

TABLE 11
Freshwater fish farming comparative advantage (Middle East)

Country	Species	Production quantity (tonnes)				RCA		RCAV		
		1985–89	1990–94	1995–99	2000–03	1985–89	2000–03	Sub-period I ¹	Sub-period II	Sub-period III
Cyprus	Carp	0	0	0	0	0.00	--	--	--	--
	Catfish	0	0	0	0	0.00	--	--	--	--
	Tilapia	1	0	0	0	22.27	--	--	--	--
	Others	0	0	0	0	0.00	--	--	--	--
Iran, (Islamic Republic of)	Carp	22 307	22 509	26 494	46 534	1.26	1.26	0.0%	0.0%	0.0%
	Catfish	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Tilapia	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Others	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
Iraq	Carp	4 451	3 240	3 637	1 811	1.26	1.26	0.0%	0.0%	0.0%
	Catfish	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Tilapia	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Others	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
Israel	Carp	8 674	7 955	7 810	7 592	0.86	0.62	-2.0%	-8.9%	-2.3%
	Catfish	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Tilapia	4 072	4 742	6 293	7 480	7.11	8.48	2.0%	8.8%	0.0%
	Others	0	0	25	378	0.00	0.17	0.0%	0.2%	2.2%
Jordan	Carp	18	13	42	2	0.37	0.00	-0.3%	-12.6%	-12.8%
	Catfish	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Tilapia	43	37	238	567	15.70	17.45	0.3%	12.6%	12.8%
	Others	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
Kuwait	Carp	0	0	0	0	--	0.00	--	--	0.0%
	Catfish	0	0	0	0	--	0.00	--	--	0.0%
	Tilapia	0	0	42	20	--	17.52	--	--	0.0%
	Others	0	0	0	0	--	0.00	--	--	0.0%
Lebanon	Carp	0	0	0	15	--	0.21	--	--	--
	Catfish	0	0	0	50	--	59.39	--	--	--
	Tilapia	0	0	0	25	--	4.87	--	--	--
	Others	0	0	0	0	--	0.00	--	--	--
Saudi Arabia	Carp	0	8	0	0	0.00	0.00	0.4%	-0.4%	0.0%
	Catfish	0	0	20	31	0.00	1.04	0.0%	0.6%	0.5%
	Tilapia	431	2 130	3 390	3 137	22.27	17.35	-0.4%	-0.2%	-0.5%
	Others	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
Syrian Arab Republic	Carp	2 040	3 149	4 923	2 942	0.98	0.57	2.7%	-0.1%	-31.1%
	Catfish	0	0	54	571	0.00	9.43	0.0%	0.9%	8.0%
	Tilapia	573	885	1 247	2 958	4.89	8.01	-2.7%	-0.8%	23.0%
	Others	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
Turkey	Carp	1 837	530	771	658	1.26	1.26	0.0%	0.0%	0.0%
	Catfish	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Tilapia	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Others	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
United Arab Emirates	Carp	0	0	0	0	0.00	--	--	--	--
	Catfish	0	0	0	0	0.00	--	--	--	--
	Tilapia	0	0	0	0	22.27	--	--	--	--
	Others	0	0	0	0	0.00	--	--	--	--

¹ Sub-period I goes from the second half of the 1980s (1985–89) to the first half of the 1990s (1990–1994); sub-period II goes from the first half of the 1990s (1990–94) to the second half of the 1990s; and sub-period III goes from the second half of the 1990s (1995–99) to the early 2000s (2000–03).

Azerbaijan, Kyrgyzstan, Kazakhstan and Georgia) attempted culture of other species during the 1990s, Georgia was the only one that had less than 100 percent specialization in carp by 2000–03.

Despite the high specialization, the region's annual cultured carp production declined from 42 000 mt in 1985–89 to only 6 700 mt in 2000–03.

Middle East

Table 11 lists 11 Middle East countries that have engaged in freshwater fish farming during the study period. Iran (Islamic Republic of), Iraq, and Turkey have completely specialized in carp farming (Table 11). While carp production has been increasing in Iran (Islamic Republic of) during the study period, Iraq and Turkey have reduced output levels.

Although carp is the most important species in the Middle East (Figure 7), Israel, Jordan, Saudi Arabia, and the Syrian Arab Republic had a strong comparative advantage in tilapia farming during the period of analysis (Table 11). The RCAV indices suggest that Israel and Jordan have been shifting their freshwater fish farming comparative advantage away from carp to tilapia farming. Israel's cultured carp production in 1985–89 doubled its tilapia production; however, tilapia farming had reached the same scale as carp farming by the early 2000s.

Catfish farming is a novelty in the Middle East. The Syrian Arab Republic, Saudi Arabia, and Lebanon were the only three countries with catfish farming production by the early 2000s. The RCAV indices suggest that the Syrian Arab Republic and Saudi Arabia have shifted their freshwater fish farming comparative advantage from carp and/or tilapia to catfish farming during the sub-periods II and III (Table 11).

Lebanon started freshwater fish farming in the early 2000s, culturing all three species (Table 11). Production has been focused mostly on catfish. Lebanon's specialization in catfish farming is nearly 60 times higher than the Asia's average (RCA index = 59.4).

South Asia

Table 12 lists six South Asian countries that have undertaken freshwater fish farming during the study period. Carp has traditionally been the most important species in South Asia (Figure 7). Nepal and Pakistan have completely specialized in carp farming (Table 12). India, the largest freshwater fish farming country in the region and second largest in the world, also shows a high specialization in carp farming. The RCAV indices suggest that India has been shifting comparative advantage from other species to carp farming (Table 12).

India has also substantial catfish farming; the RCA indices suggest that it had a strong revealed comparative advantage in catfish farming during the study period. However, its annual catfish production declined from 60 000 tonnes in 1995–99 to 20 000 tonnes in 2000–03; the corresponding negative RCAV index reflects a decline in India's comparative advantage in catfish farming.

Bangladesh is the third largest freshwater fish farming country in the world. The country also focuses on carp farming and has increased its comparative advantage during the early 2000s (Table 12). Sri Lanka, an outlier in South Asia, had completely specialized in tilapia farming during the study period.

Southeast Asia

Table 13 lists 11 Southeast Asian countries that engaged in freshwater fish farming during the study period.²⁵ As compared to other Asian sub-regions, Southeast Asia has

²⁵ Viet Nam in Southeast Asia was the fifth largest freshwater fish farming country in the world in the early 2000s (Table 8). Unfortunately, we had to exclude it from the comparative advantage analysis because disaggregated data on its freshwater fish farming industry are not available.

TABLE 12
Freshwater fish farming comparative advantage (South Asia)

Country	Species	Production quantity (tonnes)				RCA		RCAV		
		1985–89	1990–94	1995–99	2000–03	1985–89	2000–03	Sub-period I ¹	Sub-period II	Sub-period III
Bangladesh	Carp	0	0	319 279	538 619	0.00	0.99	0.0%	76.2%	7.9%
	Catfish	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Tilapia	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Others	143 708	203 183	99 157	149 237	6.66	1.55	0.0%	-76.2%	-7.9%
Bhutan	Carp	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Catfish	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Tilapia	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Others	14	32	30	30	6.66	7.15	0.0%	0.0%	0.0%
India	Carp	494 200	878 761	1 498 838	1 835 532	0.80	1.17	4.4%	8.8%	12.2%
	Catfish	36 400	44 899	61 262	22 259	3.65	1.20	-0.9%	0.2%	-1.9%
	Tilapia	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Others	252 200	337 091	227 786	123 949	2.14	0.45	-3.5%	-9.1%	-10.3%
Nepal	Carp	4 965	9 882	11 688	16 593	1.26	1.26	0.0%	0.0%	0.0%
	Catfish	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Tilapia	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Others	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
Pakistan	Carp	8 401	12 659	16 800	13 291	1.26	1.26	0.0%	0.0%	0.0%
	Catfish	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Tilapia	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Others	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
Sri Lanka	Carp	0	0	9	0	0.00	0.00	0.0%	0.3%	-0.2%
	Catfish	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Tilapia	4 400	3 500	3 257	3 848	22.27	17.52	0.0%	-0.3%	0.2%
	Others	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%

¹ Sub-period I goes from the second half of the 1980s (1985–89) to the first half of the 1990s (1990–1994); sub-period II goes from the first half of the 1990s (1990–94) to the second half of the 1990s; and sub-period III goes from the second half of the 1990s (1995–99) to the early 2000s (2000–03).

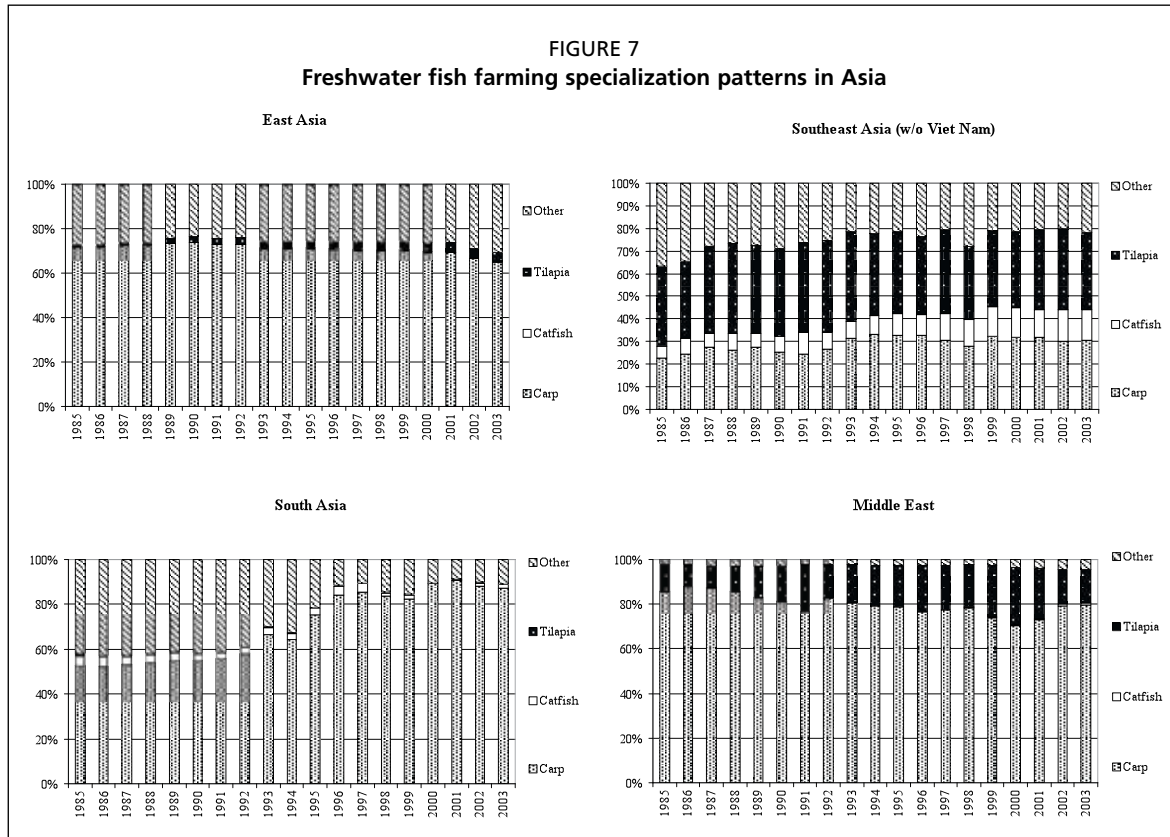
the most diversified freshwater fish farming industry (Figure 7). Unlike the other four Asian sub-regions, carp is not the dominant species. Among the 11 Southeast Asian freshwater fish farming countries (or districts) listed in Table 13, only Cambodia, Lao People's Democratic Republic and Myanmar have a strong comparative advantage in carp farming. The RCAV indices imply that this advantage has been declining in the three countries during the study period. In fact, none of the 11 Southeast Asian countries has a positive carp RCAV index during the sub-period II; the Philippines is the one outlier that gained comparative advantage in carp farming during the sub-period III (Table 13).

Tilapia is the most important species in Southeast Asia's freshwater fish farming (Figure 7) and it was cultured by all 11 countries listed in Table 13 in the early 2000s. The Philippines and Taiwan, Province of China have the strongest comparative advantage in tilapia farming with RCA indices of 15 and 14 in the early 2000s, respectively. The RCAV indices suggest that Taiwan, Province of China increased its comparative advantage in tilapia during the study period while the Philippines lost some of its tilapia advantage during sub-periods II and III (Table 13). Among the 11 Southeast Asian countries listed in Table 13, Cambodia and Myanmar were the only two with weak comparative advantage in tilapia farming in the early 2000s.

TABLE 13
Freshwater fish farming comparative advantage (Southeast Asia)

Country	Species	Production quantity (tonnes)				RCA		RCAV		
		1985–89	1990–94	1995–99	2000–03	1985–89	2000–03	Sub-period I ¹	Sub-period II	Sub-period III
Brunei Darussalam	Carp	1	3	10	17	0.54	0.31	6.5%	-27.0%	0.2%
	Catfish	0	1	0	5	0.00	6.79	17.2%	-15.3%	6.3%
	Tilapia	0	1	17	39	0.00	9.73	24.1%	26.3%	4.9%
	Others	1	0	7	10	3.80	0.98	-47.8%	16.1%	-11.4%
Cambodia	Carp	3 188	6 555	10 052	13 307	1.13	1.13	-0.1%	-1.2%	0.0%
	Catfish	285	587	894	1 169	6.27	8.40	0.5%	1.2%	0.4%
	Tilapia	95	196	292	395	0.59	0.47	-0.4%	0.1%	-0.4%
	Others	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
China, Hong Kong Special Administrative Region	Carp	3 650	3 239	1 975	1 263	0.83	0.82	-0.2%	-8.7%	12.4%
	Catfish	124	191	5	0	1.76	0.00	1.7%	-3.2%	-0.1%
	Tilapia	1 547	731	763	597	6.22	5.42	-17.0%	8.4%	7.0%
	Others	220	972	629	68	0.26	0.25	15.5%	3.4%	-19.3%
Indonesia	Carp	114 617	142 007	191 347	238 483	0.74	0.63	-3.6%	-3.4%	-0.2%
	Catfish	2 005	6 561	19 985	47 223	0.80	10.57	1.6%	3.5%	5.0%
	Tilapia	34 775	58 865	72 544	105 950	3.95	3.89	2.1%	-1.8%	0.0%
	Others	44 718	53 525	64 084	85 845	1.52	1.28	0.0%	1.7%	-4.7%
Lao People's Democratic Republic	Carp	5 250	9 356	12 326	27 086	1.10	0.63	1.8%	-29.0%	-4.9%
	Catfish	0	0	0	0	0.00	0.00	0.0%	0.0%	0.0%
	Tilapia	750	1 336	7 267	24 376	2.78	7.88	-1.8%	23.1%	7.2%
	Others	0	0	1 212	2 709	0.00	0.36	0.0%	5.8%	-2.3%
Malaysia	Carp	4 133	5 243	4 856	5 088	0.88	0.14	-25.7%	-25.9%	-6.1%
	Catfish	70	817	5 692	15 302	0.93	35.99	5.5%	16.5%	14.6%
	Tilapia	1 398	4 859	12 195	19 510	5.28	7.52	12.3%	9.0%	-7.9%
	Others	298	1 538	2 647	5 554	0.34	0.87	7.9%	0.4%	-0.6%
Myanmar	Carp	5 787	31 623	77 328	117 734	1.26	0.91	0.0%	0.0%	-27.9%
	Catfish	0	0	0	650	0.00	0.43	0.0%	0.0%	0.4%
	Tilapia	0	0	0	1 250	0.00	0.13	0.0%	0.0%	0.8%
	Others	0	0	0	43 781	0.00	1.91	0.0%	0.0%	26.8%
Philippines	Carp	6 640	4 296	4 408	14 324	0.11	0.14	-3.3%	0.0%	6.7%
	Catfish	126	1 144	1 056	1 814	0.13	1.49	1.1%	0.1%	0.4%
	Tilapia	66 190	86 113	81 805	112 920	20.12	15.15	0.8%	-1.3%	-5.2%
	Others	295	1 651	2 393	1 459	0.03	0.08	1.5%	1.2%	-2.0%
Singapore	Carp	0	0	7	14	--	0.03	--	--	-0.1%
	Catfish	0	0	8	7	--	1.10	--	--	-1.3%
	Tilapia	0	0	60	74	--	2.00	--	--	-11.1%
	Others	0	0	167	552	--	6.10	--	--	12.5%
Taiwan, Province of China	Carp	28 599	25 324	18 070	13 167	0.42	0.18	1.5%	-7.7%	-8.7%
	Catfish	76	377	297	1 532	0.07	1.75	0.4%	0.0%	1.3%
	Tilapia	50 281	50 866	45 303	75 607	12.95	14.14	1.9%	1.9%	14.0%
	Others	7 532	2 704	5 924	3 323	0.58	0.25	-3.9%	5.8%	-6.5%
Thailand	Carp	15 130	26 379	44 639	54 098	0.23	0.25	1.7%	-2.6%	1.5%
	Catfish	26 619	40 653	66 809	95 554	25.23	37.78	0.5%	0.9%	9.5%
	Tilapia	18 776	41 574	81 886	87 052	5.05	5.64	5.0%	3.5%	-7.4%
	Others	22 233	22 801	28 715	33 653	1.79	0.89	-7.2%	-1.9%	-3.6%

¹ Sub-period I goes from the second half of the 1980s (1985–89) to the first half of the 1990s (1990–1994); sub-period II goes from the first half of the 1990s (1990–94) to the second half of the 1990s; and sub-period III goes from the second half of the 1990s (1995–99) to the early 2000s (2000–03).



Catfish has been gaining position in Southeast Asia (Figure 7). Indonesia, Malaysia, and Thailand are important producers of catfish and have been increasing their comparative advantage in the species (Table 13). Only China, Hong Kong SAR, Lao People's Democratic Republic and Myanmar had weak comparative advantage in catfish farming during the early 2000s.

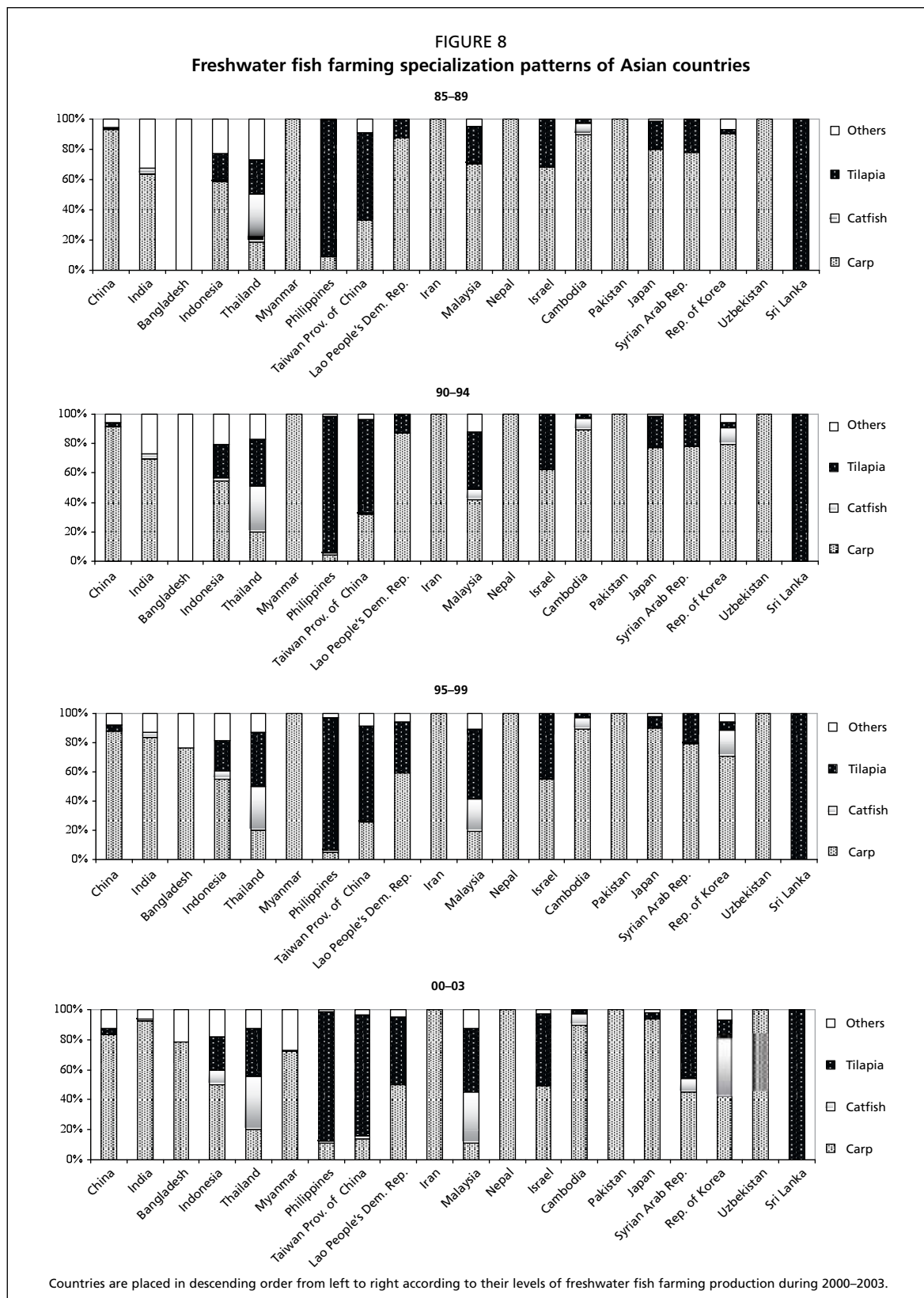
Malaysia has the most dynamic specialization pattern (Figure 8). In 1985–89, production was mostly focused on carp, although the respective RCA index (0.88) reveals that its specialization ratio in carp farming was below Asia's average. Malaysia's tilapia RCA index of 5.28 reveals its strong comparative advantage in tilapia farming. During 1990–94, Malaysia's tilapia production caught up with carp production (Table 13 and Figure 8). Catfish farming reached significant production levels at around the same time. During 1995–99, tilapia took over carp to become the number one species in Malaysia; the country's specialization ratio in catfish farming also increased (Figure 8). By 2000–03, Malaysia had further increased its specialization ratio in catfish farming; the RCAV indices revealed that comparative advantages had shifted from tilapia, carp and miscellaneous other species towards catfish farming.

4.4.2 Freshwater fish farming comparative advantage in Latin America and the Caribbean

The LAC countries cultured nearly 300 000 tonnes of freshwater finfish in 2003, which was nevertheless only 1.3 percent of the world total. Tilapia is the dominant species in the region (Figure 6), accounting for 45 percent of its total freshwater fish farming production in 2003. Carp and catfish accounted for 27 and 3 percent of production, respectively.

Caribbean

Table 14 lists 12 Caribbean countries that engaged in freshwater fish farming during the study period. Cuba is the largest freshwater farming country in the region. It



exhibited strong comparative advantage in tilapia farming during 1985-89. The RCA index of 2.27 implies that the country's specialization ratio in tilapia farming at the time was 2.27 times higher than the LAC's average. However, advantage shifted to carp and miscellaneous other species during the study period. In the early 2000s, Cuba's tilapia RCA index was merely 0.06 while its RCA index for carp had reached 1.97.