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Contents

Development of a Land-based Abalone Aquaculture System

-A Land-based Abalone Aquaculture System Using Refrigerated Containers-

Kazumi Sugawara*

Abstract

Inland water aquaculture was the favored method of Japan's seafood aquaculture industry. However, today, offshore aquaculture is growing steadily in proportion because of the occurrence of the declining quality of the water area and outbreaks such as red tide. But marine environment pollution from the excretion and leftover food of cultured fish and chemical spray and the increase in the cost of equipment and administration caused both inland water and offshore aquaculture to become unprofitable and the aquaculture industry dipped after peaking in 1985.

It is necessary that aquaculture, be it at sea or on land, does not take a tragic toll on the natural environment. With that in mind, this research focused on a land-based seafood aquaculture technology which has the least possible effect on the environment and in August 1997 a study was conducted on aquaculture technology centered in Europe which is among the advanced places in the world in terms of land-based aquaculture. First, a study on feasibility and profitability was carried out.

In 1998, the Marino-Forum 21, an industry-government-academia research group, conducted research on land-based aquaculture and developed land-based aquaculture technology. Although, there were very few problems in strictly technical terms, it was concluded that popularizing land-based aquaculture is quite hard because of poor profits due to the cheap price of cultured fish and high initial investment and running cost.

With that, from 2007, OPRF promoted research and study of a land-based abalone aquaculture system which regarded environment protection and the enhancement of profitability as fundamental issues, by placing an abalone aquaculture system inside a used refrigerated container which curbed initial investment and running costs. OPRF developed an eco-friendly land-based abalone aquaculture system (SOF aquaculture system) and have had a demonstration experiment of a commercial viable system.

This paper outlines accomplishments and issues to be considered from here on.

Key words: Land-based Aquaculture, Abalone, Used Refrigerated Containers, Biofilter

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A Pre-cautionary Approach to Preservation of Marine Ecosystem in Semi-enclosed Coastal Seas

Mitsuru Okawa*

Abstract

Marine environmental protection is now of great concern as humans have become increasingly dependent on the oceans for food, resources, and recreation. For too long, the oceans have been considered a huge dumping ground for human wastes. Ocean pollution is caused by atmospheric drainage or runoff, industrial and human liquid waste outflow, solid waste disposal, oil discharge, and a variety of natural pollution sources, such as global warming and subsea vents.

Coastal waters sustain a greater variety of flora and fauna than the high seas because of a greater abundance of nutrients and sunlight and greater carbon densities, supporting intensive benthic, demersal, and other forms of marine life. To assure that the oceans remain a great resource of food, minerals, fuels, and energy for humans, it is essential to maintain the ecological balance of the coastal zone. Coastal waters with well-balanced nutrient loadings encourage growth of macroalgae and sea-grass in shallow waters and ensure the high survival rate of fish and shellfish in such zones.

In the last few decades, well-sheltered ports have been constructed in various coastal areas in Japan. However, the ecological impacts of port construction and operations have not been negligible. Oceans are extremely sensitive, and radical changes in their chemical, thermal, and physical balance can produce great damage not only to biological, chemical, and physical activities in the water but also to the earth's atmosphere and inner crust, which are greatly affected by the oceans. In the past, ecological factors, especially relating to air and water quality, were only a secondary design issue for ports, but they are now major factors in specifying port and vessel design and operating conditions.

The link between sustainable economic development or growth and effective marine environmental management is now indisputable. The maintenance and rational management of the environment is an essential factor in long-term human advance, as growth derived from ecological depletion is not economically sustainable beyond a very short time horizon.

The field of marine environmental management deals with effective monitoring systems and analysis of traces, chains of actions, or reactions from the various sources of ocean pollution, or from their initial causes, to the resulting ecological effects or impacts.

The objective here is to provide an introduction to an integrated assessment of marine ecosystem health, the "Health Examination of the Sea," which has grown out of a keen awareness of those impacts and the increasing prominence of such principles as sustainability, responsible uses of marine resources, and the precautionary principle.

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The Health Examination of the Sea comprises basic information, examinations, evaluations, and public disclosure and management of data.

Basic information includes geographic factors, meteorological conditions, social conditions, historical factors, and managerial factors pertaining to the bay in question. The ordering of such information is an important first step in the inspection procedure of the Health Examination of the Sea and is used as criteria for the preliminary and secondary examination surveys and the comprehensive evaluation.

The preliminary examination is designed to make possible a relatively simple examination and evaluation to check for various unhealthy factors. Strict criteria were set to check for destabilizing factors and for levels easily overlooked or not especially worrisome. In those cases where the preliminary examination results in a “Healthy” evaluation, health maintenance and management should be continued. When the preliminary examination results in an “Unhealthy” evaluation, a secondary examination is carried out.

The secondary examination consists of a re-examination and more thorough examination. The re-examination undertakes a more detailed examination of the areas deemed unhealthy in the preliminary examination to confirm the diagnosis. If the unhealthy diagnosis is confirmed in the re-examination, a more thorough examination is carried out to determine the underlying causes. Although both examinations are carried out in detail, the secondary examination requires professional knowledge and expertise. There are two different outcomes of the secondary examination: either a guideline is produced for the removal or improvement of destabilizing factors, or a recommendation is made for ”surgery” in the form of a restoration and improvement of the environment.

In recent years, across the nation, there has been a decline in both the quantity and quality of monitoring of the marine environment. In the future, through the use of this Health Examination of the Sea around the country, we hope that a management system sensitive to the heretofore overlooked changes in the ecosystem and materials cycle mechanism will be put into place, along with the improvements in data collection and archiving necessary for effective implementation.

A Study on the Social System for the Human and Environmental Symbiosis: Estimate of Land-based Water Pollutant into the Tokyo Bay in the Edo Period

Katsuhiro Sakurai*

Abstract

In this study, the target area is Edo city in the 19th century, which is assumed as the land area discharging the water pollutant flowing into the Tokyo bay. Also, the target period of this research is the end of the Edo period, which is around 1800's. In Japanese history, the Edo period was from 1603 to 1868. In 1603, the Shogunate Government of Edo was established by Ieyasu Tokugawa, and the Edo period was ruled through a feudal system such as the land-owning and the class systems for all of its 265 years. Edo was the largest consumption city in Japan through the Edo period, because it was the heartland of politics and a lot of samurais lived in, which were the non-laboring class. Though Edo city had the largest population and the highest its density in the world at that time, it seemed to have the most unpolluted water environment because of the human wastes recycling and its circulation system in the Edo society.

First, this study is focused on the delimitation of the Edo city area on the basis of the official announcement by the Edo government in 1818. One of the important subjects of this study is to build a refined electronic map of Edo city. The spatial area of Edo city will be delimited by digital mapping using GIS. And, the land use pattern of the Edo city area is classified into 11 categories and the area of each category is estimated. Next, the socio-economic activity of Edo city will be quantitatively estimated based on the documents about the population and the production data in 19th century. On the basis of collected data such as the delimited area of Edo city, population, economic activity, and the area of land use, the environmental impact from the land area into the Tokyo bay will be estimated by the inflow of the total nitrogen (T-N) using the material flow model applied to Edo city, which had the recycling system of human wastes as an organic fertilizer for farming in the suburb of Edo city.

As the result of calculation, the household sector and industry sector of Edo city had each 540 tons and 26 tons of T-N emission with recycling the human and the livestock waste for farming. The amount of T-N emission from the non-point generation source is estimated at 208 tons. On the other hand, the total amount of T-N emission from the Tokyo bay area in 2000 is about 87,000 tons, which is 112 times as much as that in the Edo period.

In conclusion, this study shows that the quantitative method is useful to analyze the historical situation from the viewpoint of the environmental and socio-economic aspects. Especially, the estimation of the favorable condition of the water environment in the past should be reflected as the concrete example of the ideal sea environment to make a future vision of marine environment revitalization.

Key words: Edo, Tokyo bay, GIS, environmental impact, material flow model

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Some Aspects of Conservation of an Endangered Marine Species

In the Case of Local Activities for Conservation of Horseshoe Crab

Asuka Hino*

Abstract

The horseshoe crab (Tachypleus tridentatus), Kabutogani in Japanese, had long been a common marine species along the coast of the Inland Sea of Japan the Setonaikai, and some coastal regions of the north part of Kyushu island. The horseshoe crab, evolved from the trilobite, has survived even in two major periods of catastrophic losses of species such as the Permian and the Cretaceous losses on earth, having little evolved since Jurassic period, unlike most of the other species. Extinction of species is the rule of nature. Nature undisturbed achieves a permanency of form and structure that persists indefinitely. Nature achieves a permanency of form and structure that persists indefinitely. When disturbed and the disturbing force is removed, nature returns to exactly the same permanent state. In this permanent state of nature, there is "great chain of being" with a place for each creature (a habitat and a niche) and each creature is in its appropriate place.

However, wherever mankind has made their habitat, they have changed their environment, and they have become an important cause of threatened and endangered species. Rapid artificial change in coastal line morphology with the development of agriculture and the advanced modern civilization is one of the significant example of that.

Restoration marine ecology is still a new field. Its goal is to return damaged ecosystems to some set of conditions considered functional, sustainable, and natural.

We should explore the concepts of restoration marine ecology, with a special emphasis on how ecosystems restore themselves through the process of ecological succession.

Whether restoration can always be successful is still an open question.

All species have an inherent right to exist. Preserving a diversity of life on Earth has become an accepted goal for many people. But when that goals comes into conflict with other goals, such as economic development, the question becomes, "How much diversity and at what cost?" To find the answer, it is important to think carefully about the values of biological diversity and separate those based on science from those based on other values, such as aesthetic, ethical, religious or economic values.

In this paper, the author discusses some aspects of regional conservation activities of an endangered marine species, "horseshoe crab", as a case study. This case study on horseshoe crabs illustrate that ecological restoration can be complex and can require great care and considerable effort and that an integration of every related activity is crucial for the effective conservation of species, both of mandatory and volunteer service, as by local residents, school students, scientists, and local governments.

The horseshoe crab's blood derivative called Limulus amoeboecyte lysate has been used to detect

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infinitesimally small quantities of gram-negative bacteria, which are ubiquitous in the natural environment and lethal in the human bloodstream. Not only for this, have the author advocated that drastic measures must be taken to protect horseshoe crabs for the future benefit of all mankind. However, we must also recognize that people's values with respect to marine use are variable, resulting in periodic conflicts between those who wish to use the environment and those who wish to preserve it. Environmental mediation can help resolve conflicts when values collide.

Key words: Horseshoe crab, Endangered Species, Local Conservation Activity of Endangered Species

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