Food and Agriculture Organization of the United Nations

Global status of seaweed production, trade and utilization

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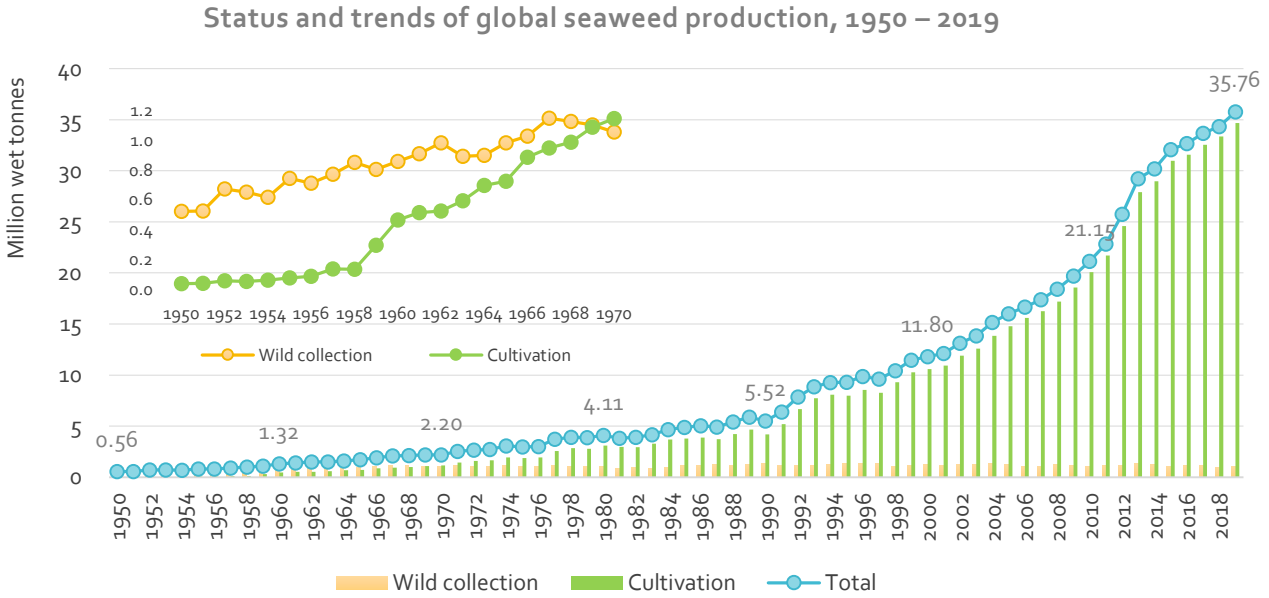
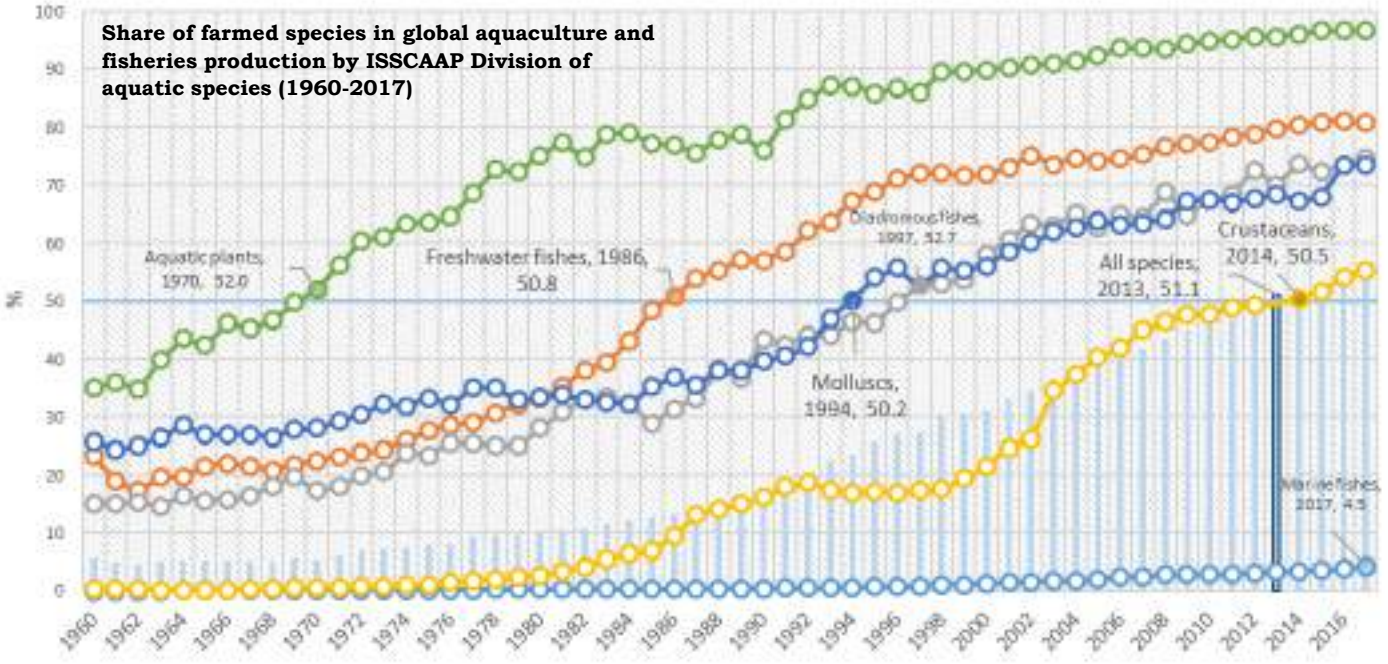
Production

In 1969, the 2.2 million tonnes of world seaweed production was evenly contributed by wild collection and cultivation. After half of a century, while the wild production remained at 1.1 million tonnes , the cultivation production has increased to 35.8 million tonnes that accounted for 97 percent of the world seaweed production in 2019. **World seaweed cultivation** production tonnage **increased 1 000 folds** from 34.7 thousand tonnes to 34.7 million tonnes **between 1950 and 2019**.



Data source: FAO 2021. FAO Global Fishery and Aquaculture Production Statistics (FishStatJ; March 2021; www.fao.org/fishery/statistics/software/fishstatj/en).

Seaweed as forerunner in global aquaculture



Source: Contribution of aquaculture to total fishery production: the 50-percent mark (WAPI factsheet; published in FAO Aquaculture Newsletter No. 60, pp. 43–45; June 2019)

High regional imbalance in seaweed production (2019)

- **35.8 million tonnes** of world seaweed production contributed by **49 countries/territories**
- **97** percent of the world production from **Asia**
- Production in the **Americas** and **Europe** dominated by **wild collection**
- Production in **Asia**, **Africa** and **Oceania** dominated by **cultivation**

Global seaweed production, 1950

Country/area	Total (farmed and wild) production (tonnes)	Share of world total (%)	Aquaculture share in total production (%)
World	**555 267**	**100.00**	**6.24**
1. Japan	145 400	26.19	22.23
2. Fmr USSR	142 594	25.68	
3. United States of America	101 577	18.29	
4. France	35 000	6.30	
5. United Kingdom	30 000	5.40	
6. Republic of Korea	16 000	2.88	7.50
7. Spain	16 000	2.88	
8. Morocco	10 300	1.85	
9. Iceland	10 000	1.80	
10. Portugal	10 000	1.80	
Others	*38 396*	*6.91*	*n.a.*

Data source: FAO 2021. FAO Global Fishery and Aquaculture Production Statistics (FishStatJ; March 2021; www.fao.org/fishery/statistics/software/fishstatj/en).

Global seaweed production, 2019

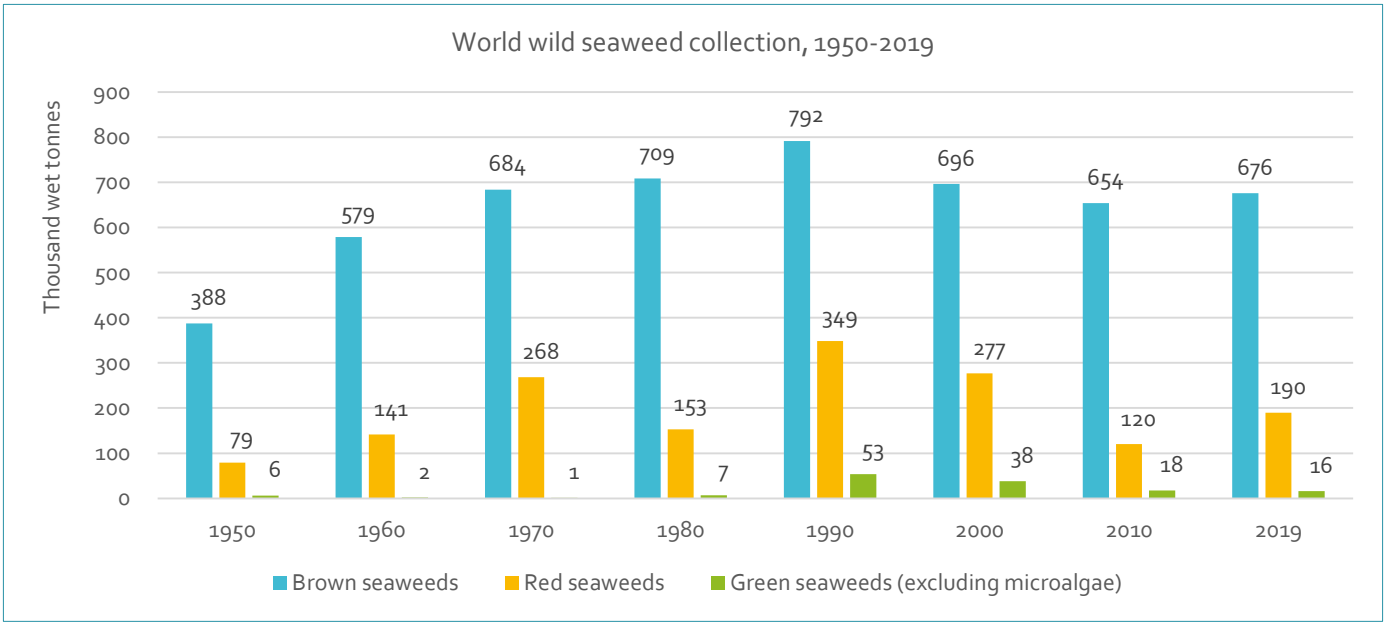
Country/area	Total (farmed and wild) production (tonnes)	Share of world total (%)	Aquaculture share in total production (%)
World	**35 762 504**	**100.00**	**96.97**
Asia	**34 826 750**	**97.38**	**99.10**
China	20 296 592	56.75	99.14
Indonesia	9 962 900	27.86	99.55
Korea, Republic of	1 821 475	5.09	99.52
Philippines	1 500 326	4.20	99.98
Korea, Dem People's Rep	603 000	1.69	100.00
Japan	412 300	1.15	83.80
Malaysia	188 110	0.53	100.00
Americas	**487 241**	**1.36**	**4.69**
Chile	426 605	1.19	5.08
Peru	36 348	0.10	0.00
Canada	12 655	0.04	0.00
Mexico	7 336	0.02	0.14
United States of America	3 394	0.01	7.75
Europe	**287 033**	**0.80**	**3.88**
Norway	163 197	0.46	0.07
France	51 476	0.14	0.34
Ireland	29 542	0.08	0.14
Russian Federation	19 544	0.05	54.10
Iceland	17 533	0.05	0.00
Africa	**144 909**	**0.41**	**81.29**
United Republic of Tanzania	106 069	0.30	100.00
Morocco	17 591	0.05	1.55
South Africa	11 155	0.03	19.32
Madagascar	9 665	0.03	91.72
Oceania	**16 572**	**0.05**	**85.32**
Solomon Islands	5 600	0.02	100.00
Papua New Guinea	4 300	0.01	100.00
Kiribati	3 650	0.01	100.00
Australia	1 923	0.01	0.00

High species concentration in seaweed production: World seaweed production concentrated in **5 species groups** (highlighted in red). FAO statistics record **27 seaweed species** items **cultivated** in 2019 (c.f. overall **443 ASFIS species items in aquaculture**);

Species groups	Scope = **World**; Scope = **Cultivation and wild collection**; Year = **2019**			
	Number of ASFIS species items in the group being cultivated and/or collected in the world	Number of countries in the world cultivating and/or collecting the species group	Total cultivation and wild production in world (wet tonnes)	Share of the region's total algae production (%)
Seaweeds	**48**	**49**	**35 762 504**	**99.84**
Brown seaweeds	18	20	17 069 418	47.65
Laminaria/Saccharina	4	11	12 411 987	34.65
Undaria	2	5	2 566 316	7.16
Sargassum	2	2	303 973	0.85
Lessonia	2	2	247 312	0.69
Macrocystis	2	3	66 779	0.19
Miscellaneous brown seaweeds	6	17	1 473 051	4.11
Red seaweeds	20	43	18 441 240	51.48
Carrageenan seaweeds (primarily *Kappaphycus/Eucheuma*)	8	25	11 685 174	32.62
Agar seaweeds (Primarily *Gracilaria*)	6	14	3 695 231	10.32
Porphyra	3	7	2 984 573	8.33
Miscellaneous red seaweeds	3	15	76 261	0.21
Green seaweeds (excluding microalgae)	8	12	32 926	0.09
Ulva	3	4	2 356	0.01
Caulerpa	1	1	1 090	0.00
Miscellaneous green seaweeds	4	7	29 480	0.08
Seaweeds nei	2	10	218 921	0.61

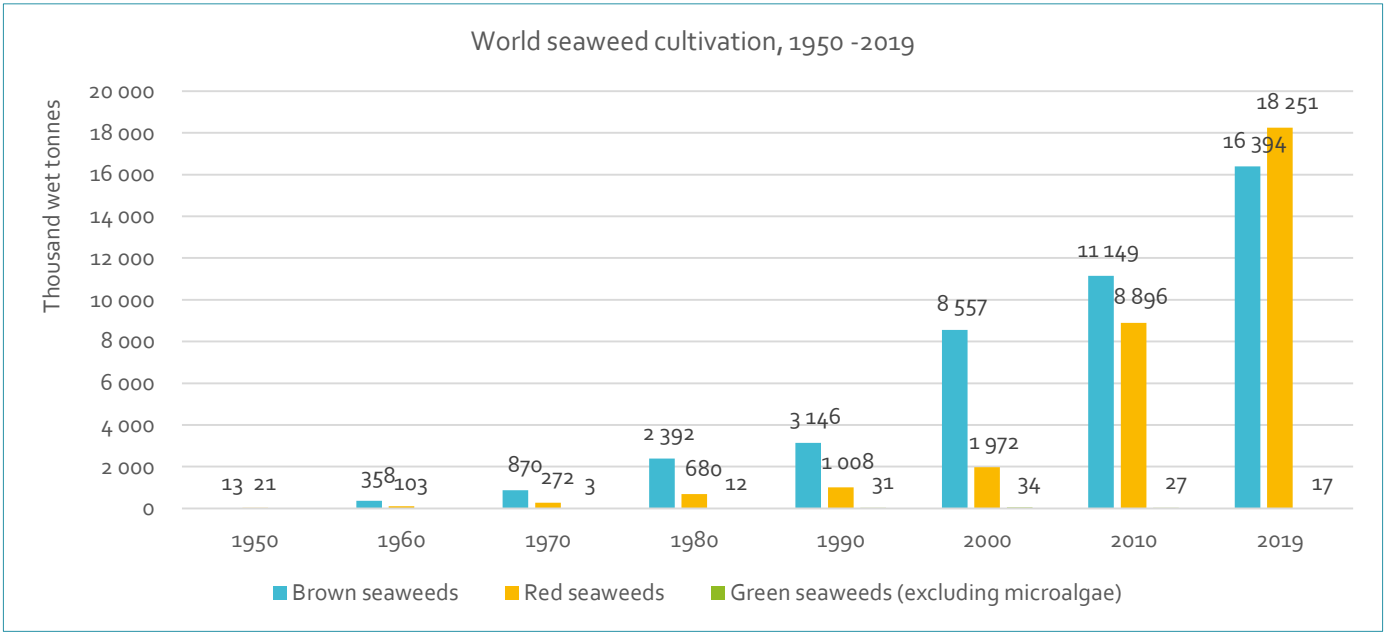
Data source: FAO 2021. FAO Global Fishery and Aquaculture Production Statistics (FishStatJ; March 2021; www.fao.org/fishery/statistics/software/fishstatj/en).

World **wild seaweed** collection **declined** from 1.33 million tonnes in **1990** to 1.08 million tonnes in **2019**, and the declined occurred to **all the three seaweed groups**, i.e. brown seaweeds (from 792 000 tonnes to 676 000 tonnes), red seaweeds (from 349 000 tonnes to 190 000 tonnes); and green seaweeds (from 53 000 tonnes to 16 000 tonnes).



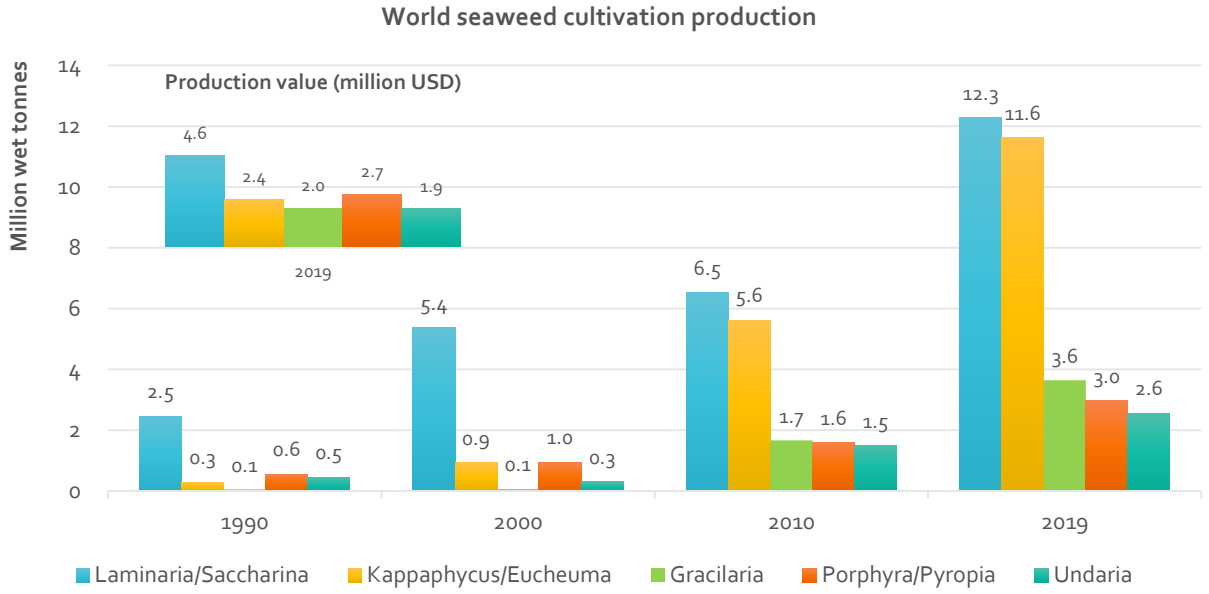
Data source: FAO 2021. FAO Global Fishery and Aquaculture Production Statistics (FishStatJ; March 2021; www.fao.org/fishery/statistics/software/fishstatj/en).

World **seaweed cultivation increased** from 4.2 million tonnes in **1990** to 34.7 million tonnes in **2019**. The growth was **contributed** by **brown seaweeds** cultivation (from 3.1 million tonnes to 16.4 million tonnes) and **red seaweeds** cultivation (from 1 million tonnes to 18.3 million tonnes), whereas **green seaweeds** cultivation **declined** from 31 000 tonnes to 17 000 tonnes.



Data source: FAO 2021. FAO Global Fishery and Aquaculture Production Statistics (FishStatJ; March 2021; www.fao.org/fishery/statistics/software/fishstatj/en).

Five genera accounted for over **95 percent of world seaweed cultivation** production in 2019; they are *Laminaria/Saccharina* (35.4 percent); *Kappaphycus/Eucheuma* (33.5 percent),;*Gracilaria* (10.5 percent); *Porphyra/Pyropia* (8.6 percent); and *Undaria* (7.4 percent).



Data source: FAO 2021. FAO Global Fishery and Aquaculture Production Statistics (FishStatJ; March 2021; www.fao.org/fishery/statistics/software/fishstatj/en).

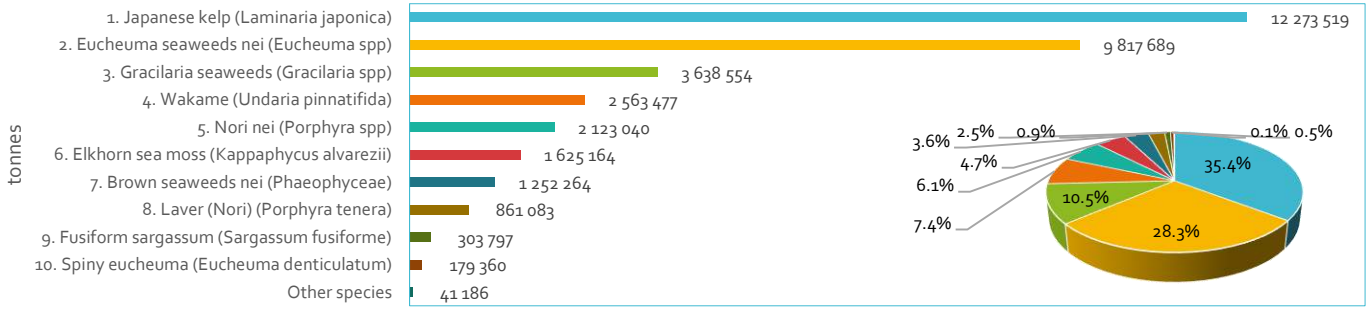
For all green seaweed species, cultivation production in 2019 was **lower than the peak level** during 1950-2019

Table 7: World green seaweed cultivation production, 1950–2019

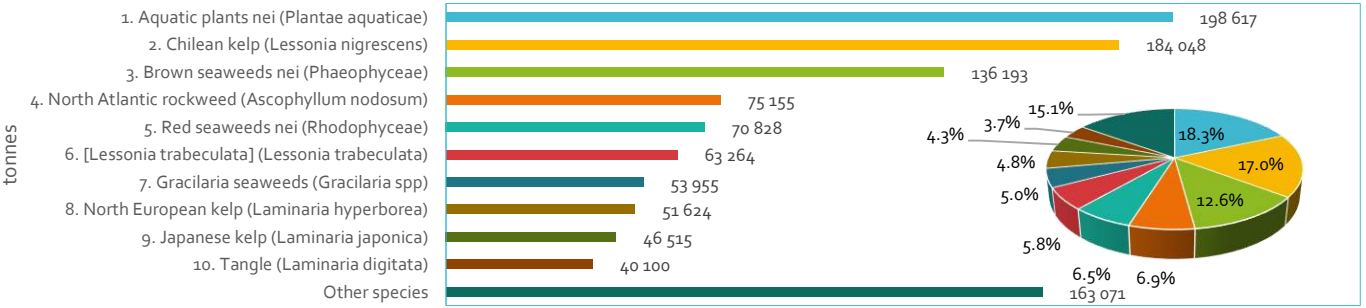
Species	Average annual production during 1950-2019 (wet tonnes)	Maximum annual production during 1950-2019		Production in 2019	
		Wet tonnes	Year	Wet tonnes	Producing countries
Green seaweeds (excluding microalgae)	**14 019**	**38 556**	**1992**	**16 696**	n.a.
1. *Caulerpa* spp	6 404	28 704	1998	1 090	PHL (100 percent)
2. *Monostroma nitidum*	3 991	17 248	1992	6 321	KOR (100 percent)
3. *Enteromorpha prolifera*	1 367	12 540	2008	-	n.a.
4. *Capsosiphon fulvescens*	1 134	7 000	2018	3 386	KOR (100 percent)
5. *Ulva* spp	515	2 900	2005	2 155	ZAF (100 percent)
6. *Codium fragile*	494	5 550	2014	3 258	KOR (100 percent)
7. Green seaweeds nei	114	863	1988	486	VNM (92.62 percent) PRT (7.2 percent) ESP (0.18 percent)
8. *Caulerpa racemosa*	0	2	2015	-	n.a.

Source: FAO. 2021. Fishery and Aquaculture Statistics. Global production by production source 1950-2019 (FishstatJ).
Notes: Green seaweeds exclude green microalgae. "-" indicates zero. PHL = Philippines; KOR = Republic of Korea; ZAF = South Africa; VNM = Viet Nam; PRT = Portugal; ESP = Spain.

World: species composition in seaweed cultivation in 2019 (34 679 134 tonnes)

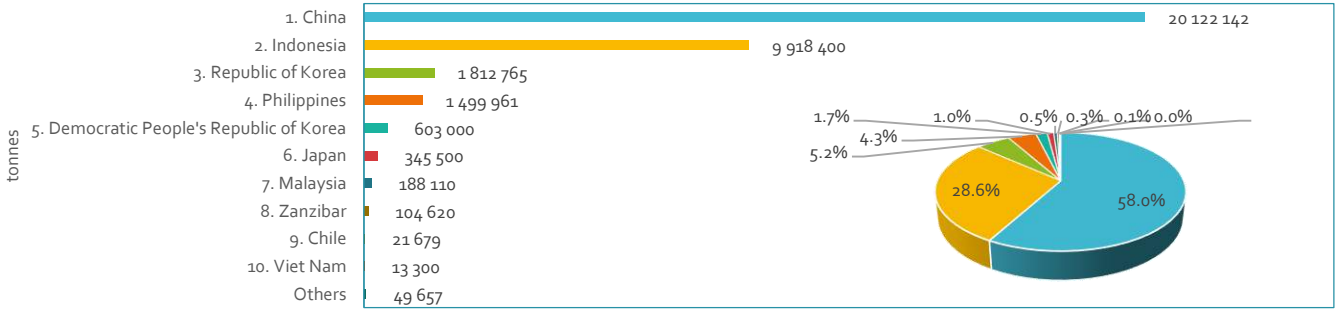


World: species composition in wild seaweed collection in 2019 (1 083 370 tonnes)

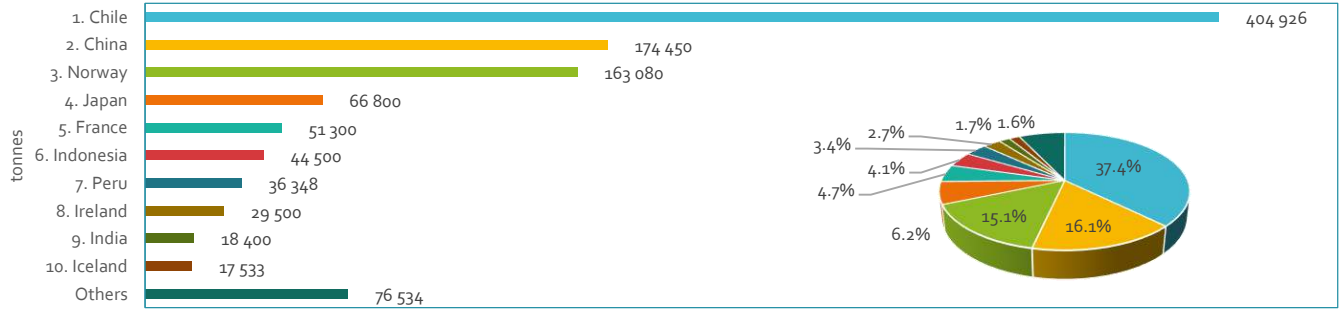


Data source: FAO 2021. FAO Global Fishery and Aquaculture Production Statistics (FishStatJ; March 2021; www.fao.org/fishery/statistics/software/fishstatj/en).

Seaweeds cultivation: countries/territories with the highest production in 2019 (world production: 34679134 tonnes)



Seaweeds wild collection: countries/territories with the highest production in 2019 (world production: 1083370 tonnes)



Data source: FAO 2021. FAO Global Fishery and Aquaculture Production Statistics (FishStatJ; March 2021; www.fao.org/fishery/statistics/software/fishstatj/en).

Trade

USD 2.65 billion world **export** of seaweeds and seaweed-based hydrocolloids (by **98 countries**) = **USD 909 million** of seaweeds + **USD 1.74 billion** seaweed-based hydrocolloids

Export of seaweeds and seaweed-based hydrocolloids, 2019

Seaweeds and seaweed-based hydrocolloids			**Seaweeds[1]**			**Seaweed-based hydrocolloids[2]**		
Exporter	Million USD	Share of world (%)	Exporter	Million USD	Share of world (%)	Exporter	Million USD	Share of world (%)
1. China	578	21.79	1. Rep. of Korea	278	30.55	1. China	523	30.00
2. Indonesia	329	12.39	2. Indonesia	218	24.01	2. Philippines	214	12.28
3. Rep. of Korea	320	12.08	3. Chile	86	9.43	3. Spain	138	7.91
4. Philippines	252	9.52	4. China	55	6.03	4. Chile	123	7.06
5. Chile	209	7.87	5. Philippines	38	4.23	5. France	114	6.53
6. Spain	145	5.48	6. Ireland	33	3.60	6. Indonesia	110	6.34
7. France	124	4.68	7. Peru	22	2.43	7. USA	84	4.82
8. USA	102	3.85	8. Japan	21	2.33	8. Germany	76	4.39
9. Germany	82	3.11	9. USA[3]	18	1.98	9. UK	65	3.75
10. UK	78	2.93	10. Canada	18	1.97	10. South Korea	43	2.45
Rest of the world	*432*	*16.30*	*Rest of the world*	*36*	*3.93*	*Rest of the world*	*252*	*14.47*
World	**2 652**	**100.00**	**World**	**909**	**100.00**	**World**	**1 743**	**100.00**

Source: UN Comtrade (accessed on 7 April, 2021)

Notes: 1. Seaweeds include cultivated and wild collected commodities under HS120220, HS120221 and HS120229. 2. Seaweed-based hydrocolloids include HS130231 (agar), HS130239 (primarily carrageenan) and HS391310 (alginate).

USD 2.9 billion world **import** of seaweeds and seaweed-based hydrocolloids (by **128 countries**) = **USD 1.26 billion** of seaweeds + **USD 1.74 billion** seaweed-based hydrocolloids

Import of seaweeds and seaweed-based hydrocolloids, 2019

Seaweeds and seaweed-based hydrocolloids			**Seaweeds[1]**			**Seaweed-based hydrocolloids[2]**		
Importer	Million USD	Share of world (%)	Importer	Million USD	Share of world (%)	Importer	Million USD	Share of world (%)
1. China	445	15.34	1. China	342	29.47	1. United States of America	225	12.96
2. Japan	341	11.76	2. Japan	241	20.80	2. Germany	112	6.44
3. United States of America	320	11.04	3. United States of America	95	8.17	3. China	103	5.93
4. Germany	124	4.27	4. Thailand	55	4.74	4. Spain	101	5.80
5. Spain	120	4.15	5. Taiwan Province of China	48	4.15	5. Japan	100	5.75
6. Russian Federation	116	3.99	6. France	35	3.02	6. Russian Federation	87	5.00
7. Thailand	112	3.86	7. Australia	30	2.57	7. United Kingdom	59	3.37
8. France	86	2.97	8. Russian Federation	29	2.47	8. Thailand	57	3.27
9. United Kingdom	80	2.76	9. Republic of Korea	29	2.46	9. Denmark	54	3.11
10. Denmark	67	2.32	10. United Kingdom	21	1.83	10. France	51	2.93
Rest of the world	*1 088*	*37.54*	*Rest of the world*	*236*	20.34	*Rest of the world*	*791*	45.45
World	**2 899**	**100.00**	**World**	**1 159**	100.00	**World**	**1 740**	100.00

Source: UN Comtrade (accessed on 7 April, 2021)

Notes: 1. Seaweeds include cultivated and wild collected commodities under HS120220, HS120221 and HS120229. 2. Seaweed-based hydrocolloids include HS130231 (agar), HS130239 (primarily carrageenan) and HS391310 (alginate).

Utilization

Seaweed utilization

- **Human foods**
  - Kelp (*Laminaria*/*Saccharina*): soup ingredient, snacks, etc.
  - Nori (*Porphyra*): sushi wrap, soup ingredient, snacks, etc.
  - Wakame (*Undaria*): salad, snacks, etc.
  - Seagrape aka green caviar (*Caulerpa*): salad
  - *Gracilaria* and *Kappaphycus/Eucheuma:* salads and pickles
- **Hydrocolloids**
  - **Carrageenan** (*Kappaphycus/Eucheuma; Sarcothalia crispate; Gigartina skottsbergii; Mazzaella laminarioides; Gymnogongrus furcellatus; Chondracanthus chamissoi*)
  - **Agar** (*Gracilaria* spp; *Gelidium* spp; *Gelidium corneum*; *Pterocladia lucida)*
  - **Alginate** (brown seaweeds in general)
- **Abalone feed**
  - Kelp, *Gracilaria* and other seaweeds in Eastern Asia
  - *Ulva* in South Africa
- **Livestock feed**
  - Brown seaweeds (Europe)
- **Biofertilizer or biostimulants**
  - Seaweeds in general (e.g. *Sargassum* used in China; *Kappaphycus* used in India).
- **Others:**
  - Cosmetics; nutraceuticals; pharmaceuticals
  - Textile fibres; biopackaging
  - Waste treatment
  - Carbon capture/sequestration
  - Bioenergy
  - …

According to Dr Lynn Cornish:

- Based upon scientific publication metrics, bioprospecting efforts between 1965 and 2012 resulted in a total of 3 129 marine natural products (MNPs) or bioactive molecules from seaweeds (53 percent from red seaweeds; 39 percent from brown seaweeds; and 8 percent from green seaweeds).
- However, the steps from discovery to development have been slow to materialize (Leal et al., 2013; Leal et al., 2020).

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Thank you

For more information, visit the WAPI webpage
http://www.fao.org/fishery/statistics/software/wapi/en