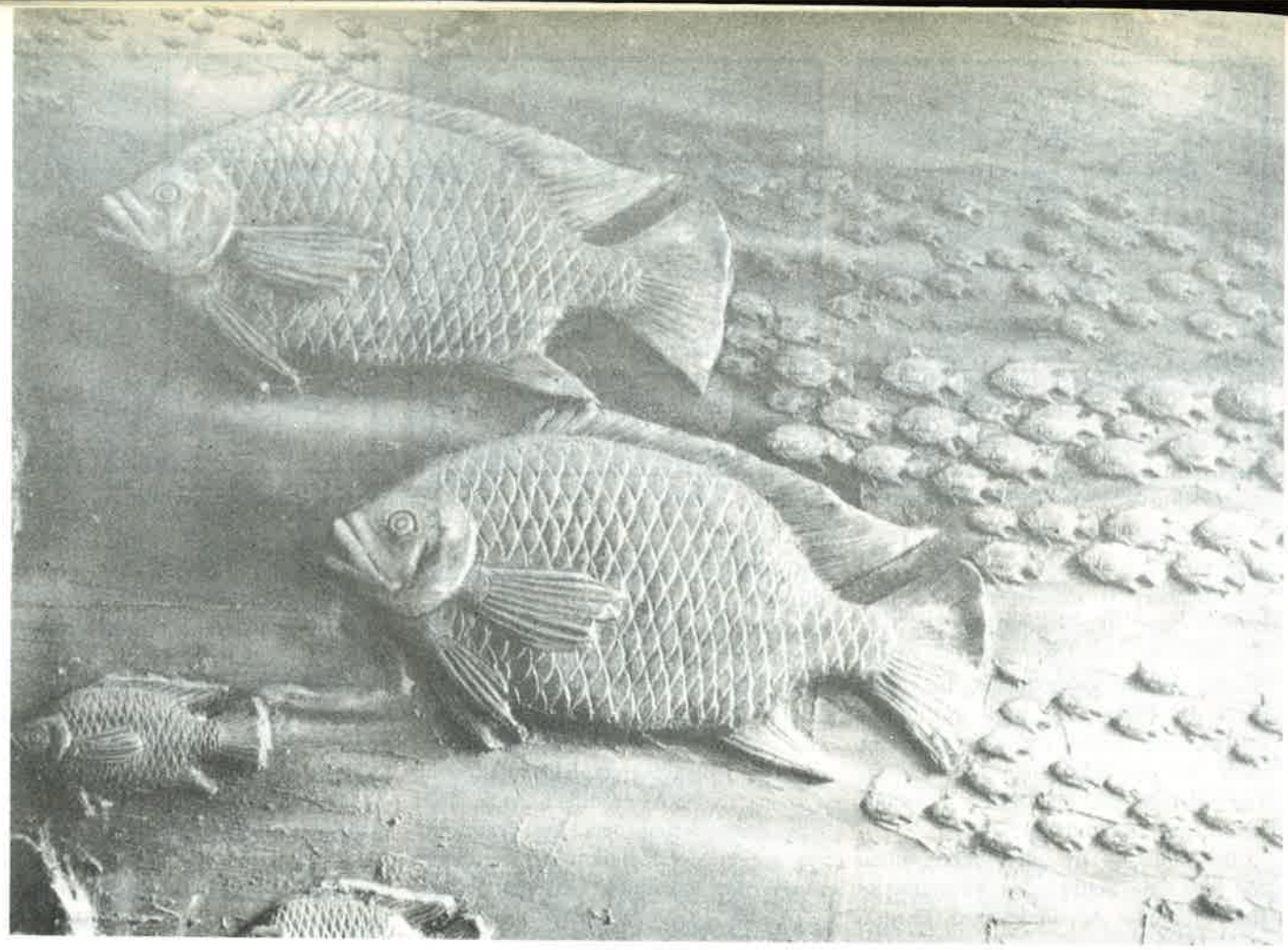

The Development of Tilapia Culture in Taiwan

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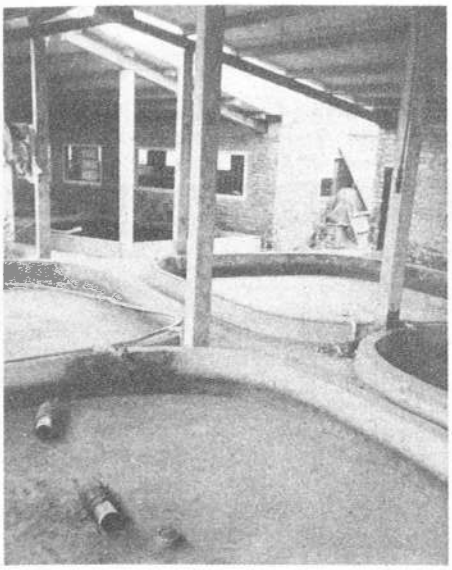
Production from finfish and shellfish culture in Taiwan has been steadily increasing in the last two decades; the total production increased from 49,972 tonnes in 1963 and 107,489 t in 1973 to 216,436 t in 1982, while the total value increased from NT$576.3 million in 1963 and NT$4,092.3 million in 1973 to NT$20,384.5 million in 1982 (Table 1). This rapid increase has resulted from the continued search for culturable commodities, breakthroughs and improvement on hatchery technology, intensification of culture systems and favorable marketability of the commodities.

Traditionally milkfish, Chinese carps and oysters were considered to be the most important culture commodities with

Faith in the future is shown in this mural of tilapias at a large tilapia hatchery in Taiwan. Photo by Roger Pullin.

Table 1. Production statistics of important cultured commodities in Taiwan (1963-1982).

Year	Production (tonnes) Total	Tilapia	Milkfish	Carp	Oyster	Eel	Production ratio (%) Tilapia/milkfish
1963	49,972	7,436	25,881	4,027	7,974	130	28.73
1964	56,291	7,700	30,686	4,556	8,495	182	25.10
1965	54,160	7,683	27,562	5,157	8,893	178	27.88
1966	58,511	8,334	29,094	5,671	10,342	196	28.64
1967	56,185	8,810	23,558	5,896	11,697	277	37.40
1968	56,595	9,232	19,709	6,699	12,573	620	46.84
1969	57,092	9,596	18,995	7,485	11,726	1,571	50.53
1970	72,724	11,362	27,857	8,012	13,072	1,996	40.77
1971	77,789	11,364	30,651	8,920	12,677	3,610	37.08
1972	81,336	10,923	24,950	10,925	13,668	6,926	43.77
1973	107,489	13,154	31,578	15,923	14,310	11,672	41.66
1974	114,472	15,192	28,907	17,483	13,371	11,847	52.55
1975	127,577	18,696	33,308	18,254	13,856	13,607	56.11
1976	135,460	22,222	25,852	19,984	13,518	18,771	85.95
1977	139,640	22,245	26,361	18,824	14,948	22,023	84.38
1978	164,405	28,112	30,153	23,260	17,966	21,299	93.24
1979	183,688	34,652	32,034	26,616	19,920	26,440	108.14
1980	175,008	34,781	19,324	27,379	20,969	33,079	179.98
1981	201,925	48,481	23,912	32,204	20,393	27,624	202.79
1982	216,436	51,504	29,524	28,387	25,202	28,877	174.49



Shallow tanks for holding tilapias during sex-inversion treatment at a large hatchery in Chiayi, central Taiwan.

Harvesting a tilapia pond, Chiayi, central Taiwan.

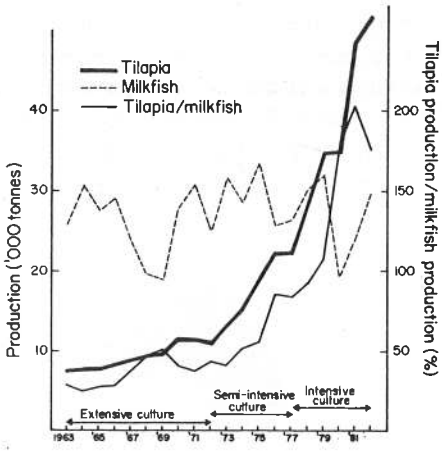
respect to total production and acreage (Table 2). However, the level of milkfish and carp culture has remained about the same over the past decade. The average yield of milkfish has been fluctuating around 2 t/ha while that of carps has increased two-fold, from 1.37 t/ha in 1973 to 2.79 t/ha in 1982.

Growth and Introductions

During the same period, the culture of tilapia has rapidly expanded, both in area (increased from 4,528 ha in 1973 to 10,256 ha in 1982) and production (13,154 t in 1973 to 51,504 t in 1982). Tilapia have consequently become the most important culture enterprise in Taiwan in recent years. The dramatic growth of tilapia culture is largely attributed to the success of continued selection of culturable tilapia strains and species, and improvements in culture technology and management.

The Java tilapia, *Oreochromis mossambicus*, was first introduced to Taiwan back in 1946. The original stock of 12 adults then multiplied and spread until they became a common food fish in all parts of the island during the post-war food shortage period. They were cultured extensively in various water bodies, including earthen ponds, irrigation canals, reservoirs and paddy fields.

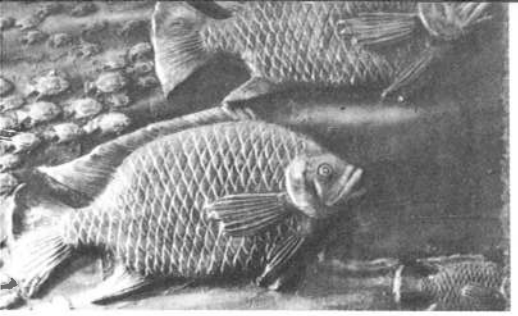
In 1973, *Tilapia zillii* was introduced from South Africa, with an attempt to establish cold-tolerant tilapia culture in Taiwan. On account of its small size, slow growth and aggressiveness towards other fish, it has never become popular with fish farmers in Taiwan.



The development of tilapia culture in Taiwan, showing the increased yields with technology improvement. Milkfish production has remained static and tilapia has now become the major aquaculture crop in Taiwan.

Table 2. Culture acreage and production of important commodities.

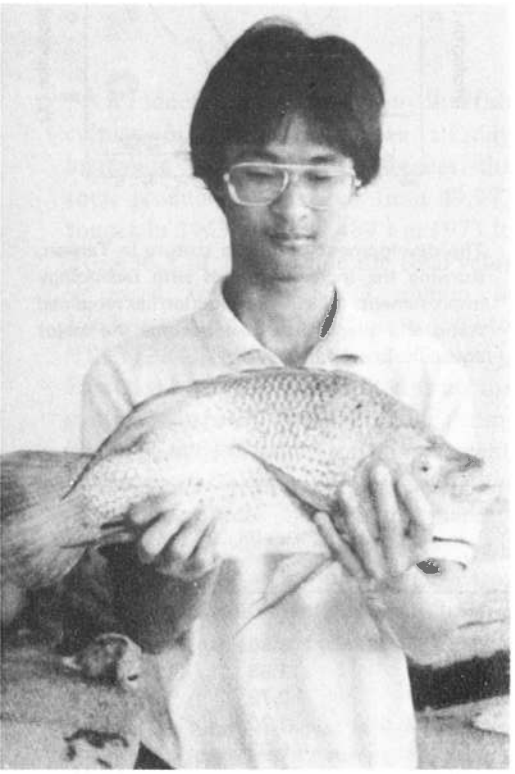
	1973				1982			
	Area (ha)	Yield (t)	Yield/ha (t)	% of total production	Area (ha)	Yield (t)	Yield/ha (t)	% of total production
Total	49,469.60	107,489	2.17		64,662.87	216,439	3.35	
Milkfish	15,663.54	36,578	2.34	29.38	15,110.89	29,524	1.95	13.64
Carp	11,615.96	15,923	1.37	14.81	10,190.76	28,387	2.79	13.16
Oyster	9,546.07	14,310	1.50	13.31	14,810.00	25,202	1.70	11.64
Tilapia	4,528.49	13,154	2.90	12.24	10,256.47	51,504	5.02	23.80
Eel	1,040.38	11,672	11.22	10.86	2,096.16	28,877	13.78	13.34



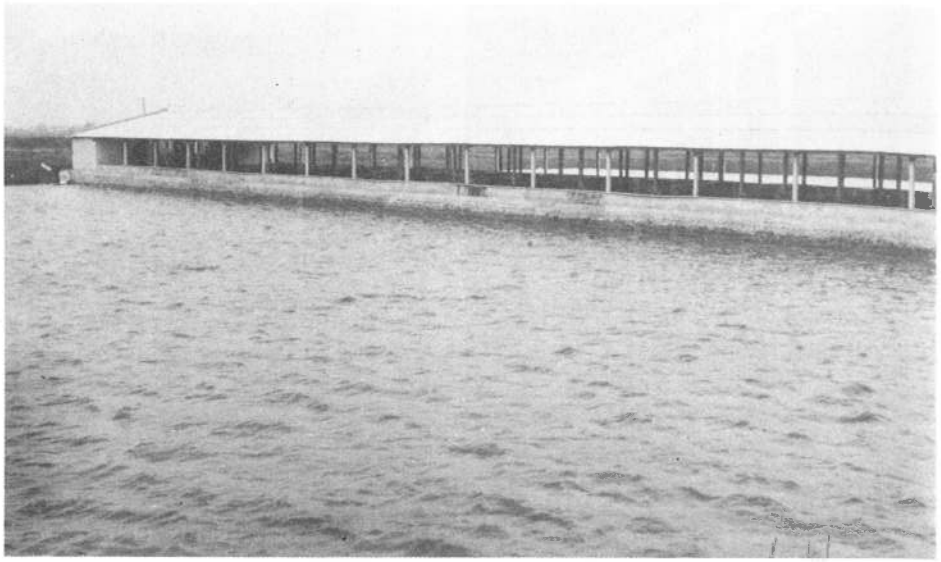
The Nile tilapia, *O. niloticus*, was introduced from Japan in 1966. Because of their favorable culture attributes, fast growth and marketability, the nile tilapia and hybrids with *O. mossambicus* have in a remarkably short time become a very popular and favored culture commodity.

The hybrids of *O. mossambicus* (♀) x *O. niloticus* (♂) named "Fu-shou Yu" (Blessed fish) showed a superior daily growth rate of 1.16 g as compared to 0.74 g of *O. niloticus* and 0.59 g of *O. mossambicus*, and were already cultured extensively by 1969.

Red tilapia, presumably originating from an *O. mossambicus* albino, began to appear unexpectedly in Taiwan in 1968. An attempt to reproduce this red tilapia strain was made through the interspecific cross of *O. mossambicus* albino x *O. niloticus*. After several years of continued selection and hybridization, the appearance of colored fry was increased from 30% of total population in 1969 to 80% in 1974. However, the culture of this strain was not commercialized until 1979.



Researcher holding a market-sized red tilapia.



Production pond and hatchery building at a large tilapia hatchery, Chiayi, central Taiwan. Photo by Roger Pullin.

Introduction of blue tilapia, *O. aureus*, from Israel was made in 1974 and was intended primarily for all-male fingerling production by interspecific hybridization and sex inversion by steroid treatments conducted by the Taiwan Fisheries Research Institute; the technology was extended to the farmers in 1977. However, further improvements on the red tilapia strain and the refinement of methods of all-male fingerling production through genetic manipulation are still continuing. Stabilization of the red tilapia strain and improvement on its body coloration have been of primary interest.

Progress of Tilapia Culture

Progress of the tilapia culture industry in Taiwan has taken place in three periods:

I. (1963-1972)

Extensive culture methods were mostly used. A slow but steady increase in production during 1963 to 1969 was due to expansion on the *O. mossambicus* culture in many different water bodies. An increased production in 1969-72 resulted from the introduction of the hybrid *O. mossambicus* x *O. niloticus* and of *O. niloticus* into the culture practices.

II. (1973-1977)

Tilapia culture shifted to semi-intensive culture systems through pond fertilization procedures. A notable increase in production can be attributed to:

a. All-male culture of *O. niloticus* through hand-sorting procedures.
b. Promotion of the development of integrated agricultural-aquacultural farming systems.

Culture of fish in combination with hog or duck farming has gained popularity in Taiwan since that time, with more than 5,000 ha of paddy fields converted into fishponds. Some reclaimed tidal land has also been used for hog-fish culture. The fish stocked in these ponds are generally tilapias, and four major Chinese carp species, with the Nile tilapia *(O. niloticus)* as the dominant tilapia species.

III.(1977-1982)

Production increased from 22,000 t in 1977 to about 35,000 t in 1979-80 and further increased during 1981-82 to 50,000 t. The first increase was largely a result of the culture of all-male tilapias produced from interspecific hybridization of *O. aureus* x *O. niloticus*. The method was further refined through genetic manipulation. Development of satisfactory pelletized feeds for tilapia species has led to the intensification of culture systems. Impact of feed development on the tilapia culture enterprise in Taiwan is manifested in the second increase in production in 1981-82. The major cultured tilapias are now all-male hybrids and red tilapia. ●