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COMMENT

Critical Need to Increase Aquatic Food Production and Food Supply from Aquaculture and Capture Fisheries: Trends and Outlook

Albert G.J. Tacon[a] and Sandra E. Shumway[b]

[a]Aquahana LLC, Kailua, HI, USA; [b]Department of Marine Sciences, University of Connecticut, Groton, CT, USA

ABSTRACT

This commentary reviews total aquatic food supply from aquaculture and capture fisheries from 2010 to 2020 at global, regional, and national levels within main producing countries; aquatic animal foods include fish, crustaceans, molluscs, and other invertebrate animals destined for direct human consumption or as fish and seafood by the FAO. Whilst total combined aquatic animal food supply from aquaculture and capture fisheries has increased on a global basis from 18.59 to 20.49 kg/capita over the past decade, the global supply has not kept up with population growth over the same period. Of particular concern was the decrease in fish and seafood food supply within the African region, decreasing from 10.40 to 9.58 kg/capita, whilst population growth increased by 3.12%/year over the same period. Moreover, the Asian region was the only region where per capita fish and seafood food supply exceeded population growth; the bulk of fish and seafood supply being sourced from increased aquaculture production of primarily freshwater fish species, compared with other regions where marine wild fisheries still dominated fish and seafood supply. Fish and seafood supply in leading aquaculture and capture fisheries producing countries between 2010 and 2020, including China, Indonesia, India, Viet Nam, Bangladesh, South Korea, Japan, and USA are presented and demonstrate growth in per capita fish and seafood supply being lower than human population growth in Ecuador, Philippines, Turkey, Chile, Norway, Brazil, Myanmar, the South Korea, and Japan. If aquatic food supplies from aquaculture and inland/marine capture fisheries are to make an increasing global contribution to healthy diets, then the increased production and market availability of these products needs to be promoted by governments and actively encouraged and stimulated, particularly within the African continent.

KEYWORDS

Aquaculture; capture fisheries; fish; malnutrition; per capita food supply; seafood

Introduction

Aquatic foods represent a much-needed healthy food source in the global fight against malnutrition and achieving food security. Aquatic animal foods including fish, crustaceans, molluscs, and other invertebrate animals destined for direct human consumption are referred to in this commentary as *Fish and Seafood*. Despite the numerous nutritional merits of increased aquatic food consumption compared with terrestrial meat and processed meat-based fast-food products (Tacon and Metian 2013; FAO & WHO 2019; Ahern et al. 2021; Golden et al. 2021; Von Braun et al. 2021; Bavinck et al. 2023; Naylor et al. 2023; Tacon et al. 2023), there is also growing concern about the long-term sustainability (or not) of aquatic food supplies to meet current and future needs (Clonan et al. 2012; Thurstan and Roberts 2014; Kobayashi et al. 2015; Roheim et al. 2018; Costello et al. 2020; Farmery et al. 2022). This commentary discusses trends in aquatic food supply over the past decade from 2010 to 2020 at global, regional, and national levels within main-producing countries, and the potential to sustain the aquatic food supply with respect to human population growth.

Fish and seafood supply and human population growth

Although total global fish and seafood food[1] supply has increased over the past decade from 18.59 kg/capita in 2010 to 20.49 kg/capita in 2020 (compound annual growth rate – CAGR of 0.98%/year), fish supply has not kept up with human population growth over the same period (CAGR 0.98% and 1.21%, respectively; Table 1, FAO 2023a). A similar situation

CONTACT Albert G. J. Tacon agjtacon@aol.com Aquahana LLC, Kailua, HI 96734 USA.

[1]Fish and seafood products is a specific term used within the FAO Food Balance Sheets, and includes freshwater fish, demersal fish, pelagic fish, other marine fish, crustaceans, cephalopods, other molluscs, and other aquatic invertebrate animals, and excludes aquatic mammals, reptiles, seaweeds, and aquatic plants.

Table 1. Human population growth, total terrestrial meat supply, and fish and seafood (aquaculture and capture fisheries) supply on a global and regional basis (FAO 2023a).

Region	World	Africa	Asia	Europe	Northern America	Central America	South America	Oceania
Population in 2010 (Thousand)	6,869,582	968,893	4,191,841	740,044	346,395	157,590	392,309	36,269
Population in 2020 (Thousand)	7,749,323	1,317,984	4,623,943	747,105	368,745	179,670	430,458	42,170
Population CAGR* 2010-2020 (%/year)	1.21	3.12	0.98	0.09	0.63	1.32	0.93	1.52
Total meat supply in 2010 (kg/cap)	41.62	17.57	30.63	75.95	115.98	57.35	76.19	100.29
Total meat supply in 2020 (kg/cap)	42.76	16.70	33.26	75.51	124.73	63.54	82.62	99.60
Supply CAGR 2010-2020 (%/year)	0.27	−0.51	0.83	−0.06	0.73	1.03	0.81	−0.07
Fish & Seafood supply in 2010 (kg/cap)	18.59	10.40	20.83	22.07	21.52	10.57	9.17	26.27
Fish & Seafood supply in 2020 (kg/cap)	20.49	9.58	24.66	21.68	22.58	11.57	9.78	23.04
Supply CAGR 2010-2020 (%/year)	0.98	−0.82	1.70	−0.18	0.48	0.91	0.65	−1.3
Freshwater fish (kg/cap)	8.18	3.62	11.13	4.1	5.33	3.53	3.13	3.21
Demersal fish (kg/cap)	2.71	1.51	2.32	7.15	4.44	1.08	2.02	4.71
Pelagic fish (kg/cap)	3.08	3.52	2.53	5.46	2.76	3.95	2.9	7.91
Other marine fish (kg/cap)	1.09	0.67	1.45	0.43	0.52	0.17	0.36	1.83
Crustaceans (kg/cap)	2.23	0.18	2.75	1.8	5.92	1.76	0.77	2.61
Cephalopods (kg/cap)	0.46	0.05	0.54	0.93	0.46	0.35	0.17	0.94
Other molluscs (kg/cap)	2.53	0.04	3.62	1.77	3.09	0.62	0.39	1.74
Invertebrate animals (kg/cap)	0.2	0	0.32	0.03	0.06	0.09	0.05	0.09
Aquatic plants (kg/cap)	2.9	0	4.86	0	0	0	0	0

*CAGR: compound annual growth rate.

Table 2. Total reported aquaculture production and capture fisheries landings in 2021.

Aquaculture[1]	Metric tonnes	Capture fisheries[1]	Metric tonnes
Total aquaculture	126,035,297	Total captured	92,342,716
Finfish	59,417,382	Finfish	78,333,738
• Freshwater fish	– 85.0%	- Freshwater fish	– 13.1%
• Diadromous fish	– 4.7%	- Diadromous fish	– 2.5%
• Marine fish	– 10.3%	- Marine fish	– 84.3%
Molluscs	18,418,981	Molluscs	6,390,187
Crustaceans	11,884,903	Crustaceans	6,052,980
Aquatic plants	35,171,590	Aquatic plants	1,140,334
Misc. invertebrates	530,809	Misc. invertebrates	423,609
Top 16 producers		Top 16 landings	
China	72,805,297	China	13,142,837
Indonesia	14,606,533	Indonesia	7,206,879
India	9,408,300 E	Peru	6,576,171
Viet Nam	4,749,274	Russian Fed.	5,167,703
Bangladesh	2,638,745	India	5,024,905 E
Korea Republic	2,427,677	USA	4,282,433
Philippines	2,272,527	Viet Nam	3,540,250
Norway	1,665,112	Japan	3,150,890
Egypt	1,576,189	Norway	2,555,512
Chile	1,443,520	Chile	2,390,072
Thailand	989,898	Bangladesh	1,982,483
Japan	963,680	Philippines	1,842,067
Myanmar	929,217	Myanmar	1,665,740 E
Ecuador	896,435	Mexico	1,628,652
Korea DPR	680,560 E	Morocco	1,432,199
Brazil	650,356	Thailand	1,412,123

[1]Includes fish, crustaceans, molluscs, miscellaneous aquatic invertebrates, amphibians, reptiles, and aquatic plants (FAO 2023b).
E FAO estimate.

existed with total terrestrial meat food supply, which only increased from 41.52 kg/capita to 42.76 kg/capita from 2010 to 2020 (CAGR 0.27%; Table 1).

Notwithstanding these global trends, Asia was the only region where the growth in aquatic fish and seafood supply exceeded population growth (1.70%/year and 0.98%/year, respectively (Table 1). Moreover, although aquatic fish and seafood supply increased in Central America, South America, and North America (by 0.91%/year, 0.65%/year and 0.48%/year, respectively), annual growth in supply was below population growth within these regions (1.32%/year, 0.93%/year, and 0.63%/year, respectively; Table 1). Of particular concern was the decrease in fish and seafood supply within the African region, decreasing from 10.40 kg/capita to 9.58 kg/capita, whilst population growth increased by 3.12%/year over the same period. A similar trend was also observed in Oceania and Europe, where fish and seafood supply decreased by −1.30%/year in Oceania (population growth 1.52%/year) and −0.18%/year in Europe (population growth 0.09%/year; Table 1, FAO 2023a).

Role of capture fisheries and aquaculture in aquatic food supply

In marked contrast to the Asian region, where the bulk of fish and seafood supply is primarily sourced from increased aquaculture production (the Asian region producing 91.6% of total global aquaculture production in 2021, and production increased at a CAGR of 5.31%/year since 2000, compared with a CAGR of 0.32% for capture fisheries in the region: Table 2; FAO 2023b); this was not the case for other regions where marine capture fisheries still dominate fish and seafood supply (Figure 1).

Trophic level implications

Although freshwater fish species (usually feeding low on the aquatic food chain) contributed to over half of total fish supply globally and within the Asian region in 2020 (54.3% and 63.8%, respectively), this was not the case in other regions (Figure 2). Marine pelagic and demersal fish species (usually feeding

higher on the aquatic food chain) dominated fish supply in those regions where capture fisheries still overshadow aquaculture production, including Central America 59.6% total food fish supply, Africa 61.2%, South America 62.8%, Europe 76.1%, and Oceania 81.8% (Table 2, Figure 1).

It is important to note that cultured aquatic plants or seaweeds contributed an additional 2.9 kg/capita globally and 4.86 kg/capita to total fish and seafood food supply in the Asian region in 2020 (live weight basis); total aquatic food supply including aquatic plants being 20.49 + 2.9 (23.39 kg/capita: globally) and 24.66 + 4.86 (29.52 kg/capita: Asia; Figure 2, Table 1, FAO 2023a).

Selected national fish and seafood production food supply trends

Table 3 shows per capita fish and seafood supply within the top 20 aquaculture producers in 2020 and graphically in Figure 3 (including supply trends 2010

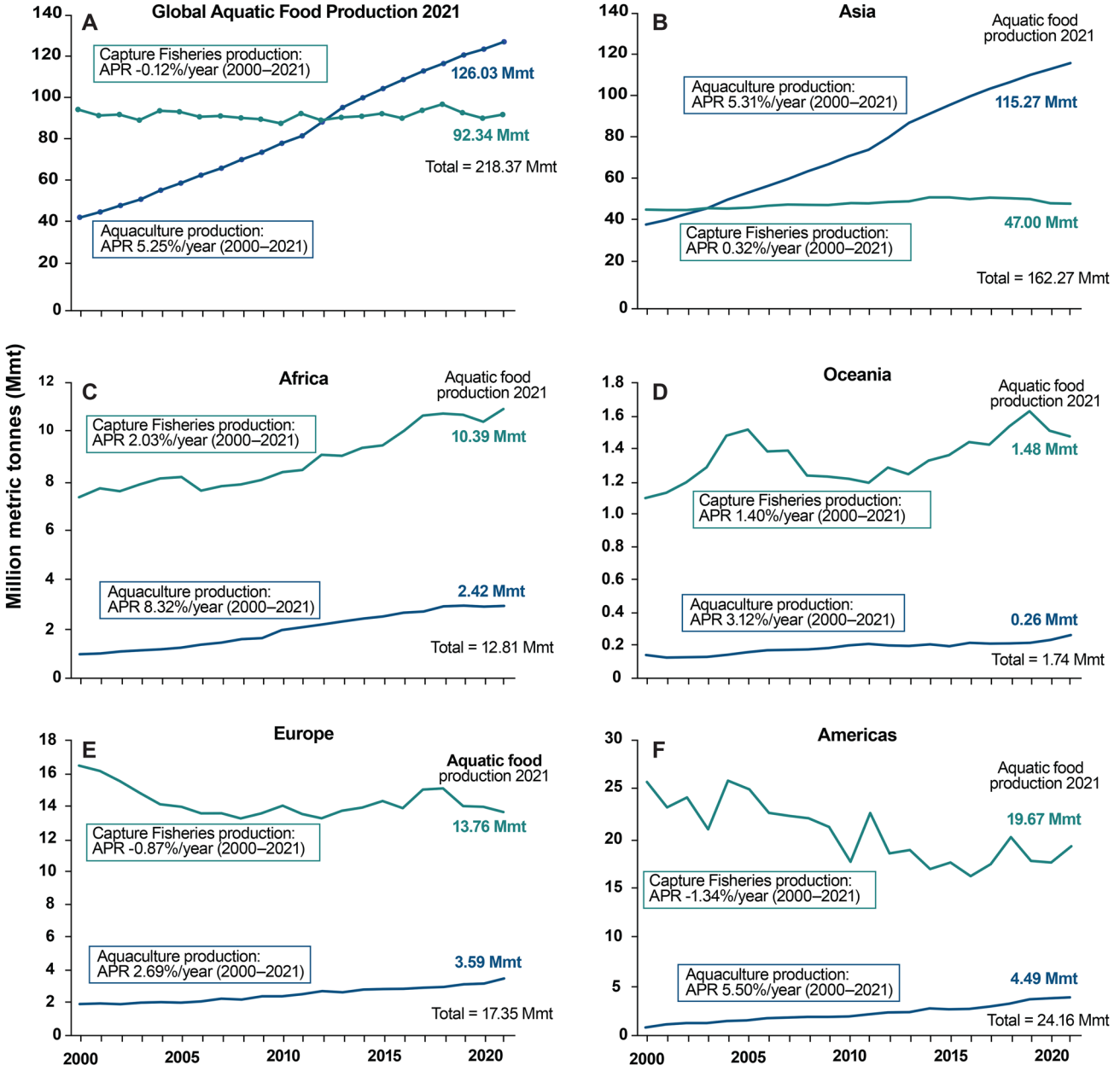

Figure 1. (A) Total global landings of aquatic products from 2000 to 2021 (includes whole live weight equivalent of fish, crustaceans, molluscs, miscellaneous aquatic invertebrates, amphibians, reptiles, and aquatic plants; (B) Total landings of aquatic products in Asia from 2000 to 2021; (C) Total landings of aquatic products in Africa from 2000 to 2021; (D) Total landings of aquatic products in Oceania from 2000 to 2021; (E) Total landings of aquatic products in Europe from 2000 to 2021; (F) Total landings of aquatic products in the Americas from 2000 to 2021 (FAO 2023b).

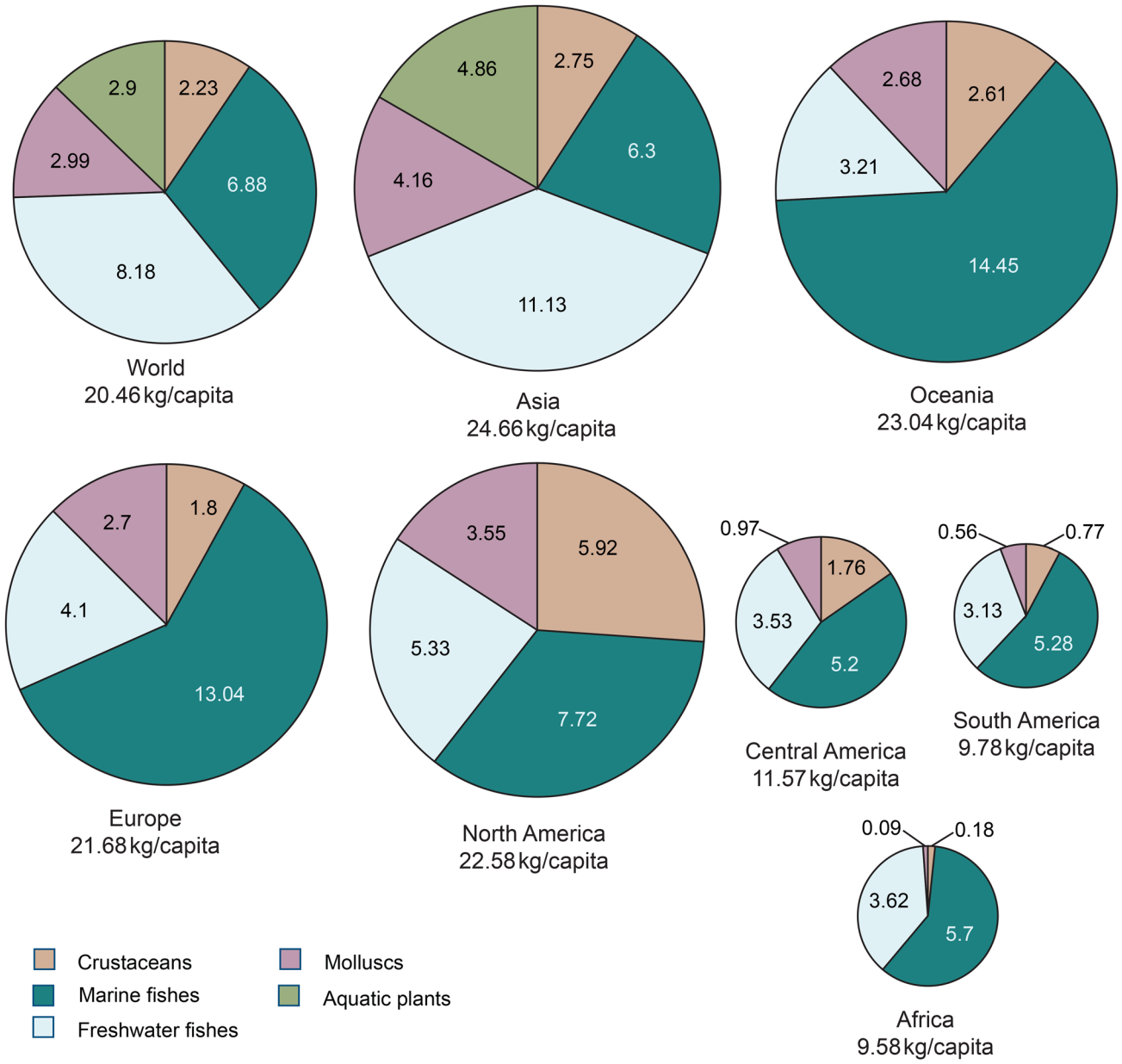

Figure 2. Contribution of fish and seafood to food supply in 2020 by trophic level.

to 2020 for China, Indonesia, India, Viet Nam, Bangladesh, South Korea, Japan, and the USA).

Based on the data shown, the following positive and negative trends were evident:

- Per capita fish and seafood supply was highest in South Korea 55.27 kg, Malaysia 54.70 kg, Norway 50.18 kg, Japan 46.2 kg, Myanmar 45.02 kg, Indonesia 44.44 kg, China 39.91 kg, and Viet Nam 39.56 kg;
- Growth in per capita annual supply of fish and seafood was greatest for Indonesia 4.7%/year, followed by Iran 3.8%, India 3.6%, Bangladesh 2.9%, Egypt 2.5%, and China 2.2%;
- Growth in per capita supply was higher than population growth in China 0.5%/year, Indonesia 1.2%, India 1.1%, Viet Nam 1.0%, Bangladesh 1.1%, Egypt 2.1%, Thailand 0.4%, and South Korea DPR 0.5%;
- Growth in per capita supply was lower than population growth in Ecuador 1.6%, Philippines 1.5%/year, Turkey 1.5%, Chile 1.1%, Norway 1.0%, Brazil 0.8%, Myanmar 0.7%, South Korea 0.3%, and Japan 0.2%;

Table 3. Per capita fish and seafood supply by the top twenty aquaculture producers in 2020 (kg/capita; FAO 2023a).

Country	Per capita[1] & APR 2010-20		FWF[2]	DF[3]	PF[4]	MFo[5]	Crust[6]	Cephl[7]	Mo[8]	AA[9]	AP[10]
China	39.91	2.2	17.28	3.28	0.33	1.67	5.95	0.6	9.97	0.83	14
Indonesia	44.44	4.7	19.72	5.8	11.07	2.73	3.96	0.39	0.35	0.41	0
India	7.98	3.6	6.25	0.62	0.43	0.19	0.4	0	0.09	0	0
Viet Nam	39.56	1.6	17.82	0.34	2.82	7.41	5.26	3.21	2.58	0.12	0
Bangladesh	26.71	2.9	22.41	0.57	0.53	1.95	1.26	0	0	0	0
Korea Rep	55.27	−0.2	2.01	17.42	14.83	0.28	3.43	6.74	9.55	1.01	34.22
Philippines	29.07	−1.4	7.45	3.73	13.92	0.99	1.35	0.69	0.93	0.01	0
Norway	50.18	−0.8	10.6	22.82	5.76	0.05	10.05	0.06	0.82	0.01	0
Egypt	27.09	2.5	14.98	5.74	5.39	0.33	0.5	0.09	0.06	0	0
Chile	14.77	0.4	1.1	1.69	7	0.02	3.02	0.22	0.89	0.83	0
Thailand	29.16	1.7	9.1	1.28	11.6	0.04	2.52	3.27	1.3	0.04	0
Japan	46.2	−1.3	5.11	6.63	13.98	5.18	6.14	3.15	5.67	0.34	0.93
Myanmar	45.02	0.2	31.88	0	0.27	12.78	0.07	0	0.01	0.02	0
Ecuador	8.22	−0.4	1.31	3.26	3.12	0.01	0.45	0.07	0.01	0.01	0
Korea DPR	11	1.1	0.56	5.13	0.61	3.79	0.32	0.28	0.3	0	0
Brazil	8.08	−0.6	4.27	2.22	0.72	0.18	0.51	0.04	0.13	0	0
Iran	12.62	3.8	6.23	0.94	4.45	0.43	0.53	0.01	0	0.03	0
Turkey	5.52	−2.1	1.31	1.22	2.35	0	0.07	0.06	0.5	0	0
USA	22.79	0.6	5.34	4.43	2.69	0.54	6.18	0.51	3.07	0.03	0
Malaysia	54.70	−1.1	6.36	11.89	18.64	9.21	3.92	2.34	1.80	0.54	0

[1]Per capita supply kg/year & fish and seafood supply (CAGR: compound average growth rate) between 2010-2020, [2]Freshwater fishes, [3]Demersal fishes, [4]Pelagic fishes, [5]Other marine fishes, [6]Crustaceans, [7]Cephlapods, [8]Other molluscs, [9]Other aquatic invertebrates, [10]Aquatic plants.

- Despite growth of the aquaculture sector in most Asian countries, Europe (Norway, Turkey) and the Americas (Ecuador, Brazil), annual per capita fish and seafood supply decreased in Turkey −2.1%, Philippines −1.4%, Japan −1.3%, Malaysia −1.1%, Norway −0.8%, Brazil −0.6%, Ecuador −0.4%, and the South Korea −0.2% between 2010 and 2020;
- Highest total per capita supply of finfish (includes freshwater fish, demersal fish, pelagic fish, and other marine fish) in 2020: Malaysia 46.1 kg/capita, Myanmar 44.93 kg/capita, Indonesia 39.32 kg/capita, Norway 39.23 kg/capita, and Viet Nam 28.39 kg/capita;
- Highest total per capita supply of crustaceans in 2020: Norway 10.05 kg, USA 8.18 kg, Japan 6.14 kg, China 5.95 kg, and Viet Nam 5.26 kg;
- Highest total per capita supply of cephalopods in 2020: South Korea 6.74 kg, Thailand 3.27 kg, Viet Nam3.21 kg, and Japan 3.15 kg;
- Highest total per capita supply of shelled molluscs in 2020: China 9.97 kg, South Korea 9.55 kg, Japan 5.67 kg, and the USA 3.70 Kg;
- Highest total per capita supply of aquatic plants in 2020: South Korea 34.22 kg, China 14 kg, and Japan 0.93 kg;
- Freshwater fish species constituted 83.9% and 78.3% of total aquaculture fish and seafood supply in Bangladesh and India in 2020, respectively (Figure 3).

Concluding remarks and future outlook

If aquatic fish and seafood food supplies from aquaculture and capture fisheries are to make an increasing global contribution to healthy diets (FAO & WHO 2019; Ahern et al. 2021; Naylor et al. 2021; Costa-Pierce et al. 2022; Peng et al. 2023; Tacon et al. 2020), then the increased sustainable production (in the case of aquaculture) and consumption of aquatic food products, needs to be stimulated and encouraged. In the case of the African continent, the increased production and consumption of non-fed species such as farmed molluscs and aquatic plants should also be promoted and encouraged actively. These species supplied less than 1% of the total aquatic food supply in 2020, with production not being dependent upon the external provision of compound feed inputs (Chopin and Tacon 2020; Peng et al. 2024). Clearly, increased sustainable aquaculture production and enhanced sustainably managed capture fisheries production should be promoted by governments and actively promoted to provide a healthy and sustainable food source for the global population to help combat malnutrition and address food security – a growing issue and concern with increasing climate-related impacts on food supply chains.

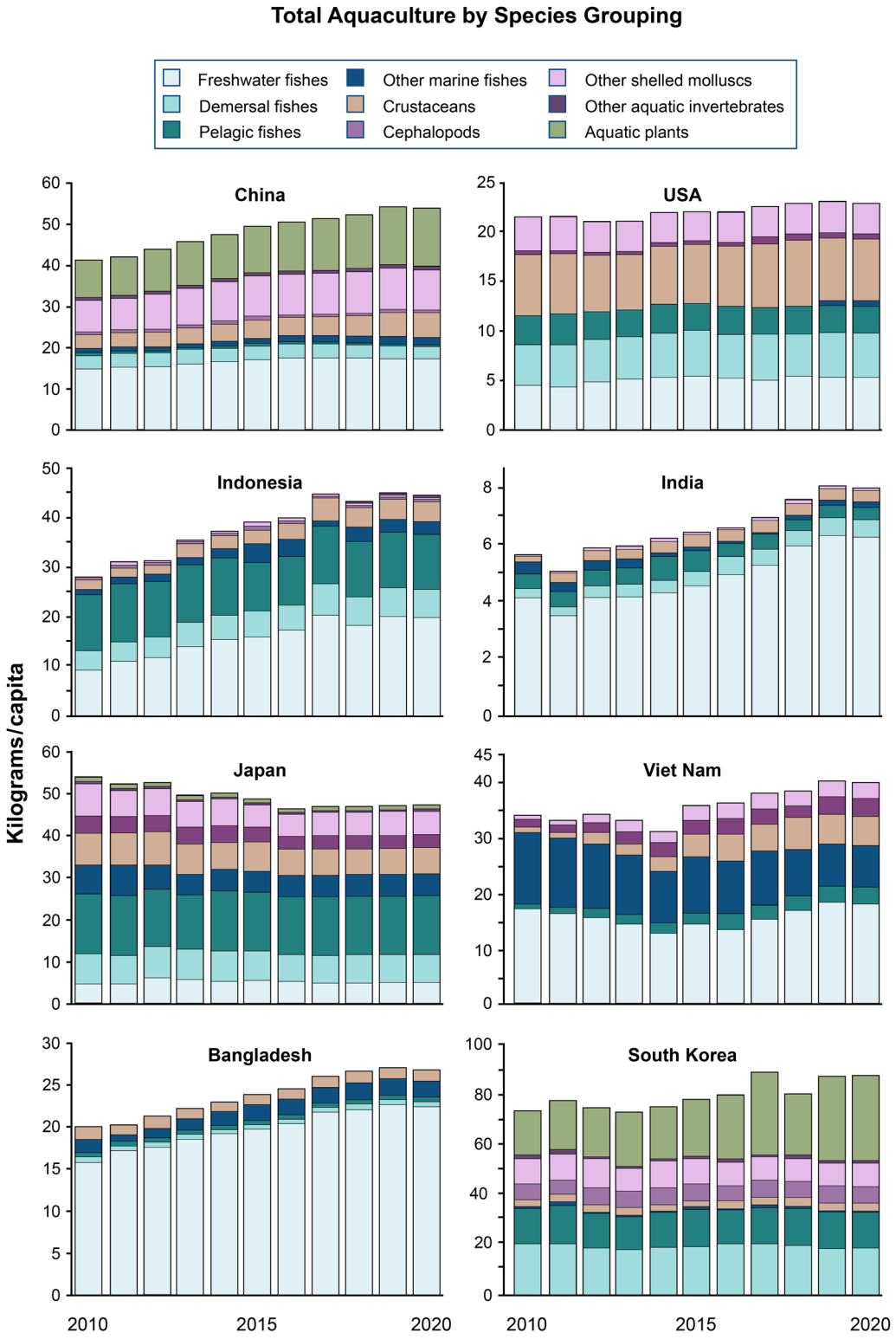

Figure 3. Per capita fish and seafood aquaculture supply 2010 to 2020 for China, USA, Indonesia, India, Japan, Viet Nam, Bangladesh, and South Korea (FAO 2023a).

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Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Albert G.J. Tacon http://orcid.org/0000-0002-2505-6209

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