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Seasonal Variation of Edible Portion Yield and Coefficient of Fatness of Pacific Oyster (*Crassostrea gigas*) in Kamak Bay, Korea

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In order to determined the appropriate processing season of Pacific oyster (*Crassostrea gigas*), 30 individuals cultured in Kamak Bay on the southern coast of Korea were taken bimonthly 7 times a year, and seasonal variation of edible portion weight, edible portion yield and coefficient of fatness were investigated. There were close relationships between edible portion weight (X) and total weight (Y) and between coefficient of fatness (X) and edible portion yield (Y), which were expressed in regression lines, *i.e.* Y=0.2709X-1.9094 (r=0.9254) and Y=44.0596X+15.1127 (r=0.8485), respectively. From the results of seasonal variation of edible portion weight, yield and coefficient of fatness, the appropriate processing season of raw Pacific oyster was between winter and spring, that is, between December and following April the next year.

Key words: Pacific oyster, *Crassostrea gigas*, Processing season, Coefficient of fatness, Edible portion yield, Seasonal variation

Introduction

The food chemical factors of Pacific oyster *Crassostrea gigas* is important for processing, and they show variations on the basis of seasons, growth rate, and diet. Akashige (1990) and Akashige and Fushimi (1992) investigated monthly changes in the weight of fresh oyster and found that the seasonal variations are remarkable throughout the year. Galtsoff (1964) and Akashige and Fushimi (1992) reported that the seasonal changes in the coefficient of fatness in raw oyster was highest in April, while Tsuchiya (1962) analyzed that the amount of glycogen in raw oyster was at the maximum in March.

The oyster optimal for food chemical processing should be high in coefficient of fatness and edible portion yield and be produced in season where chemical constituents are abundant. In general, Pacific oysters farmed on the southern coasts of Korea are harvested from October. For the last 10 years (1991-2000), the average annual production of cultured oyster was 199,000 M/T, and 42.9% of them were harvested between October and December while 29.4% of them were between January and March (MAFF, 1992-1996; MMAF, 1997-2001). However, considering the coefficient of fatness and edible portion yield of Pacific oyster suggested in the previous studies, the optimal time of harvesting may be between January and April rather than between October and December.

Kamak Bay is a shallow sea with an average depth of about 6.3 m (Lee and Chang, 1982). This bay produces 83,400 M/T in 1987, which accounted for 29% of the total shellfish production in the country (Lee et al., 1992), but the average annual production has been reduced to 15.1% (MAFF, 1992-1996; MMAF, 1997-2001) between 1991 and 2000. Also, 4,576 ha of this bay area is a designated area as No. Ⅳ.

This study determined the optimal period for the processing of raw Pacific oyster based on the seasonal variation of edible portion weight, edible portion yield, and coefficient of fatness.

Materials and Methods

Materials

Pacific oyster (*C. gigas*) were taken directly from an oyster farm in Kamak Bay near the Yosu city, Jeonnam. Hanging cultured in June, the oysters were

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taken 7 times bimontly over a year period from 3 culture farms of the same water depth (2 m) (Fig. 1). Samples were cleaned with seawater and sorted on board, and were delivered to lab at a low temperature in an ice-box.

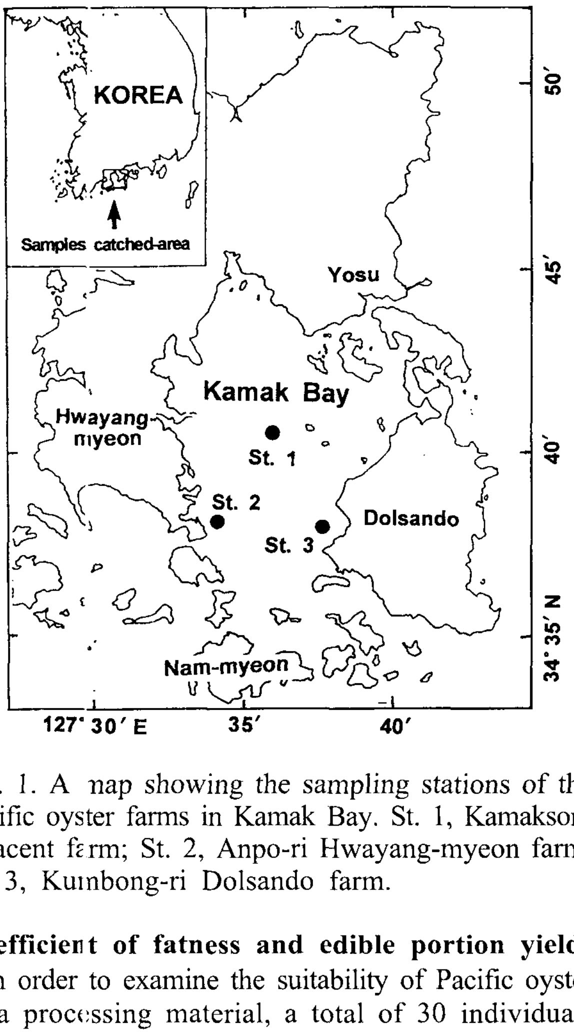

Fig. 1. A map showing the sampling stations of the Pacific oyster farms in Kamak Bay. St. 1, Kamaksom adjacent farm; St. 2, Anpo-ri Hwayang-myeon farm; St. 3, Kumbong-ri Dolsando farm.

Coefficient of fatness and edible portion yield

In order to examine the suitability of Pacific oyster as a processing material, a total of 30 individuals each time 10 from the 3 different culture farms, were taken 7 times a year, and shell height, shell length, shell width and total weight were measured (Table 1). Coefficient of fatness was calculated using a formula, recommended by JSFS (1989), (edible portion weight×1000/shell height×shell length×shell width), and the result of edible portion yield was expressed in percentages of edible portion weight per total weight.

Statistical analysis

The relationship between shell height and total weight, and that between shell length and total weight were defined by exponential curves using least square method (Snedecor and Cochran, 1967), and relationship between total weight and edible portion weight, and that between coefficient of fatness and edible portion yield were expressed in regression lines by least square method (Harris, 1995).

Results and Discussion

Morphological characteristics of Pacific oyster produced in Kamak Bay area was shown in Table 1. Annual average range of shell height was 52.8-81.1 mm (an average of 68.2 mm), and range of shell length was 33.4-52.6 mm (an average of 43.7 mm), and range of shell width was 21.9-32.4 mm (an average of 27.0 mm). As shell height (X) increased, total weight (Y) also increased, and their relationship was expressed in an exponential curve, $Y=0.0001503X^{2.9682}$ (Fig. 2). Similarly, the relationship between shell length (X) and total weight (Y) was expressed in an exponential curve, $Y=0.00652X^{2.3211}$ (Fig. 3).

Edible portion weight varied significantly depending on seasonal changes as in Fig. 4. The average edible portion weight was 2.5 g in the preceding August, but as shell height increased, edible portion weight also increased to 7.0 g in October, 11.6 g in

Table 1. Morphological characteristics of Pacific oyster[1] cultured in Kamak Bay

Sample code[2]	Sampling date	Number of samples	Shell height (mm)	Shell length (mm)	Shell width (mm)	Total weight (g)
A	Aug. 17	30	52.8±5.4	33.4±5.7	21.9±3.5	17.8±4.0
B	Oct. 18	30	65.4±9.2	37.6±4.3	24.3±3.3	32.3±8.4
C	Dec. 19	30	73.5±10.9	42.7±6.7	27.7±6.3	51.8±13.3
D	Feb. 13	30	81.1±7.5	52.2±6.3	29.7±4.5	58.2±18.4
E	Apr. 18	30	67.3±9.5	46.1±8.3	29.4±5.4	45.3±14.2
F	Jun. 21	30	71.5±8.8	52.6±4.4	32.4±4.2	58.2±16.4
G	Aug. 21	30	65.7±7.5	41.3±6.9	23.3±4.4	40.8±19.8
	Average	68.2±8.7	43.7±7.2	27.0±3.9	43.5±14.7	9.9±4.3

[1]Mean±S.D. (n=30). [2]Sampled area: Refer to Fig. 1.

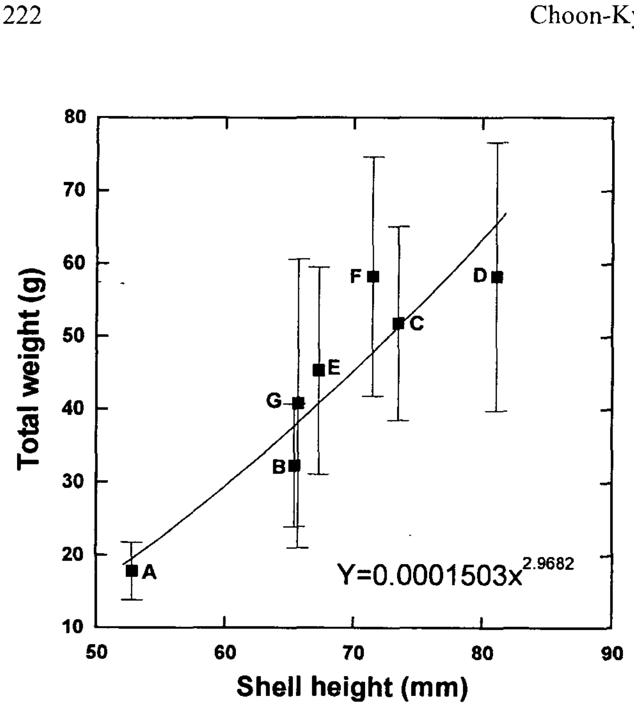

Fig. 2. Relationship between shell height and total weight of Pacific oyster. For sample code, refer to Table 1. Vertical bars indicated the standard deviation.

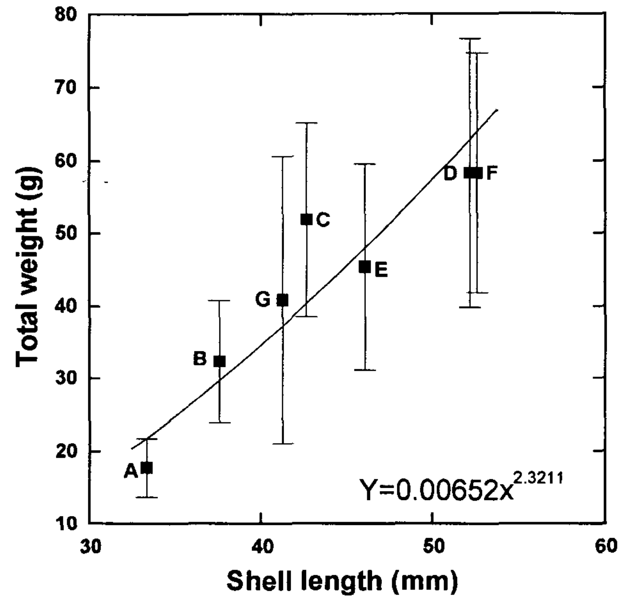

Fig. 3. Relationship between shell length and total weight of Pacific oyster. For sample code, refer to Table 1. Vertical bars indicated the standard deviation.

December, and its annual peak of 15.7 g in February. However, the edible portion weight gradually reduced afterwards to 12.6 g in April, 11.3 g in June, and 8.4 g in the following August. The present study showed the lowest value of edible portion weight in June and August of the following year with the

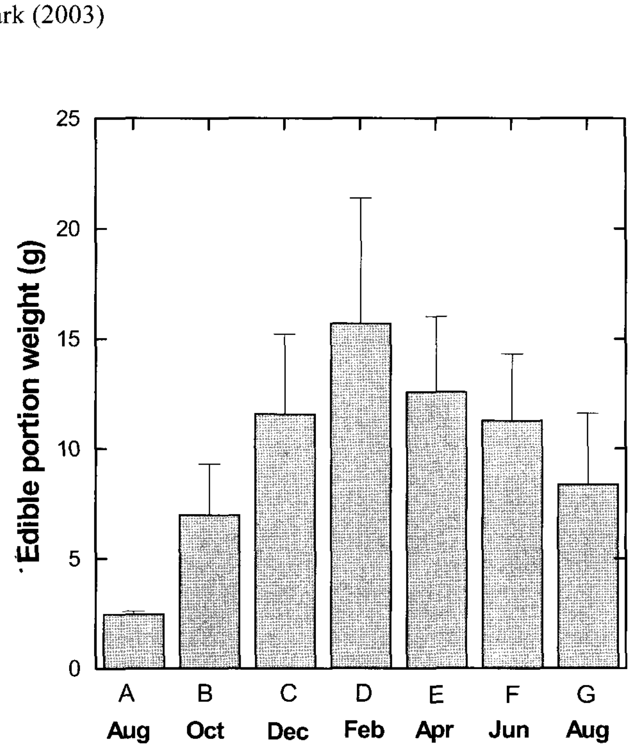

Fig. 4. Seasonal variation of edible portion weight in Pacific oyster. For sample code, refer to Table 1.

exception of August and October of the previous year which was an early growth period for seed oysters. It is assumed that adult oysters spawn between early May and August. The relation of edible portion weight (Y) to total weight (X) was expressed as Y=0.2709X -1.9049, where correlation coefficient (r) was 0.9254, meaning a very high correlation (Fig. 5).

The annual average range of coefficient of fatness was 0.1329-0.3632, and the annual average was 0.2387 (Table 2). Coefficient of fatness was high in the preceding August and October and in April, and the value was at its lowest in the following August. The reason for this difference in coefficient of fatness values was that even though both the preceding August and the following August were the same seasonal period, the preceding August was an early growth period *i.e.* 2 months after hanging culture whereas the following August was a spawning period for adult oysters.

The annual average range of edible portion yield was 14.0-27.8%, and the average was 21.8% (Table 2). Edible portion yield was 14.0% in the preceding August, which was 2 months after hanging culture of seed oysters, but 4 months later it increased drastically to 21.7% in October, 22.4% in December, and 27.0% in February. And in April it reached at its highest annual peak of 27.8%, and decreased to

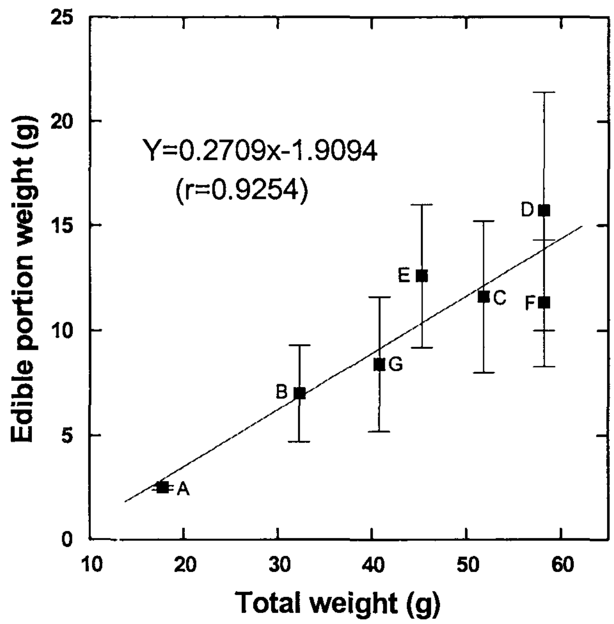

Fig. 5. Relationship between total weight and edible portion weight of Pacific oyster. For sample code, refer to Table 1. Vertical bars indicated the standard deviation.

Table 2. Seasonal variation of the coefficient of fatness and edible portion yield in Pacific oyster cultured in Kamak Bay

Sampling date[1]	Number of samples	Coefficient of fatness[2]	Edible portion yield[3]
Aug. 17	30	0.3625	14.0
Oct. 18	30	0.3632	21.7
Dec. 19	30	0.1334	22.4
Feb. 13	30	0.2147	27.0
Apr. 18	30	0.3048	27.8
Jun. 21	30	0.1592	19.4
Aug. 21	30	0.1329	20.6
Average		0.2387±0.1036	21.8±4.7

[1]Refer to Table 1.

[2] $\frac{\text{Edible portion weight}}{\text{Shell height} \times \text{Shell length} \times \text{Shell width}} \times 1000$

[3] $\frac{\text{Edible portion weight}}{\text{Total weight}} \times 100$

19.4% and 20.6% in June and August, respectively.

In the present study, all of the edible portion weight, coefficient of fatness and edible portion yield of raw Pacific oyster were high in February and April but low in the following August. Coefficient of fatness (X) and edible portion yield (Y) in raw Pacific oyster were in a close relationship (Fig. 6), which was expressed in a regression line, Y=44.0596X+15.1127, where correlation coefficient was 0.8485 representing the positive relationship (Fig. 7).

The present study showed that edible portion weight, edible portion yield and coefficient of fatness

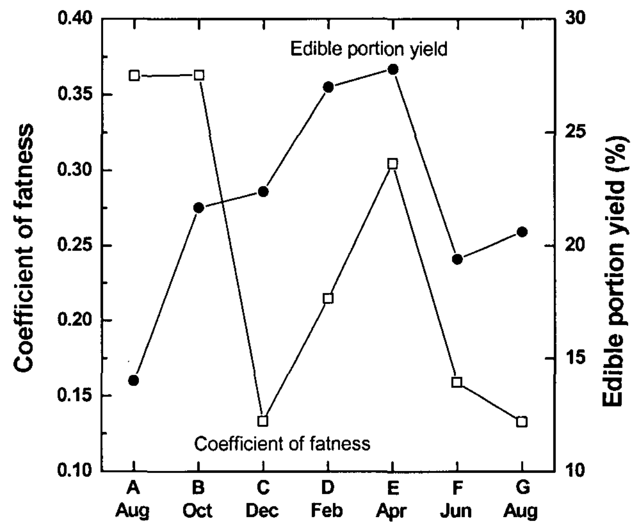

Fig. 6. Bimonthly variation in coefficient of fatness and edible portion yield in Pacific oyster. For sample code, refer to Table 1.

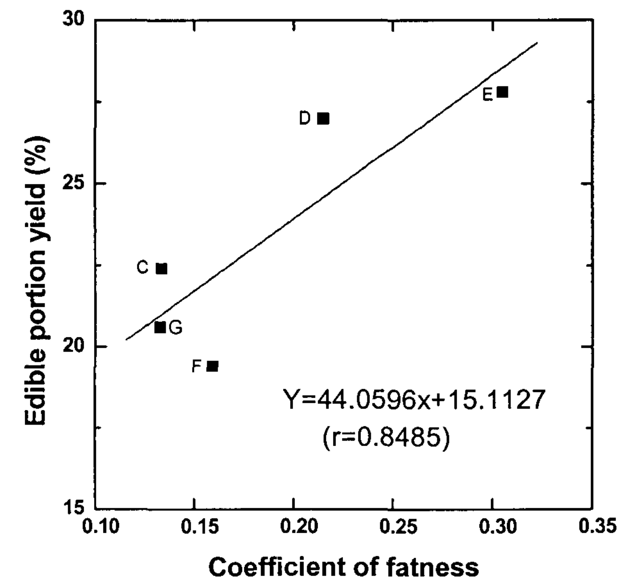

Fig. 7. Relationship between coefficient of fatness and edible portion yield of Pacific oyster. For sample code, refer to Table 1.

were relatively low in December, compared to the following February and April that showed higher values. Therefore, the suitable time of processing Pacific oyster was thought to be between winter and spring, when edible portion weight, edible portion yield and coefficient of fatness were high. In other words, period between December and the following April the ideal time of harvesting Pacific oyster for processing.

References

Akashige, S. 1990. Seasonal variation of serum constituents in the oyster *Crassostrea gigas* in Hiroshima Bay. Nippon Suisan Gakkaishi. 56, 953-958. (in Japanese)

Akishige, S and T. Fushimi. 1992. Growth, survival, and glycogen content of triploid Pacific oyster *Crassostrea gigas* in the waters of Hiroshima, Japan. Nippon Suisan Gakkaishi, 58, 1063-1071. (in Japanese)

Galtsoff, P.S. 1964. The American Oyster *Crassostrea virginica* Gmelin. Fish. Bull., 64, 381-396.

Harris, D.C. 1995. Quantitative Chemical Analysis. 4th ed. W.H. Freeman and Co. Press, New York, USA, pp. 71-85.

JSFS (The Japanese Society of Fisheries Science). 1989. Dictionary of fishery science. Koseishakoseikaku. Tokyo, Japan, pp. 316. (in Japanese)

Lee, K.H. and S.D. Chang. 1982. The exchange of sea water in Kamak Bay. J. Kor. Soc. Oceanogr., 17, 12-18. (in Korean)

Lee, K.H., M.N. Kim and C.Y. Woo. 1992. On yield conditions and growth characteristic of oyster, *Crassostrea gigas* in Kamak Bay, Kor. Bull. Mar. Sci. Inst. Yosu Nat'l. Fish. Univ., 1, 13-27. (in Korean)

MAFF (Ministry of Agriculture, Forestry and Fisheries). 1992-1996. Statistical Yearbook of Agriculture Forestry and Fisheries. Dongyang Munhwa Co. Ltd. Seoul, Korea. (in Korean)

MMAF (Ministry of Marine Affairs and Fisheries). 1997-2001. Statistical Yearbook of Marine Affairs and Fisheries. Cheongwoo Moonwhasa, Seoul, Korea. (in Korean)

Snedecor, G.W. and W.G. Cochran. 1967. Statistical Methods. 6th ed. Iowa State College Press. Ames. Iowa, pp. 485.

Tsuchiya, Y. 1962. Marine Chemistry. Koseishakoseikaku, Tokyo, Japan, pp. 8-15. (in Japanese)

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