

# The introduction and distribution of tilapias in Asia and the Pacific<sup>1</sup>

A global account of inland fish introductions and transfers was first published by Welcomme (1984, 1988); this dataset has been updated to include other taxa and marine species in the FAO Database on Introductions of Aquatic Species (DIAS). Welcomme and Vidthayanon (1999) used information in DIAS and recently examined the introductions and transfers in Southeast Asia, particularly in countries of the Lower Mekong River Basin. According to DIAS (Table 1), 12 tilapia species (six *Oreochromis* spp.; two *Sarotherodon* spp.; and four *Tilapia* spp.) and one hybrid have been introduced into 30 countries the region, including the Taiwan Province of China and Hong Kong Special Administrative Region (Hong Kong SAR).

As reported in Welcomme (1988) aquaculture was the prime reason for the introductions of tilapias (Table 1). For the vast majority of the records in DIAS there has been no evaluation of the ecological or social/economic impact of the introduction (DIAS–Figure A). However, of the impacts assessed, there were more positive social and economic impacts reported than negative environmental impacts. Although Welcomme (1988) and others (Beverton 1992) reported that the majority of introductions did not result in the establishment of alien species in the wild, the records in DIAS indicated that most tilapia introductions to Asia and the Pacific were successful at establishing reproducing populations (DIAS–Figure B).

Of the species introduced to Asia, *O. mossambicus* and *O. niloticus* are by far the most important from both production and scientific points of view. These species are now widely distributed in most of Asia and occur in natural and quasi-natural waters making them a part of the fish fauna of most of tropical and even sub-tropical Asian aquatic environments, thus creating an increased concern among some conservationists and environmental lobby groups (Pethiyagoda, 1994). Tilapia species tend to hybridize relatively easily, a trait that had been utilized in tilapia aquaculture development from the very early stages (Hickling, 1960; 1963). Introgressive hybridization in cultured stocks (Macaranas *et al.*, 1986) and self-recruiting stocks (De Silva and Ranasinghe, 1989) of tilapia species, particularly between *O. mossambicus* and *O. niloticus*, have been reported from many countries. The “red tilapia”, a hybrid between strains of *O. mossambicus* x *O. niloticus* is currently considered as important to aquaculture in Asia (Welcomme and Vidthayanon 1999).

Several species of tilapias (*O. mossambicus*, *O. niloticus*, *O. aureus*, *O. hornorum* and *Tilapia zillii*) were introduced to the South Pacific Islands in the mid-1950s. Information about those introductions, particularly the introductions to relatively small islands, is scarce (Nelson and Eldredge, 1991). However, introductions to the larger Melanesian

<sup>1</sup> In this document, Asia and the Pacific refers to countries in Asia and Oceania under FAO regional classification.

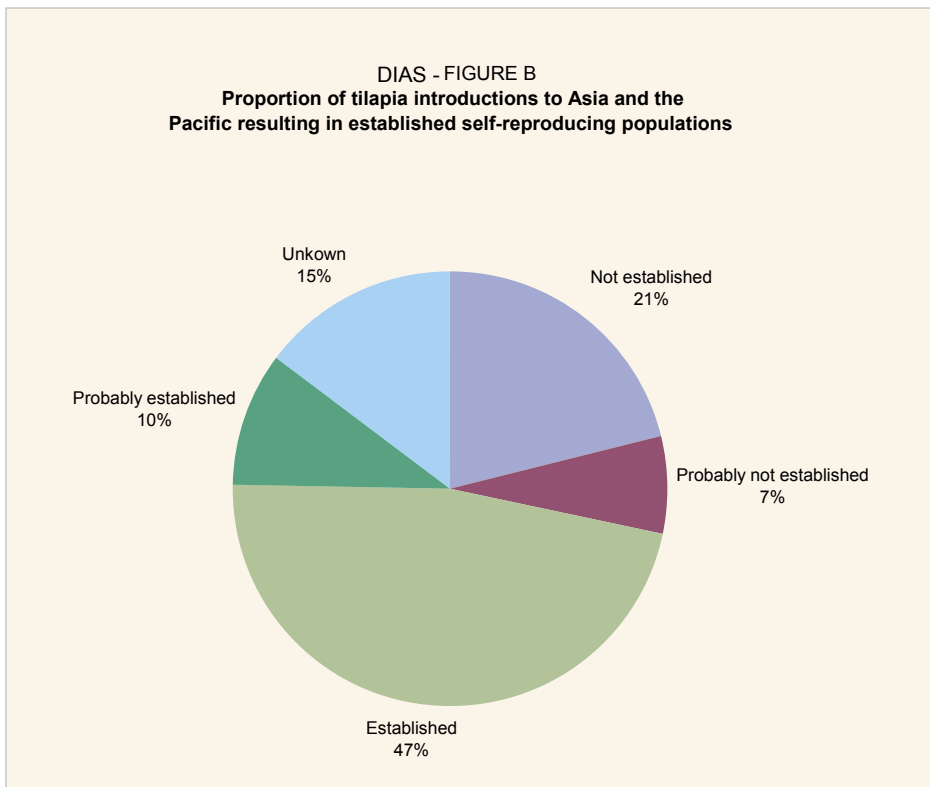
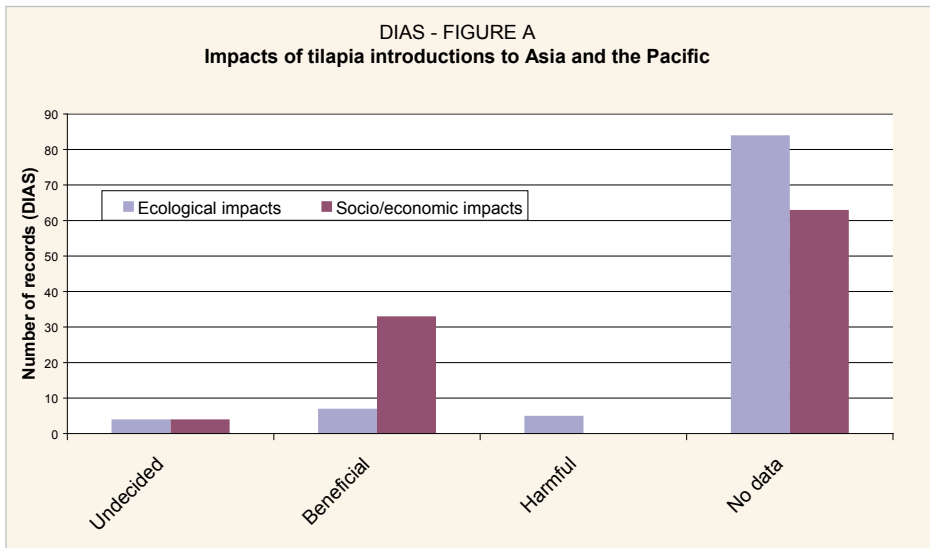
TABLE 1  
Summary of tilapia introductions to Asia (data from FAO DIAS)

Species	Introduced to	From	Date of first introduction	Purpose
<i>Oreochromis aureus</i>	Philippines	USA and Singapore	1977	aquaculture
	Singapore	unknown	unknown	unknown
	China	Hong Kong SAR	1981	aquaculture
	Taiwan Province of China	Israel	1974	aquaculture
	Fiji	unknown	1974	research
	Thailand	Israel	1970	aquaculture
	Japan	Taiwan Province of China , USA and Syria	1980, 1983-1984	aquaculture
	Pakistan	Egypt	1985	fisheries
	Australia	unknown	unknown	unknown
	Myanmar		1977	aquaculture
	Viet Nam	China	2002	research
	China	USA	1981	no data
	<i>Oreochromis macrochir macrochir</i>	Japan	USA	1964
<i>Oreochromis mossambicus</i>	Singapore	Indonesia	1943	unknown
	Hong Kong SAR	Singapore and Thailand	1940, 1948	aquaculture
	Fiji	Malaysia	1954	aquaculture
	Papua New Guinea	Malaysia	1954	aquaculture
	Japan	Thailand	1954	aquaculture
	Bangladesh	Thailand	1954	aquaculture
	Sri Lanka	East Africa	1952	aquaculture
	Northern Mariana Is. (Pagan)	Northern Mariana Islands (Saipan)	1955	fisheries
	Micronesia	unknown	1970s	aquaculture
	Australia	unknown	unknown	ornamental fish
	Kiribati (Gilbert Is.)	unknown	1963	aquaculture
	Vanuatu (Efate & Tana Islands)	New Caledonia	1956	fisheries
	Solomon Is. (Malaita and Sta. Anna)	unknown	1957	aquaculture
	India	Sri Lanka, Thailand	1952	aquaculture
	Viet Nam	Africa and Philippines	1951, 1955	aquaculture

Species	Introduced to	From	Date of first introduction	Purpose
	Pakistan	Indonesia, Egypt, Thailand	1951, 1954	aquaculture
	India	Sri Lanka, Thailand	1952	fisheries
	Republic of Korea	Thailand	1953	research
	Maldives	unknown	1965	research
	Pakistan	Indonesia, Egypt, Thailand	1951, 1954	fisheries
	Pakistan	Egypt	1954	fisheries
	Maldives	unknown	1965	bait
	Thailand	Malaysia	1949	aquaculture
	Philippines	Thailand	1950	aquaculture
	French Polynesia	unknown	1950s	aquaculture
	Malaysia	Indonesia	1943-1945	aquaculture
	Indonesia	East Africa	1939	aquaculture
	Taiwan Province of China	Indonesia	1944	aquaculture
	New Caledonia	Philippines	1955	aquaculture
	Northern Mariana Is. (Saipan)	Philippines	1955	fisheries
	Guam	Philippines	1954	aquaculture
	Tuvalu	unknown	unknown	aquaculture
	Samoa	Fiji	1955	aquaculture
	American Samoa	Western Samoa	1957	fisheries
	Nepal	unknown	1985	aquaculture
	Cook Is.	Fiji	1955	aquaculture
	Republic of Korea	Thailand	1953	aquaculture
	Maldives	unknown	1965	fisheries
	Cambodia	Viet Nam	1980	aquaculture
	China	Viet Nam	1957	aquaculture
	Pakistan	Egypt	1954	aquaculture
	Myanmar	China	1953	aquaculture
	India (Rajasthan)	India (West Bengal)	1990	accidental
	India (Rajasthan)	India (West Bengal)	1990	aquaculture
	India (Rajasthan)	India (West Bengal)	1990	fisheries
	Lao PDR	Thailand/Japan	1965	aquaculture
<i>Oreochromis niloticus</i>	Cambodia	Viet Nam	1980	aquaculture
	Nepal	unknown	1985	aquaculture
	Singapore	unknown	1970s	aquaculture

Species	Introduced to	From	Date of first introduction	Purpose
	Cook Is. (Rarotonga)	Fiji	1993	aquaculture
	Pakistan	Egypt	1985	aquaculture
	India	Thailand	1990	fisheries
	Pakistan	Egypt	1985	fisheries
	Nepal	Thailand	1988	research
	Viet Nam	Taiwan Province of China, Philippines, Thailand	1973, 1989, 1994	aquaculture
	India	Thailand	1990	natural diffusion
	China	Sudan	1978	aquaculture
	Nepal	Thailand	1988	aquaculture
	Thailand	Japan	1965	aquaculture
	Myanmar	Unknown	1977	aquaculture
	Lao PDR	Thailand	unknown	aquaculture
	Indonesia (Irian Jaya)	unknown	1971	unknown
	Philippines	Thailand and Israel	1970, 1973	aquaculture
	Fiji	Israel	1968	aquaculture
	Hong Kong SAR	Taiwan Province of China	1972	aquaculture
	Thailand	Japan	1965	aquaculture
	Japan	Egypt	1962	aquaculture
	Taiwan Province of China	Japan	1966	aquaculture
	Malaysia	Thailand	1979	aquaculture
	Sri Lanka	unknown	unknown	unknown
	Bangladesh	Thailand	1974	aquaculture
	Indonesia	Taiwan Province of China	1969, 1980 onwards	aquaculture
	China	Philippines	1994	no data
<i>Oreochromis niloticus x Oreochromis mossambicus</i>	China	Taiwan Province of China	1983	no data
	Cambodia	Thailand	1991	no data
<i>Oreochromis spilurus spilurus</i>	Philippines	Saudi Arabia	1985	aquaculture
<i>Oreochromis</i> spp.	Philippines	Taiwan (Prov. of China)	1979	fisheries
	Philippines	Taiwan (Prov. of China)	1979	aquaculture
	Indonesia	Philippines	1980	aquaculture

Species	Introduced to	From	Date of first introduction	Purpose
<i>Oreochromis urolepis hornorum</i>	Japan	Israel	1981	aquaculture
	Fiji	Taiwan Province of China	1985	research
	Taiwan Province of China	Costa Rica	1981	aquaculture
	Sri Lanka	East Africa	1969	unknown
<i>Oreochromis urolepis urolepis</i>	Fiji	unknown	unknown	unknown
<i>Sarotherodon galilaeus galilaeus</i>	China	Africa	1981	aquaculture
	Japan	USA	1964	aquaculture
<i>Sarotherodon melanotheron</i>	China	Ghana	2002	no data
	Japan	USA	1960	unknown
<i>Tilapia mariae</i>	Australia	unknown	1960s	ornamental fish
<i>Tilapia rendalli</i>	Sri Lanka	Zaire	1955	aquaculture
	Papua New Guinea	UK	1991	fisheries
	Sri Lanka	East Africa	1969	aquaculture
	Taiwan Province of China	South Africa	1981	aquaculture
	Thailand	Belgium	1955	aquaculture
<i>Tilapia sparrmanii</i>	Japan	USA	1959	aquaculture
<i>Tilapia zillii</i>	Fiji	Hawaii	1957	aquaculture
	Japan	Egypt	1962	aquaculture
	New Caledonia	Hawaii	1954	aquaculture
	China	Africa	1981	aquaculture
	Guam	Hawaii	1956	weed control
	Taiwan Province of China	South Africa	1963	research
	Sri Lanka	East Africa	1969	unknown
	Philippines	Israel	1970, 1977	aquaculture
	Philippines	Israel	1970, 1977	fisheries
	Thailand	Malaysia	1949	aquaculture



islands such as Papua New Guinea and Fiji are relatively well documented (Andrews, 1985; West and Glucksman, 1976; Werry, 1998). It is believed that most of these introductions were designed to improve local fisheries through stock enhancement, provide live bait for the tuna industry, and contribute to aquaculture, as well as biological control, (e.g. aquatic weed and mosquito control). There have also been inadvertent introductions of



*Tilapia farm in Sarawak, Malaysia*

*O. mossambicus* to some islands; most notable was the introduction to the Fanninf Atoll in one of the Linne Islands of the Polynesian group (Lobel, 1980). Apart from the origin of the early introductions, which were mainly from Asia (Singapore, Malaysia, etc.), later introductions and transfers between islands are not well-documented.

The origin of the first introduction of tilapias into Asia is not clear except for the fact that, by 1950, *O. mossambicus* had spread into many Asian countries. At present, tilapias are a part of the fish assemblages in most Asian countries. In most countries, tilapias have had a noticeable impact on fish production, although the contribution is not officially reported to FAO by many countries. It is difficult, if not impossible, to single out a country in which tilapias have not become established after introduction.

The introduction of *O. mossambicus* to Asia was hailed as the solution to the short supply of animal protein in the region (Lin, 1977). However, due to its recurring problems of overcrowding and stunting in small ponds, *O. niloticus* became the preferred species due to its higher growth rate, a reduced tendency to stunt and better consumer appeal (Smith and Pullin, 1984). In spite of the rather wide-scale introduction into Asian waters, there is no explicit evidence to indicate that tilapias have been overly destructive environmentally; nor is there evidence to indicate what effect these species have on biodiversity.

Tilapias continue to make an important and a significant contribution to fish production in Asia, both in the inland capture fishery and aquaculture sectors. Bartley *et al.* (in press) reported 1 66 737 tonnes of total tilapia production from many ASEAN countries and China. This is an underestimate of the production as many ASEAN countries have introduced tilapias and are farming them, but do not report production to FAO. Although small-scale fisheries and rural aquaculture share many commonalities and are often difficult to separate completely (e.g. culture-based fisheries in Sri Lanka), the two sectors are treated as distinct entities in this document.

