POMPANO MARICULTURE: PAST SUCCESS AND PRESENT OPPORTUNITIES

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ABSTRACT

The Florida Pompano (*T.carolinus*) is the prize marine finfish of Florida and Gulf Coast gourmet restaurants. This fish, over the years, has consistently been the highest priced finfish from Florida waters.

The commercial farming of the Florida Pompano was successfully accomplished by a private company from 1970 to 1974. This vertically integrated marine finfish farm operated on the south central coast of the Dominican Republic. This accomplishment was the first commercial tropical marine finfish farm ever created in the western hemisphere. Pompano eggs, fry, and finished product were produced twelve months a year. The basic technology created by this venture has been improved over the last decade and now provides a greater business opportunity that warrants consideration by industry.

INTRODUCTION

The Florida Pompano (*Trachinotus carolinus*) has for many years been considered the finest marine table fish from tropical U.S. water. This fish's reputation is a hallmark of New Orleans best gourmet restaurants as well as others throughout the south eastern U.S.A. In some areas one can expect to pay as much as $8.00 per pound retail for this fish in the round. This equates to in excess of $16.00 per pound for its filets. Depending on the time of the year and availability of this fish the retail price has been reported as high as $12.00 per pound in the round. With today's market demand and prices a pompano fish farmer could reasonably expect to receive $3.00 to $5.00 per pound in the round. Pompano mariculture can meet most desirous demand of portion control and quality product.

The history of serious mariculture investigations was started back in the mid 1960's by both public institutions and private companies. After many years and at least 50 million dollars exhausted by all, only one group of researchers met with developing a commercially viable method for the intensive farming of this fish. This group was the technical nucleus of a U.S. private company called Oceanography Mariculture Industries, Inc.. Their principal offices and laboratories were in West Palm Beach, Florida. In 1972, this company set out to build the first and only vertically integrated tropical marine finfish farm known in the western hemisphere. After the appropriate site selection surveys were completed the company chose the Dominican Republic as the best site in which to build its commercial pompano farm. By early 1973 the construction was complete and operation began. The pompano venture was short lived due to three major

problems which will be discussed later. However, so may years later it is interesting to note there has been no other commercial tropical marine finfish farming venture since O.M.I.'s. It is therefore my intent to briefly focus on what took place within this private company regarding pompano farming. Hopefully, this will enlighten others to again consider the pompano as a viable mariculture candidate. Beyond this, I would also hope to convey to others that sea framing of marine tropical finfish, in general, is today technologically practical.

PAST SUCCESS OF POMPANO MARICULTURE

Starting in the mid 1960's there was a rather intense effort made by many groups to develop basic methods for the controlled spawning and larval rearing of the Florida Pompano. Within the reported scientific literature there are at least a dozen notable papers that dealt with the husbandry of this fish. Recognized researchers such as Frank Hoff, E.S. Iversen, Frederick H. Berry, Theodore Smith, J.H. Finucane, W. Swingle, W. Tatum, and others contributed to the knowledge about this fish. It is unfortunate for the public scientific communities and mariculturists interests, in general, that the most notable and accomplished research of its time was described within the records of a private company.

The business goal of Oceanography Mariculture Industries, Inc. or O.M.I. was to develop a vertically integrated technology that would yield a known monthly production of saleable pompano at a price that would allow for corporate profit. The technological goal was achieved by 1973 and the confidence for which the company expanded into commercial production was based solely on the results of it's research, it's determination of production costs, and the market for the Florida Pompano.

In order to achieve the corporate goal it was determined that the major cost centers, except for fish foods, would be most economically minimized by locating the farm in the Dominican Republic. The Dominican Republic was then and is now an ideal environment in which to practice mariculture. Land and labor costs were minimal compared to Florida. The country enjoys high quality oceanic water on its south coast. This area also has a temperature which was nearly ideal for the pompano. The country was agriculturally developed so as to allow for an agriculture infrastructure that could meet the fish farms needs for fuels, electricity, telephones, chemicals, and feed stuffs. Beyond these physical benefits the government of the Dominican Republic graciously offered O.M.I special economic considerations for locating its farm there.

To meet the goal of known monthly production of saleable pompano the company developed the required technologies necessary to produce pompano eggs from its broodstock center 52 weeks per year, to produce pompano fry from its hatchery 52 weeks per year and then to produce saleable pompano from its grow out farm 52 weeks per year.

The O.M.I. broodstock program achieved total success in meeting its given goals. The primary areas of operational control and success were as follows,

A. Annual control of vitilogenisis and spermeogenisis in broodstock fish.
B. Complete artificial inducement of fertilizable ova.
C. Controlled artificial fertilization and incubation.
D. Broodstock recruitment by phenotypic selection from successive generations.
E. Controlled artificial diets that enhanced viable ova production percentages.

The original broodstock pompano were wild caught near Sebastian Inlet on central Florida's east coast. Nearly 600 of these two to five pound fish were air lifted on one airplane to Santo Domingo in the summer of 1973. These adult pompano were housed in a specially designed building at the farm site. Through central building controls the groups of adult pompano were systematically exposed to varying environmental conditions such as day length and temperature fluctuations which caused the fish to gonadally ripen. When the adults were known to be ready for spawning they were removed from their broodstock tanks and transferred to spawning rooms. Once the exact ovarian oocyte stages and ova sizes were determined the female and males fish were injected with varying doses and types of gonaditropins. Generally within 32 hours from the first injection the females would be running ripe. Their eggs would then be manually extracted without harm to the broodstock fish. The male fish would then be stripped and the milt would be mixed with the eggs by the broodstock technician. After spawing, these fish would be returned to the broodstock center where they would be recycled and spawned again six months later.

For the year of 1974 a total of 10.4 million normal fertilized eggs were produced by the broodstock center and made available to the hatchery (figure 1). The annualized spawning success was 62%. This means that of all female pompano subjected to the hormone inducement method, 62% of them spawned normally. The average yield of eggs per female was 114,000. It is also of interest to point out that second generation pompano (F_1) were routinely spawned by late 1974. The spawning manipulations achieved equal success in these fish.

Historically, the hatchery development phase of larval rearing the Florida Pompano was the great stumbling block. A few researchers had reported some minimal success, comparatively speaking, with artificially spawning this fish but none had developed a known and reliable technique for the hatchery phase. The literature describes two successes by two different researchers, M. Moe and Frank Hoff, of having a few pompano larvae achieve metamorphosis. Later attempts to replicate this success apparently failed. To my knowledge there was no other larval rearing success other than that of O.M.I.. This company succeeded in developing a controlled and dependable method for commercially rearing the Florida Pompano larvae. The hatchery technique was primarily the work of the author.

The phase one business goal was to hatchery produce 25,000 pompano fry per month, twelve months per year. The corporate record shows (figure 2) that an average 37,539 pompano fry were produced in the Dominican Republic per month in the year of 1974.

This fry output was accomplished in a hatchery building that consisted of hatchery tanks holding a total of 20,000 gallons. Of the 10.4 million viable eggs produced by the broodstock center only 4.7 million were actually used for hatchery stocking.

In order to achieve these hatchery results four operational centers had to be successfully managed. They were:

A. Annual control of live zooplankton mass culture. The primary organisms here were the marine rotifer (*Brachionus plicatilis*) and brine shrimp (*Artemia salina*).
B. Phyical environmental control of hatchery parameters such as temperature, salinity, and lighting.
C. Controlled artificial larval diets required to be administered at a specific time during larval development.
D. Control of biological parameters such as water quality and disease prevention.

The pompano hatchery was harvested when the larvae had reached full metamorphosis, a total length of 15 mm., and weighed at least one gram. This hatchery period required, on the average, 22 days. By the time of hatchery harvest the pompano fry had been trained to eat artificial food. However, it was found that the growth performance of the juveniles was economically enhanced by feeding them 20% of their daily ration in live brine shrimp. This live brine shrimp supplement was continued until the fry reach ten grams.

The juvenile pompano farm consisted of 24 concrete tanks and each tank held 2,500 gallons. The juvenile pompano resided there for eight weeks where they grew from one gram to a ten gram average. The best growth rate achieved was with a 100% live brine shrimp diet. On live brine shrimp the fish grew to ten grams in only six weeks. A ten gram pompano is sufficiently large and strong enough to be placed in a growout environment. O.M.I. chose to grow their pompano to market size in small tanks at a very high density. However, a ten gram pompano could be pond or cage grown from this size on.

The O.M.I. growout farm was a design where three 20 foot diameter by 2 foot deep tanks were vertically connected so water from the top tank ran to the second and the second tank ran to the third. The design criteria suggested that 2,000 pompano could be grown to market size in these tank systems in 36 weeks (figure 3). That density is roughly one pond of pompano to every two gallons of water at time of harvest. Unfortunately, O.M.I. only had nine months to operationally test the efficacy of this system before going out of business. What was learned, in my opinion, was that the pompano grew economically from 10 grams to 150 to 200 grams on O.M.I. formulated foods. At 150 to 200 gram size the pompano, without diet change, went from a food conversion ratio of 3.5 : 1 to at least 6 : 1. The exact cause of this slow down was never understood by O.M.I. and it ran out of time before it could correct the problem. It is this author’s opinion after many more years of fish breeding experience, that the farm design was inadequate to meet the spacial and environmental needs of the pompano beyond the 150 to 200 gram size. The accumulative

effect of shallow water, bright sun light, poor water quality in the lower tanks and over crowded conditions all stressed this fish. This intense stress interfered with its normal metabolic growth abilities. I postulate that if the Florida Pompano were transferred at 100 grams to larger tanks as was the case with Neptunian Mariculture pompano growout method in the Florida Keys, or put into large sea cages like those developed by Aqumar in Martinique, the O.M.I. growout results would have shown immediate economic improvement.

The Dominican Republic pompano farm ceased operations in December of 1974. The primary reasons for the business closing were,

1. Rapidly inflating fuel costs due to the Arab Embargo of 1973 & 1974. By December of 1974 the company could not purchase enough fuel at any price to keep its water pumps running.
2. O.M.I. was a subsidiary of a public stock company (O.D.C.) which was under attack by its major stock holders and the S.E.C. for fraudulently side steaming funds that were raised and committed to the O.M.I. mariculture project.
3. The third major problem was then believed to be the slow down in the growth of the pompano beyond the 200 gram size.

The top management of O.M.I. was able to find an immediate business solution to the 200 gram pompano growth problem by attracting two major institutional buyers that wanted small portion controlled pompano filets. These buyers incorporated these butterfly filets into pre-prepared complete dinners that were sold to the major airlines as in-flight meals. This example is one of the many ready markets for small finfish. Of all three of the major problems facing the company the one that could not be overcome was the cost and the lack of fuel in the Dominican Republic during that period.

PRESENT STATE OF THE ART FOR POMPANO MARICULTURE

After the closing of the O.M.I. venture I am not aware of any other commercial pompano venture since. The work of Aquamar in Martinique between 1981 and 1984 seems notable to mention. This group caught wild juvenile permit (*T. falcatus*) and palometa (*T. goodei*) and grew them up in rather novel designed floating net drums or cages. The permit is a very closely related species to the Florida Pompano. We found at O.M.I. that both these fish responded similarly to mariculture practices. After reviewing what literature I could find and verbal communications with colleagues I do not believe this group found any similar reduction in growth at the 150 to 200 gram size of permit as O.M.I. did with the pompano. Further, work done by this author in my Florida Keys mariculture facility in 1979 also suggests that pompano of 150 grams and larger are intolerant to high density and small tank confinement.

It is also notable to point out that the Florida Pompano had been breed and raised through F_2 generation in the Dominican Republic and at the author's facility in the Florida Keys. In both instances the selection criteria for which fish to breed was the fish with the fastest

growth rate. It was obvious from both the data collected and visual observations that the F_1 & F_2 fish both out performed wild first generation fish in the category of growth rate and survival. As is the case with other higher forms of vertebrates there was a 'domestication effect' on F_1 & F_2 fish. These fishes behavior was more docile and less outwardly bothered by outside stimulus. Therefore, current state of the art suggests a definite improvement in growout performance with successive generations. Also, this author believes as do others, that it is quite possible to hybrid cross the permit with the pompano. The hope would be that the hybrid may retain the fast growth rate ability of the permit and retain the excellent table qualities of the pompano.

An interesting observation reported by T.C. Kloth (O.M.I. Broodstock Manager) is that data from thousands of wild caught adult pompano demonstrates an obvious sexual dimorphism. Mr. Kloth reports (verbal communication) that in at least 90% or better of the wild caught pompano of the size class from 2 to 5 pounds were females. The belief is that if the broodstock technician could produce all female fish the resultant growout economics could be enhanced.

The present business opportunities with pompano mariculture should be obvious to those practitioners of this trade. Not all of the pompano farming techniques are completely refined but enough are so as to allow for economic success in my opinion. The national pompano fishery is depleted to one tenth of its catch of just twelve years ago. The fishermen in 1974 were paid $2.00 per pound for pompano in Florida and are now paid $5.00 per pound in the Florida Keys for whole fish. It is estimated that the Dominican pompano farm would produce pompano for $1.25 per pound (scaled to one million pounds per year). In comparison, a pompano farm today should be able to produce pompano at somewhere around $1.75 per pound (scaled to one million pounds per year). Beyond one million pounds per year production the economy of scale effect will further reduce production costs.

This author believes, as do others, that the countries of the Caribbean area have ideal conditions both economically and physically for marine finfish mariculture. This agribusiness technology is readily available and awaiting people and companies with the vision and ability to put it to use.

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ABOUT THE AUTHOR (As reported at time of Presentation):

Mr. McMaster received a B.S. Degree in Fisheries Management in 1968 from Utah State University and then did graduate studies at San Diego State University in 1969. He was first employed by the National Marine Fisheries Service and then by Scripps Institute of Oceanography, La Jolla, Calif. from 1969 to 1971. Mr. McMaster conducted original applied research on finding methods for the mass culture of the saltwater rotifer *Brachionus plicatilis*, various unicellular algaes, and larval finfish rearing methods. In 1971 he accepted an offer to join a large private company as Vice President for Research and Development. At this position he created the fundamental technologies for the vertically integrated commercial production of the Florida Pompano, *Trachinotus carolinus*. This company built and operated the first and only tropical marine finfish aquaculture farm in the western hemisphere. This farm was located in the Dominican Republic.

In 1975 Mr. McMaster founded his own company, Ocean Farming Systems, Inc. a Florida Corporation. Located in the Florida Keys he built the second tropical marine finfish and brine shrimp farm ever built in the western hemisphere. Then in 1984 he formed a new Florida Corporation called Mariculture Technologies International, Inc. which he owns and operates today in the Florida Keys.

Mr. McMaster over the course of 18 years in commercial mariculture ventures has accumulated an experience level of which few enjoy. He has authored numerous popular, technical, and business articles along with consulting with other proposed ventures tthroughout the Caribbean and South American area. Return to main document.

POMPANO EGG PRODUCTION 1974
OMI, 1974
Figure 1

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Month	Number of Spawns	Injected Females	Spawning Females	Spawn Success	Total Eggs	Developing Eggs	Eggs per Spawning Female
January	4	17	14	82%	1,755,000	1,125,000	125,000
February	3	15	13	87	1,710,000	990,000	131,000
March	4	20	14	70	1,500,000	1,157,000	107,000
April	3	15	7	47	680,000	570,000	97,000
May	4	19	13	68	1,730,000	1,360,000	133,000
June	3	14	9	64	1.050,000	770,000	117,000
July	4	15	7	47	620,000	460,000	88,000
August	4	23	17	65	1,960,000	1,450,000	130,000
September	3	17	8	47	930,000	705,000	118,000
October	5	31	15	48	1,330,000	490,000	89,000
November	3	20	13	65	1,500,000	1,235,000	115,000
December	1	4	1	25	150,000	130,000	130,000
Total	41	210	131	62%	14,915,000	10,442,000	1,380,000

POMPANO FRY PRODUCTION, JAN-NOV, 1974
OMI, 1974
Figure 2

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Month	Eggs from Spawn	**Fry Produced**	**Percent Yield**	**Length (mm)**	**Weight (mg)**	**Days in Hatchery**
January	66,900	5,109	7.64	17.0	95	30
February	323,300	22,614	6.99	17.0	95	30
March	601,800	30,981	5.15	18.0	99	30
April	362,100	19,290	5.33	17.8	108	30
May	309,000	38,197	12.36	17.3	99	26
June	428,000	82,949	19.38	20.3	186	26
July	367,000	33,082	9.01	15.9	79	25
August	444,350	34,123	7.68	18.2	130	25
September	775,900	39,039	5.03	18.1	125	21
October	452,250	55,451	12.26	17.9	103	21
November	602,600	89,631	11.55	18.2	126	21
Total	4,733,000	450,466	9.52	17.8	112	25.5