STOCK ENHANCEMENT OF SEA URCHIN (*TRIPNEUSTES GRATILLA*) IN NORTHWESTERN LUZON, PHILIPPINES: A MANAGEMENT STRATEGY

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ABSTRACT

Two successful cases of sea urchin enhancement activities were considered using the experiences of two neighboring provinces in Ilocos Sur and Ilocos Norte, both located in Northwestern Luzon, Philippines. One case was done at the coastal waters of Nagabungan Bay in Pasuquin, Ilocos Norte, which experienced a decline in sea urchin population in the early 1990s with 1 - 2 pcs 100 m$^{-2}$ fishing area. The reseeding project was done in 2002. One thousand pieces of sea urchin juveniles were stocked in submerged plastic cages in the reef area of the said bay. These were grown to adult size in four months, maintained as spawners, and allowed to naturally spawn to repopulate the area. In 2004, sea urchin abundance in the bay and neighboring towns increased to 30 - 60 pcs 100 m$^{-2}$.

Another case was done at Nalvo, Sta. Maria, Ilocos Sur, where sea urchin stock enhancement activity was successful. A declining sea urchin abundance of only 20 pcs 100 m$^{-2}$ fishing area was also observed in the late 1980s. In the early 1990s, the University of Northern Philippines reared sea urchin in cages leading to the development of sea urchin culture in the area. After two years, the population of sea urchin tremendously increased to more than 100 pcs 100 m$^{-2}$. The supply of juveniles was enough to sustain commercial culture in the area. The children of local fishermen gather sea urchin juveniles along the reef area and sell them to culturist at P2 each (US$ 0.04/pc). The culture of sea urchin became an industry with 25 percent of the total households engaging in it.

Keywords: sea urchin, enhancement, commercial culture, management strategy

INTRODUCTION

Stock enhancement is one of the fishery management strategies adapted to enhance the productivity of coastal waters and answer the problem of overfishing, which is a common issue facing coastal nations. Stock enhancement, popularly known as sea ranching, is successful in some parts of Japan for some selected species such as salmon and red sea bream.

Stock enhancement is widely practiced to enhance the wild stocks of fish and other fishery resources in the marine environment as well as in inshore waters. It refers to the production systems in which man’s intervention is restricted to, or is concentrated on the introduction of
additional organisms in an aquatic population at a particular stage of the life cycle. This is generally achieved through the seeding or planting of open aquatic ecosystems with spat, fingerlings, or other early stages of selected species. This is done to sustain or enhance the recruitment of wild populations or creating new populations and new productions of new areas. Major examples of such systems include the cultivation of mollusks, seaweeds, finfishes or culture fisheries in landlocked open waters (Troadec, 1991)

The concept of stock enhancement as a management strategy in improving the population in the wild of red sea bream is shown in Figure 1 (Ungson, 1995). The Figure clearly illustrates how sea ranching will increase red sea bream production in the wild. The stocked red sea bream enters into the fishery after 1 to 11 years of release. However, not all of the released red sea bream are taken by the fishery. Some of the released red sea bream will escape the fishery and become spawners, thus increasing the number of spawners in the wild. Consequently, this will contribute to the increase in recruits of red sea bream, thereby enhancing the natural production in the sea.

The above mechanism is also applicable to other finfishes and other invertebrates like sea urchin, abalones, shrimps, and prawns.

OVERVIEW OF THE SEA URCHIN FISHERY

Sea urchin is one of the major fishery resources in the world which is rapidly expanding in many countries because of the high demand for its gonads or roe. The sea urchin fishery stock poses a threat of overfishing as shown in the dwindling catches reported in most major fisheries.

The most commercially exploited sea urchin species in the Philippines is *Tripneustes gratilla*. It is locally known as “maritangtang” or “kudenkuden”. Its fishery had been a major source of livelihood in many coastal villages particularly along the Northwestern coast of Luzon Island and Bicol Region. Sea urchin were harvested for local and export markets in Bolinao, Pangasinan. Harvest for export markets was intermittent in the mid 1970’s, but became more regular in the early 1980’s.

As cited in Junio-Menez (1998), with the landed catches of sea urchin, the fishery generated millions of pesos per annum from 1988 to 1992 (Talaue-McManus and Kesner, 1995). It had been reported that the total net income for sea urchin landed at one major site, the Silaqui Island, which peaked in 1989 at PhP 9.6 M (US$348,000).

In 1989, about 2.5M sea urchins were collected from the reef area (~32 km²) near this site, considering that 40-50 sea urchins of 45-85 mm test diameter are required to produce 1 kg of sea urchin roe. The estimated value of landed roe decreased to PhP 3.2 M (US$ 128,000) in 1991 and PhP 1.9 M (US$76,000) in 1992, due to a drastic decline in the landed catch (Talaue-McManus and Kesner, 1995).

The alarming situation of the sea urchin fishery in Bolinao led to an assessment study on the natural population in 1987-1988 by the researchers of UP-Marine Science Institute. Research
findings showed that the fishery was overexploited. Moreover, results of the study showed a seasonal ban on sea urchin collection from December to February (the assumed peak spawning) was then legislated by the local government of Bolinao, since 1988 (Juinio-Menez, 1998). It is sad to note that the closed season was enforced only for two years and catch continued to decline until the fishery collapsed during the second half of 1992.

The uncontrolled and nonselective harvesting of sea urchin is common to other parts of Northwestern Luzon like in the coastal waters of Ilocos Norte and Ilocos Sur. Such undesirable practices had also led to the collapse of the sea urchin fishery in the two provinces.

Fig. 1. Flow diagram of red sea bream ranching in Kagoshima, Japan. (Adopted from Ungson, 1995)
CASES OF SEA URCHIN ENHANCEMENT

The sea urchin fishery in Ilocos Norte and Ilocos Sur is open access in nature, thus, managing of the said resource is complicated. Gathering of sea urchin is free and unlimited. This condition is worsened by the prevalence of dynamite fishing and the use of cyanide in the area and vicinity.

The two study areas in Ilocos Norte (Nagabungan Bay in Pasuquin at 120°42’E, 18°30’N) and Ilocos Sur (Nalvo, Sta. Maria at 120°42’E, 17°20’N) are both located in Northwestern Luzon (Figure 2). Both areas are characterized by having compact sandy substrate with patchy corals and seagrass beds. Nagabungan Bay has a depth of 6 m during high tide and 2.5 m during low tide. On the otherhand, Nalvo, Sta. Maria, Ilocos Sur, has a maximum depth of 4 m and minimum depth of 1 m.

The sea urchin catch production data in the Philippines specifically in these two provinces were undocumented. However, based on the claims of fishermen in the area as well as personal observation of the author before the sea urchin stock enhancement activity, sea urchin population had drastically declined and is about to be extinct. Many fishermen in both areas claimed that there are no more sea urchin (T. gratilla) visible in their fishing grounds since the late 1980s to 1990s. From 1970s to early 1980s, fishermen were harvesting sackloads of sea urchin. The gonads or roe were extracted and sold to their neighborhood. Through the years, gathering of sea urchin became a livelihood among the coastal folks in the area.

Nagabungan Bay, Pasuquin, Ilocos Norte

The severe decline of sea urchin population in the early 1990’s with a density of 1 - 2 pcs 100 m\(^{-2}\) fishing area prompted the researchers of the Mariano Marcos State University, Bureau of Fisheries and Aquatic Resources, Provincial Government of Ilocos Norte, and the local government of Pasuquin to explore strategies to revive the sea urchin fishery. In February 2002, 1,000 juveniles of T. gratilla were distributed in three submerged plastic cages (1m x 1m x 0.3m) in the reef area of Nagabungan Bay. The juveniles were fed with seaweeds (Sargassum) and allowed to grow to adult size. The adult sea urchins were maintained as spawners allowing them to naturally spawn and repopulate the area.

After two years of the project, a survey among fishermen and field assessment through visual census in the area and neighboring coastal towns were conducted to determine the changes in urchin population density. Findings showed that there was an increase in sea urchin population from 1 - 2 pcs 100 m\(^{-2}\) to 30 – 60 pcs 100 m\(^{-2}\) fishing area.

Neighboring coastal towns also observed a tremendous increase in the sea urchin population similar to the study area. The said increase in northern neighboring towns like Burgos, Bangui, and Pagudpud can be possibly explained by Karlson & Levitan (1990) that sea urchin (Diadema antillarium) is a broadcast spawner with larvae requiring 50 to 90 days to complete development and dispersal distances from source populations to sites of settlement and recruitment are claimed to be on the orders of hundreds km. Another factor that accounts for the changes in population structure and densities may be due to recruitment, predation, food availability, and
various physical parameters such as wave action which had been found to significantly affect echinoid population (Lawrence & Sammarco, 1982). Recruitment was dependent on the number of spawners in the area. In this study, 1000 pcs of spawners in submerged plastic cages were added to the natural spawners in the area. The visible effect on the increase of sea urchin population had made the fishermen aware of the importance of the project. Some of them had already started putting up cages in the area, collecting juveniles, grow them to marketable size and sell it to acquaintances and for their food consumption.

Nalvo, Sta. Maria, Ilocos Sur

A similar declining catch production was observed on the sea urchin fishery in the coastal reef area of Nalvo, Sta. Maria, Ilocos Sur in the late 1980s with only 20 – 40 pcs 100 m$^2$ fishing area. Despite of the decrease in the catch production of sea urchin, no actions were made by the government and local fisherfolks because of lack of knowledge on its biology. Not until the early part of 1990’s, when the University of Northern Philippines introduced to the fisherfolks sea urchin culture. After two years of culture, sea urchin population increased to more than 100 pcs/100 m$^2$ fishing area.
The fisherfolks started sea urchin culture with 2 – 5 cages per fisherfolk. At present, some owned 4 – 12 cages proving that sea urchin culture is a good alternative livelihood. The success of the project made more fishermen to become interested in sea urchin culture. Most of the sea urchin farmers had considered culturing sea urchin as their major source of income rather than fishing, thus decreasing the pressure exerted into the fishery. The sea urchin farmers had already organized an association, the Nalvo Sea Urchin Fishermen Association with more than 90 members. This association now plays an important role in the harvesting and price regulation of sea urchin.

The mechanism on the grow out culture of sea urchin in Nalvo is illustrated in Figure 3. Days of culture depend on the size of sea urchin juveniles stocked in cages. Mongo seed size juveniles of sea urchin (5-10 mm test diameter) can be harvested in 6-8 months, while a medium size sea urchin of about 20-30 mm test diameter can be harvested in 3-4 months culture period. Seaweeds (*Sargassum*) which are abundant in the reef area are collected for feeding the sea urchin. The sea urchin farmers use different sizes of cages made of bamboo, nylon, plastic chicken wire and 16 mm steel bar. Some have 6m x 6m x 0.6m cage. A cages cost about P1,000 (US$18.18) with a life span of 2-3 years. Maintenance of the cages is done by brushing and shaking them to remove decaying seaweeds. In a 6m x 6m x 0.6m cage, 800 to 1000 pieces of sea urchin can be stocked, while a 6m x 4m x 0.6m cage can accommodate a stocking density of 300 to 700 pieces of sea urchin.

Sea urchin culture is a year round activity and it is already an established industry in Nalvo, Sta. Maria, Ilocos Sur. It had become a major source of income among the villagers. Such activity involves other members of the family not only the husband but also the wife and children. The husband’s main role is the construction of the cage, while the wife and children sometimes do the feeding and cleaning of cages since the cages are installed in shallow water in the reef area. In Nalvo, about 25 percent of the villagers were involved in sea urchin culture. Small children ages 7 – 12 years old are engaged in gathering sea urchin juveniles and sell these to culturists within the area or to other neighboring towns or provinces at P2 (US$0.04) per piece depending on the size. Some school children get their daily allowance by merely picking sea urchin juveniles.

Sea urchin farmers sell their products in the market and along the shore to the local tourists, most of whom are balikbayans who come to the area. The regular price of sea urchin is P70.00 (US$1.27) to P80.00 (US$1.45) per kg. Each kg would contain about 6 -8 pieces of sea urchin. Sea urchin culture had helped a lot of fisherfolks by increasing their income, solve unemployment, provide good alternative livelihood which is not dangerous as compared to fishing. It also helps minimize illegal methods of fishing in the area, maintain cleanliness of the sea, and increase tourism.
MECHANISM OF STOCK ENHANCEMENT OF SEA URCHIN AS A MANAGEMENT STRATEGY

The management strategy adapted by growing sea urchin juveniles to spawners in submerged cages in the two study areas had increased sea urchin recruits in the wild as shown in Figure 4. The spawners were continuously maintained in cages to naturally spawn in the area. The recruits were allowed to grow to marketable size (adults) in the natural ground. Some were taken by the fishery, while others left in the natural grounds became spawners. The spawners continued to spawn until caught by the fishery or die due to natural cause, thereby, increasing the sea urchin population in the area and neighboring areas as shown in the findings of this study. This is possible considering that sea urchin in its early life stage is planktonic which are carried by the movement of the water before settlement. This process becomes a continuous cycle of spawning and growth which undoubtedly would increase the sea urchin population.

This phenomenon was made a reality in the case of Nagabungan Bay and Nalvo which had tremendously increased the population density of sea urchin. The visible result of increasing sea urchin population in the two fishing grounds made fisherfolks realize the importance of maintaining spawners in the open sea can make the resource sustainable.
Sea urchin juveniles put in submerged cages

3 – 4 months grow out culture

Spawners in submerged cages (marketable size)

Spawn

Increase of sea urchin recruits in the wild

Grow to marketable size

Sea urchin fishery

Grow to marketable size

Spawners in the wild

Grow

Increase of sea urchin recruits in the wild

Spawn

Fig. 4. Mechanism of increasing sea urchin recruits in the wild through the maintenance of spawners in cages
CONCLUSION

The management strategy of maintaining sea urchin spawners in submerged cages in the reef areas of Nagabungan Bay in Ilocos Norte and Nalvo, Sta. Maria in Ilocos Sur had proven successful in the increase of sea urchin population. This strategy of reviving the sea urchin population, in both areas, proved that a low cost technology of maintaining spawners in cages in natural grounds is more practical than putting up a land based hatchery that entails a lot of cost both in the construction and its maintenance. Further, this technology is more environment friendly than the latter. Thus, this technology is highly recommended for developing countries that could hardly afford to put up hatcheries and planning to adapt stock enhancement as a way of reviving an overexploited fishery resource.

REFERENCES


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