A NOTE OF SOME ASPECTS IN HOOK RATE OF KOREAN ATLANTIC TUNA LONGLINE FISHERY FOR 1975-77

by

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SUMMARY

The Korean tuna yield is mainly dependent upon the longline fishing gear whose preeminent species consist of yellowfin, bigeye and albacore from any ocean, including the Atlantic. Accordingly, it is natural that nations which own their own boats should use hook rate in catch per unit of effort as an index of population size.

This report deals with the changes of hook rate on all species caught by year, and also the level of hook rate by species and month is compared. On the other hand, it attempts to examine whether yearly average hook rate for 1975-77 is considerably different or not by means of the testing of statistical hypothesis.

RESUME

La production thonière coréenne dépend surtout de la pêche à la palangre, laquelle porte avant tout sur l'albacore, le thon obèse et le germon dans tous les océans, y compris l'Atlantique. Il est donc logique que les pays qui possèdent leurs propores bateaux de pêche utilisent le taux par hameçon de la capture par unité d'effort comme indice de l'importance de la population.

Le présent rapport traite des modifications annuelles du taux par hameçon pour toutes les espèces capturées; on y effectue également une comparaison des taux par hameçon par espèces et par mois. On tente, par ailleurs, de déterminer si le taux moyen annuel par hameçon pour 1975-1977 est significativement différent, ou non, au moyen des tests d'hypothèses utilisées en statistiques.

RESUMEN

La producción coreana de túnidos depende en gran parte del palangre, que captura principalmente rabil, patudo y atún blanco en todos los océanos, incluyendo el Atlántico. En consecuencia, es lógico que los países propietarios de los barcos, utilicen la tasa por anzuelos en la captura por unidad de esfuerzo como índice del tamaño de la población.

El informe trata sobre los cambios en la tasa por anzuelos en relación con todas las especies capturados por año, y establece una comparación entre el nivel de la tasa por anzuelo por especies y por mes. Por otra parte, se intenta averiguar si el índice anual medio de anzuelos en el período 1975-1977 es sustancialemente diferente o no, comprobando las hipótesis estadísticas.

Catch statistics

Annual catch of Korean tunas and tuna-like fishes in this ocean was in the vicinity of 12,500 metric tons during 1967 – 1969, and since 1970 it increased to the level of about three times as much as in former years. It reached a maximum of 47,000 metric tons in 1975 and averaged 38,600 metric tons during 1970 – 1977.

In catch fluctuation by major species for the above period, albacore tuna was the largest portion in 1971 (31.1%) and 1972 (37.4%), followed by yellowfin and bigeye tuna. But the largest portion changed to yellowfin from 1973 on and has fixed its trend by the current year, while bigeye has not appeared a common pattern for the years (Table 1).

Data source

Fishing activity of Korean tuna longliners in this ocean has been carried out since 1964 and bait boats began fishing in 1972. As of 1978, 120 longliners and 18 bait boats are operating.

Data checked by captains or firms from tuna fishing boats, in conformity with our indicated reporting forms, is being gathered so as to get various information on fisheries resources research, and the data is compiled in detail by subarea (5° x 5°), species, by month and year.

It is already submitted to SCRS in the form of task 2 and promulgated in Data Record of ICCAT (Data Record, Vol. 9 – 10, 1977 a,b). Data used in this report is the data derived from 1975 to 1977 (coverage: 19.3% in 1975, 49.8%) in 1976, and 35.2% in 1977) and preliminary data from 1978 (January – May).

Result and Discussion

Distribution of fishing ground

The total number of hooks used are chosen as an unit of fishing effort in making catch per unit of effort in weight (Kg) per 1,000 hooks. Fig. 1 shows the distribution of fishing ground of Korean tuna longliners on all species caught by 5° x 5° area. In connection with this a healthy fishing ground appears around the equatorial area (10°N – 10°S) on the whole and the scope of that shows that in the north Atlantic it extends near 40°N in every year but is under a bias toward the west year after year, and in contrast to this in the south Atlantic it has gradually widened from 20°S to the waters 40°S, 30°W.

Changes of annual hook rate

Annual hook rate, as shown in Fig. 2, has decreased slightly from year to year. However the first quarter of every year in general appears to have higher level than the others but other seasons have not revealed a constant trend. In another analysis, standard deviation (S.D.) and coefficient of variation (C.V.), based on the data above explained, are calculated as follows:

$$S.D = \sqrt{\frac{1}{N}\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

$$C.V = S.D/\bar{x}$$

Both their values have fallen off every year (Table 2). It means that Korean tuna longline fishing in the ocean is approximated into a steady state gradually, although it shows the status as above illustrated, and it is as indicated by species (see Fig. 2 and Table 2), yellowfin records the highest abundance among these species for the years and has a two peak season with first and third quarter but markedly poor abundant index shows in November and December. S.D. and C.V. of this fish show the same tendency with all species. It means that yellowfin is the most commonly caught fish in Korean tuna longline fishery. Albacore has shown the lowest abundance compared to the others, especially in 1975. In November and December, however, its trend maintains an increase for the years. This is a reciprocal status as compared with yellowfin which retains a lower level, and values of S.D. and C.V. are rather larger against the previous year. This implies that the fishing of albacore is done selectively. Bigeye's hook rate is the highest in 1975 but on the whole it persists with parallel status and there is not a common trend in S.D. and C.V.'s value.

Review of hook rate for two contrasting species

The monthly value of hook rate between yellowfin-albacore, albacore-bigeye and bigeye-yellowfin respectively is plotted against centripetal point where the average hook rate by year intersects each other (Fig. 3).

Yellowfin–albacore relationship: In 1975 and 1976 when yellowfin matain-tained high level, albacore was rather lower, but in 1977, in contrast to this, it appeared to have an opposite status on the whole. This suggests a certain connection for two species. Albacore–bigeye relation-ship: In 1975 and 1976 both species are considerably lower level but in 1977 it shows reciprocal status. Bigeye–yellowfin relationship: There is not an apparent trend for a while for the two species but a healthy status with the highest abundance exists mutually from January to March in 1975 and 1976, and also a poor level appears occasionally.

Testing of statistical hypothesis of average hook rate for two contrasting years

Common equations adopted here are as follows:

$$\hat{\sigma}^2 = \left[\sum_{i=1}^{n}(x_i-\bar{x}) + \sum_{i=1}^{n}(y_i-\bar{y})\right] / r$$

and with

$$\hat{\sigma}_{\bar{x}-\bar{y}} = \hat{\sigma}\sqrt{\frac{1}{N_1}+\frac{1}{N_2}}$$

from equation above

$$|t| = \left|(\bar{x}-\bar{y})/\hat{\sigma}_{\bar{x}-\bar{y}}\right|$$

where $\hat{\sigma}^2$:value of unbiased estimate of population

$r = N_1+N_2-2$:degree of freedom

$\hat{\sigma}_{\bar{x}-\bar{y}}$:value of unbiased estimate of standard error at $\bar{x}-\bar{y}$

N_1 , N_2 :number of samples in every year for two contrasting years

t :value of t-distribution table at 0.01 of significant level.

The results are shown in Table 3. In the cases for two contrasting years of 1976–1977 and 1977–1975 these are not significant differences but in the case of 1975–1976 is significant. However its value of differences is not so considerable. It seems that the average hook rate extracted from the samples by year during 1975 – 1977 is not to have different level. In other words they can be used as a representative of catch per unit of effort if the annual hook rate has some different values.

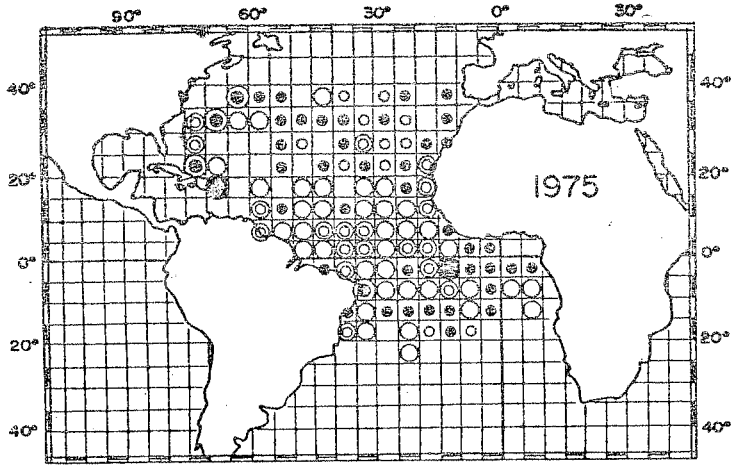
Conclusion

This report suggests that hook rate of Korean tuna longline fishery in this ocean is slightly decreased year after year. Among all species caught, yellowfin is the most pre-eminent species, followed by bigeye and albacore from 1975 to January – May of 1978. The fishing seems to be a steady state gradually from the result of standard deviation and coefficient of variation. In the review of hook rate for the two contrasting species, there seems to be a common pattern for yellowfin–albacore but not to be a pattern within other species. From the testing of staistical hypothesis yearly average hook rate for two contrasting years there appears to be no significant difference on the whole, although in the case of 1975–1976 it is significant.

Reference cited

ICCAT. 1977a. Data record, Vol. 9. Inter. Comm. Conserv. Atlantic Tunas, Madrid, Spain, 12 – 18 p.

ICCAT. 1977b. Data record, Vol. 10. Inter. Comm. Conserv. Atlantic Tunas, Madrid, Spain, 274 – 284 p.



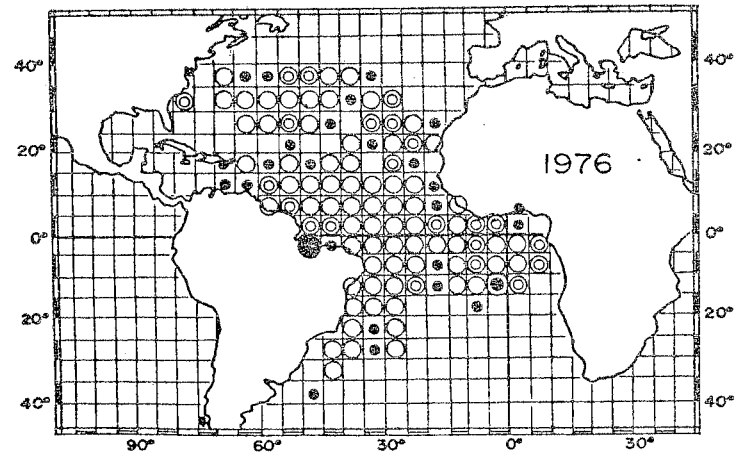


Fig. 1. Hook rate per 1,000 hooks by 5° x 5° area of all species caught by Korean tuna longliners, 1975 - 1977.

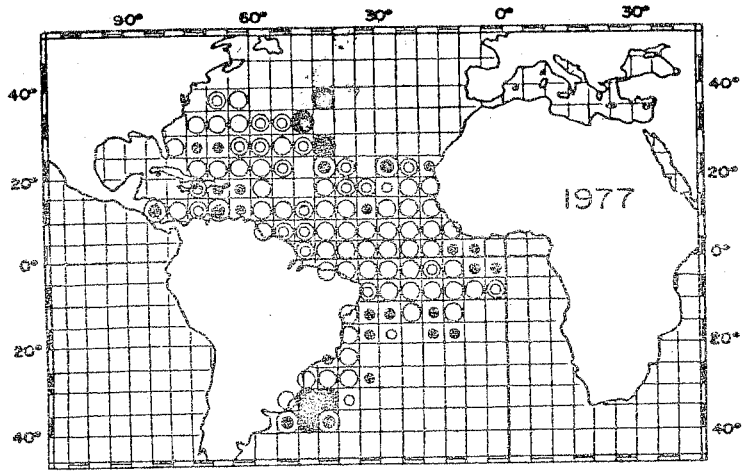


Fig. 1 . continued .

Table 1. Korean tunas catch in metric tons and portion in percent by species in the Atlantic ocean, 1967 - 1977

Year	species / Total	Yellowfin		Albacore		Bigeye	
		catch	%	catch	%	catch	%
1967	12,836						
1968	12,624						
1969	12,594						
1970	34,865						
1971	37,142	9,901	26.7	11,539	31.1	7,353	19.8
1972	36,345	11,078	30.5	13,577	37.4	5,730	15.8
1973	34,460	13,744	39.9	8,525	24.7	5,829	16.9
1974	38,326	17,687	46.1	5,216	13.6	7,376	19.2
1975	46,949	16,603	35.4	6,073	12.9	11,912	25.4
1976	35,383	11,576	32.7	8,755	24.7	7,557	21.4
1977	45,604	17,422	38.2	9,408	20.6	8,250	18.1

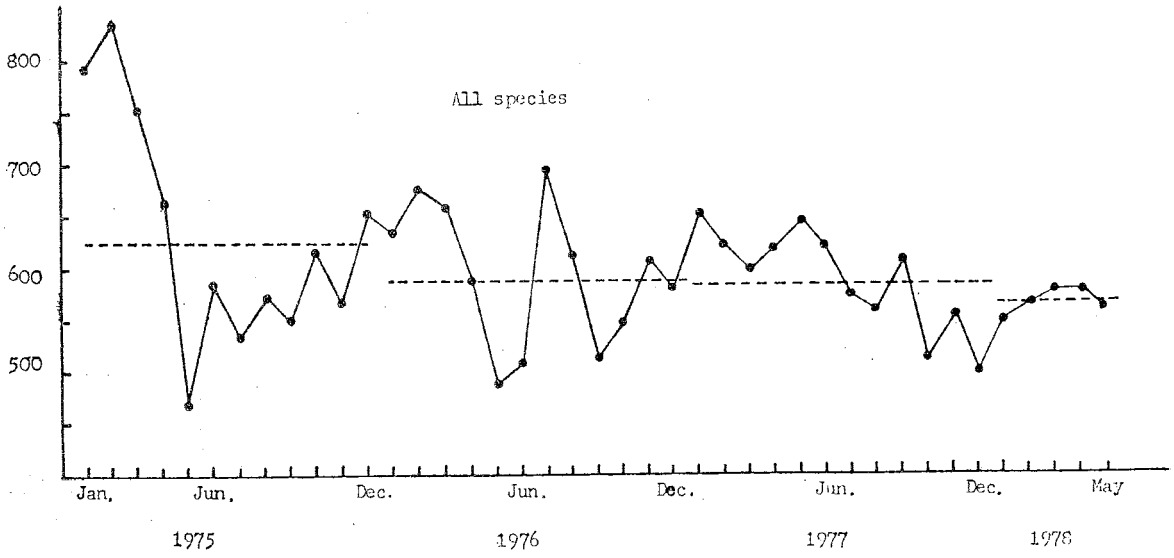


Fig. 2. Monthly change of hook rate per 1,000 hooks of all species and major species caught by Korean longliners, 1975 - 1978 (Jan. - May).

Table 2. Standard deviation (S.D) and Coefficient of variation (C.V) of annual hook rate by species, 1975 - 1978 (5 months)

Year	Item \ species	All species	Yellowfin	Albacore	Bigeye
1975	S . D	107	75	35	57
	C.V (%)	17.1	28.1	53.0	29.5
1976	S . D	66	48	42	45
	C.V (%)	11.2	22.1	27.6	31.5
1977	S . D	48	53	40	17
	C.V (%)	8.2	22.2	31.0	11.6
1978 Jan. - May	S . D	20	27	41	41
	C.V (%)	3.7	13.4	34.5	23.6

Table 3. Testing of statistical htpothesis of average hook rate for two contrasting years, 1975 - 1977 (significant level is 0.01)

Year	1975	1976	1977
1975		O	X
1976	$\lvert t \rvert : t_{67}$ $2.717 > 2.660$		X
1977	$\lvert t \rvert : t_{52}$ $2.610 < 2.660$	$\lvert t \rvert : t_{83}$ $0.441 < 2.660$	

O : significant

rotation X : not significant

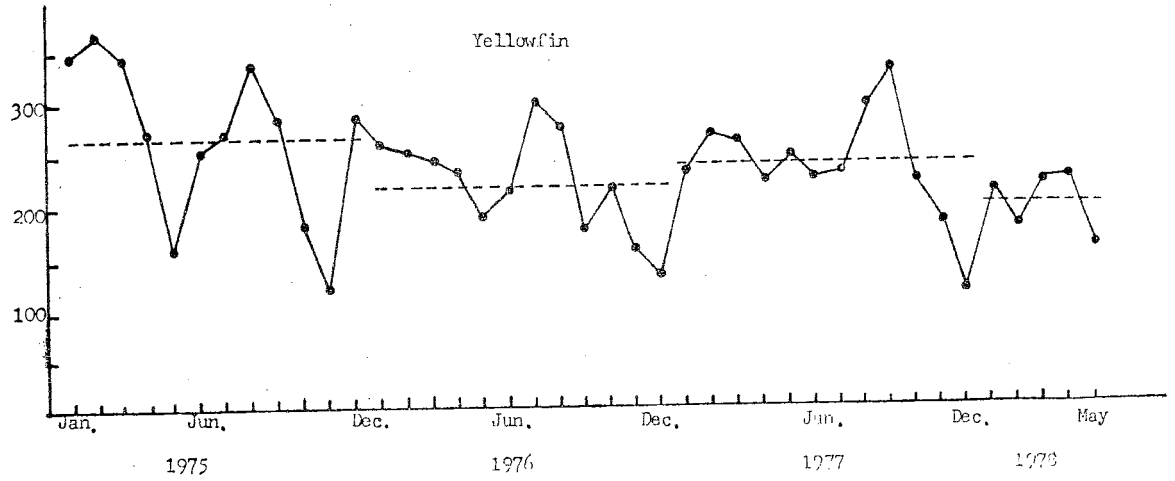
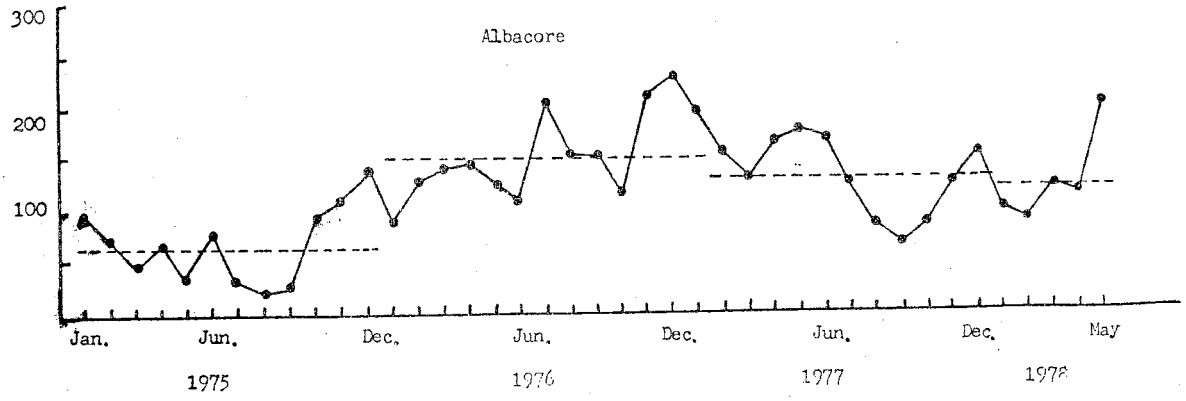


Fig. 2. continued.1.



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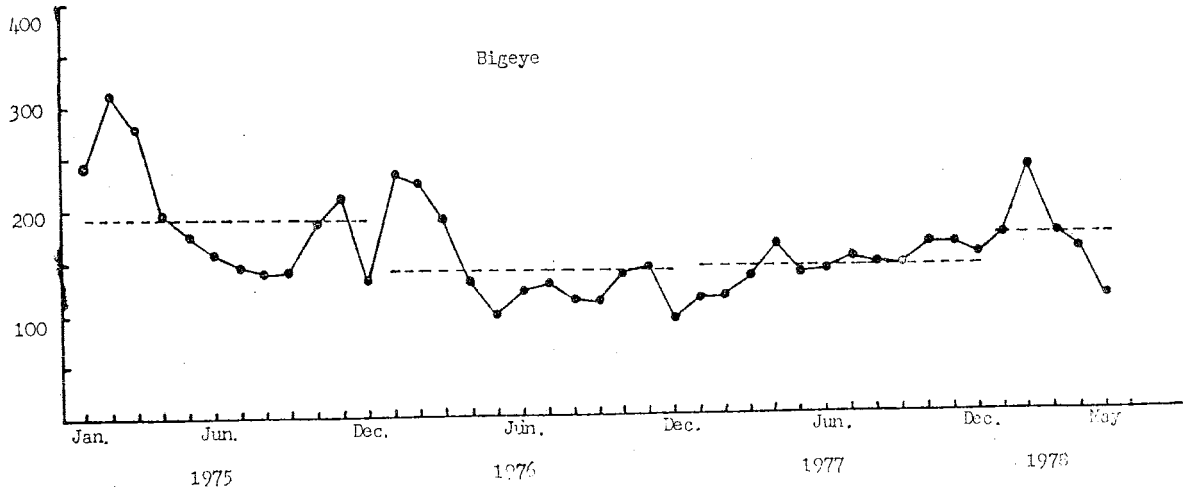

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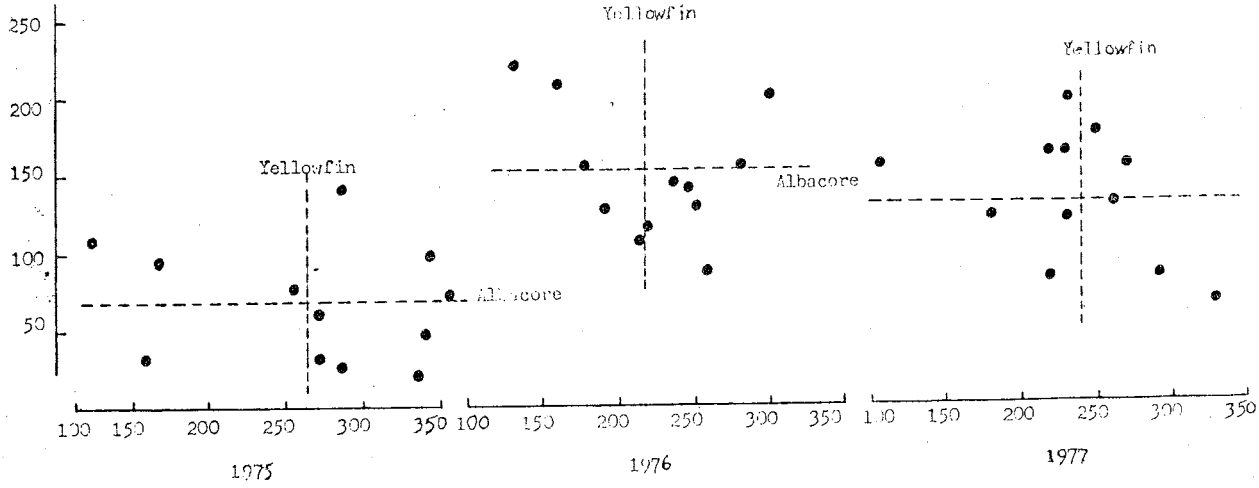
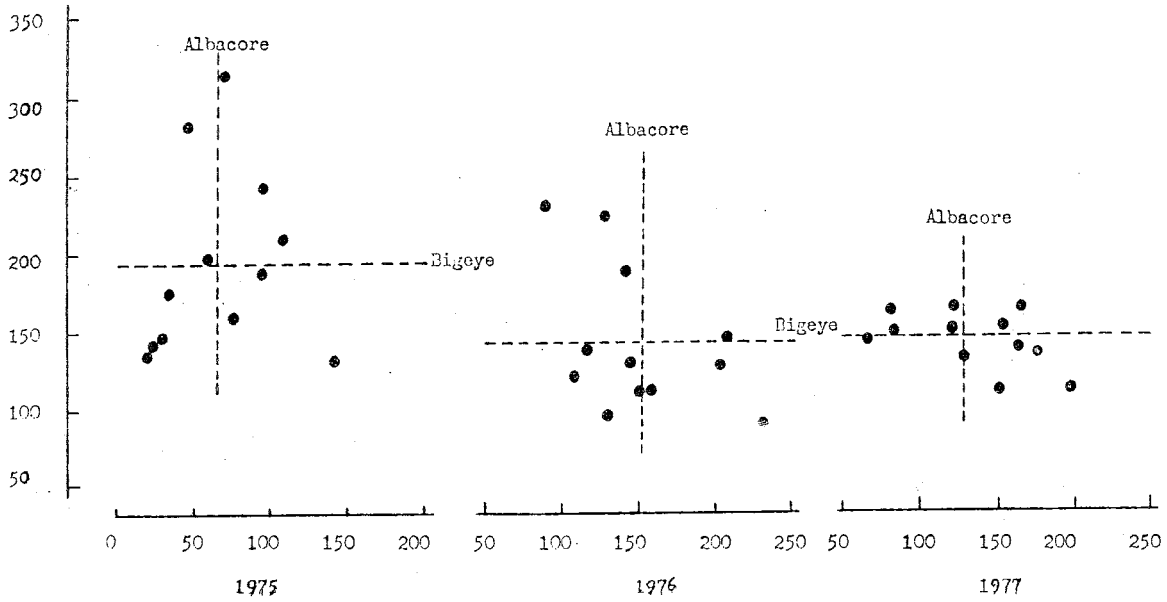


Fig. 3. Comparision of monthly hook rate per 1,000 hooks for two contrasting species, 1975 - 1977. Dotted line in each panel indicates level of annual average hook rate for two species.



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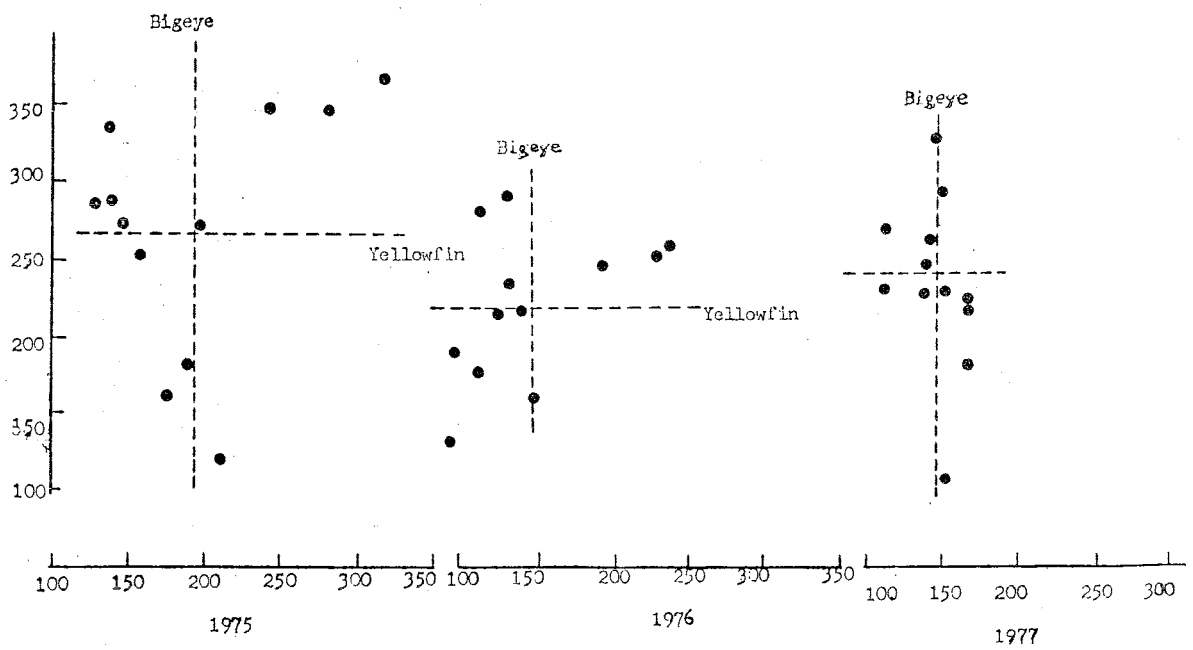

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