Culture of Abalone *(Haliotis asinina)* in Cages

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Abstract

This experimental study sought to determine the feasibility of culturing abalone (H. asinina) in cages. It was conducted in Sulvec Cove, Narvacan, Ilocos Sur from November 2003 to May 2004.

Three cages made of polyethylene net measuring 6 in x 12 in x 24 in. were utilized in this study. Abalone seeds of approximately the same sizes were gathered along the area and were stocked randomly in each cage with 100, 150, and 200 stocking density, representing Ti, T and T,

Natural food (microalgae) attached to stones were placed inside the cages and served as their food. Gracilaria spp. was also given as supplemental food to the experimental organisms, ad libitum.

From the result of the experiment, the abalones assigned to Treatment I (100 stocking density) yielded the heaviest mean final weight and highest mean final shell length of 1.793 kg. and 1.76 cm., respectively. No significant differences occurred on the growth of the cultured organisms in terms of the mean final weight and mean final shell length. In terms of the survival rate, Treatment I obtained the highest with 50%.

Abalone can be cultured in cages using stocking densities of 100, 150, and 200, although a stocking density of 100 is recommended to attain a higher survival rate.

The very low survival rate of H. asinina cultured in cages simply dictates that a thorough investigation on the life cycle of this organism must be done, especially the feeding habit, salinity, and temperature requirements in order to successfully grow it in a captive environment.

It is further recommended that net cages to be used must be smaller in mesh size to be very sure that the cultured organisms do not escape when there is no food available in the cages.

Introduction

Background of the Study

The world's aquaculture production of abalone increased ranging from 1,124 metric tons during the 1990's to 2,474 MT in 1997 (FAO, 1999). This production mostly came from Taiwan. However, during the period 1996-1997, South Africa, USA and Korea contributed an aggregate production of 1,188 MT. The large increase in aquaculture production is triggered by the fast decline in harvest from capture fishery.

The decreasing commercial catch and the high price of abalone in both the domestic and export markets have stimulated much interest in the development of its aquaculture. Abalone commands a high price and is considered an exportable aquaculture commodity in many countries today. In effect, it has become one of the most exploited marine resources worldwide.

The Philippines is also considered as one of the principal countries harvesting abalone from capture fishery, largely for export markets. Although the culture of this marine organism is now established in some parts of the country, no attempt has been done in the Ilocos Region.

In Ilocos Sur, particularly in Narvacan and Santa, abalone seeds were once abundantly found along these areas. Fishermen usually sell small-sized abalones at P20.00/cup, never letting the organisms reach their desired marketable sizes. If the capture of small abalone seeds is not minimized, this mollusk species could be in danger of extinction in the near future. With this premise, the researchers tried a method by which these marine organisms could be rehabilitated and grown into desirable sizes. It also tried to test if abalones can be grown in a captive environment.

Objectives

This study sought to determine the feasibility of culturing abalone *(H. asinina)* in cages in Sulvec Cove, Narvacan, Ilocos Sur.

Specifically it tried to:

1. determine the growth performance of abalone in terms of:
   a. mean weight, and
   b. mean shell length;
2. compare the abalone growth using different stocking densities:
   a. 100/cage,

2. 150/cage. and
3. 200/cage;

3. determine the significant difference on the growth performance of abalone in cages using different stocking densities, and
4. determine the survival rate of the cultured abalones.

Operational Definition of Terms

Abalone. This refers to the experimental animals. They are scientifically known as *Haliosis asinina* and locally known as "maknal."

Stocking Density. It is the number of abalones stocked per cage.

Survival Rate. This is the total number of abalones recovered at the end of the culture period.

Review of Literature and Studies

In 1997, FAO reported that the world's abalone production from capture fishery amounts only to 220 metric tons. Australia, China and New Zealand are the major exporters of abalone. The total abalone production from capture fishery in the country was recorded at 63 metric tons in 199I, and increased to 448 metric tons in 1996.

Abalones are noctumal. They prefer to remain in one place and they seldom migrate to distant places. Habitat selection differs among different sizes of abalones. In areas where large or adult abalones are found, no juveniles of less than 30 mm. shell length are found, and vice versa. These organisms are dioecious, that is the sexes are separate and the mode of fertilization is external. Sexually mature males are distinguished by their creamy white gonads while females have dark green gonads.

Cultured abalones become sexually mature 6-8 months in tanks and averaging 30-40 mm in shell length.

Abalones are "broadcast spawners," that is, the eggs and sperm are shed into the water column where fertilization takes place. During the spawning, the male usually releases sperm much earlier, which then stimulates females to spawn.

The feeding habits of abalones depend on the growth stages. Newly-hatched larvae are still dependent on their yolk from nutrition. When they metamorphose and become veligers, they begin to attach themselves to substrates

such as rocks where they start feeding on microalgae, mostly cpiphytic diatoms that grow on the surfaces of natural and artificial substrates.

There arc different ways of culturing abalones to marketable size. In California, these organisms are grown in land-based tanks, in raceways and in ponds. Although abalone culture in tanks and ponds enables the fanner to have full control of the rearing process, it may require large initial investment in land, building and tank facilities, water pumping costs, and other equipment.

The usc of floating cages in protected coves and bays or anchored on the ocean floor is another alternative. It may have lesser investment cost than the land-based operation as it does not entail construction of permanent structures such as concrete tanks (Fermin, 2000).

Fermin in 2000 conducted a trial for grow-out culture of abalone in flow-through tanks. The abalones were stocked at a density of 68/m' and fed with *G/acilaria* spp. ad libitum. After ½ months, the culture organisms reached marketable sizes at an average of 55 grams a piece. The researcher found it necessary to feed the abalones with seaweeds because they do not respond well to artificial feeding at an early stage. A diet containing 27% crude protein promoted a higher growth rate compared to those fed with seaweeds.

Grow-out of hatchery produced juveniles in floating sea cages is currently being verified in one of the islands of Northern Iloilo. The use of wild seaweeds that are endemic in the area as food for the caged abalone is being tested.

Methodology

This study determined the feasibility of culturing abalone in cages. It was conducted at Sulvec Cove, Narvacan Ilocos Sur from November 2003 to May 2004.

Three cages made of polyethylene net measuring 6in x 12in x 24in were utilized in this study. Abalone seeds of approximately the same sizes were gathered along the area and were stocked randomly in each cage with 100, 150, and 200 stocking density, representing Ti, T and T

Natural foods (microalgae) attached to stones were placed inside the cages and served as their food. *Glacilaria* spp. was also given as supplemental food to the experimental organisms, ad libitum.

The abalones were sampled every two months to minimize stress. Ten (10) pieces of abalones were rnndomly gathered and weighed individually to detenninc the growth increment, with the use of an electronic weighing scale. Sampling was

done during low tide in order to have ample time to gather the animal since the cages were set at the seafloor.

The data gathered in this experimental study was treated with the use of the mean and percentage. Analysis of Variance (ANOVA) was also used to determine the significant difference on the growth of abalone reared at different stocking densities.

Results and Discussion

Table la shows the mean weight of the abalone cultured at different stocking densities.

The abalones assigned to Treatment I with a stocking density of 100, yieldcd the heaviest mean final wcight of 1.793 kg., followed by T with a 150 stocking density, with 1.35 kg., and finally T3(200) with 1.12 kg.

Table la. Mean weights of abalone *(Haliotis asinina)*

OBSERVATIONS/SAMPLING	T_1 (100)	T, (150)	T_3 (200)
Initial weight	0.64	0.61	0.60
1	1.39	1.09	0.92
38	2.15	1.60	1.27
3%	2.99	2.10	1.67
Mean	1.793	1.35	1.12

The mean shell length of the cultured abalones is reflected in Table lb; those assigned to Treatment 1 gained the highest mean shell length of 1.76 cm., followed by Treatment 2 with 1.57 cm., and finally Treatment 3 with 1.37 cm.

Table 1b. Mean shell length of abalone *(H. asinina)*

OBSERVATIONS/SAMPLING	T, (100)	T, (150)	T_3 (200)
Initial shell length	0.96 cm.	0.92	0.75
1°	1.72	1.56	1.41
2	2.03	1.64	1.42
3%	2.57	2.09	2.05
Mean	1.954	1.55	1.408

Table 2a. ANOVA on significant differences in the growth of *H. asinina* in terms of mean weight

SOURCE OF VARIATION	SUM OF SQUARES	DF	MEAN SQUARE	F	DECISION
Between groups	.947	2	0.4735		
Within groups	4.915	9	0.546	.867	Accept Ho
Total	**5.862**	11			

Table 2a reveals that the F-ratio of .867 is not significant at .05 probability level. This finding indicates that culture of *H. asinina* can be done using either a stocking density of 100, 150, or 200.

Table 2b. ANOVA on significant differences in the growth of *h. asinine* in terms of mean shell length

SOURCE OF VARIATION	SUM OF SQUARES	dF	MEAN SQUARE	F	DECISION
Between groups	.617	2	0.3355		
Within groups	3.373	9	0.3748	0.895	Accept Ho
Total	3.99	11			

Table 2b likewise reveals that the F-ratio of 0.895 is not significant at .05 probability level. This finding indicates that growth of *H. asinina* in terms of the shell length is not affected with the stocking densities of 100, 150, and 200.

Table 3. Survival rate of *H. asinina*.

TREATMENT	# OF STOCK	# OF ABALONES LEFT	%SURVIVAL
1(100)	100	50	50%
2(150)	150	42	28%
3(200)	200	30	15%

On the survival rate of the cultured abalones, Treatment 3(200 SD) had the least with only 15%, followed by Treatment 2 with 28%, and Finally Treatment 1 with *50%.*

This finding indicates that the more crowded the experimental organisms, the least chances arc for them to survive. This is due to the fact that they have to compete for space as well as food.

Conclusion and Recommendations

Abalone can be cultured in cages using stocking densities of 100, 150, and 200, although a stocking density of 100 is recommended to attain a higher survival rate.

The very low survival rate of *H. asinina* cultured in cages simply dictates that a thorough investigation on the life cycle of this organism must be done, especially the feeding habit, salinity, and temperature requirements in order to successfully grow it in a captive environment.

It is further recommended that net cages to be used must be smaller in mesh size to be very sure that the cultured organisms do not escape when there is no food available in the cages.

References

ADB/NACA. 1998. *Aquaculture Sustainability and the Environment. Report on a Regional Study and Workshop on Aquaculture Sustainability and Environment.* Bangkok, Thailand.

Aquaculture Asia. July-Scptcmber 1999. Volume IV, No. 3.

Bardach, et al. 1982. *Aquaculture: The Farming and Husbandry of Freshwater and Marine Organisms.* John Wiley and Sons, Inc. USA.

Barnes, R. D. 1986. *Invertebrate Zoology.* 5Edition. Saunders College Publishing, USA.

PCAFNARRD, DOST, BFAR. 1987. *Status of Mollusk Resources and Prospects for Development.* Los Baros, Laguna.