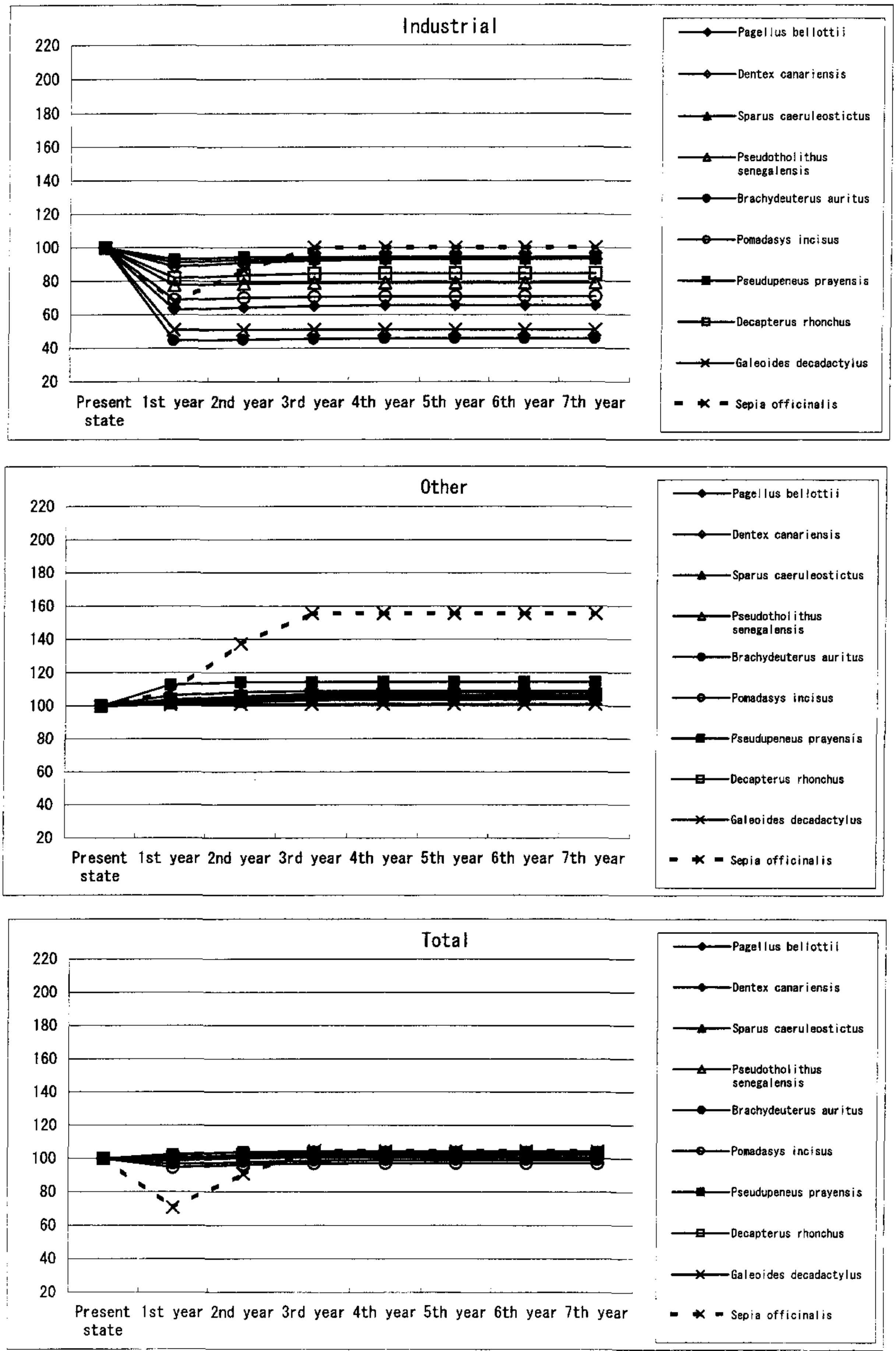
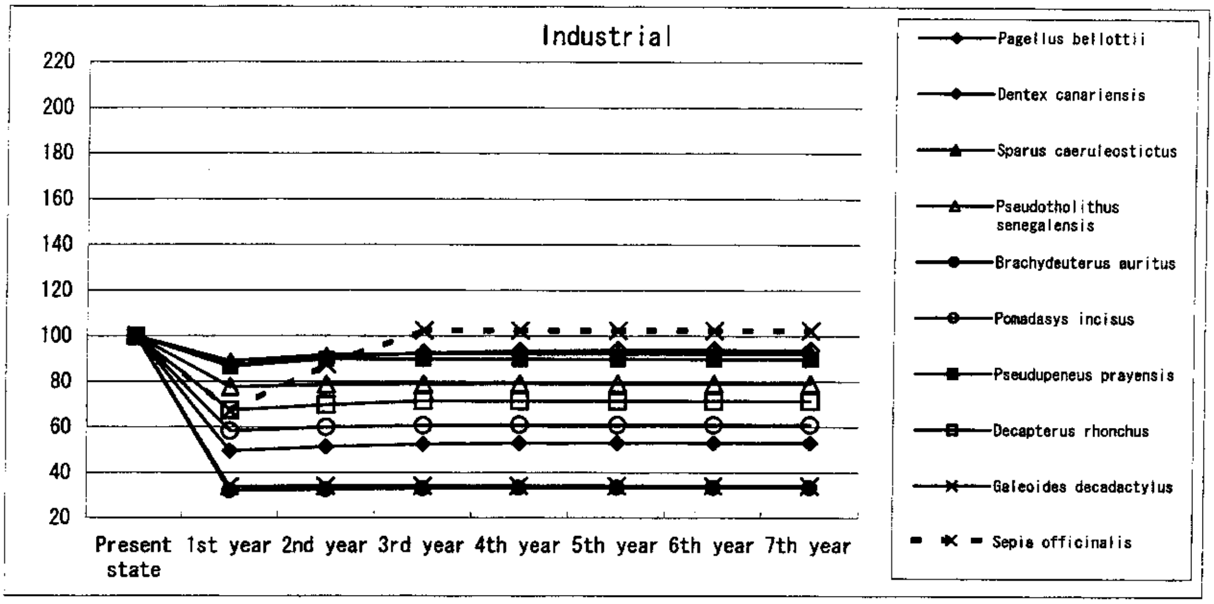
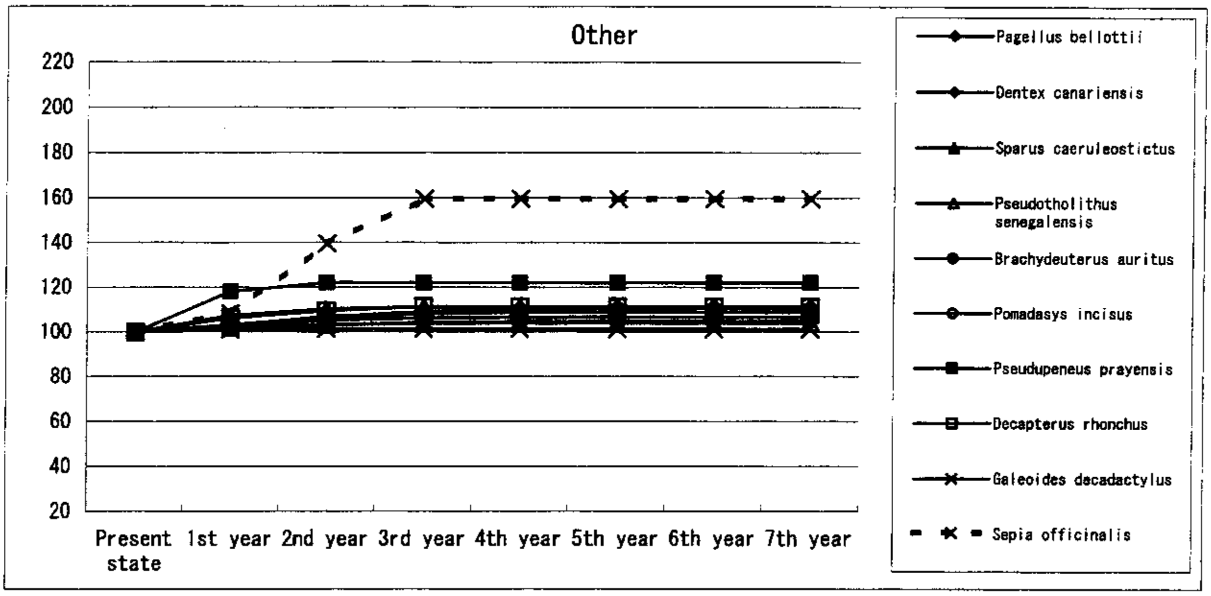


Fig. 5-2-7-3(4) Changes in value of gross landing(relative value)
(No.4 : 70mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)





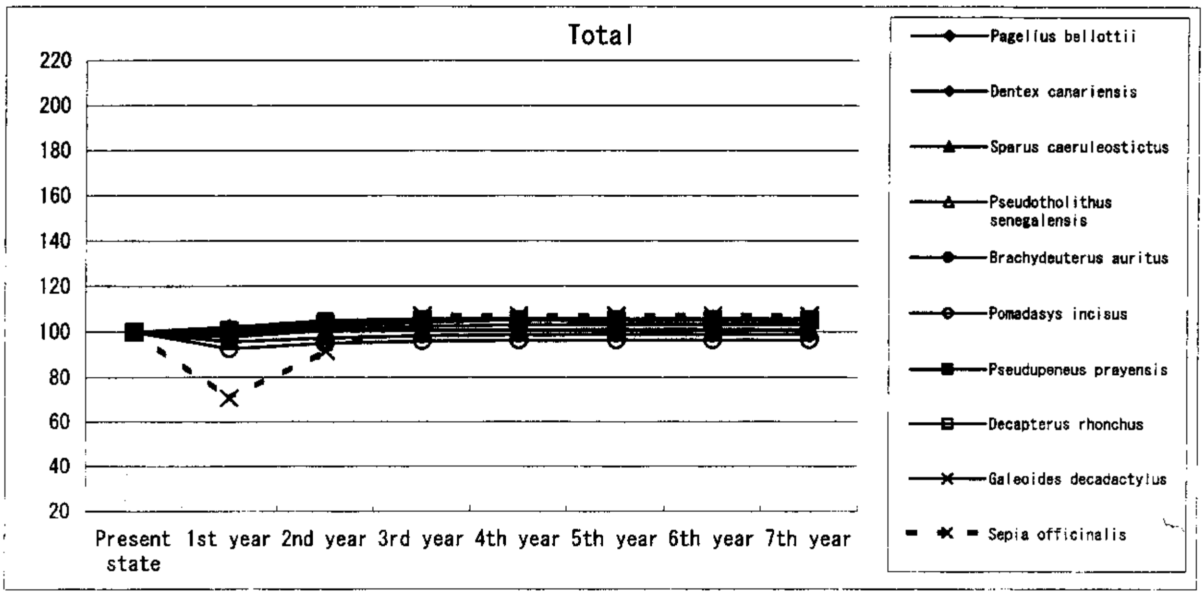
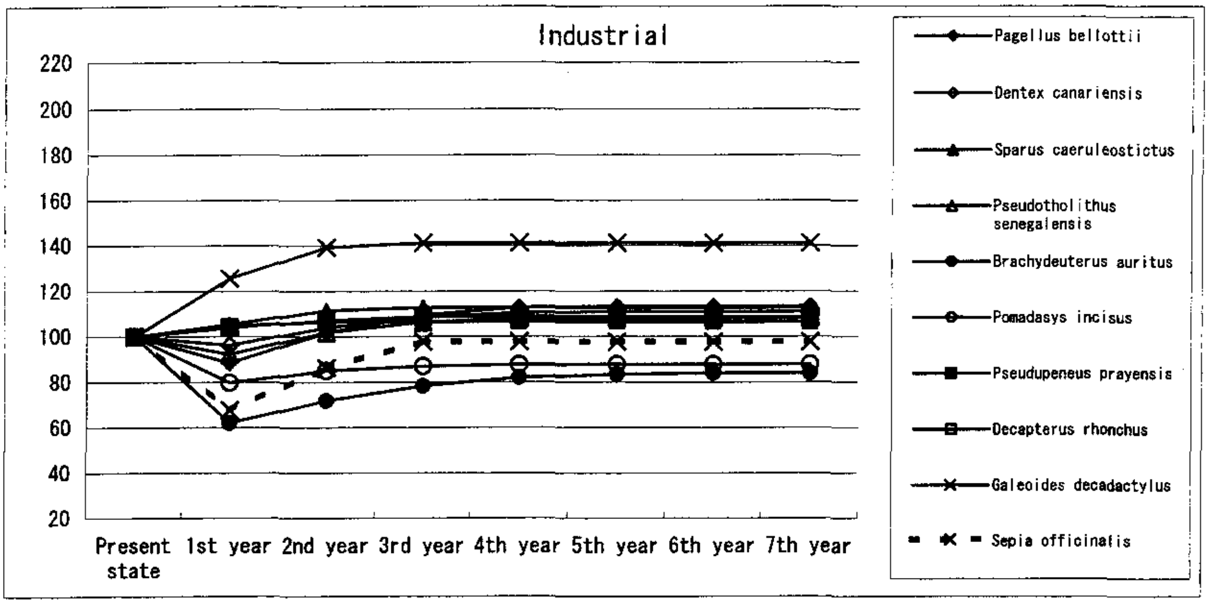
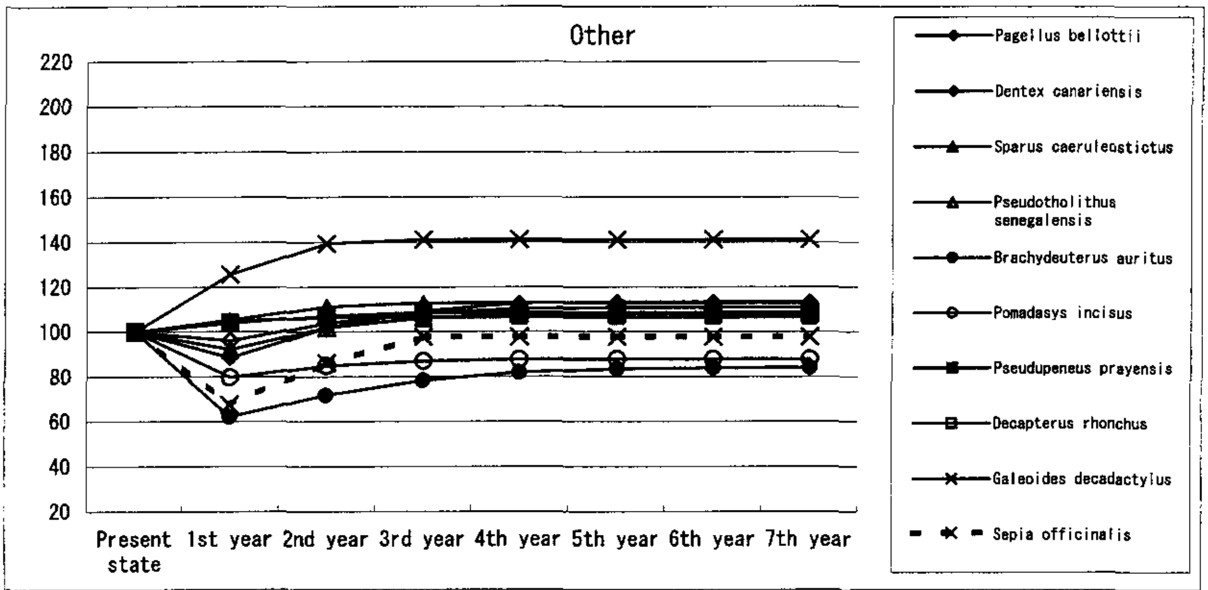


Fig. 5-2-7-3(5) Changes in value of gross landing (relative value)
(No.5 : 80mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)





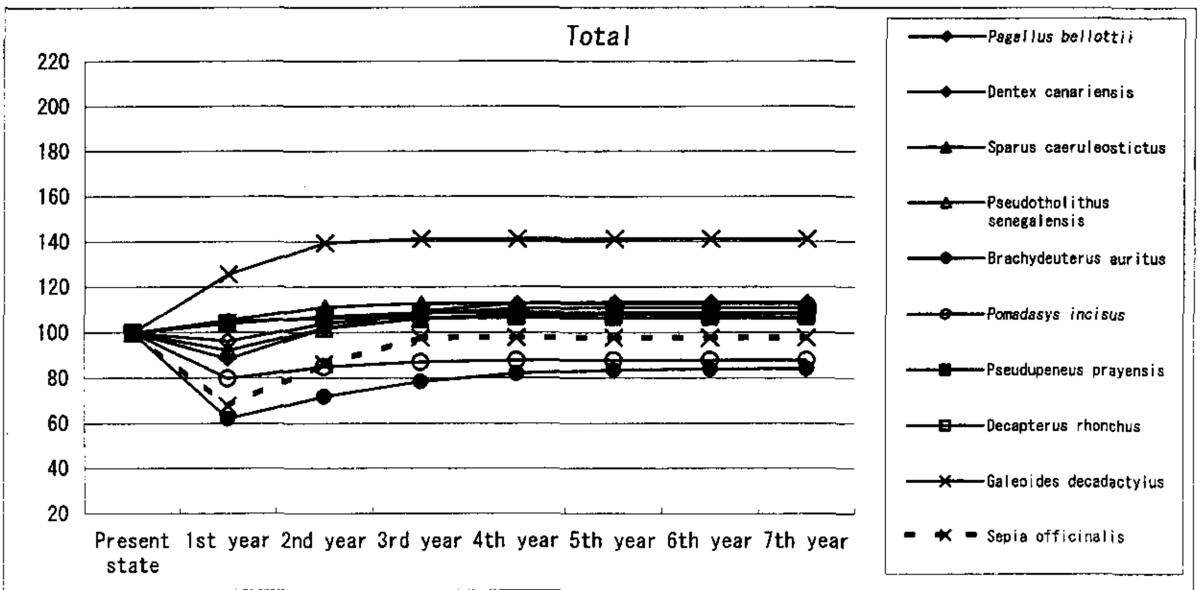
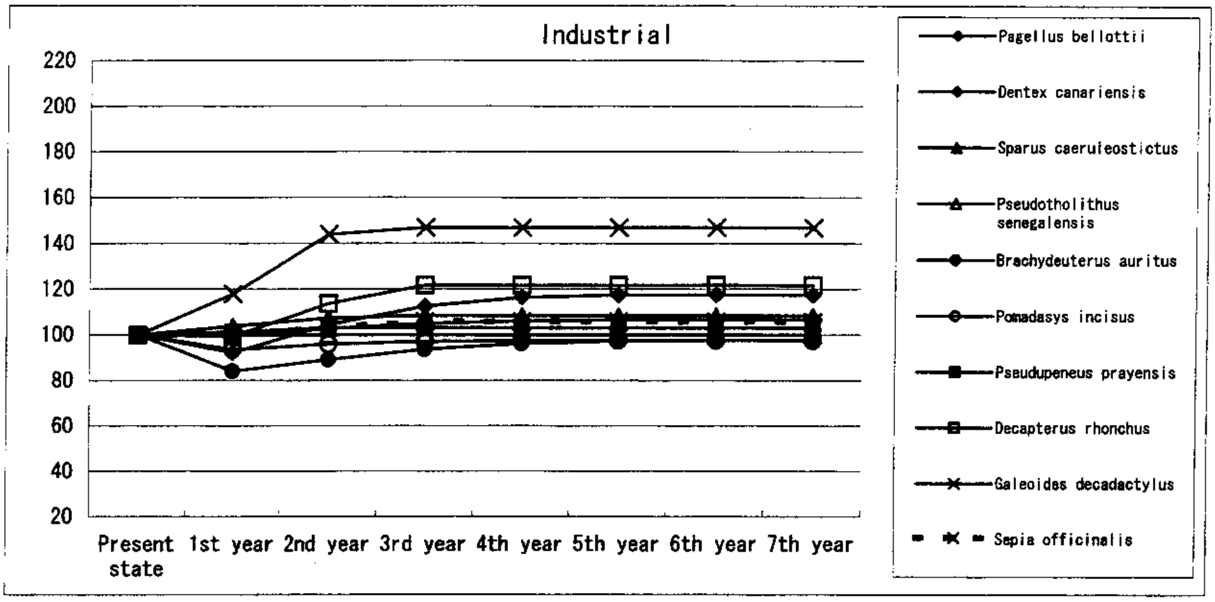
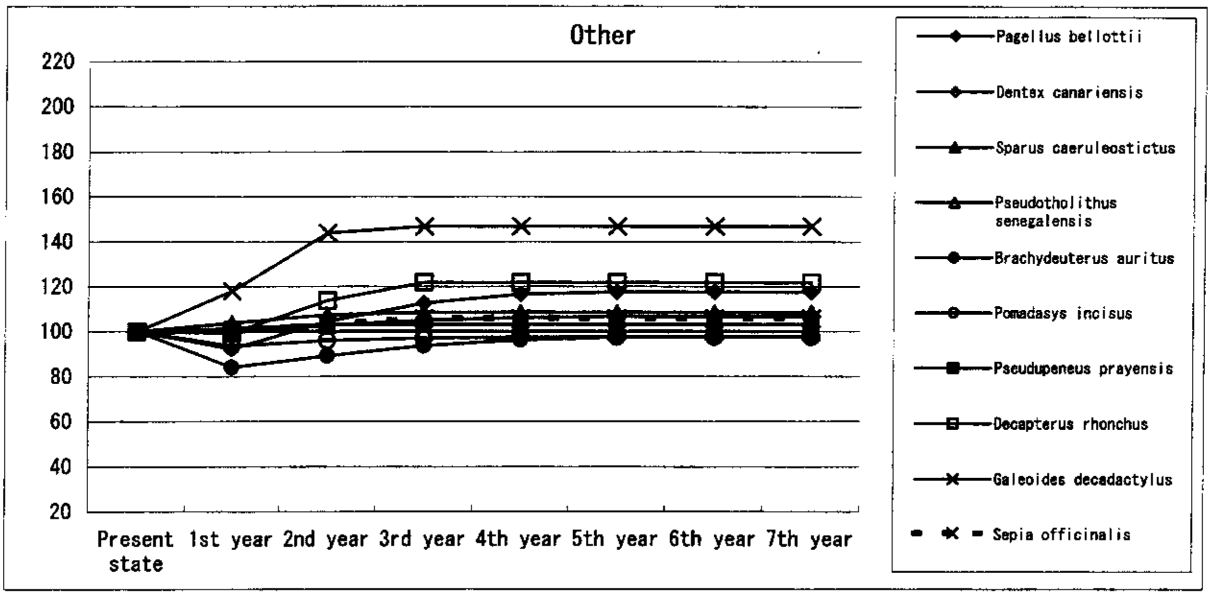


Fig. 5-2-7-3(6) Changes in value of gross landing(relative value)
(No.6 : to introduce a closed period for all fisheries from October through December)





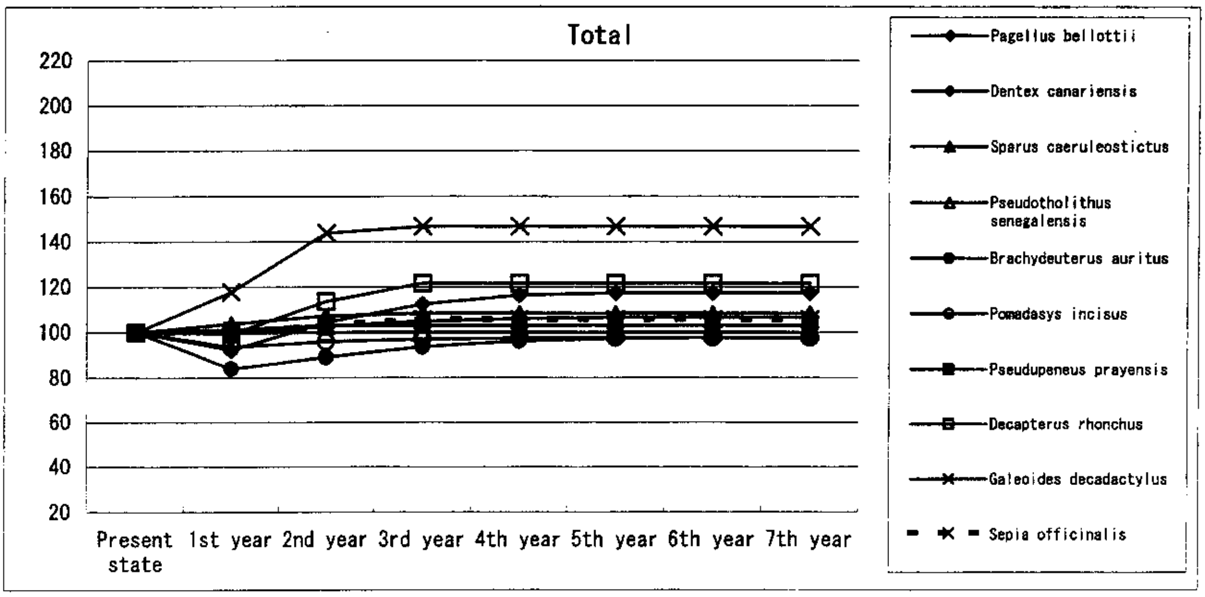
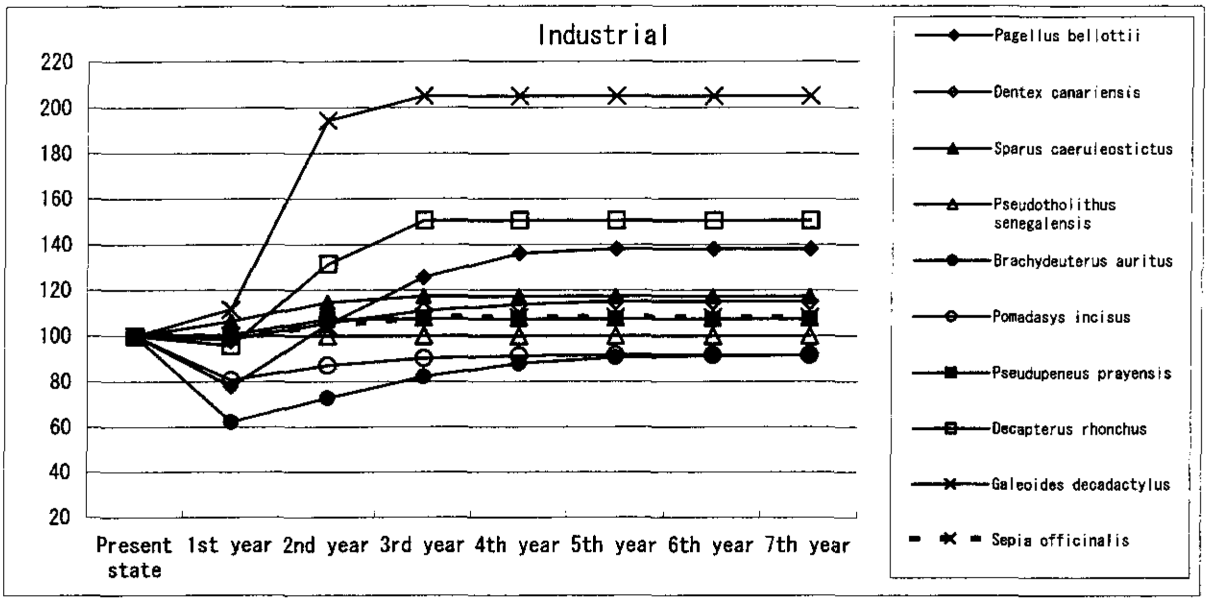
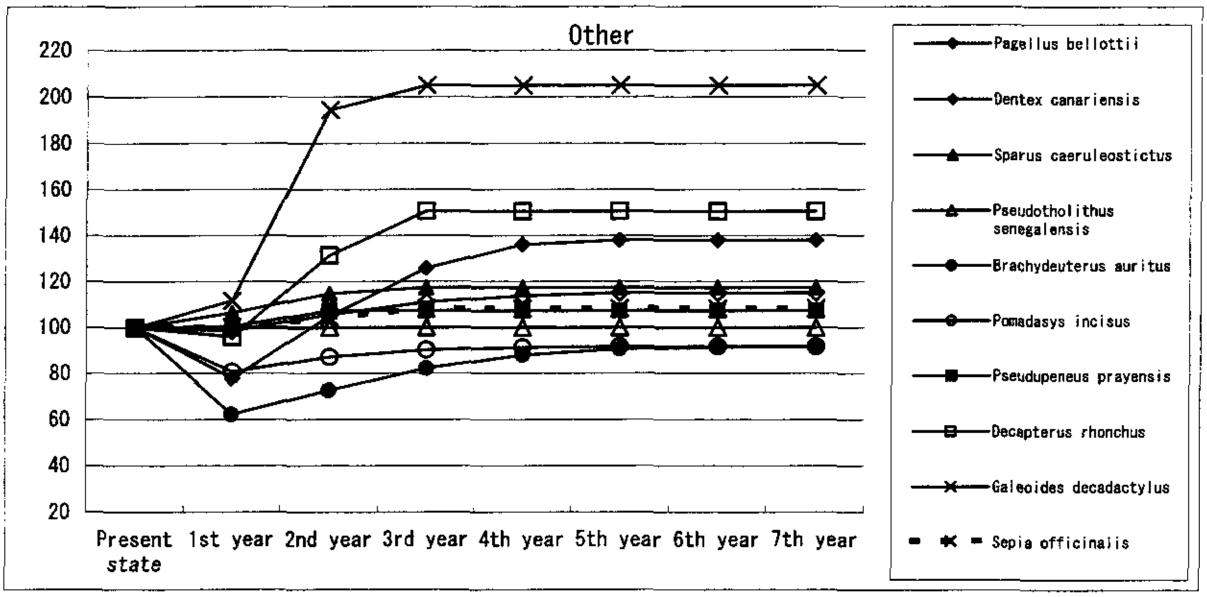


Fig. 5-2-7-3(7) Changes in value of gross landing (relative value)
(No.7 : mesh size regulation to equivalent to 70 mm for all fisheries)





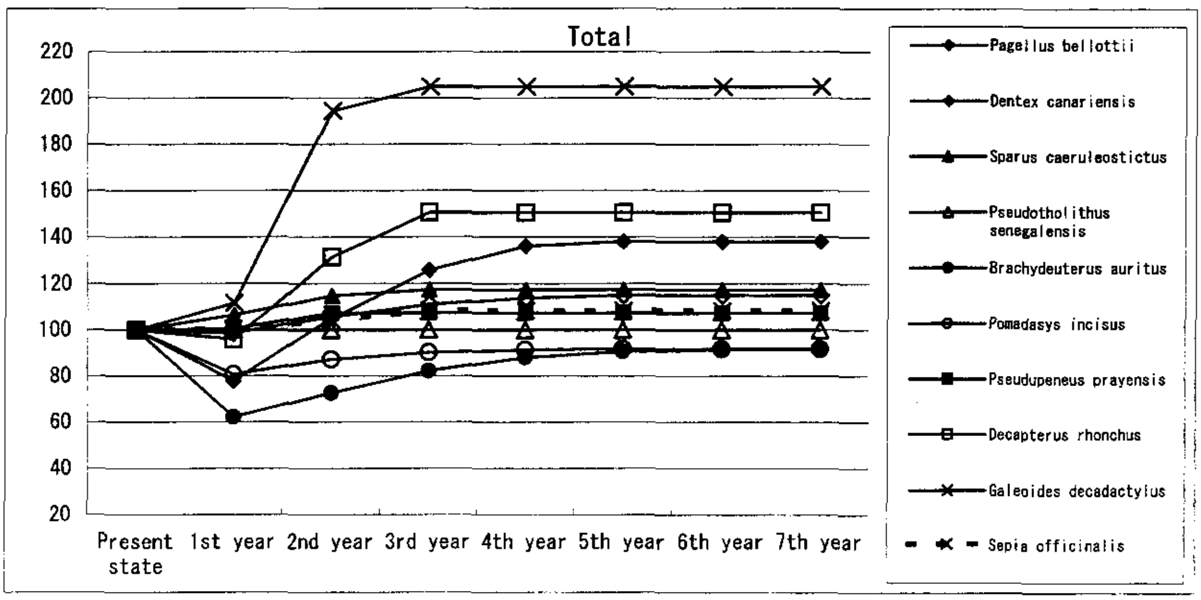


Fig. 5-2-7-3(8) Changes in value of gross landing (relative value)

(No.8 : mesh size regulation to equivalent to 80 mm for all fisheries)

Table 5-2-7-1(1) Changes in selectivity rates when mesh size is set to 70mm and 80 mm(mesh selectivity rate of 60mm:100)

Pagellus bellottii

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
70mm	1	29	30	31	33	36	40	33	32	31	30	29	29
	2	76	81	84	87	90	92	44	49	55	61	66	72
	3	98	99	99	99	99	100	94	95	96	97	98	98
	4	100	100	100	100	100	100	100	100	100	100	100	100
	5	100	100	100	100	100	100	100	100	100	100	100	100

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80mm	1	10	10	11	11	12	14	14	13	12	12	11	11
	2	39	44	50	55	61	66	16	18	21	25	29	33
	3	90	92	93	94	95	96	71	75	79	83	85	88
	4	99	99	99	99	100	100	97	97	98	98	99	99
	5	100	100	100	100	100	100	100	100	100	100	100	100

Dentex canariensis

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
70mm	1	74	87	94	98	99	100	100	100	17	23	35	55
	2	100	100	100	100	100	100	100	100	100	100	100	100
	3	100	100	100	100	100	100	100	100	100	100	100	100
	4	100	100	100	100	100	100	100	100	100	100	100	100
	5	100	100	100	100	100	100	100	100	100	100	100	100

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80mm	1	26	43	62	78	88	94	97	99	4	5	8	14
	2	100	100	100	100	100	100	100	100	99	100	100	100
	3	100	100	100	100	100	100	100	100	100	100	100	100
	4	100	100	100	100	100	100	100	100	100	100	100	100
	5	100	100	100	100	100	100	100	100	100	100	100	100

Sparus caeruleostictus

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
70mm	1	88	95	98	99	100	100	100	100	32	41	57	76
	2	100	100	100	100	100	100	100	100	100	100	100	100
	3	100	100	100	100	100	100	100	100	100	100	100	100

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80mm	1	58	75	87	93	97	98	99	100	12	15	24	39
	2	100	100	100	100	100	100	100	100	100	100	100	100
	3	100	100	100	100	100	100	100	100	100	100	100	100

Brachydeuterus auritus

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
70mm	1	34	35	36	38	39	41	31	31	31	32	32	33
	2	57	60	63	65	68	70	43	45	47	50	52	55
	3	83	85	86	87	89	90	72	74	76	78	80	82
	4	95	95	95	96	96	97	91	91	92	93	93	94
	5	98	98	98	99	99	99	97	97	97	98	98	98
	6	99	99	99	99	99	99	99	99	99	99	99	99
	7	100	100	100	100	100	100	100	100	100	100	100	100

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80mm	1	12	13	13	14	14	15	12	12	12	12	12	12
	2	24	25	27	29	31	33	16	17	18	19	21	22
	3	50	52	55	57	59	61	36	38	40	43	45	47
	4	75	76	78	79	81	82	64	66	68	70	71	73
	5	89	89	90	91	91	92	83	84	85	86	87	88
	6	95	95	95	96	96	96	92	93	93	94	94	94
	7	97	98	98	98	98	98	96	97	97	97	97	97

Table 5-2-7-1(2) Changes in selectivity rates when mesh size is set to 70mm and 80 mm(mesh selectivity rate of 60mm:100)

Pomadasys incisus

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
70mm	1	57	53	50	47	44	42	90	83	76	71	66	61
	2	37	39	41	44	47	51	40	38	37	36	36	36
	3	79	82	85	87	89	90	55	60	64	68	72	76
	4	97	97	97	98	98	98	92	93	94	95	95	96
	5	99	99	99	99	99	100	98	99	99	99	99	99
	6	100	100	100	100	100	100	100	100	100	100	100	100
	7	100	100	100	100	100	100	100	100	100	100	100	100

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80mm	1	37	33	30	26	24	22	83	72	62	54	48	42
	2	16	16	17	18	20	22	20	18	17	16	16	15
	3	47	51	55	59	63	66	25	28	31	35	38	42
	4	84	86	87	88	89	90	69	72	75	78	80	82
	5	95	95	96	96	96	97	91	92	93	94	94	95
	6	98	98	98	98	98	98	97	97	97	98	98	98
	7	99	99	99	99	99	99	99	99	99	99	99	99

Pseudupeneus prayensis

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
70mm	1	78	84	89	92	95	96	98	98	47	54	62	71
	2	100	100	100	100	100	100	100	100	99	99	99	100

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80mm	1	47	56	65	73	79	84	88	91	21	25	31	39
	2	98	98	99	99	99	99	100	100	93	95	96	97

Decapterus rhonchus

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
70mm	0	55	59	63	68	73	78				51	51	53
	1	96	97	98	98	99	99	82	86	89	92	94	95
	2	100	100	100	100	100	100	99	99	100	100	100	100

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80mm	0	31	33	37	41	46	52				29	29	29
	1	87	89	92	93	95	96	58	64	70	75	79	83
	2	99	99	99	100	100	100	97	97	98	98	99	99

Galeoides decadactylus

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
70mm	1	44	51	59	67	75	81	87	90	35	34	36	39
	2	98	99	99	99	100	100	100	100	93	95	97	98
	3	100	100	100	100	100	100	100	100	100	100	100	100

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
80mm	1	18	21	26	33	40	49	57	65	15	14	14	15
	2	91	93	95	96	97	98	98	99	73	79	84	88
	3	100	100	100	100	100	100	100	100	99	99	99	100

Table 5-2-7-1(3) Changes in selectivity rates when mesh size is set to 70mm and 80 mm(mesh selectivity rate of 60mm:100)

Sepia officinalis

	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
70mm	0							5	72	100	100	100	100
	1	100	100	100	100	100	100	100	100	100	100	100	100
	2	100	100	100	100	100	100	100	100	100	100	100	100

80mm	Age\Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
	0							0	9	84	100	100	100
	1	100	100	100	100	100	100	100	100	100	100	100	100
	2	100	100	100	100	100	100	100	100	100	100	100	100

Table 5-2-7-2(1) Unit prices of evaluation-target species (×1000 cedi/kg)

Pagellus bellottii

Age\Month	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
1	10.4	10.5	10.5	10.6	10.7	10.8	10.8	10.9	11.0	11.2	11.3	11.4
2	11.5	11.7	11.8	11.9	12.1	12.3	12.4	12.6	12.8	13.0	13.2	13.4
3	13.6	13.8	14.0	14.2	14.4	14.7	14.9	15.1	15.4	15.6	15.9	16.2
4	16.4	16.7	17.0	17.3	17.6	17.9	18.2	18.5	18.8	19.1	19.4	19.7
5	20.0	20.4	20.7	21.0	21.4	21.7	22.0	22.4	22.7	23.1	23.5	23.8

Dentex canariensis

Age\Month	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
1	11.1	11.4	11.7	12.0	12.4	12.8	13.3	13.8	14.3	14.9	15.5	16.1
2	16.8	17.5	18.3	19.1	19.9	20.8	21.7	22.6	23.6	25.0	25.0	25.0
3	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
4	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
5	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0

Sparus caeruleostictus

Age\Month	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
1	10.7	11.0	11.4	11.8	12.3	12.8	13.4	14.0	14.7	15.5	16.3	17.1
2	18.0	18.9	19.9	20.9	21.9	23.0	25.0	25.0	25.0	25.0	25.0	25.0
3	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0

Pseudotolithus senegalensis

Age\Month	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
1	10.3	10.4	10.5	10.7	10.9	11.1	11.3	11.6	11.9	12.2	12.6	13.0
2	13.4	13.9	14.4	14.9	15.5	16.1	16.7	17.4	18.1	18.8	19.6	20.4
3	21.2	22.0	22.9	23.8	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
4	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
5	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
6	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0

Brachydeuterus auritus

Age\Month	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
1	7.3	7.3	7.4	7.4	7.4	7.4	7.5	7.5	7.5	7.5	7.6	7.6
2	7.6	7.6	7.7	7.7	7.7	7.8	7.8	7.8	7.9	7.9	7.9	8.0
3	8.0	8.0	8.1	8.1	8.1	8.2	8.2	8.2	8.3	8.3	8.3	8.4
4	8.4	8.5	8.5	8.5	8.6	8.6	8.7	8.7	8.7	8.8	8.8	8.8
5	8.9	8.9	9.0	9.0	9.0	9.1	9.1	9.2	9.2	9.2	9.3	9.3
6	9.4	9.4	9.4	9.5	9.5	9.5	9.6	9.6	9.7	9.7	9.7	9.8
7	9.8	9.9	9.9	9.9	10.0	10.0	10.0	10.1	10.1	10.2	10.2	10.2

Pomadasys incisus

Age\Month	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
1	10.0	10.0	10.0	10.0	10.0	10.1	10.1	10.1	10.2	10.2	10.3	10.3
2	10.4	10.5	10.5	10.6	10.7	10.8	10.9	11.0	11.2	11.3	11.4	11.5
3	11.7	11.8	11.9	12.1	12.2	12.3	12.5	12.6	12.8	12.9	13.1	13.2
4	13.4	13.5	13.7	13.8	14.0	14.1	14.3	14.4	14.6	14.7	14.9	15.0
5	15.1	15.3	15.4	15.5	15.7	15.8	15.9	16.1	16.2	16.3	16.4	16.6
6	16.7	16.8	16.9	17.0	17.1	17.2	17.3	17.5	17.6	17.7	17.8	17.8
7	17.9	18.0	18.1	18.2	18.3	18.4	18.5	18.5	18.6	18.7	18.8	18.9

Pseudupeneus prayensis

Age\Month	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
1	11.2	11.4	11.7	12.1	12.4	12.8	13.2	13.6	14.1	14.6	15.1	15.6
2	16.1	16.7	17.2	17.8	18.4	19.0	19.6	20.3	20.9	21.5	22.2	22.8

Table 5-2-7-2(2) Unit prices of evaluation-target species (×1000 cedi／kg)

Decapterus rhonchus

Age＼Month	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
0				8.5	8.6	8.8	8.9	9.1	9.3	9.6	9.8	10.1
1	10.4	10.7	11.1	11.4	11.8	12.2	12.7	13.1	13.6	14.1	14.6	15.2
2	15.7	16.3	16.9	17.6	18.2	18.9	20.0	20.0	20.0	20.0	20.0	20.0
3	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
4	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0

Galeoides decadactylus

Age＼Month	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
1	11.7	12.1	12.6	13.1	13.6	14.2	14.9	15.6	16.3	17.1	18.0	18.9
2	19.8	20.8	21.8	22.9	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
3	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0

Sepia officinalis

Age＼Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
0							10.6	11.0	11.6	12.4	13.3	14.3
1	15.5	16.9	18.4	20.0	21.9	23.8	25.0	25.0	25.0	25.0	25.0	25.0
2	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0

Table 5-2-7-3(1-1) Changes in the stock number of *Pagellus bellottii* (×1,000 individuals)

No. 1 (70mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	153,835	153,835	153,835	153,835	153,835	153,835	153,835
2	96,517	97,495	97,495	97,495	97,495	97,495	97,495
3	24,980	25,587	25,846	25,846	25,846	25,846	25,846
4	6,465	6,478	6,635	6,702	6,702	6,702	6,702
5	1,673	1,674	1,677	1,717	1,735	1,735	1,735
Total	283,471	285,067	285,487	285,595	285,612	285,612	285,612

The present %SPR : 21.9 %SPR after the seven years : 22.4

No. 2 (80mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	153,835	153,835	153,835	153,835	153,835	153,835	153,835
2	96,517	97,781	97,781	97,781	97,781	97,781	97,781
3	24,980	26,423	26,769	26,769	26,769	26,769	26,769
4	6,465	6,537	6,915	7,005	7,005	7,005	7,005
5	1,673	1,675	1,694	1,792	1,815	1,815	1,815
Total	283,471	286,252	286,994	287,182	287,206	287,206	287,206

The present %SPR : 21.9 %SPR after the seven years : 22.9

No. 3 (to introduce a closed season for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	153,835	153,835	153,835	153,835	153,835	153,835	153,835
2	96,517	96,928	96,928	96,928	96,928	96,928	96,928
3	24,980	25,559	25,668	25,668	25,668	25,668	25,668
4	6,465	6,615	6,769	6,797	6,797	6,797	6,797
5	1,673	1,712	1,752	1,792	1,800	1,800	1,800
Total	283,471	284,650	284,952	285,021	285,029	285,029	285,029

The present %SPR : 21.9 %SPR after the seven years : 22.4

No. 4 (70mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	153,835	153,835	153,835	153,835	153,835	153,835	153,835
2	96,517	97,616	97,616	97,616	97,616	97,616	97,616
3	24,980	25,988	26,284	26,284	26,284	26,284	26,284
4	6,465	6,624	6,891	6,970	6,970	6,970	6,970
5	1,673	1,712	1,754	1,825	1,846	1,846	1,846
Total	283,471	285,775	286,380	286,529	286,550	286,550	286,550

The present %SPR : 21.9 %SPR after the seven years : 22.8

No. 5 (80mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	153,835	153,835	153,835	153,835	153,835	153,835	153,835
2	96,517	97,827	97,827	97,827	97,827	97,827	97,827
3	24,980	26,608	26,969	26,969	26,969	26,969	26,969
4	6,465	6,667	7,102	7,198	7,198	7,198	7,198
5	1,673	1,714	1,767	1,882	1,908	1,908	1,908
Total	283,471	286,651	287,500	287,712	287,737	287,737	287,737

The present %SPR : 21.9 %SPR after the seven years : 23.1

No. 6 (to introduce a closed period for all fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	153,835	153,835	153,835	153,835	153,835	153,835	153,835
2	96,517	100,653	100,653	100,653	100,653	100,653	100,653
3	24,980	31,482	32,831	32,831	32,831	32,831	32,831
4	6,465	8,148	10,269	10,709	10,709	10,709	10,709
5	1,673	2,109	2,658	3,349	3,493	3,493	3,493
Total	283,471	296,227	300,246	301,378	301,521	301,521	301,521

The present %SPR : 21.9 %SPR after the seven years : 28.2

Table 5-2-7-3(1-2) Changes in the stock number of *Pagellus bellottii* (×1,000 individuals)

No. 7 (mesh size regulation to equivalent to 70 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	153,835	153,835	153,835	153,835	153,835	153,835	153,835
2	96,517	106,635	106,635	106,635	106,635	106,635	106,635
3	24,980	31,831	35,168	35,168	35,168	35,168	35,168
4	6,465	6,588	8,394	9,274	9,274	9,274	9,274
5	1,673	1,675	1,707	2,175	2,403	2,403	2,403
Total	283,471	300,564	305,740	307,088	307,316	307,316	307,316

The present %SPR : 21.9 %SPR after the seven years : 27.7

No. 8 (mesh size regulation to equivalent to 80 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	153,835	153,835	153,835	153,835	153,835	153,835	153,835
2	96,517	109,791	109,791	109,791	109,791	109,791	109,791
3	24,980	44,778	50,936	50,936	50,936	50,936	50,936
4	6,465	7,216	12,935	14,714	14,714	14,714	14,714
5	1,673	1,692	1,889	3,385	3,851	3,851	3,851
Total	283,471	317,312	329,386	332,662	333,128	333,128	333,128

The present %SPR : 21.9 %SPR after the seven years : 36.5

Table 5-2-7-3(2-1) Changes in the stock number of *Dentex canariensis* (×1, 000 individuals)

No. 1 (70mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	3,280	3,280	3,280	3,280	3,280	3,280	3,280
2	1,557	1,590	1,590	1,590	1,590	1,590	1,590
3	477	477	487	487	487	487	487
4	146	146	146	149	149	149	149
5	45	45	45	45	46	46	46
Total	5,504	5,537	5,547	5,551	5,552	5,552	5,552

The present %SPR : 24.6 %SPR after the seven years : 25.1

No. 2 (80mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	3,280	3,280	3,280	3,280	3,280	3,280	3,280
2	1,557	1,633	1,633	1,633	1,633	1,633	1,633
3	477	477	500	500	500	500	500
4	146	146	146	153	153	153	153
5	45	45	45	45	47	47	47
Total	5,504	5,580	5,603	5,611	5,613	5,613	5,613

The present %SPR : 24.6 %SPR after the seven years : 25.8

No. 3 (to introduce a closed season for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	3,280	3,280	3,280	3,280	3,280	3,280	3,280
2	1,557	1,585	1,585	1,585	1,585	1,585	1,585
3	477	491	500	500	500	500	500
4	146	150	155	158	158	158	158
5	45	46	47	49	50	50	50
Total	5,504	5,552	5,566	5,571	5,571	5,571	5,571

The present %SPR : 24.6 %SPR after the seven years : 25.6

No. 4 (70mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	3,280	3,280	3,280	3,280	3,280	3,280	3,280
2	1,557	1,601	1,601	1,601	1,601	1,601	1,601
3	477	491	505	505	505	505	505
4	146	150	155	159	159	159	159
5	45	46	47	49	50	50	50
Total	5,504	5,567	5,587	5,593	5,594	5,594	5,594

The present %SPR : 24.6 %SPR after the seven years : 25.9

No. 5 (80mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	3,280	3,280	3,280	3,280	3,280	3,280	3,280
2	1,557	1,636	1,636	1,636	1,636	1,636	1,636
3	477	491	516	516	516	516	516
4	146	150	155	163	163	163	163
5	45	46	47	49	51	51	51
Total	5,504	5,602	5,633	5,642	5,645	5,645	5,645

The present %SPR : 24.6 %SPR after the seven years : 26.4

No. 6 (to introduce a closed period for all fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	3,280	3,280	3,280	3,280	3,280	3,280	3,280
2	1,557	1,656	1,656	1,656	1,656	1,656	1,656
3	477	528	562	562	562	562	562
4	146	162	179	191	191	191	191
5	45	50	55	61	65	65	65
Total	5,504	5,676	5,732	5,750	5,754	5,754	5,754

The present %SPR : 24.6 %SPR after the seven years : 28.4

Table 5-2-7-3(2-2) Changes in the stock number of *Dentex canariensis* (×1, 000 individuals)

No. 7 (mesh size regulation to equivalent to 70 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	3,280	3,280	3,280	3,280	3,280	3,280	3,280
2	1,557	1,677	1,677	1,677	1,677	1,677	1,677
3	477	477	513	513	513	513	513
4	146	146	146	157	157	157	157
5	45	45	45	45	48	48	48
Total	5,504	5,623	5,660	5,671	5,675	5,675	5,675

The present %SPR : 24.6 %SPR after the seven years : 26.4

No. 8 (mesh size regulation to equivalent to 80 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	3,280	3,280	3,280	3,280	3,280	3,280	3,280
2	1,557	1,840	1,840	1,840	1,840	1,840	1,840
3	477	477	563	563	563	563	563
4	146	146	146	172	172	172	172
5	45	45	45	45	53	53	53
Total	5,504	5,787	5,874	5,900	5,908	5,908	5,908

The present %SPR : 24.6 %SPR after the seven years : 28.9

Table 5-2-7-3(3) Changes in the stock number of *Sparus caeruleostictus* (×1, 000 individuals)

No. 1 (70mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	10,920	10,920	10,920	10,920	10,920	10,920	10,920
2	1,561	1,595	1,595	1,595	1,595	1,595	1,595
3	223	223	228	228	228	228	228
Total	12,704	12,739	12,744	12,744	12,744	12,744	12,744

The present %SPR : 11.3 %SPR after the seven years : 11.6

No. 2 (80mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	10,920	10,920	10,920	10,920	10,920	10,920	10,920
2	1,561	1,637	1,637	1,637	1,637	1,637	1,637
3	223	223	234	234	234	234	234
Total	12,704	12,780	12,791	12,791	12,791	12,791	12,791

The present %SPR : 11.3 %SPR after the seven years : 11.9

No. 3 (to introduce a closed season for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	10,920	10,920	10,920	10,920	10,920	10,920	10,920
2	1,561	1,604	1,604	1,604	1,604	1,604	1,604
3	223	229	236	236	236	236	236
Total	12,704	12,754	12,761	12,761	12,761	12,761	12,761

The present %SPR : 11.3 %SPR after the seven years : 11.8

No. 4 (70mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	10,920	10,920	10,920	10,920	10,920	10,920	10,920
2	1,561	1,621	1,621	1,621	1,621	1,621	1,621
3	223	229	238	238	238	238	238
Total	12,704	12,771	12,779	12,779	12,779	12,779	12,779

The present %SPR : 11.3 %SPR after the seven years : 12.0

No. 5 (80mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	10,920	10,920	10,920	10,920	10,920	10,920	10,920
2	1,561	1,648	1,648	1,648	1,648	1,648	1,648
3	223	229	242	242	242	242	242
Total	12,704	12,798	12,811	12,811	12,811	12,811	12,811

The present %SPR : 11.3 %SPR after the seven years : 12.2

No. 6 (to introduce a closed period for all fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	10,920	10,920	10,920	10,920	10,920	10,920	10,920
2	1,561	1,724	1,724	1,724	1,724	1,724	1,724
3	223	246	272	272	272	272	272
Total	12,704	12,891	12,917	12,917	12,917	12,917	12,917

The present %SPR : 11.3 %SPR after the seven years : 13.2

No. 7 (mesh size regulation to equivalent to 70 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	10,920	10,920	10,920	10,920	10,920	10,920	10,920
2	1,561	1,688	1,688	1,688	1,688	1,688	1,688
3	223	223	241	241	241	241	241
Total	12,704	12,831	12,849	12,849	12,849	12,849	12,849

The present %SPR : 11.3 %SPR after the seven years : 12.3

No. 8 (mesh size regulation to equivalent to 80 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	10,920	10,920	10,920	10,920	10,920	10,920	10,920
2	1,561	1,861	1,861	1,861	1,861	1,861	1,861
3	223	223	266	266	266	266	266
Total	12,704	13,004	13,047	13,047	13,047	13,047	13,047

The present %SPR : 11.3 %SPR after the seven years : 13.5

Table 5-2-7-3(4-1) Changes in the stock number of *Pseudotolithus senegalensis* (×1,000 individuals)

No. 1 (70mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	6,244	6,244	6,244	6,244	6,244	6,244	6,244
2	4,242	4,242	4,242	4,242	4,242	4,242	4,242
3	2,461	2,461	2,461	2,461	2,461	2,461	2,461
4	561	561	561	561	561	561	561
5	128	128	128	128	128	128	128
6	29	29	29	29	29	29	29
Total	13,664	13,664	13,664	13,664	13,664	13,664	13,664

The present %SPR : 16.9 %SPR after the seven years : 16.9

No. 2 (80mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	6,244	6,244	6,244	6,244	6,244	6,244	6,244
2	4,242	4,242	4,242	4,242	4,242	4,242	4,242
3	2,461	2,461	2,461	2,461	2,461	2,461	2,461
4	561	561	561	561	561	561	561
5	128	128	128	128	128	128	128
6	29	29	29	29	29	29	29
Total	13,664	13,664	13,664	13,664	13,664	13,664	13,664

The present %SPR : 16.9 %SPR after the seven years : 16.9

No. 3 (to introduce a closed season for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	6,244	6,244	6,244	6,244	6,244	6,244	6,244
2	4,242	4,245	4,245	4,245	4,245	4,245	4,245
3	2,461	2,475	2,477	2,477	2,477	2,477	2,477
4	561	574	578	578	578	578	578
5	128	131	134	135	135	135	135
6	29	30	31	31	31	31	31
Total	13,664	13,699	13,709	13,711	13,711	13,711	13,711

The present %SPR : 16.9 %SPR after the seven years : 17.4

No. 4 (70mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	6,244	6,244	6,244	6,244	6,244	6,244	6,244
2	4,242	4,245	4,245	4,245	4,245	4,245	4,245
3	2,461	2,475	2,477	2,477	2,477	2,477	2,477
4	561	574	578	578	578	578	578
5	128	131	134	135	135	135	135
6	29	30	31	31	31	31	31
Total	13,664	13,699	13,709	13,711	13,711	13,711	13,711

The present %SPR : 16.9 %SPR after the seven years : 17.4

No. 5 (80mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	6,244	6,244	6,244	6,244	6,244	6,244	6,244
2	4,242	4,245	4,245	4,245	4,245	4,245	4,245
3	2,461	2,475	2,477	2,477	2,477	2,477	2,477
4	561	574	578	578	578	578	578
5	128	131	134	135	135	135	135
6	29	30	31	31	31	31	31
Total	13,664	13,699	13,709	13,711	13,711	13,711	13,711

The present %SPR : 16.9 %SPR after the seven years : 17.4

Table 5-2-7-3(4-2) Changes in the stock number of *Pseudotolithus senegalensis* (×1,000 individuals)

No. 6 (to introduce a closed period for all fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	6,244	6,244	6,244	6,244	6,244	6,244	6,244
2	4,242	4,272	4,272	4,272	4,272	4,272	4,272
3	2,461	2,579	2,597	2,597	2,597	2,597	2,597
4	561	683	716	721	721	721	721
5	128	156	190	199	200	200	200
6	29	35	43	53	55	56	56
Total	13,664	13,970	14,063	14,087	14,091	14,091	14,091

The present %SPR : 16.9 %SPR after the seven years : 21.7

No. 7 (mesh size regulation to equivalent to 70 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	6,244	6,244	6,244	6,244	6,244	6,244	6,244
2	4,242	4,242	4,242	4,242	4,242	4,242	4,242
3	2,461	2,461	2,461	2,461	2,461	2,461	2,461
4	561	561	561	561	561	561	561
5	128	128	128	128	128	128	128
6	29	29	29	29	29	29	29
Total	13,664	13,664	13,664	13,664	13,664	13,664	13,664

The present %SPR : 16.9 %SPR after the seven years : 16.9

No. 8 (mesh size regulation to equivalent to 80 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	6,244	6,244	6,244	6,244	6,244	6,244	6,244
2	4,242	4,242	4,242	4,242	4,242	4,242	4,242
3	2,461	2,461	2,461	2,461	2,461	2,461	2,461
4	561	561	561	561	561	561	561
5	128	128	128	128	128	128	128
6	29	29	29	29	29	29	29
Total	13,664	13,664	13,664	13,664	13,664	13,664	13,664

The present %SPR : 16.9 %SPR after the seven years : 16.9

Table 5-2-7-3(5-1) Changes in the stock number of *Brachydeuterus auritus* (×1,000 individuals)

No. 1 (70mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	996,558	996,558	996,558	996,558	996,558	996,558	996,558
2	617,226	618,528	618,528	618,528	618,528	618,528	618,528
3	327,433	329,730	330,425	330,425	330,425	330,425	330,425
4	142,966	143,775	144,783	145,088	145,088	145,088	145,088
5	45,725	45,876	46,135	46,459	46,557	46,557	46,557
6	14,624	14,641	14,689	14,772	14,876	14,907	14,907
7	4,677	4,679	4,685	4,700	4,727	4,760	4,770
Total	2,149,209	2,153,786	2,155,803	2,156,531	2,156,759	2,156,823	2,156,833

The present %SPR : 32.8 %SPR after the seven years : 33.3

No. 2 (80mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	996,558	996,558	996,558	996,558	996,558	996,558	996,558
2	617,226	618,948	618,948	618,948	618,948	618,948	618,948
3	327,433	331,439	332,363	332,363	332,363	332,363	332,363
4	142,966	145,321	147,100	147,510	147,510	147,510	147,510
5	45,725	46,411	47,175	47,752	47,886	47,886	47,886
6	14,624	14,723	14,944	15,190	15,376	15,419	15,419
7	4,677	4,692	4,724	4,795	4,874	4,933	4,947
Total	2,149,209	2,158,092	2,161,812	2,163,117	2,163,515	2,163,617	2,163,631

The present %SPR : 32.8 %SPR after the seven years : 33.8

No. 3 (to introduce a closed season for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	996,558	996,558	996,558	996,558	996,558	996,558	996,558
2	617,226	618,141	618,141	618,141	618,141	618,141	618,141
3	327,433	329,797	330,286	330,286	330,286	330,286	330,286
4	142,966	144,978	146,025	146,241	146,241	146,241	146,241
5	45,725	46,826	47,485	47,827	47,898	47,898	47,898
6	14,624	14,976	15,337	15,553	15,665	15,688	15,688
7	4,677	4,790	4,905	5,023	5,094	5,131	5,138
Total	2,149,209	2,156,066	2,158,737	2,159,630	2,159,884	2,159,944	2,159,952

The present %SPR : 32.8 %SPR after the seven years : 33.8

No. 4 (70mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	996,558	996,558	996,558	996,558	996,558	996,558	996,558
2	617,226	618,822	618,822	618,822	618,822	618,822	618,822
3	327,433	330,960	331,816	331,816	331,816	331,816	331,816
4	142,966	145,387	146,953	147,333	147,333	147,333	147,333
5	45,725	46,906	47,700	48,214	48,339	48,339	48,339
6	14,624	14,985	15,372	15,633	15,801	15,842	15,842
7	4,677	4,791	4,909	5,036	5,121	5,177	5,190
Total	2,149,209	2,158,410	2,162,132	2,163,413	2,163,791	2,163,887	2,163,901

The present %SPR : 32.8 %SPR after the seven years : 34.0

No. 5 (80mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	996,558	996,558	996,558	996,558	996,558	996,558	996,558
2	617,226	619,057	619,057	619,057	619,057	619,057	619,057
3	327,433	331,924	332,909	332,909	332,909	332,909	332,909
4	142,966	146,227	148,233	148,673	148,673	148,673	148,673
5	45,725	47,202	48,278	48,941	49,086	49,086	49,086
6	14,624	15,031	15,516	15,870	16,088	16,135	16,135
7	4,677	4,798	4,931	5,091	5,207	5,278	5,294
Total	2,149,209	2,160,797	2,165,482	2,167,098	2,167,577	2,167,696	2,167,711

The present %SPR : 32.8 %SPR after the seven years : 34.3

Table 5-2-7-3(5-2) Changes in the stock number of *Brachydeuterus auritus* (×1,000 individuals)

No. 6 (to introduce a closed period for all fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	996,558	996,558	996,558	996,558	996,558	996,558	996,558
2	617,226	628,568	628,568	628,568	628,568	628,568	628,568
3	327,433	357,671	364,244	364,244	364,244	364,244	364,244
4	142,966	169,701	185,373	188,780	188,780	188,780	188,780
5	45,725	61,200	72,645	79,354	80,812	80,812	80,812
6	14,624	19,574	26,198	31,097	33,969	34,593	34,593
7	4,677	6,260	8,379	11,215	13,312	14,541	14,809
Total	2,149,209	2,239,533	2,281,965	2,299,815	2,306,243	2,308,096	2,308,363

The present %SPR : 32.8 %SPR after the seven years : 49.0

No. 7 (mesh size regulation to equivalent to 70 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	996,558	996,558	996,558	996,558	996,558	996,558	996,558
2	617,226	633,409	633,409	633,409	633,409	633,409	633,409
3	327,433	356,777	366,131	366,131	366,131	366,131	366,131
4	142,966	153,211	166,941	171,318	171,318	171,318	171,318
5	45,725	47,617	51,029	55,602	57,060	57,060	57,060
6	14,624	14,831	15,445	16,552	18,035	18,508	18,508
7	4,677	4,703	4,770	4,967	5,323	5,800	5,952
Total	2,149,209	2,207,106	2,234,283	2,244,537	2,247,834	2,248,784	2,248,936

The present %SPR : 32.8 %SPR after the seven years : 38.5

No. 8 (mesh size regulation to equivalent to 80 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	996,558	996,558	996,558	996,558	996,558	996,558	996,558
2	617,226	638,709	638,709	638,709	638,709	638,709	638,709
3	327,433	380,141	393,372	393,372	393,372	393,372	393,372
4	142,966	174,694	202,815	209,874	209,874	209,874	209,874
5	45,725	54,888	67,069	77,865	80,575	80,575	80,575
6	14,624	15,890	19,075	23,308	27,060	28,002	28,002
7	4,677	4,860	5,281	6,340	7,747	8,994	9,307
Total	2,149,209	2,265,740	2,322,878	2,346,025	2,353,894	2,356,083	2,356,396

The present %SPR : 32.8 %SPR after the seven years : 48.2

Table 5-2-7-3(6-1) Changes in the stock number of *Pomadasys incisus* (×1,000 individuals)

No. 1 (70mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,673	15,673	15,673	15,673	15,673	15,673	15,673
2	7,403	7,403	7,403	7,403	7,403	7,403	7,403
3	3,482	3,484	3,484	3,484	3,484	3,484	3,484
4	1,344	1,357	1,358	1,358	1,358	1,358	1,358
5	356	358	361	361	361	361	361
6	94	94	95	96	96	96	96
7	25	25	25	25	25	25	25
Total	28,378	28,395	28,400	28,401	28,401	28,401	28,401

The present %SPR : 57.9 %SPR after the seven years : 58.4

No. 2 (80mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,673	15,673	15,673	15,673	15,673	15,673	15,673
2	7,403	7,403	7,403	7,403	7,403	7,403	7,403
3	3,482	3,485	3,485	3,485	3,485	3,485	3,485
4	1,344	1,376	1,377	1,377	1,377	1,377	1,377
5	356	363	372	372	372	372	372
6	94	95	97	99	99	99	99
7	25	25	25	26	26	26	26
Total	28,378	28,421	28,433	28,436	28,437	28,437	28,437

The present %SPR : 57.9 %SPR after the seven years : 59.3

No. 3 (to introduce a closed season for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,673	15,673	15,673	15,673	15,673	15,673	15,673
2	7,403	7,403	7,403	7,403	7,403	7,403	7,403
3	3,482	3,483	3,483	3,483	3,483	3,483	3,483
4	1,344	1,360	1,360	1,360	1,360	1,360	1,360
5	356	366	371	371	371	371	371
6	94	97	100	101	101	101	101
7	25	26	26	27	28	28	28
Total	28,378	28,408	28,417	28,419	28,419	28,419	28,419

The present %SPR : 57.9 %SPR after the seven years : 59.1

No. 4 (70mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,673	15,673	15,673	15,673	15,673	15,673	15,673
2	7,403	7,403	7,403	7,403	7,403	7,403	7,403
3	3,482	3,485	3,485	3,485	3,485	3,485	3,485
4	1,344	1,369	1,370	1,370	1,370	1,370	1,370
5	356	368	375	375	375	375	375
6	94	97	100	102	102	102	102
7	25	26	26	27	28	28	28
Total	28,378	28,421	28,432	28,435	28,436	28,436	28,436

The present %SPR : 57.9 %SPR after the seven years : 59.5

No. 5 (80mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,673	15,673	15,673	15,673	15,673	15,673	15,673
2	7,403	7,403	7,403	7,403	7,403	7,403	7,403
3	3,482	3,485	3,485	3,485	3,485	3,485	3,485
4	1,344	1,383	1,384	1,384	1,384	1,384	1,384
5	356	372	383	383	383	383	383
6	94	98	102	105	105	105	105
7	25	26	27	28	29	29	29
Total	28,378	28,440	28,457	28,461	28,462	28,462	28,462

The present %SPR : 57.9 %SPR after the seven years : 60.2

Table 5-2-7-3(6-2) Changes in the stock number of *Pomadasys incisus* (×1,000 individuals)

No. 6 (to introduce a closed period for all fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,673	15,673	15,673	15,673	15,673	15,673	15,673
2	7,403	7,403	7,403	7,403	7,403	7,403	7,403
3	3,482	3,486	3,486	3,486	3,486	3,486	3,486
4	1,344	1,414	1,416	1,416	1,416	1,416	1,416
5	356	405	426	427	427	427	427
6	94	107	122	128	129	129	129
7	25	28	32	37	39	39	39
Total	28,378	28,518	28,559	28,571	28,573	28,573	28,573

The present %SPR : 57.9 %SPR after the seven years : 64.0

No. 7 (mesh size regulation to equivalent to 70 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,673	15,673	15,673	15,673	15,673	15,673	15,673
2	7,403	7,403	7,403	7,403	7,403	7,403	7,403
3	3,482	3,491	3,491	3,491	3,491	3,491	3,491
4	1,344	1,404	1,407	1,407	1,407	1,407	1,407
5	356	363	379	380	380	380	380
6	94	95	97	101	101	101	101
7	25	25	25	26	27	27	27
Total	28,378	28,454	28,475	28,481	28,483	28,483	28,483

The present %SPR : 57.9 %SPR after the seven years : 60.2

No. 8 (mesh size regulation to equivalent to 80 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,673	15,673	15,673	15,673	15,673	15,673	15,673
2	7,403	7,403	7,403	7,403	7,403	7,403	7,403
3	3,482	3,495	3,495	3,495	3,495	3,495	3,495
4	1,344	1,493	1,498	1,498	1,498	1,498	1,498
5	356	389	432	434	434	434	434
6	94	97	106	118	118	118	118
7	25	25	26	28	32	32	32
Total	28,378	28,575	28,633	28,649	28,653	28,653	28,653

The present %SPR : 57.9 %SPR after the seven years : 64.6

Table 5-2-7-3(7) Changes in the stock number of *Pseudupeneus prayensis* (×1,000 individuals)

No. 1 (70mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	4,097	4,097	4,097	4,097	4,097	4,097	4,097
2	672	687	687	687	687	687	687
Total	4,770	4,784	4,784	4,784	4,784	4,784	4,784

The present %SPR : 51.6 %SPR after the seven years : 52.1

No. 2 (80mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	4,097	4,097	4,097	4,097	4,097	4,097	4,097
2	672	722	722	722	722	722	722
Total	4,770	4,820	4,820	4,820	4,820	4,820	4,820

The present %SPR : 51.6 %SPR after the seven years : 53.4

No. 3 (to introduce a closed season for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	4,097	4,097	4,097	4,097	4,097	4,097	4,097
2	672	687	687	687	687	687	687
Total	4,770	4,784	4,784	4,784	4,784	4,784	4,784

The present %SPR : 51.6 %SPR after the seven years : 52.1

No. 4 (70mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	4,097	4,097	4,097	4,097	4,097	4,097	4,097
2	672	698	698	698	698	698	698
Total	4,770	4,795	4,795	4,795	4,795	4,795	4,795

The present %SPR : 51.6 %SPR after the seven years : 52.5

No. 5 (80mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	4,097	4,097	4,097	4,097	4,097	4,097	4,097
2	672	729	729	729	729	729	729
Total	4,770	4,826	4,826	4,826	4,826	4,826	4,826

The present %SPR : 51.6 %SPR after the seven years : 53.6

No. 6 (to introduce a closed period for all fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	4,097	4,097	4,097	4,097	4,097	4,097	4,097
2	672	700	700	700	700	700	700
Total	4,770	4,798	4,798	4,798	4,798	4,798	4,798

The present %SPR : 51.6 %SPR after the seven years : 52.6

No. 7 (mesh size regulation to equivalent to 70 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	4,097	4,097	4,097	4,097	4,097	4,097	4,097
2	672	702	702	702	702	702	702
Total	4,770	4,799	4,799	4,799	4,799	4,799	4,799

The present %SPR : 51.6 %SPR after the seven years : 52.6

No. 8 (mesh size regulation to equivalent to 80 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	4,097	4,097	4,097	4,097	4,097	4,097	4,097
2	672	783	783	783	783	783	783
Total	4,770	4,881	4,881	4,881	4,881	4,881	4,881

The present %SPR : 51.6 %SPR after the seven years : 55.6

Table 5-2-7-3(8) Changes in the stock number of *Decapterus rhonchus* (×1,000 individuals)

No. 1 (70mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	45,027	45,027	45,027	45,027	45,027	45,027	45,027
1	11,565	11,967	11,967	11,967	11,967	11,967	11,967
2	1,562	1,565	1,619	1,619	1,619	1,619	1,619
Total	58,154	58,558	58,613	58,613	58,613	58,613	58,613

The present %SPR : 9.4 %SPR after the seven years : 9.8

No. 2 (80mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	45,027	45,027	45,027	45,027	45,027	45,027	45,027
1	11,565	12,285	12,285	12,285	12,285	12,285	12,285
2	1,562	1,570	1,668	1,668	1,668	1,668	1,668
Total	58,154	58,882	58,980	58,980	58,980	58,980	58,980

The present %SPR : 9.4 %SPR after the seven years : 10.1

No. 3 (to introduce a closed season for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	45,027	45,027	45,027	45,027	45,027	45,027	45,027
1	11,565	11,669	11,669	11,669	11,669	11,669	11,669
2	1,562	1,564	1,578	1,578	1,578	1,578	1,578
Total	58,154	58,259	58,274	58,274	58,274	58,274	58,274

The present %SPR : 9.4 %SPR after the seven years : 9.5

No. 4 (70mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	45,027	45,027	45,027	45,027	45,027	45,027	45,027
1	11,565	12,025	12,025	12,025	12,025	12,025	12,025
2	1,562	1,567	1,629	1,629	1,629	1,629	1,629
Total	58,154	58,618	58,681	58,681	58,681	58,681	58,681

The present %SPR : 9.4 %SPR after the seven years : 9.8

No. 5 (80mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	45,027	45,027	45,027	45,027	45,027	45,027	45,027
1	11,565	12,321	12,321	12,321	12,321	12,321	12,321
2	1,562	1,572	1,675	1,675	1,675	1,675	1,675
Total	58,154	58,920	59,022	59,022	59,022	59,022	59,022

The present %SPR : 9.4 %SPR after the seven years : 10.1

No. 6 (to introduce a closed period for all fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	45,027	45,027	45,027	45,027	45,027	45,027	45,027
1	11,565	12,364	12,364	12,364	12,364	12,364	12,364
2	1,562	1,577	1,686	1,686	1,686	1,686	1,686
Total	58,154	58,968	59,077	59,077	59,077	59,077	59,077

The present %SPR : 9.4 %SPR after the seven years : 10.1

No. 7 (mesh size regulation to equivalent to 70 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	45,027	45,027	45,027	45,027	45,027	45,027	45,027
1	11,565	15,423	15,423	15,423	15,423	15,423	15,423
2	1,562	1,584	2,112	2,112	2,112	2,112	2,112
Total	58,154	62,034	62,562	62,562	62,562	62,562	62,562

The present %SPR : 9.4 %SPR after the seven years : 12.6

No. 8 (mesh size regulation to equivalent to 80 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	45,027	45,027	45,027	45,027	45,027	45,027	45,027
1	11,565	20,353	20,353	20,353	20,353	20,353	20,353
2	1,562	1,645	2,895	2,895	2,895	2,895	2,895
Total	58,154	67,024	68,275	68,275	68,275	68,275	68,275

The present %SPR : 9.4 %SPR after the seven years : 17.0

Table 5-2-7-3(9) Changes in the stock number of *Galeoides decadactylus* (×1,000 individuals)

No. 1 (70mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,297	15,297	15,297	15,297	15,297	15,297	15,297
2	758	763	763	763	763	763	763
3	38	38	38	38	38	38	38
Total	16,092	16,098	16,098	16,098	16,098	16,098	16,098

The present %SPR : 4.1 %SPR after the seven years : 4.2

No. 2 (80mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,297	15,297	15,297	15,297	15,297	15,297	15,297
2	758	768	768	768	768	768	768
3	38	38	38	38	38	38	38
Total	16,092	16,102	16,103	16,103	16,103	16,103	16,103

The present %SPR : 4.1 %SPR after the seven years : 4.2

No. 3 (to introduce a closed season for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,297	15,297	15,297	15,297	15,297	15,297	15,297
2	758	761	761	761	761	761	761
3	38	38	38	38	38	38	38
Total	16,092	16,095	16,096	16,096	16,096	16,096	16,096

The present %SPR : 4.1 %SPR after the seven years : 4.1

No. 4 (70mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,297	15,297	15,297	15,297	15,297	15,297	15,297
2	758	764	764	764	764	764	764
3	38	38	38	38	38	38	38
Total	16,092	16,099	16,099	16,099	16,099	16,099	16,099

The present %SPR : 4.1 %SPR after the seven years : 4.2

No. 5 (80mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,297	15,297	15,297	15,297	15,297	15,297	15,297
2	758	768	768	768	768	768	768
3	38	38	38	38	38	38	38
Total	16,092	16,103	16,103	16,103	16,103	16,103	16,103

The present %SPR : 4.1 %SPR after the seven years : 4.2

No. 6 (to introduce a closed period for all fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,297	15,297	15,297	15,297	15,297	15,297	15,297
2	758	1,131	1,131	1,131	1,131	1,131	1,131
3	38	56	84	84	84	84	84
Total	16,092	16,484	16,512	16,512	16,512	16,512	16,512

The present %SPR : 4.1 %SPR after the seven years : 5.4

No. 7 (mesh size regulation to equivalent to 70 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,297	15,297	15,297	15,297	15,297	15,297	15,297
2	758	1,619	1,619	1,619	1,619	1,619	1,619
3	38	38	82	82	82	82	82
Total	16,092	16,954	16,998	16,998	16,998	16,998	16,998

The present %SPR : 4.1 %SPR after the seven years : 6.3

No. 8 (mesh size regulation to equivalent to 80 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
1	15,297	15,297	15,297	15,297	15,297	15,297	15,297
2	758	3,473	3,473	3,473	3,473	3,473	3,473
3	38	43	195	195	195	195	195
Total	16,092	18,812	18,965	18,965	18,965	18,965	18,965

The present %SPR : 4.1 %SPR after the seven years : 11.1

Table 5-2-7-3(10) Changes in the stock number of *Sepia officinalis* (×1,000 individuals)

No. 1 (70mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	15,594	15,594	15,594	15,594	15,594	15,594	15,594
1	7,863	8,289	8,289	8,289	8,289	8,289	8,289
2	1,678	1,678	1,769	1,769	1,769	1,769	1,769
Total	25,135	25,561	25,652	25,652	25,652	25,652	25,652

The present %SPR : 38.1 %SPR after the seven years : 40.2

No. 2 (80mm mesh size regulation in Industrial fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	15,594	15,594	15,594	15,594	15,594	15,594	15,594
1	7,863	8,473	8,473	8,473	8,473	8,473	8,473
2	1,678	1,678	1,808	1,808	1,808	1,808	1,808
Total	25,135	25,746	25,876	25,876	25,876	25,876	25,876

The present %SPR : 38.1 %SPR after the seven years : 41.0

No. 3 (to introduce a closed season for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	15,594	15,594	15,594	15,594	15,594	15,594	15,594
1	7,863	9,678	9,678	9,678	9,678	9,678	9,678
2	1,678	2,129	2,620	2,620	2,620	2,620	2,620
Total	25,135	27,401	27,893	27,893	27,893	27,893	27,893

The present %SPR : 38.1 %SPR after the seven years : 53.7

No. 4 (70mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	15,594	15,594	15,594	15,594	15,594	15,594	15,594
1	7,863	10,275	10,275	10,275	10,275	10,275	10,275
2	1,678	2,129	2,782	2,782	2,782	2,782	2,782
Total	25,135	27,998	28,651	28,651	28,651	28,651	28,651

The present %SPR : 38.1 %SPR after the seven years : 57.1

No. 5 (80mm mesh size regulation in Industrial fisheries and to introduce a closed period for Industrial fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	15,594	15,594	15,594	15,594	15,594	15,594	15,594
1	7,863	10,530	10,530	10,530	10,530	10,530	10,530
2	1,678	2,129	2,851	2,851	2,851	2,851	2,851
Total	25,135	28,253	28,975	28,975	28,975	28,975	28,975

The present %SPR : 38.1 %SPR after the seven years : 58.5

No. 6 (to introduce a closed period for all fisheries from October through December)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	15,594	15,594	15,594	15,594	15,594	15,594	15,594
1	7,863	9,869	9,869	9,869	9,869	9,869	9,869
2	1,678	2,179	2,735	2,735	2,735	2,735	2,735
Total	25,135	27,643	28,198	28,198	28,198	28,198	28,198

The present %SPR : 38.1 %SPR after the seven years : 55.6

No. 7 (mesh size regulation to equivalent to 70 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	15,594	15,594	15,594	15,594	15,594	15,594	15,594
1	7,863	8,328	8,328	8,328	8,328	8,328	8,328
2	1,678	1,678	1,777	1,777	1,777	1,777	1,777
Total	25,135	25,601	25,700	25,700	25,700	25,700	25,700

The present %SPR : 38.1 %SPR after the seven years : 40.3

No. 8 (mesh size regulation to equivalent to 80 mm for all fisheries)

Age	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year
0	15,594	15,594	15,594	15,594	15,594	15,594	15,594
1	7,863	8,531	8,531	8,531	8,531	8,531	8,531
2	1,678	1,678	1,821	1,821	1,821	1,821	1,821
Total	25,135	25,803	25,946	25,946	25,946	25,946	25,946

The present %SPR : 38.1 %SPR after the seven years : 41.3