

## Changes of Some Harvested populations of Gamtae, *Ecklonia cava* Kjellman

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### 훼손된 감태군락의 변화

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감태는 다년생海藻로서 모자반류와 더불어海中林을 이루어 어류의 회유장 및 산란장을 提供할 뿐만 아니라 패류의 먹이로도 利用되는 重要한 海藻의 일종이다.

最近 濟州道에서는 알긴산의 원료로서 감태의 需要가 늘어나자 風藻에만 의지하던 감태를 해녀를 통한 인위적 採取도 하게 되어 감태군락의 破壞가 念慮되었다.

著者は 1979년 4월부터 1980년 3월 까지 濟州道 동부연안에서 採取되어 毀損된 군락과 자연상태의 군락을 比較 調査하였다.

자연 상태에서의 감태는 2~3년생이 주된 군

락을 조성하고 있으며, 단위면적( $m^2$ )당 6.02 ~ 5.33 개체였다.

採取된 군락중 1년이 경과된 地域에서는 자연상태의 군락과 比較했을 때 一時的으로 4배의 개체수를 보이지만, 반면에 2~3년 경과한 군락에서는 약 2배로서 자연상태의 군락과 비슷했다.

비록 採取된 군락의 개체수가 2배 이상된다고 해도 이것은 인근 감태군락에서 온 포자가 착생하여 生育된 것으로 생각된다. 이는 一般的으로 이 海藻의 포자방출 時期가 늦가을이라고 생각 할 때 現在의 감태 採取時期인 여름철에서 늦어도 8월부터 2개월은 그 時期를 늦추는 것이 바람직하다.

### INTRODUCTION

In Korean water, it is a well known fact that Gamtae (*Ecklonia cava* Kjellman) and Mojaban (*Sargassum* spp.) are the main components of underwater marine algal forest. They form shelter and spawning places for fishes and feeds for topshells and abalone, etc.

In Jeju island, there is a manufacturing plant producing alginic acids from Gamtae which drifted on the shore after typhoon. In the last several years, however, the demands for Gamtae has increased rapidly, and necessary amounts for producing alginic acids could

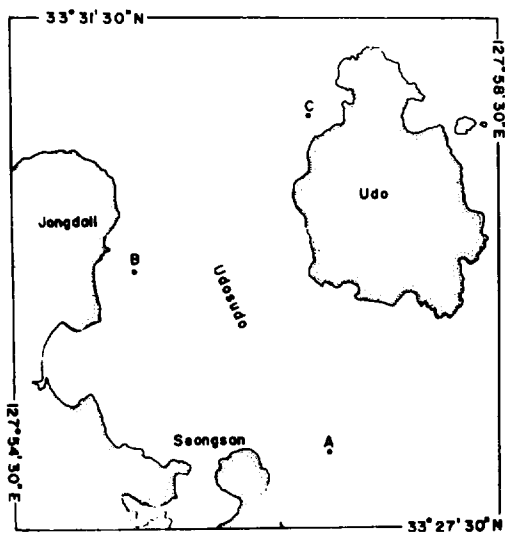


Fig. 1. Showing the three investigated sites.

not supply the needs. Therefore, women divers have harvested Gamtae for the purpose of supplementing the supply unfortunately they have done so without consideration, and the overharvesting of Gamtae brings out the problem of destruction of its algal populations.

The previous studies about Gamtae are very limited. Only a few investigations were made namely on the distribution of this species (Kang, 1966; 1968; Kang et al., 1978; Lee et al., 1971; Lee, 1974, 1976; Lee, 1976), on its growth and seasonal variation of weight (Iwahashi, 1968 a, 1968 b), on the changes of year class (Iwahashi, 1971); as a line in the chain of ecological study, and on the age and growth (Hayashida: 1977).

The present study attempts to determine the ages of structure of the intact Gamtae population and to compare it to those of the harvested population. Discussions were made on the ecological effect of harvest of Gamtae population.

## METHODS

Three different sites (Fig. 1) were selected to investigate Gamtae (*Ecklonia cava* Kjellman) populations in the eastern part of Jeju island, and the investigations were performed from April 1979 to March 1980.

The investigations of unharvested algal population in natural condition were made in depths up to 20 m ~ 22 m, beyond the usual diving depth of women divers. Substrata of these places composed mainly of sand and extruding flat rocks. The investigations were carried out in one of the flat rocky areas by scuba diving using a 5 m x 5 m rope quadrat to collect all the Gamtae fronds.

All collected fronds were cut in cross sections (Fig. 2) in the middle portion between the starting point of holdfast and the first pinnate blade, and the growth rings (Hayashida: 1977) were examined under a light microscopy.

The harvested Gamtae populations were investigated on three different sites: one year old population after harvesting near the Udo coast (Fig. 1.C), two and three years old populations near Jongdali coast (Fig. 1.B). The water depth of those three investigated sites were within the range of 7 m ~ 10 m, and the substrata condition of the three sites were almost identical (Fig. 1.A).

RESULTS and DISCUSSIONS

In 1979 the unharvested population (Table 1) has its maximum density 33.9 individuals per  $m^2$  in August and it decreased to 10.13 individuals per  $m^2$  in October. The mean density was 18.40 frond per  $m^2$ . Two or three years old fronds were the dominant group, and the mean density was 6.02 ~ 5.53 individuals per  $m^2$ . While the other algal groups with no growth ring groups with shown its individual number as 3.88 per  $m^2$ , and three growth ring group was 0.82, and four growth ring group 0.10, during the investigating year of April 1979 ~ March 1980.

In one year old group was increased at the rate of 55% compared with the growth ring group, while individual number of two growth ring group was decreased at the relatively small rate of 8% compared with one growth ring group. But individual numbers of three and four growth rings decreased at the rate of 85% and 88% compared two and three growth ring groups during the investigating periods from April 1979 to March 1980.

The individual numbers were compared from July to August with the number of October to November 1979 after the summer typhoon season was over. All of individual numbers were decreased; at the rate of 67% in no growth ring group, 75% in one ring growth group, at relatively small rate of 19% in two growth ring group, 76% in three growth ring group, and maximum rate of 100% in four growth ring group.

Therefore, the consisting age of the main individual groups in unharvested populations could estimate its age as 2~3 years old. The other individuals were left out from population and disappeared or washed ashore by wild waves after bad weather condition.

On the other hand, individuals of growth ring counted the number as 21.16 per  $m^2$ , while one growth ring individuals was 6.81 after the first appearance but its number indicated that they were decreased at the rate of 68% compared with no ring group (Table 2) in the harvested Gamtae population with one year passed.

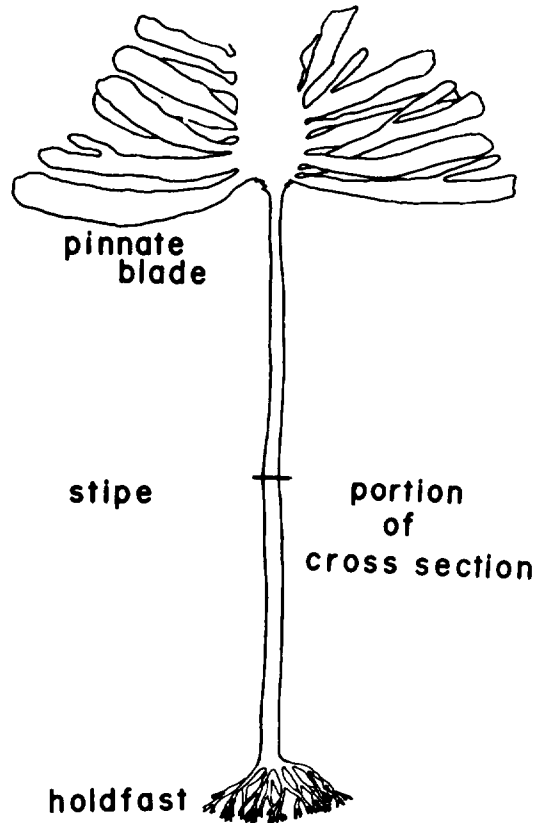


Fig. 2. Gamtae frond, *Ecklonia cava* Kjell., showing the portion of cross section.

Table 1. Monthly changes of Gamtae (*Ecklonia cava* Kjellman) density based on the unharvested population

Month		'79												'80			average
		4	5	6	7	8	9	10	11	12	1	2	3	( $m^2$ )			
No. Individual ( $m^2$ )	No G.R.	2.48	2.92	4.32	4.84	10.44	-	2.28	2.76	-	1.56	-	3.22	3.88			
	1 G.R.	6.44	7.6	8.16	12.28	15.84	-	3.28	3.72	-	4.16	-	6.04	6.02			
	2 G.R.	7.32	6.56	5.4	5.88	6.36	-	4.25	5.72	-	6.08	-	7.12	5.53			
	3 G.R.	0.64	0.4	0.84	1.96	1.08	-	0.32	0.44	-	0.96	-	0.76	0.82			
	4 G.R.	0.08	0.16	0	0.28	0.2	-	0	0	-	0	-	0.24	0.10			
	5 G.R.	0	0	0	0	0.04	-	0	0	-	0	-	0.12	0.02			

G.R. growth ring

— Failed to collect fronds

In two years Gamtae population (Table 3) after harvest, the average individual number of no ring group was 7.54 per  $m^2$ , while one growth ring group was 3.27, which shows decreasing tendency at the rate of 57 % compared with no growth ring group. On the contrary, the average individual number with three growth ring were 5.2, which shown approximately 60 % increase rate compared with two growth ring group.

Table 2. Monthly changes of one year passed Gamtae density after harvest

Month		79												80			average
		4	5	6	7	8	9	10	11	12	1	2	3	( $m^2$ )			
No. Individual ( $m^2$ )	No G.R.	38.48	29.84	32.12	25	19.88	-	8.16	7.32	-	-	8.48	-	21.16			
	1 G.R.	0	0	0	7.04	6.52	-	7.40	5.84	-	-	7.28	-	6.81			

In the harvested sites, all of the Gamtae populations were much higher in individual numbers and approximately two times higher than unharvested Gamtae population, but it is interesting that the individual number with no growth ring group was 21.16 per  $m^2$ , while one growth ring group was 6.81 at the rate of 60% decrease. However, it was decreased at the rate of 24% in the three years old algal population of Gamtae (Table 4)

Changes of some harvested populations of gamtae

Usually, high decrease rate reached upto 70 % after typhoon (Iwahashi:1971). Similar results were obtained in the one year old Gamtae population after harvest. But in two populations, two and three old after harvest, the decrease rate reduced at the rate of 57 % and 24% respectively. It was supposed as the result of protection by adult fronds when the young ones were weak.

Table 3. Monthly changes of two years passed Gamtae population after harvest

Month		'79									'80		average	
		4	5	6	7	8	9	10	11	12	1	2	3	( $m^2$ )
No. Individual ( $m^2$ )	No G.R.	10.92	10.04	7.68	8.16	10.64	-	3.36	3	-	-	6.52	-	7.54
	1 G.R.	0	0	2.16	3.8	4.28	-	1.52	1.96	-	-	5.92	-	3.27
	2 G.R.	3.88	3.44	4.36	6.48	8.52	-	4.16	4.28	-	-	6.56	-	5.20

Some divers engaged in the harvest of Gamtae insisted that if one frond was cut off the two new fronds grow. However, this is a groundless thought if one takes into the sporing periods (Okamura : 1936) of Gamtae spore. If one part of Gamtae fronds is harvested in some Gamtae population and all of remaining other fronds drifted and left out, it is very difficult to recover with new population. For that reason, harvesting period of this algae must avoid summer season and delay at least two month from August to prevent the damage of a Gamtae populations.

Table 4. Monthly changes of three years passed Gamtae density after harvest

Month		'79									'80		average	
		4	5	6	7	8	9	10	11	12	1	2	3	( $m^2$ )
No. Individual ( $m^2$ )	No G.R.	6.48	7.08	7.56	8.2	7.72	-	1.72	2.36	-	-	6.96	-	6.01
	1 G.R.	0	0	0	2.76	6.16	-	3.52	2.88	-	-	7.48	-	4.56
	2 G.R.	5.04	7.28	5.96	8.6	7.24	-	4.64	3.88	-	-	5	-	5.95
	3 G.R.	2.2	1.16	1.84	1.48	2.64	-	0.72	0.84	-	-	1.32	-	1.52

## SUMMARY

Populational changes of Gamtae (*Ecklonia cava* Kjellman) harvested by women divers were investigated to compare with three unharvested Gamtae populations at the three different sites in the eastern part of Jeju island from April 1979 to March 1980.

Main consisting individuals of Gamtae population were 2~3 years old fronds as seen by the growth ring, and its individual numbers were 6.02~5.33 per  $m^2$  in the unharvested Gamtae population.

In the harvested Gamtae population with one year passed, individual numbers of fronds approximately four times temporarily, while, the other two groups with two and three years old were far surpassed in individual numbers, reached up to two times more than unharvested Gamtae population.

However, if the sporing period is late fall, above increasing rate of individual numbers in harvested populations could be thought of an effect of discharged spores from other populations of Gamtae. Therefore, the harvesting periods, presently known as summer season, must delay at least two month from August, although the sporing period can not be defined exactly.

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