MARICULTURE, Ltd.

And the Conservation of the Green Turtle

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A 40 pound green turtle (Chelonia Mydas) at Mariculture's Farm. One of 50,000.

INTRODUCTION

Mariculture Ltd., incorporated in 1968, is the world's first commercial turtle farm. Its operations are situated in the Cayman Islands, B.W.I., and there it raises green turtles (at the present time it has over 50,000) under controlled conditions, processes them and markets the end products. The Company is well capitalised, is controlled by solid individual and institutional investors, and, although motivated by commercial considerations, is aware of its opportunities to assist in the conservation of the turtle and to help in the development of an "aqua-culture" technology.

The green turtle (Chelonia Mydas) is commercially the most valuable species of turtle, the other principal ones of which are the hawksbill, leatherback, loggerhead and ridley. Apart from its commercial value, the green turtle is of considerable cultural and scientific interest.

Through the expenditure of considerable funds on research, Mariculture has developed its own turtle rearing technology and should now be able to prosper as a commercial concern. Further research will be undertaken, which will undoubtedly be of interest and value to the conservationist community. However, financial exigencies prevent Mariculture from undertaking a research programme on the scale and in the depth probably desirable from a conservation view point.

Nonetheless, Mariculture would be willing to collaborate with or undertake work on behalf of conservationist-oriented research organizations. Ideally such research programmes would be conducted in an integrated research centre working closely with Mariculture on location in the Cayman Islands.

We have attempted in the text which follows to present a picture of Mariculture's background, its operations and its view of its conservationist role.

THE CONCEPT OF COMMERCIAL TURTLE FARMING

Considering that 70% of the earth's surface is covered by water, that bodies of water can probably be more productive of food than can land, and that there is increasing pressure on the world's food resources, the interest shown in the last decade and a half in the intensive farming of marine life (or "aqua-culture" as it has come to be called) may be regarded as long overdue.

Mariculture Ltd.'s operation which began in 1968 represented Man's first serious attempt to domesticate and rear intensively for commercial ends a migratory sea animal.

Mariculture's concept of commercial turtle farming was born of the following suppositions:

(a) high market potential. Almost every part of the green turtle's anatomy has commercial value, but the scarcity and unpredictability of supplies of turtle products had prevented this potential from being fully exploited;

(b) low production costs. Green turtles are mainly herbivorous, so the food they consume would be cheap. They are cold-blooded, so the food-weight conversion ratio would be low, and they are big (a green turtle will grow to 700 lbs. or more).

DEVELOPMENT OF A TECHNOLOGY

Mariculture Ltd. was incorporated in the summer of 1968, following indications arising out of experiments with a small number of green turtles in Florida that turtles would grow rapidly in captivity and that the cost of raising them would not be commercially prohibitive. Mariculture set out to raise turtles on a commercial scale, something that had never been attempted before. There were presented such problems as how should the turtles be accommodated, what density was tolerable, to what diseases were they prone when herded together, what were the risks of an epidemic, how sensitive were they to psychological disorders, what feed mixture was most suitable, what was the optimum processing weight, what was the breeding cycle, under what conditions would they breed, could a regular supply of young turtles be secured while breeding problems were solved.

Thus, it was a high risk venture, but through much hard work and after many set-backs and considerable expenditure, Mariculture developed from scratch its own "turtle technology". Solutions to most of the problems have been found and it would now appear clear that turtles can be raised in large numbers economically. Performance in terms of growth rates, mortality and feed conversion ratios are improving steadily.

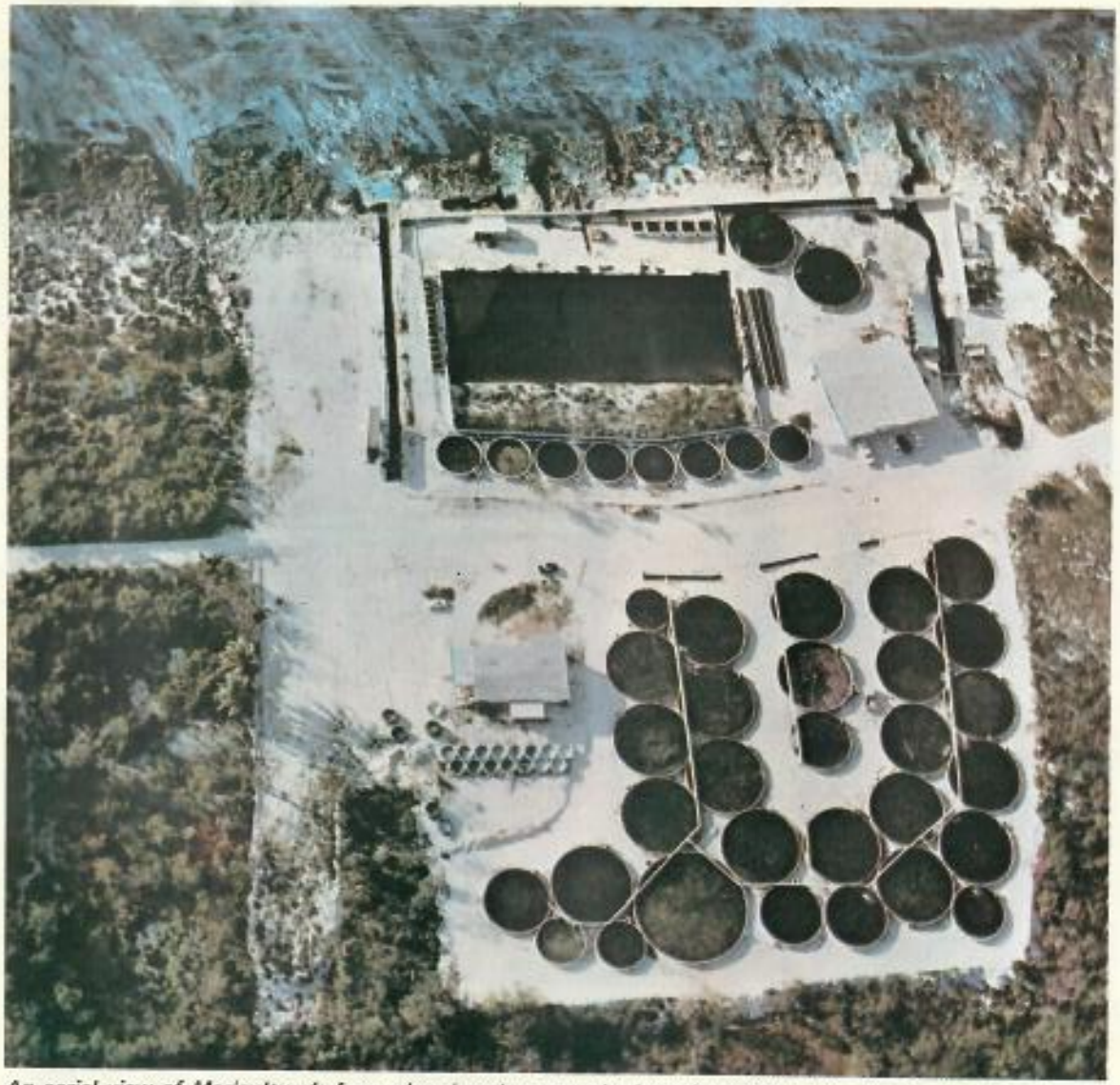
OPERATIONS

Mariculture's operations are situated on Grand Cayman Island of the Cayman Islands in the British West Indies. The Cayman Islands are a British Crown Colony and are considered politically stable; the climate and the temperature of the sea water are ideally congenial to turtles.

The turtle farm is situated on six and a half acres of freehold land, and the Company has the option to acquire a further two and a half acres. The operation is land-based, with the turtles being accommodated in pens filled with sea water. Including those used for experimental purposes, there is a total of 158 pens whose capacities vary from 120 gallons to 90,000 gallons, plus a one million gallon breeding pond. A further six pens of 80,000 gallons each are under construction. The water is changed continuously and rapidly, the farm pumping into its pens 2.6 million gallons of water per hour.

Mariculture is building its breeding stock but has not yet developed its own breeding cycle. Until it does so, new turtle stocks are and will continue to be obtained from the wild nesting beaches of the Caribbean and Atlantic. Mariculture collects eggs from the beaches and hatches them under controlled conditions at the farm. The turtles are then reared for a period of three years or so when they are processed and their products - meat, soup products, oil, shell and leather are marketed. At the present time, Mariculture has over 50,000 turtles.

Processing and marketing are to begin this year and production is to rise steadily to a target of over three million pounds in 1975.



An aerial view of Mariculture's farm, showing the pens, the large breeding pond, the breeding beach (below the pond), and the offices on the right. More pens,and an abattoir have since been built.

FINANCIAL HISTORY AND SHAREHOLDERS

Mariculture Ltd. was incorporated in the Cayman Islands in August 1968. The operations were financed almost wholly by share subscriptions until late 1970 when Commonwealth Development Finance Company Limited (CDFC) provided a guarantee to the Bank of Nova Scotia Ltd. of an overdraft facility of *CI$ 500,000. This year, CI$850,000 has been raised by a Rights Issue of convertible loan stock. The Company has, to date, spent some CI$1.8 million of which CI$500,000 has been on research. 1972 will be the first year in which Mariculture will enjoy a significant cash flow from its operations.

Mariculture has over 180 shareholders. The largest is CDFC, a U.K. based development finance company set up in 1953 to provide finance for projects (principally in association with private enterprise) in developing countries. CDFC holds 27% of the equity. The other shareholders are mainly private individuals from the Cayman Islands, the United Kingdom and the United States. The Directors hold 33% of the equity.

*One Cayman Island Dollar (CI $) is equivalent to One Jamaica Dollar or £0.50 or US $1.30.

DIRECTORS AND MANAGEMENT

(a) **Directors:** There are eleven directors, seven of whom are non-executive. The executive directors are:

Irvin S. Naylor
President and one of the founders. Aged 36. U.S. Citizen. A successful businessman who has founded and runs a number of companies.

Henry H. Hamlin
One of the founders. Aged 41. U.S. Citizen. A successful businessman with a background in engineering. Is a director of a number of companies.

Mark Fisher
Aged 30. U.K. Citizen. Has eight years experience in the management of intensive agricultural enterprises.

Keith J. Norman
CDFC's nominee director. Aged 45. Regional Director for CDFC in the Caribbean and Latin America. U. K. Citizen. Previously Commercial Director of the U.K. Atomic Energy Authority.

Antony G. A. Fisher
Not formally, but is effectively a member of the Executive Committee. One of the founders. Aged 56. U.K. Citizen. In 1954 founded the Buxted Chicken Company Ltd., one of the pioneers of the broiler industry in Europe. He founded the Institute of Economic Affairs and the International Institute for Economic Research.

(b) **Management:** In the first few years of its existence, Mariculture's management was scientifically oriented. Now that much progress has been made on production development and the operation is now market oriented, management has a more commercial flavour. The General Manager who is in charge of day to day management is Michael Goodier, M.I. Mech.E., aged 34, a U.K. Citizen who has had a successful business career in England. He joined Mariculture in August 1971 as Farm Manager and since then the rate of improvement of the operations has increased significantly. He is supported by a management team of four. There are 40 employees.

Scientific support has been provided partly by resident employees, but the bulk of it has, especially recently, come from collaboration with university personnel. The Company has two technical advisers, one a marine biologist, the other a microbiologist, both of the University of Miami in Florida where Mariculture has established a scholarship for the study of the physiology of the turtle. The Company works closely with a number of other North American universities as well. The fruits of this work and the cross fertilization of ideas that has been encouraged have been of great value to Mariculture. It is fortunate for the Company that its operations have aroused extensive academic interest.

CDFC act as the Company's financial advisers. The auditors are Messrs. Pannell Kerr, Foster & Company on Grand Cayman Island. The Registrars are Bank of Nova Scotia Trust Company (Cayman) Ltd. who also perform secretarial functions for Mariculture.

THE RATIONALE FOR A CONSERVATION PROGRAMME FOR THE GREEN TURTLE

A statement made by the International Union for Conservation of Nature and Natural Resources (IUCN) in March 1969 reported that "the present world situation for the great marine turtles is tragic ... we are now faced with massive depletion and extinction inside this century ... under these critical conditions, conservation on a correspondingly massive scale becomes of urgent and obvious importance, if the world is not to lose a natural resource of such economic, scientific and aesthetic importance".

The report might well have added "cultural importance". In his book, The Green Turtle and Man, James J. Parsons writes:

> "Both in Asia and in the Americas the turtle was one of the mythical animals on which the world was believed to rest The Burmese are said to consider sea turtles divine, keeping them in tanks in pagoda grounds where they are fed special foods. Among the North Australian Aborigines, the sea turtle is one of the principal totems. Pliny wrote of a cave-dwelling people at the entrance to the Red Sea who, although they were Chelonophages ("turtle eaters"), worshipped the turtle as sacred. Among many groups, extraordinary medicinal virtues are attributed to the oil of the turtle. It is perhaps not surprising, then, that the eating of turtle flesh is taboo among several peoples and of ceremonial significance among others.".

There is considerable scientific interest in the green turtle which, in many respects is an extraordinary animal. Turtles that are born on, say, Ascension Island - an important nesting ground - have to swim hundreds of miles to a feeding ground and the females invariably return to Ascension Island to lay their eggs. An important feeding ground is to be found off the coast of Brazil. Turtles born on Ascension Island must cross 1400 miles of water across currents and with apparently no "land marks" to guide them. It is not known how they find their way; nor how or why the females inevitably return to breed at the place of their birth. There are many other gaps in the knowledge of the green turtle. For instance, it is not known where a wild green turtle goes or what it does in the first year of its life, "the missing year" as it is called, and little is known of the breeding cycle. There is scope for much research.

The green turtle has been of prime economic importance in times of more abundant supply. For example, for the explorers and settlers of the Caribbean region, and later for masters and slaves, meat from the green turtle was a staple food. The meat is most palatable (in contrast to that of other species of turtle); green turtle soup is much sought after; the oil has various cosmetic applications; the shell has ornamental uses; and the hide can be cured to produce an attractive leather. Improving the supply position should restore the green turtle's economic importance.

Eggs hatching at Mariculture's farm. They are collected in baskets from Atlantic and Caribbean beaches and are incubated under controlled conditions at the farm. Each newly born green turtle weighs less than one ounce.

Thus, the green turtle, one in 500 of whose hatchlings reach maturity in the wild, has a just and urgent call on the conservationists.

Turtles in an experimentation pen in which they are tested and observed under changing dietary and environmental conditions by Mariculture's scientific staff.

MARICULTURE'S CONTRIBUTION TO THE CONSERVATIONIST EFFORT AND MARINE SCIENCE

The concluding words to Professor Archie Carr's book, So Excellent a Fishe: A Natural History of Sea Turtles, are:

"A technology of green turtle husbandry will have to be developed. Once that is worked out it will be a double blessing: people will be fed and species will be saved."

Mariculture can save the species; but most conservationists would probably agree that this is not enough. What is required is for the species in its own habitat to be saved. Through genuine concern for the problem and enlightened self-interest, Mariculture is trying to assist in this too:

(a) Under its agreements with the authorities which control the beaches from which Mariculture collects its eggs, the Company repatriates some 1% of its hatched turtles to the beaches of origin, when they are a year or more old. It is during the first year of life that the turtle is most vulnerable to predators and disease; thus, if only 0.2% of wild hatchlings reach maturity, Mariculture's contribution to the conservation of the wild population must be significant. This is especially so when it is considered that some of the eggs that Mariculture collects have been laid on beaches where there is a high proportion of new volcanic ash which prevents hatching; and others from beaches where the nests are ruined by high tides. Mariculture has now made nine egg collections and has achieved an average hatching rate of about 80%. Some 85% of the farm's newly born turtles survive to reach one year old. In due course, Mariculture will develop its own breeding fleet, the operation will become self-sufficient and it will no longer be necessary to collect eggs from the beaches. Mariculture will, nonetheless, continue its rehabilitation programme. So far, more than 1,000 green turtles have been released on a planned basis.

(b) Mariculture has given other specific help. The Company has assisted in a tagging exercise in Costa Rica, is providing advice for a conservationist programme in Ascension Island, and has offered similar advice in Surinam, has given a number of green turtles to a conservationist experiment station in Florida, and has rescued a number of eggs laid on beaches in Grand Cayman Island with the intention of releasing the turtles that have hatched once they can fend for themselves. This is a step in an attempt to restore the wild green turtles to Cayman waters.

(c) Most importantly, Mariculture has given turtles to Universities for their research and has furnished them with much information. The long term re-establishment of the green turtle in its natural habitat will be precarious until its life cycle is fully understood and documented. Mariculture is making a valuable effort to enable this.

Two members of Mariculture's breeding stock, weighing over 350 pounds each . The turtle grass (thalassia) in the foreground constitutes an important part of the mature green turtle's diet, both in the wild and at Mariculture's farm.

Finally, by providing a regular supply of high quality turtle products, Mariculture's commercial activities will relieve the pressure upon the wild green turtle.

THE FUTURE

It is probable that there are more captive turtles at Mariculture's farm than there are free mature turtles in the whole of the Caribbean Sea. It is almost certain that green turtles will survive, and at least possible that they will survive in the wild. To make this certain, the turtle has to be better understood, and, for this to happen, research expertise, time and expenditure are demanded.

There are other turtle farms, all of which are conservationist inspired, but the scale of Mariculture's operations and the Company's strong financial backing make Mariculture especially suitable for the conduct of research. Mariculture's operations represent Man's first attempt to farm on a large scale a migratory sea animal. Some of the lessons learned by Mariculture regarding the green turtle will be applicable to other forms of marine life. And it is possible that in some respects Mariculture will be a prototype in the development of Aqua-culture as a science and an industry.

It is believed that it would be in the interests of marine conservation and science if Grand Cayman Island was to become an important research centre for the study of marine life. It is envisaged that such a centre would be under the day to day management of Mariculture; and under the ultimate direction of its Foundation.

Among the specific programmes to which priority could be given could be investigations into the breeding cycle and navigational motivations and skills, the creation of a gene pool, and the institution of central archives for the collation and dissemination of information on the turtle.

View of pens each holding over 1,500 nine month old green turtles. Mariculture uses an empirically derived weight/volume formula to determine the number of turtles appropriate for each pen.