Bulletin of Marine Ecology and Environment Status of China in 2020

Ministry of Ecology and Environment People's Republic of China The Bulletin of Marine Ecology and Environment Status of China in 2020 is hereby released in accordance with the Environmental Protection Law of the People's Republic of China and the Marine Environmental Protection Law of the People's Republic of China.

Minister
Minister of Ecology and Environment
the People's Republic of China

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Introduction

In 2020, guided by the Xi Jinping Thought on Socialism with Chinese Characteristics for a New Era, all localities and departments thoroughly implemented Xi Jinping Thought on Ecological Civilization and his important instructions to strengthen maritime power and build a maritime community with a shared future. In accordance with the decisions and plans made by the Communist Party of China (CPC) Central Committee and the State Council, and with the aim to improve marine ecological environmental quality, we took coordinated efforts to advance marine ecological environmental protection on all fronts, which achieved positive progress and staged success in the critical battle against pollution.

In 2020, we monitored seawater quality in 1,350 national monitoring sites, 193 riverine sections flowing into the sea, 442 sewage outlets with daily discharge volume exceeding 100 tons, and 31 bathing beaches. We also monitored the marine sediment quality of 540 national monitoring sites and the ecological status of 24 typical marine ecosystems.

The monitoring results showed that China's marine ecology and environment status remained stable in 2020. The overall quality of marine water was getting better, with 96.8% of the marine water under jurisdiction of China according with the Seawater Quality Standard Grade I. In the coastal area, 77.4% of these areas had Excellent or Good water quality, up by 0.8% compared with the previous year. The polluted areas were mainly located at Liaodong Bay, Yellow River Estuary, Jiangsu Coast, Yangtze River Estuary, Hangzhou Bay, Zhejiang Coast, and Pearl River Estuary. The dominant indicators failing the Seawater Quality Standard were inorganic nitrogen and active phosphate. The health status of typical marine ecosystems remained stable overall. The water quality of all the monitored sea-entering rivers is Slightly Polluted on the whole, with no significant change compared with the previous year. The marine environment quality in the ocean dumping zones and oil/gas exploration zones basically met the environmental protection requirements for marine functional zones. The environmental quality of marine fishery areas was generally in good status. Both the frequency and the cumulative area of recorded red tides have slightly decreased from the previous year. There were no oil spills or chemical spills of more than 100 tons in the sea areas under China's jurisdiction.

1 Marine Environmental Quality

1.1 Seawater Quality

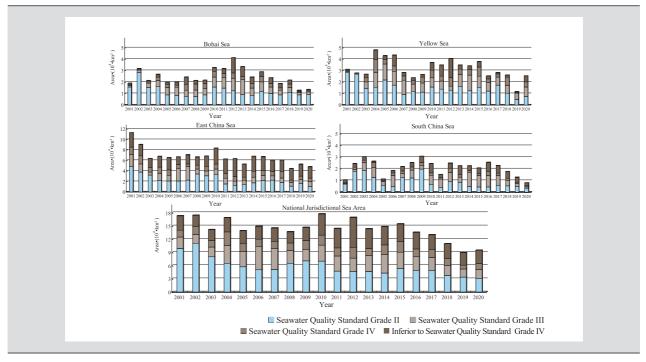
1.1.1 Water Quality of Sea areas under jurisdiction of China

In the summer of 2020, seawater quality in 1,350 state monitoring sites were monitored (monitoring of 9 other sites was cancelled due to poor sea conditions).

Sea area meeting the Seawater Quality Standard Grade I accounted for 96.8% of the total, remains at almost the same as the previous year. The area with water quality not meeting the Seawater

Quality Standard Grade IV was 30,070 km², increased by 1,730 km² from last year. The main pollution indicators were inorganic nitrogen and active phosphate.

Compared with 2015, sea area meeting the Seawater Quality Standard Grade I increased by 2.0%. The area with water quality not meeting the Seawater Quality Standard Grade IV decreased by 9,950 km². During the 13th Five-year Plan period (2016-2020), water quality of sea areas under jurisdiction of China trended to improve.



Total sea area under jurisdiction of China with water quality not meeting the Seawater Quality Standard Grade I from 2001 to 2020



Water quality status of sea areas under jurisdiction of China in 2020

Seawater Quality in Each Region

Bohai Sea The sea area with water quality not meeting the Seawater Quality Standard Grade I was 13,490 km², increased by 750 km² compared with the previous year. The sea area with water quality not meeting Grade IV was 1,000 km², decreased by 10 km² compared with the previous year and mainly located at Liaodong Bay and the Yellow River Estuary.

Yellow Sea The sea area with water quality not meeting the Seawater Quality Standard Grade I was 25,360 km², increased by 13,810 km² compared with the previous year. The sea area with water quality not meeting Grade IV was 5,080 km², increased by 4,320 km² compared with the previous year and mainly located at Jiangsu Coast.

East China Sea The sea area with water quality not meeting the Seawater Quality Standard Grade I was 48,000 km², decreased by 4,610 km² compared with the previous year. The sea area with water quality not meeting Grade IV was 21,480 km², decreased by 760 km² compared with the previous year and mainly located at Yangtze River Estuary, Hangzhou Bay, Zhejiang Coast.

South China Sea The sea area with water quality not meeting the Seawater Quality Standard Grade I was 8,080 km², decreased by 4,690 km² compared with the previous year. The sea area with water quality not meeting Grade IV was 2,510 km², decreased by 1,820 km² compared with the previous year and mainly located at Pearl River Estuary.

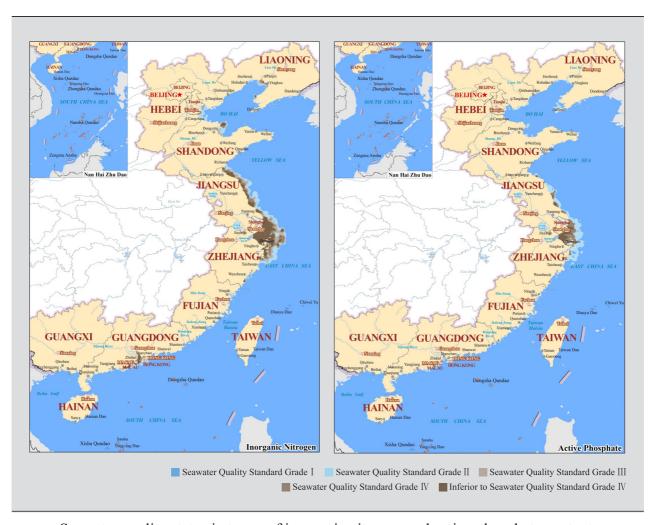
Main Pollution Indicators

Inorganic Nitrogen The sea area with inorganic nitrogen content not meeting the Seawater Quality Standard Grade I was 85,560 km², increased by 12,410 km² compared with the previous year. The sea area with inorganic nitrogen content not meeting the Seawater Quality Standard Grade IV was 29,670 km², increased by 2,370 km² compared with the previous year and mainly located at Liaodong Bay, the Yellow River Estuary, Jiangsu Coast, Yangtze River Estuary, Hangzhou Bay, Zhejiang Coast, and Pearl River Estuary.

Active Phosphate The sea area with active phosphate content not meeting the Seawater Quality Standard Grade I was 50,320 km², decreased by 1,040 km² compared with the previous year. The sea area with active phosphate content not meeting the Seawater Quality Standard Grade IV was 6,790 km², decreased by 2,450 km² compared with the previous year and mainly located at Jiangsu Coast, Yangtze River Estuary, Hangzhou Bay, and Zhejiang Coast.

Total sea area with water quality not meeting Grade I under jurisdiction of China in 2020 (km²)

Sea Area	Grade II	Grade III	Grade IV	Inferior to Grade IV	Total
Bohai Sea	9,170	2,300	1,020	1,000	13,490
Yellow Sea	7,430	8,300	4,550	5,080	25,360
East China Sea	10,800	8,910	6,810	21,480	48,000
South China Sea	3,330	1,140	1,100	2,510	8,080
Total	30,730	20,650	13,480	30,070	94,930



Seawater quality status in terms of inorganic nitrogen and active phosphate content in sea areas under jurisdiction of China in 2020

1.1.2 Seawater Quality of Coastal Areas

The comprehensive assessment based on the monitoring conducted in spring, summer and autumn indicated that the seawater quality of coastal area* has steadily improved. The sea area meeting the Seawater Quality Standard Grade I and II accounted for 77.4%, which increased by 0.8% from last year. The sea area with water

quality not meeting the standard of Grade IV accounted for 9.4%, decreased by 2.3% compared with the previous year. The category of coastal seawater quality was relatively good, and main pollution indicators were inorganic nitrogen and active phosphate.

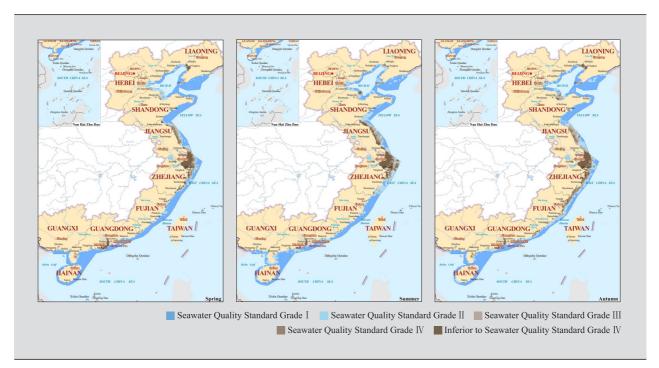
Proportion of the coastal water areas at different quality levels in China in 2020 (%)

Season	Year	Grade I	Grade II	Grade III	Grade IV	Inferior to Grade IV	Grade I and II
a .	2020	68.7	11.1	6.9	4.5	8.8	79.8
Spring	2019	51.9	24.6	6.1	4.2	13.2	76.5
Compared previo	d with the us year	16.8	-13.5	0.8	0.3	-4.4	3.3
C	2020	56.0	22.6	6.9	4.4	10.1	78.6
Summer	2019	43.6	34.8	8.1	3.4	10.1	78.4
Compared previous		12.4	-12.2	-1.2	1.0	0.0	0.2
Autumn	2020	57.5	16.4	9.2	7.6	9.3	73.9
Autuilli	2019	44.4	30.5	6.8	6.6	11.7	74.9
Compared with the previous year		13.1	-14.1	2.4	1.0	-2.4	-1.0
Average	2020	60.7	16.7	7.7	5.5	9.4	77.4
Average	2019	46.6	30.0	7.0	4.7	11.7	76.6
Compared previo	d with the us year	14.1	-13.3	0.7	0.8	-2.3	0.8

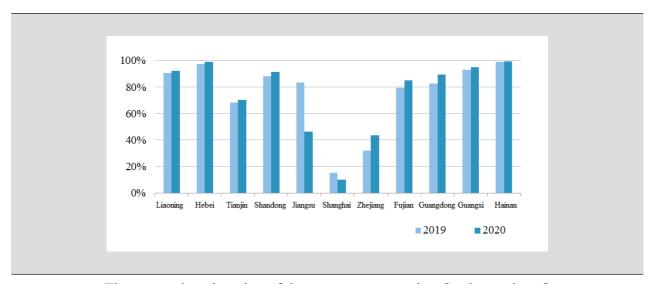
The sea area meeting the Seawater Quality Standard Grade I and II in Liaoning, Hebei, Tianjin, Shandong, Zhejiang, Fujian, Guangdong and Guangxi increased, while the sea area with water quality not meeting the standard of Grade IV decreased compared with last year. The sea area meeting the Seawater Quality Standard Grade I

and II and not meeting Grade IV in Hainan remained almost the same as that in the previous year. The sea area meeting the Seawater Quality Standard Grade I and II in Shanghai and Jiangsu decreased, while the sea area with water quality not meeting Grade IV increased compared with last year.

^{*} Coastal area is classified according to the National Marine Functional Zoning (Year 2011-2020)



Water quality status distribution of the coastal water areas in China in 2020



The proportion changing of the water areas meeting Grade I and II of Seawater Quality Standard in coastal province in 2020

Compared with 2015, The proportion of coastal water with water quality meeting the Seawater Quality Standard Grade I and II increased by 9.0%, while that of coastal water with water quality not meeting Grade IV decreased by 3.6%.

During the 13th Five-Year Plan period, the proportion of coastal water with water quality meeting the Seawater Quality Standard Grade I and II accounted for 73.8% on average and trended to improve overall.

1.1.3 Water Quality of Major Bays

In 2020, among 44 bays larger than 100 km², 8 bays had seawater quality not meeting the Seawater Quality Standard Grade IV in all three monitoring seasons (spring, summer and autumn),

which decreased by 5 from last year. The main pollution indicators were inorganic nitrogen and active phosphate.



Water quality status distribution of key bays in summer of 2020

1.1.4 Eutrophication*

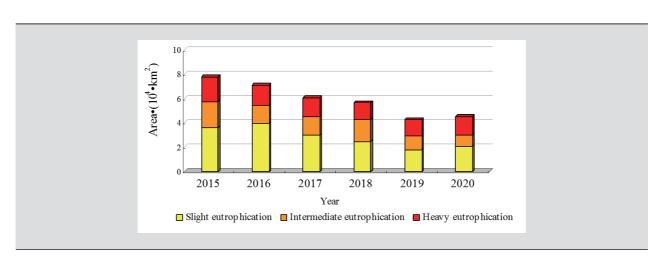
In 2020, sea areas under eutrophication status totaled 45,330 km² in summer, increased by 2,620 km² from last year. The sea areas with Slight, Intermediate, and Heavy eutrophication were 20,770 km², 9,450 km² and 15,110 km², respectively. Heavy eutrophication areas were mainly located at Liaodong Bay, Yellow River Estuary, Jiangsu Coast, Yangtze River Estuary, Hangzhou

Bay, and Pearl River Estuary.

Compared with 2015, the sea areas under eutrophication status decreased by 32,420 km², and Heavy eutrophication areas decreased by 5,080 km². During the 13th Five-year Plan period, total eutrophicating sea areas under jurisdiction of China trended to decline.

Sea areas under eutrophication status with jurisdiction of China in 2020 (km²)

Sea Area	Slight Eutrophication	Intermediate Eutrophication	Heavy Eutrophication	Total
Bohai Sea	3,170	860	220	4,250
Yellow Sea	5,580	3,230	1,300	10,110
East China Sea	10,490	4,520	12,310	27,320
South China Sea	1,530	840	1,280	3,650
Total	20,770	9,450	15,110	45,330



Variation of eutrophicating areas under jurisdiction of China from 2015 to 2020

^{*} Eutrophication status is classified based on the calculated result of eutrophication index (E), which has the calculation formula of $E = \text{COD}_{\text{Cr}} \times \text{inorganic nitrogen} \times \text{active phosphate} \times 10^6/4500$. $E \ge 1$ indicates eutrophication, $1 \le E \le 3$ indicates Slight eutrophication, $3 \le E \le 9$ indicates Intermediate eutrophication, and $E \ge 9$ indicates Heavy eutrophication.



Eutrophication status distribution of jurisdictional seas of China in 2020

1.2 Marine Sediment Quality

In 2020, marine sediment quality in 540 state sites was monitored.

The overall quality of marine sediment was Good*, with 96.5% of sites met grade Good for the sediment quality. Among them, the percentage of sediment sites rated as Good was 100% for

the Bohai Sea and Yellow Sea, but 97.1% and 91.7% for the East China Sea and South China Sea respectively.

Comparing with 2015, the percentage of sediment sites rated as Good was almost the same. During the 13th Five-year Plan period, the sediment qualities remained stable.

Sediment qualities of jurisdictional seas of China in 2020 (%)

Sea Area	Percentage of Sites as Good	Percentage of Sites as Fair	Percentage of Sites as Poor	Sediment Quality Grade
Bohai Sea	100	0.0	0.0	Good
Yellow Sea	100	0.0	0.0	Good
East China Sea	97.1	2.9	0.0	Good
South China Sea	91.7	7.7	0.6	Good
Total	96.5	3.3	0.2	Good

Contents of copper in 89.2% of sediment sites met Marine Sediment Quality Standard

Grade I, while that of other indicators exceeding 95%.

Good: a maximum of one indicator inferior to the Marine Sediment Quality Standard Category I, and no indicator inferior to the Marine Sediment Quality Standard Category III;

Fair: more than one indicator inferior to the Marine Sediment Quality Standard Category I, and no indicator inferior to the Marine Sediment Quality Standard Category III;

Poor: one or more indicators fail to meet the Marine Sediment Quality Standard Category III.

Determining the sediment quality by region

Good: less than 5% of sediment sites are rated as "Poor", and not less than 70% of sediment sites are rated as "Good";

Fair: 5% to 15% of sediment sites are rated as "Poor"; or less than 5% of sediment sites are rated as "Poor", and over 30% of sediment sites are rated as "Fair" or "Poor";

Poor: more than 15% of sediment sites are rated as "Poor".

^{*}Determining the sediment quality by Site:



Spatial distributions of sediment quality status in the jurisdictional seas of China in 2020

1.3 Water Quality of Bathing Beaches

In the swimming season in 2020, in the 31 monitored bathing beaches, the days with Good seawater quality* accounted for 78.1%, the days with Moderate seawater quality accounted for 18.6%, and the days with Poor seawater quality accounted for 3.3%. The integrated assessment of the whole swimming season this year showed that 10 bathing beaches were in Good water quality, including Huludao Suizhong Dongdaihe Bathing Beach, Qinhuangdao Laohushi Bathing Beach, Qinhuangdao Pingshuiqiao Bathing Beach, Weihai International Bathing Beach, Qingdao No.1 Bathing Beach, Rizhao Seaside National Forest Park Bathing Beach, Zhoushan Zhujiajian

Bathing Beach, Pingtan Longwangtou Bathing Beach, Yangjiang Zhapo Bathing Beach and Haikou Holiday Bathing Beach. The water quality was mainly impacted by fecal coliform, and some bathing beaches were impacted by flotsam.

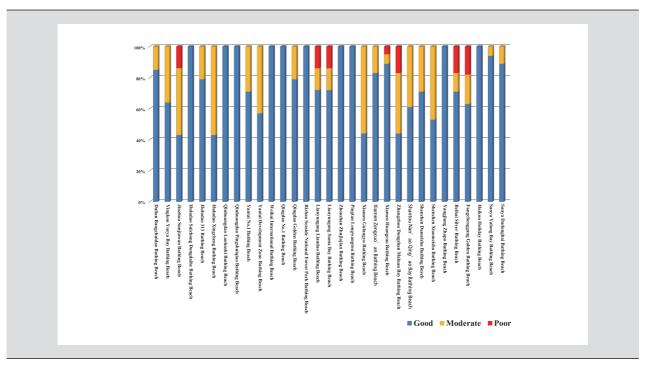
The proportion of days with Good seawater quality in 2020 in monitored bathing beaches increased significantly compared with 2015, and the 95th percentile value of fecal coliform in seawater in 2020 decreased by 65.6% compared with 2015. During the 13th Five-year Plan period, the proportion of days with the Good seawater quality in the monitored bathing beach during swimming season trended to increase, and the annual seawater quality improved significantly.

Good: all indicators meet the requirements of "Good";

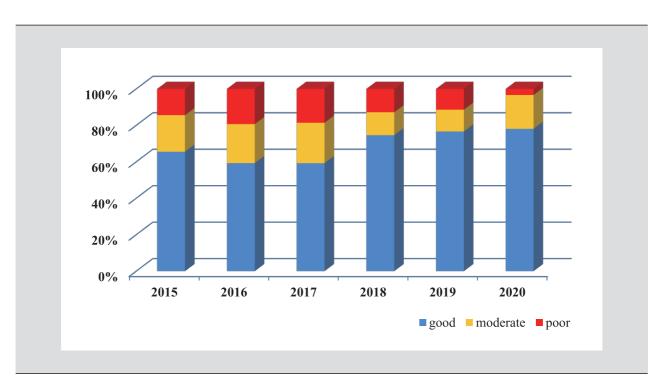
Moderate: at least one indicator meets the requirements of "Moderate", and no indicator indicates "Poor";

Poor: at least one indicator meets the requirements of "Poor".

^{*}Daily Water quality of Bathing Beaches:



Status of water quality of bathing beaches in coastal cities of China in 2020



Proportion of different water quality grades in monitored bathing beach from 2015 to 2020

Annual variation of fecal coliforms (95 percentile value) in monitored bathing beaches from 2015 to 2020

1.4 Radioactivity Level in Marine Environment

In 2020, marine radioactivity monitoring was carried out in 82 nearshore points, 12 sea areas adjacent to nuclear power plants, and the western Pacific Ocean waters.

The natural radionuclide activity concentrations of the coastal waters and marine organisms were within the background level, no abnormality was observed in the artificial radionuclide activity concentrations, and the artificial radionuclide activity concentration in sea water is far below the limit based on *Sea Water Quality Standard* (GB 3097-1997).

No abnormality was observed in terms of activity concentration of artificial radionuclide of seawater, sediment, intertidal soil and marine organisms in the sea areas adjacent to nuclear power plants of Haiyang (Shandong Province), Sanmen (Zhejiang Province), Yangjiang (Guangdong Province), Taishan (Guangdong Province), Fangchenggang (Guangxi Province) and Changjiang (Hainan Province). The concentration of tritium activity increased slightly compared with the background level before the nuclear power plants operated in

some seawater samples adjacent to nuclear power plants of Hongyanhe (Liaoning province), Tianwan (Jiangsu province), Qinshan (Zhejiang province), Ningde (Fujian province), Fuqing (Fujian province) and Dayawan (Guangdong province). The evaluation results showed that the radiation dosage to the public generated by the mentioned plants is still far below the national dosage limit, and no impact on environmental safety and public health.

The Western Pacific waters remained affected by the Fukushima nuclear accident in Japan. The activity concentration of Cesium-137 in seawater exceeded the background level record prior to the nuclear accident. The characteristic nuclide of Fukushima accident as Cesium-134 could still be detected. No abnormality on radioactivity level of radionuclide was observed in marine organisms and sediment.

During the 13th Five-year Plan period, the level of marine radioactivity in the nearshore waters and the sea areas adjacent to nuclear power plants in China was stable. The Western Pacific waters remained impacted by the Fukushima nuclear accident in Japan.

2 Marine Ecological Status

2.1 Typical Marine Ecosystems

In 2020, the health status of typical ecosystems, including estuary, bay, mudflat, coral reef, mangrove and seagrass bed were monitored. Among 24 monitored typical marine ecosystems, 7 of them were in Healthy condition*, 16 in Sub-healthy condition and 1 in Unhealthy condition.

Estuary Ecosystem 7 monitored estuary ecosystems were all in Sub-healthy condition. The seawater in most estuaries were seriously eutrophic. The sediment qualities were Good on the whole, while which in the Pearl River Estuary was Fair. Most marine biological qualities were generally Good. In most estuary ecosystems, the density of phytoplankton was higher than normal range, the density and biomass of zooplankton exceeded normal ranges, and the density and biomass of macrobenthos were lower than normal ranges. The density and biomass of macrobenthos in the Liaohe Estuary and the Luanhekou-Beidaihe Estuary were significantly below normal range.

Healthy: Ecosystems maintain their natural attributes. Biological diversity and ecosystem structure are basically in stable conditions, and ecosystems function well. Ecological pressures brought about by human activities are well within the carrying capabilities of the ecosystems.

Sub-healthy: Ecosystems basically maintain natural attributes. Biological diversity and ecosystem structure experience certain degrees of changes. However, ecosystems maintained main service functions. Yet ecological pressures caused by environmental pollution, human activities, and unreasonable use of resources, already exceed the carrying capabilities of the ecosystems.

Unhealthy: The natural attributes of ecosystems change significantly. Biological diversity and ecosystem structure experience relatively great changes, and main ecosystem service functions are seriously weakened or totally lost. Ecological pressures caused by environmental pollution, human activities, and unreasonable use of resources, vastly exceed the carrying capabilities of the ecosystems.

^{*}The health status of marine ecosystems falls into three categories, namely, Healthy, Sub-healthy, and Unhealthy conditions.

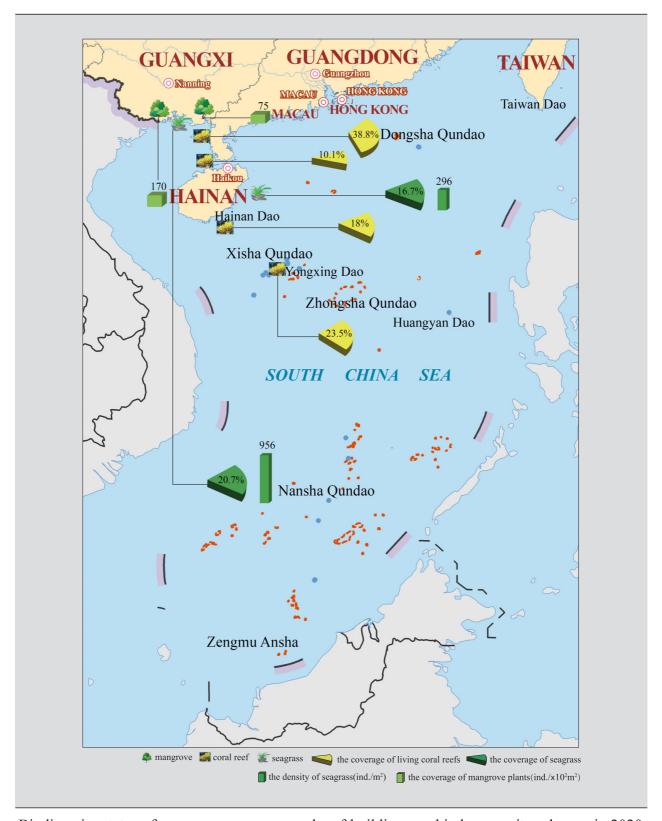
Bay Ecosystem Among the monitored bay systems, 7 were in Sub-healthy condition, whereas Hangzhou Bay was in Unhealthy condition. The seawater was seriously eutrophic in the Hangzhou Bay. The sediment qualities were fairly Good on the whole. Most marine biological qualities were generally Good, whereas some shellfish in the Hangzhou Bay was found to have exceeding Cd concentration. In most bay ecosystems, the density of phytoplankton was higher than normal range. The density and biomass of zooplankton were lower than normal range, while the density and biomass of zooplankton were significantly low in Yueqing Bay. The density and biomass of macrobenthos were lower than normal range, whereas the species number and diversity index in Hangzhou Bay were relatively low.

Mudflat Ecosystem The Northern Jiangsu Mudflat ecosystem was in Sub-healthy condition. The density of phytoplankton was lower than the normal range. The density and biomass of macrobenthos were lower than normal range. The area of beach vegetation was about 236.9 km². The dominant vegetation types in the ecosystem were cordgrass (*Spartina alterniflora*), seepweed and reed.

Coral Reef Ecosystem 4 monitored coral reef ecosystems were all in Healthy condition. The living coral coverage in the Eastern Hainan Coast and Xisha Islands were 18.0% and 23.5% respectively, significantly higher than that of five years ago.

Mangrove Ecosystem 2 monitored mangrove ecosystems were in Healthy condition. The area and community type of mangroves remained stable, and the average density of mangroves in the Beilun Estuary and the density of macrobenthos in the Guangxi Beihai significantly increased compared with that of the five years ago.

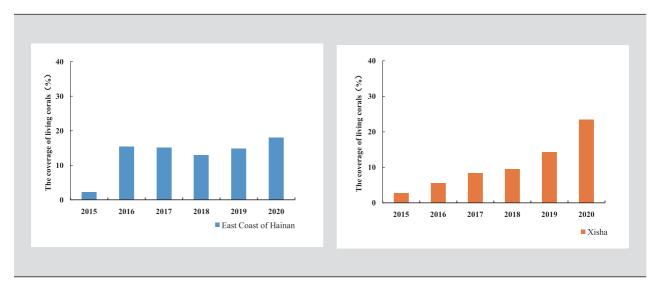
Seagrass Bed Ecosystem The seagrass bed ecosystem in the Guangxi Beihai was in Healthy condition, with the average density of seagrass reaching 956 ind./m², significantly higher than that of the five years ago. The seagrass bed ecosystem in the Eastern Hainan Coast was in Sub-healthy condition, with the average density of seagrass significantly lower than that of the five years ago.



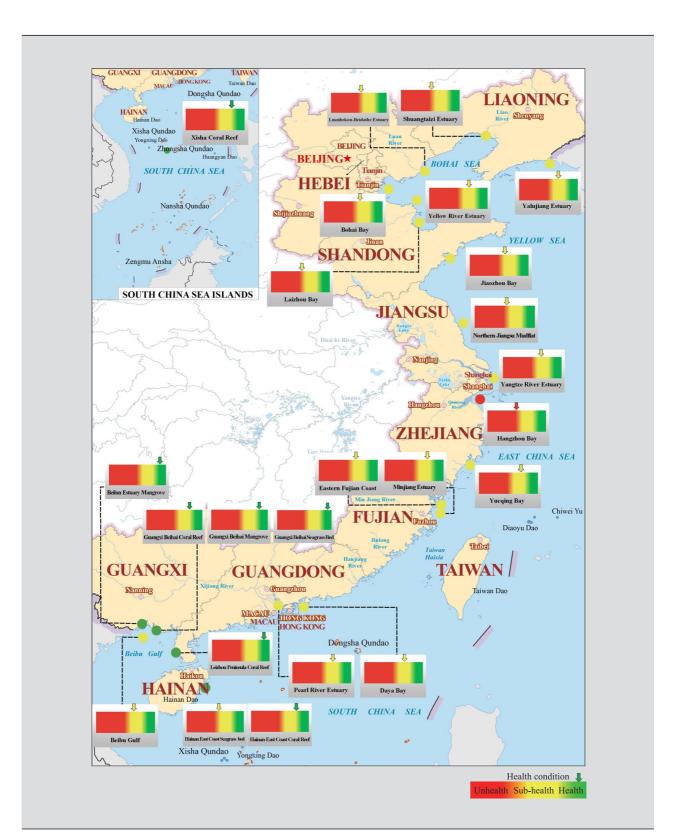
Biodiversity status of seagrass, mangrove, and reef-building coral in key monitored areas in 2020

During the 13th Five-year Plan period, most monitored estuary ecosystems and bay ecosystems were in Sub-healthy condition. The proportion of the area with Excellent and Good seawater quality (Grade I and II) trended to increase. The disproportion of nitrogen/phosphorus ratio relieved. Marine sediment quality was generally Good. The decreasing trend of biological habitat areas was controlled effectively. The diversity indexes of phytoplankton and zooplankton increased in most estuaries and bays, and the diatom/dinoflagellate ratio increased. However, the proportion of food species (*Copepoda*) decreased, and the density of fish eggs and larvae

was generally at a low level. The mudflat ecosystem was in Sub-healthy condition, and the vegetation area was basically stable. The mangrove ecosystems were in Healthy condition. The area of mangroves increased and the community structure remained stable in the monitored area. The coral reef and seagrass bed ecosystems fluctuated between Healthy and Sub-healthy condition. In the past five years, the health status of Xisha coral reef improved continuously, with the species number and coverage of living coral reefs increasing every year. The average density of seagrass continuously declined in the East Coast of Hainan in the past five years.



The coverage of living corals in the East Coast of Hainan and Xisha from 2015 to 2020



Health status of typical ecosystems in 2020

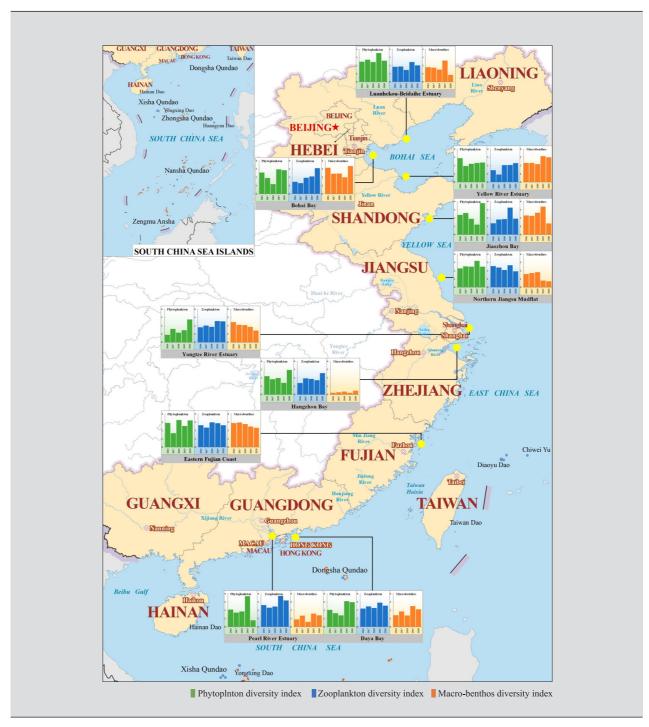
Basic status of typical marine ecosystems in 2020

Ecosystem type	Ecosystem Monitored area type	Area (km²)	Health	Ecological Status
	Yalujiang Estuary	1900	Sub-healthy	The density of phytoplankton was extremely low. The density of zooplankton was extremely high, whereas the biomass was extremely low. The biomass of macrobenthos was high.
	Shuangtaizi Estuary	3000	Sub-healthy	Seawater was seriously eutrophic. The density of phytoplankton was extremely high. The density and biomass of zooplankton were extremely high. The density and biomass of macrobenthos were extremely low.
	Luanhekou-Beidaihe Estuary	006	Sub-healthy	The density of phytoplankton was extremely high. The density of zooplankton was extremely high, whereas the biomass was extremely low. The density and biomass of macrobenthos were extremely low.
Letinom,	Yellow River Estuary	2600	Sub-healthy	Seawater was seriously eutrophic. The density of zooplankton was high whereas the biomass was extremely low. The density of macrobenthos was extremely high.
Estuary	Yangtze River Estuary	13668	Sub-healthy	Seawater was seriously eutrophic. The density of zooplankton was low, whereas the biomass was extremely low. The density of macrobenthos was extremely high, whereas the biomass was low.
	Minjiang Estuary	1400	Sub-healthy	The density of phytoplankton was extremely high. The density of zooplankton was extremely high. The biomass of macrobenthos was extremely high.
	Pearl River Estuary	3980	Sub-healthy	Seawater was seriously eutrophic. The density of phytoplankton was extremely high. The density of zooplankton was high, whereas the biomass was extremely high. The density and biomass of macrobenthos were extremely low.
	Bohai Bay	3000	Sub-healthy	The density of phytoplankton was high. The biomass of zooplankton was extremely low. The density of macrobenthos was low, whereas the biomass was extremely low.
	Laizhou Bay	3770	Sub-healthy	The density of zooplankton was extremely high, whereas the biomass was extremely low. The density and biomass of macrobenthos were extremely high.
	Jiaozhou Bay	006	Sub-healthy	The density of phytoplankton was extremely high. The density of zooplankton was extremely high. The density and biomass of macrobenthos were extremely high.
Bay	Hangzhou Bay	2000	Unhealthy	Seawater was seriously eutrophic. The density of phytoplankton was extremely high. The density of zooplankton was extremely low, whereas the biomass of zooplankton was low. The density and biomass of macrobenthos were extremely low.
•	Yueqing Bay	464	Sub-healthy	The density and biomass of zooplankton were extremely low. The density of macrobenthos was low.
	Eastern Fujian Coast	5063	Sub-healthy	The density of phytoplankton was extremely high. The density and biomass of zooplankton was extremely high. The density and biomass of macrobenthos were low.
	Daya Bay	1200	Sub-healthy	The density of phytoplankton was extremely low. The density of zooplankton was low, whereas the biomass was extremely low. The density of macrobenthos was extremely low.
	Beibu Gulf	0006	Sub-healthy	The density of phytoplankton was extremely high. The density of zooplankton was extremely high. The density of macrobenthos was extremely low, whereas the biomass was extremely high.
Mudflat	Northern Jiangsu Mudflat	15400	Sub-healthy	Seawater was eutrophic. The density of phytoplankton was extremely low. The density of zooplankton was extremely high, and the biomass was extremely low. The density and biomass of macrobenthos were extremely low. The area of mudflat increased.
	Leizhou Peninsula	1150	Healthy	The species number of coral reef remained stable compared with that in 2015.
Coral reef	Guangxi Beihai	120	Healthy	The species number of coral reef increased compared withthat in 2015. Reef-building corals bleached in varying degrees in 2020.
	Hainan East Coast	3750	Healthy	The coverage of living coral reefs significantly increased compared with that in 2015.
	Xisha Islands	400	Healthy	The coverage of living coral reefs significantly increased compared with that in 2015.
Manorove	Guangxi Beihai	120	Healthy	The density of mangrove remained stable basically.
o o o o o o	Beilun Estuary	150	Healthy	The coverage of mangroves remained stable basically, with an increase in mangrove density.
Seagrass	Guangxi Beihai	120	Healthy	The average density of seagrass significantly increased compared with that in 2015.
ped	Eastern Hainan Coast	3750	Sub-healthy	The average density of seagrass obviously decreased compared with that in 2015.

Plankton and macrobenthos species number, abundance, diversity index and dominant species in summer in the key monitored areas in 2020

							Zooplankton ^{1,2}	11,2				
Monitored			Phytoplanton ¹	n,	Species		Macro-zo	Macro-zooplankton			Macrobenthos	80
Area	Species number	Density (×10 ⁴ cell s/m ³)	Diversity index	Dominant species	number	Density (ind./m³)	Diversity index	Dominant species	Species number	Density (ind./m²)	Diversity index	Dominant species
Yalujiang Estuary	44	174	2.67	Ceratium horridum Pseudo-nitzschia pungens	28	169	2.65	Paracalanus parvus Sagitta crassa	49	217.4	1.97	Ruditapes philippinarum Qgyrides orientalis
Shuangtaizi Estuary	38	4,352	1.72	Chaetoceros curvisetus Skeletonema costatum	38	415	2.61	Paracalanus parvus Aidanosagitta crassa	31	48.9	1.21	Sinonovacula constricta
Luanhe - Beidaihe Estuary	51	563	2.60	Eucampia zoodiacus Rhizosolenia setigera	46	1,247	2.03	Sagitta crassa Evadne tergestina	26	70.5	0.85	Ophiura kinbergi Branchiostoma tsingtauense
Yellow River Estuary	42	291	2.37	Skeletonema costatum Pseudo-nitzschia pungens	40	42	2.31	Aidanosagitta crassa Pleurobrachia globosa	88	849.4	3.01	Arcuatula senhousei Ringicula doliaris
Yangtze River Estuary	165	221	2.77	Pseudo-nitzschia pungens Thalassiothrix frauenfeldii	120	100	2.54	Calanus sinicus Sagitta enflata	30	80.7	1.41	l
Minjiang Estuary	06	4,370	3.12	Skeletonema costatum Pseudo-nitzschia pungens	79	106	2.94	Subeucalanus subcrassus Sagitta enflata	41	140.0	1.72	Ophiocnemis marmorata Typhlocarcinus villosus
Pearl River Estuary	81	61,133	08.0	Skeletonema costatum Skeletonema tropicum	192	257	3.19	Lucifer hanseni Penilia avirostris	45	51.7	1.39	Potomocorbula laevis
Bohai Bay	56	164	2.50	Alexandrium tamarense Akashiwo sanguinea	18	63	1.94	Corycaeus affinis Paracalanus parvus	23	54.4	0.72	Arcuatula senhousei
Laizhou Bay	57	28	2.63	Cerataulina pelagica Skeletonema costatum	52	32	2.47	Aidanosagitta crassa Paracalanus parvus	105	624.7	3.20	Echinocardium cordatum Aricidea fragilis
Jiaozhou Bay	64	104	2.86	Chaetoceros curvisetus Biddulphia regia	56	534	3.12	Sagitta crassa Labibocera euchaeta	95	1,468.3	3.37	Ruditapes philippinarum Heteromastus filiforms
Hangzhou Bay	119	167	2.95	Skeletonema costatum Ditylum brightwellii	25	99	2.57	Acartia erythraea Acanthomysis longirostris	6	6.4	0.47	Sternaspis sculata
Yueqing Bay	120	351	2.19	Skeletonema costatum Ditylum brightwellii	117	101	2.95	Pseudeuphausia sinica Acartia spinicauda	26	19.2	1.19	Glycera chirori
Eastern Fujian Coast	100	252	3.21	Pseudo-nitzschia pungens Skeletonema costatum	76	886	2.64	Sagitta enflata Temora turbinata	89	90.3	2.33	Aglaophamus dibranchis Sternaspis sculata
Daya Bay	71	18	2.99	Ceratium furca	154	164	2.56	Penilia avirostris Temora turbinata	59	59.2	2.12	Ophelina grandis Paphia undulata
Beibu Gulf	129	768	2.77	Rhizosolenia bergonii Skeletonema costatum	253	291	3.11	Sagitta enflata Eucalanus subcrassus	146	87.3	2.60	Xenophthalmus pinnotheroides Amphiodia obtecta
Northern Jiangsu Wetland	105	29	3.82	Skeletonema costatum Chaetoceros lorenzianus	49	329	1.94	Labidocera euchaeta Acartia pacifica	14	4.3	1.36	Siliqua minima
Changshan Island	41	97	1.97	Ceratium tripos Ceratium fusus	40	154	2.12	Sagitta crassa Penilia avirostris	53	160.0	2.60	Ophiopholis mirabilis
Miaodao Island	4	97	2.47	Chaetoceros lorenzianus Chaetoceros curvisetus	59	463	3.36	Eirene kambara Penilia avirostris	86	748.7	3.30	Sthenolepis japonica
Nanao Island	108	756	3.31	Nitzschia delicatissima Chaetoceros affinis	142	2,006	3.44	Penilia avirostris Temora turbinata	99	48.8	2.38	Terebellides stroemii
Motor 1 Mont o	o caous polamos	drive between	1th montgon	Notes 1 Most commission with Loth mondon and I and not II while and contraments for the Debai Day called with not I ?	the for the		Handa daniel.		to the control of		1	

Note: I. Most samples were collected with both plankton net II and net II, while only samples for the Bohai Bay collected with net I. 2. The species diversity index is used to measure the species number and the individual number of individual for species it to the total individuals for all species in the sample.



The biodiversity index of plankton and macrobenthos in summer in the key monitored areas from 2016 to 2020

2.2 Marine Natural Protected Areas

By the end of 2020, 14 national marine nature reserves and 67 national marine parks have been established in China, covering the total areas of about 394,000 ha and 737,000 ha, respectively.

The ecological protection status* of 4 national marine nature reserves were monitored and

assessed. The ecological protection status of Liaoning Yalujiang Estuary Coastal Wetland National Nature Reserve, Hebei Changli Gold Coast National Nature Reserve and Zhejiang Nanji Islands Marine National Nature Reserve was Good. The ecological protection status of Binzhou Shell Island and Wetland National Nature Reserve was Moderate.

^{*}The ecological protection status of Marine Natural Reserves was classified as five grades: Excellent, Good, Moderate, Relatively Poor and Poor:

Excellent: The native habitats for the main protected objects have been effectively protected without obvious disturbance by development.

Good: The native habitats for the main protected objects are well protected with lesser disturbance by development.

Moderate: The native habitats for the main protected objects are damaged with obvious disturbance by development.

Relatively Poor: The native habitats for the main protected objects are partially vanished with severe disturbance by development.

Poor: The native habitat for the main protected objects are mostly vanished with violent disturbance by development.



- 1. Liaoning Yalujiang Estuary Coastal Wetland National Nature Reserve
- Numenius madagascariensis as IUCN endangered species was recorded.

The ecological protection status was Good.

2. Hebei Changli Gold Coast National Marine Nature Reserve

The ecological protection status was Good.

3. Binzhou Shell Island and Wetland National Nature Reserve

The area of shell bank was 40.82 ha.

Numenius madagascariensis and Tringa guttifer as IUCN endangered species, Saundersilarus saundersi as vulnerable species were recorded. The ecological protection status was Moderate.

4. Zhejiang Nanji Islands Marine National Nature Reserve

The ecological protection status was Good.

5. Fujian Xiamen Rare Marine Species National Nature Reserve

The average quantity density of lancelet was 43 ind./m², the average biomass density was 2.4g/m². Compared with previous year, the average biomass density increased, while the average quantity density decreased.

A total of 28 inviduals of Chinese white dolphin (*Sousa chinensis*) were recorded during the autumn voyages.

- 6. Guangxi Shankou Mangrove Ecological National Nature Reserve
- 5 species of mangroves were recorded.
- 7. Guangxi Beilun Estuary National Nature Reserve 4 species of mangroves were recorded.
- 8. Hainan Sanya Coral Reefs National Nature Reserve The average coverage of live coral was 15.1%, which increased compared with the previous year.

The ecological protection status of monitored national marine nature reserves in 2020

2.3 Coastal wetlands

In 2020, 9 ecological indexes including wetland distribution and area, water recharging, water quality, eutrophication, vegetation, birds, plant invasion, restoration and utilization, and major threats, were monitored in 15 coastal wetlands of international importance, covering an area of 385,500 hectares. The qualities of ecological condition remained stable overall.

Birds observations and vegetation surveys were carried out at 72 line transects of 9 wetland regions, including Shuangtaizi Estuary, Shandong Yellow River Delta Wetland, Yancheng National Nature Reserve, Chongming Dongtan Nature Reserve, Shanghai, Fujian Zhangjiangkou National Mangrove Nature Reserve, Zhanjiang

Mangrove National Nature Reserve, Shankou Mangrove Nature Reserve, Guangxi Beilun Estuary National Nature Reserve, and Dongzhaigang. A total of 6 kinds of birds on the IUCN Red List of Threatened Species were recorded, including Grus japonensis, Ciconia boyciana, Calidris tenuirostris, Numenius madagascariensis (ENDANGERED) and Grus monacha, Saundersilarus saundersi (VULNERABLE). Suaeda salsa, Phragmites australis, Imperata cylindrica, and other 7 salt marsh plants were recorded. Additionally, 8 species of mangrove were monitored, which were Avicennia marina, Kandelia candel, Aegiceras corniculatum, Rhizophora stylosa, Bruguiera gymnorrhiza, Laguncularia racemosa, Rhizophora apiculata, and Hibiscus tiliaceus.

3 Status of Main Pollution Sources into the Sea

3.1 Riverine Sources

In 2020, 193 water sections of rivers flowing into the sea were monitored under the national monitoring program, but 2 of which were not monitored due to drying up.

In general, rivers flowing into the sea in China were under Slight Pollution*, with no significant change compared with the previous year. Among the 193 monitored sections, no section had water quality meeting Grade I of Environmental Quality Standards for Surface Water, which was the same compared with the previous year. 43 sections, accounting for 22.3%, reached the standard of Grade II, which increased by 2.8% over last year; 88 sections reached Grade III, accounting for

45.6%, which increased by 10.9% over last year; 48 sections reached Grade IV, accounting for 24.9%, which decreased by 7.7% over last year; 13 sections fell into Grade V, accounting for 6.7%, which decreased by 2.2% over last year; only 1 section failed to reach Grade V, accounting for 0.5%, which decreased by 3.7% over last year. The dominant pollution indicators were chemical oxygen demand (COD_{Cr}), permanganate index, five-day biochemical oxygen demand (BOD₅), total phosphorus (TP) and ammonia-N. Content of dissolved oxygen (DO), fluoride, arsenic and petroleum exceeded the surface water quality standard in some monitored sections.

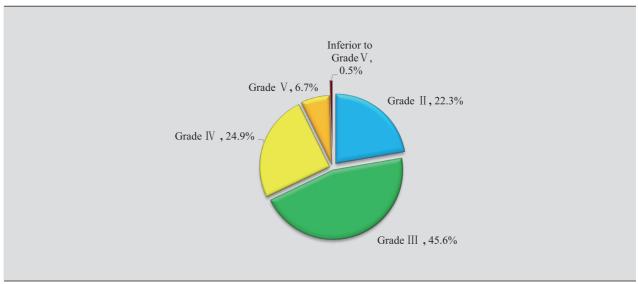
Excellent: 90% and above of waters meet Grade I~III quality level;

Good: 75%(including 75%) ~90% of waters meet Grade I~III;

Slight Pollution: less than 75% of waters meet Grade I \sim III, and less than 20% of waters are inferior to Grade V; Moderate Pollution: less than 75% of waters meet Grade I \sim III, and 20%(including 20%) \sim 40% of waters fail Grade V; Heavy Pollution: less than 60% of waters meet Grade I \sim III, and 40% and above of waters fail Grade V.

^{*}Integrated water quality of rivers flowing into the sea is classified into five grades:

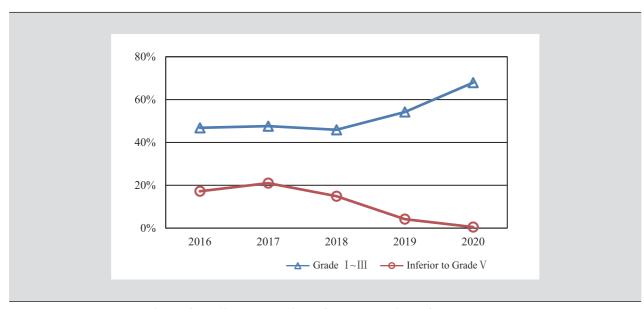
Sea Area			W	ater Quality	Categories		
Sca Mica	Grade I	Grade II	Grade III	Grade IV	Grade V	Inferior to Grade V	Total
Bohai Sea	0	3	17	16	10	0	46
Yellow Sea	0	8	27	16	1	0	52
East China Sea	0	8	13	4	0	0	25
South China Sea	0	24	31	12	2	1	70
Total	0	43	88	48	13	1	193



Proportion of water sections at different quality levels of sea-entering rivers nationwide in 2020

Compared with 2015, the proportion of water quality that has reached Grade I~III in monitoring sections increased by 26.4%, while the proportion of water quality inferior to Grade V decreased

by 21.0%. The water environment quality of sea-entering rivers had been notably improved during the 13th Five-year Plan period.



Proportion of quality categories of water sections from 2016 to 2020

Proportion of waters at different quality levels of sea-entering rivers in coastal provinces (autonomous regions and municipalities) and dominant pollution indicators in 2020 (%)

Province	Water Quality	Grade I	Grade II	Grade III	Grade IV	Grade V	Inferior to Grade V	Dominant Pollution Indicators
Liaoning	Good	0.0	22.2	66.7	11.1	0.0	0.0	COD _{Cr} , permanganate index
Hebei	Slight Pollution	0.0	8.3	41.7	33.3	16.7	0.0	COD _{Cr} , BOD ₅ , permanganate index
Tianjin	Slight Pollution	0.0	0.0	0.0	25.0	75.0	0.0	COD _{Cr} , BOD ₅ , permanganate index
Shandong	Slight Pollution	0.0	13.8	24.1	55.2	6.9	0.0	COD _{Cr} , permanganate index, TP
Jiangsu	Slight Pollution	0.0	6.5	64.5	25.8	3.2	0.0	COD _{Cr} , permanganate index, TP
Shanghai	Excellent	0.0	100.0	0.0	0.0	0.0	0.0	-
Zhejiang	Good	0.0	30.8	53.8	15.4	0.0	0.0	COD _{Cr} , BOD ₅ , TP
Fujian	Good	0.0	27.3	54.5	18.2	0.0	0.0	TP, DO
Guangdong	Good	0.0	37.5	40.0	20.0	0.0	2.5	Ammonia-N, COD _{Cr} , permanganate index
Guangxi	Excellent	0.0	18.2	72.7	9.1	0.0	0.0	Ammonia-N, TP, COD _{Cr}
Hainan	Slight Pollution	0.0	36.8	36.8	15.8	10.5	0.0	permanganate index, COD _{Cr} , BOD ₅

The statistics for pollution indicators of water sections of sea-entering rivers in 2020

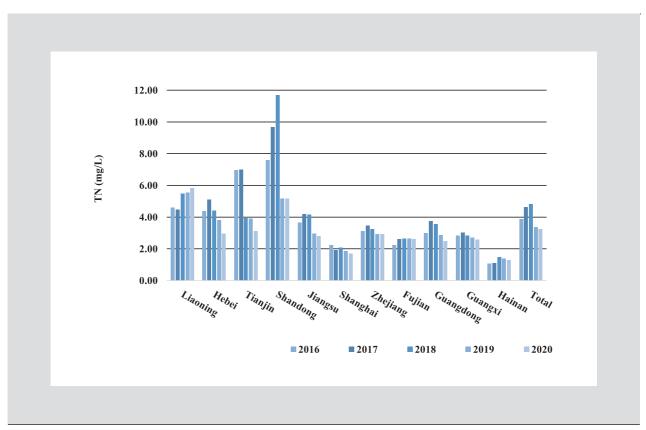
Pollution indicators of water sections of sea-entering rivers in China in 2020 (%)

Sea Area	Exceeding Ratio >30%	30%≥ Exceeding Ratio ≥10%	Exceeding Ratio <10%
All	_	$COD_{Cr}(23.8)$, permanganate index(18.7)	BOD ₅ (9.8), TP(8.3), ammonia-N (4.1), DO(3.1), fluoride(1.6), petroleum(0.5), arsenic(0.5)
Bohai Sea	COD _{Cr} (47.8), permanganate index(45.7)	BOD ₅ (26.1)	fluoride(6.5), TP(4.3), petroleum (2.2), arsenic (2.2)
Yellow Sea	_	COD _{Cr} (26.9), permanganate index(17.3), TP(13.5)	BOD ₅ (7.7), ammonia-N(1.9)
East China Sea	_	_	TP(8.0), COD _{Cr} (8.0), BOD ₅ (4.0), ammonia-N(4.0), DO(4.0)
South China Sea	_	COD _{Cr} (11.4)	ammonia-N(8.6), permanganate index((8.6), TP(7.1), DO(7.1), BOD ₅ (2.9)

^{*}Figures in parentheses represent the exceeding rate of the indicator

Of all sea-entering river sections nationwide, 23.8% of the monitored sections had excessive surface water quality standard for COD_{Cr}, which had the highest proportion among all indicators, ranging between 0.2~54.0 mg/L and 17.1 mg/L on average; 18.7% of the monitoring sections contained permanganate above standard value, with its concentration ranging 0.4~31.2 mg/L and 4.7 mg/L on average; The proportion failing to meet the standard for BOD₅ was 9.8%, with the concentration ranging 0.2~18.0 mg/L and 2.5 mg/L on average; The proportion failing to meet the standard for TP was 8.3% with the concentra-

tion ranging 0.002~0.66 mg/L and 0.122 mg/L on average; The proportion failing to meet the standard for ammonia-N was 4.1% with the concentration ranging 0.02~6.79 mg/L and 0.38 mg/L on average. In 2020, the average TN(total nitrogen) concentration of all nationwide sea-entering rivers was 3.23 mg/L, which decreased by 4.4% compared with the previous year. Of the 193 sections of rivers flowing into the sea, there were 68 sections with annual average TN concentration above the national average value (3.23 mg/L).



Average TN concentration of sea-entering rivers in coastal provinces (autonomous regions and municipalities) from 2016 to 2020

3.2 Pollutant Discharge Outlets

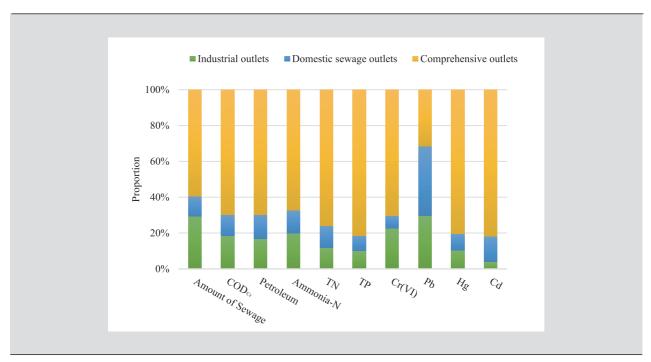
In 2020, 442 of industrial sewage outlets, domestic sewage outlets, and comprehensive sewage outlets with daily discharge volume exceeding 100 m³ were monitored.

The total sewage discharge amount of 442 monitored outlets was approximately 7.12993 billion

tons. Among various types of sewage outlets into the sea, comprehensive outlets contributed the largest amount of sewage, followed by industrial outlets, and domestic sewage outlets the smallest. Among all the monitored pollutants, except lead, amount of pollutants of the comprehensive outlets was the largest.

Discharge amount of sewage and major pollutants from different types of seaward sewage outlets in 2020

Type of Sewa	age	Number of Sewage Outlets	Amount of Sewage (×10 ⁴ ton)	COD _{Cr} (ton)	Petroleum (ton)	Ammonia-N (ton)	TN (ton)	TP (ton)	Cr(VI) (kg)	Pb (kg)	Hg (kg)	Cd (kg)
Industrial Outlets		189	209,665	27,413	109.7	852	5,592	146	489.9	4,176	40.1	162.1
Domestic Sev Outlets		56	78,961	17,561	86.6	536	5,661	124	148.5	5,488.6	35.4	50.8
Comprehens Outlets	sive	197	424,367	103,927	453.5	2,868	35,611	1,183	1,514.7	4,436.3	306.7	379.6
Total		442	712,993	148,901	649.8	4,256	46,864	1,453	2,153.1	14,100.9	382.2	592.5

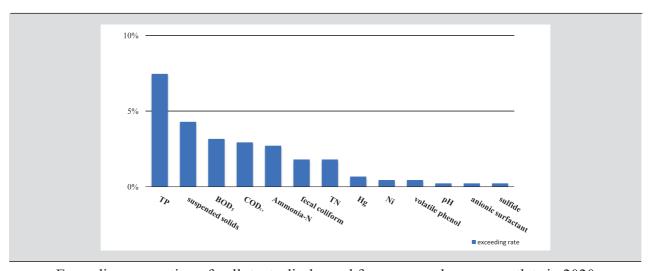


Proportion of sewage and major pollutants from different types of seaward sewage outlets in 2020

In some sewage outlets, content of suspended solids, BOD₅, COD_{Cr}, ammonia-N, fecal coliform, TN, mercury, nickel, volatile phenol, pH, anionic surfactant and sulfide failed to meet the water quality standard. Other pollutants did

not exceed the standard.

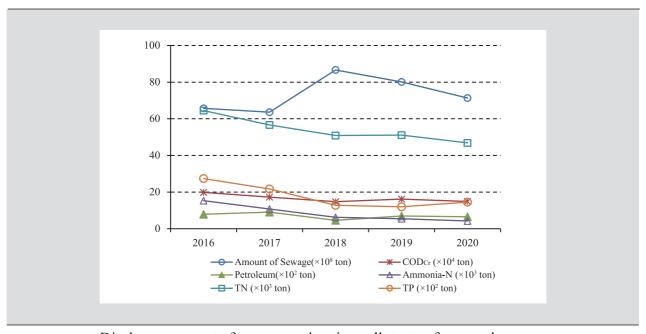
Among the four major sea areas, the East China Sea received the largest amount of sewage, followed by the South China Sea and the Yellow Sea.



Exceeding proportion of pollutants discharged from seaward sewage outlets in 2020

Compared with 2015, the total sewage discharge from outlets increased, while the discharge of main pollutants such as COD_{Cr} decreased. During the 13th Five-year Plan period, the total sewage discharge from outlets had a fluctuating increase

firstly, then decreased in 2019-2020 since peaking in 2018. The discharge of main pollutants like COD_{Cr} had a fluctuating decrease.



Discharge amount of sewage and major pollutants of seaward sewage outlets nationwide from 2016 to 2020

Total amount of sewage and major pollutants from sewage outlets received by different sea areas in 2020

Sea Area	Number of Sewage Outlets	Amount of Sewage ×10 ⁴ ton)	COD _{Cr} (ton)	Petroleum (ton)	Ammonia Nitrogen	TN (ton)	TP (ton)	Cr(VI) (kg)	Pb (kg)	Hg (kg)	Cd (kg)
Bohai Sea	57	82,897	9,551	76.0	209	2,185	75	111.2	5,803.5	50.0	176.5
Yellow Sea	77	117,566	27,647	185.2	618	9,564	194	1,086.2	1,401.8	160.6	44.4
East China Sea	165	376,512	77,261	299.0	2,055	24,835	391	709.0	811.0	124.0	245.1
South China Sea	143	136,019	34,441	89.7	1,373	10,281	794	246.8	6,084.6	47.7	126.5

Total discharge amount of sewage and major pollutants from sewage outlets into the sea in coastal provinces (autonomous regions and municipalities) in 2020

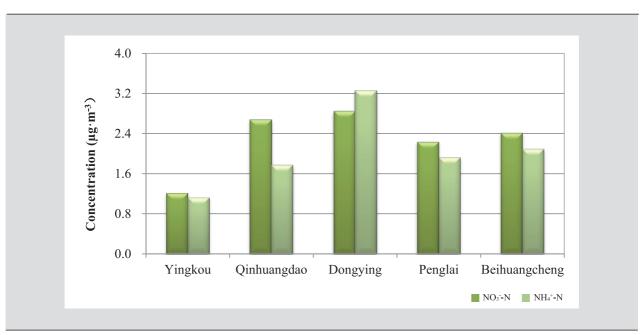
Province	Number of Sewage	Amount of Sewage	COD _{Cr} (ton)	Petroleum (ton)	Ammonia Nitrogen	TN (ton)	TP (ton)	Cr(VI) (kg)	Pb (kg)	Hg (kg)	Cd (kg)
Liaoning	25	41,691	6,400	85.1	144	2,978	64			1.9	0.8
Hebei	7	57,237	1,978	0.3	39	709	34	28.0	12.8	5.8	0.3
Tianjin	14	4,918	949	1.5	21	255	5		52.0	2.1	2.9
Shandong	68	90,547	26,060	154.4	583	7,357	152	1,096.9	6,890.5	195.4	190.7
Jiangsu	20	6,070	1,812	19.9	40	451	15	72.4	250.0	5.4	26.3
Shanghai	10	28,245	6,573	24.9	122	1,782	33		273.4	44.8	59.7
Zhejiang	100	209,630	55,927	198.9	1,291	17,898	238	403.6	492.4	74.6	179.3
Fujian	55	138,637	14,761	75.3	641	5,155	120	305.3	45.2	4.6	6.1
Guangdong	72	81,563	19,401	61.2	616	5,359	181	236.9	5,144.1	33.5	91.6
Guangxi	44	19,760	4,796	20.9	357	1,815	532	9.9	503.0	4.0	30.9
Hainan	27	34,696	10,245	7.5	400	3,106	80		437.5	10.1	4.0

3.3 Deposition of Atmospheric Pollutants

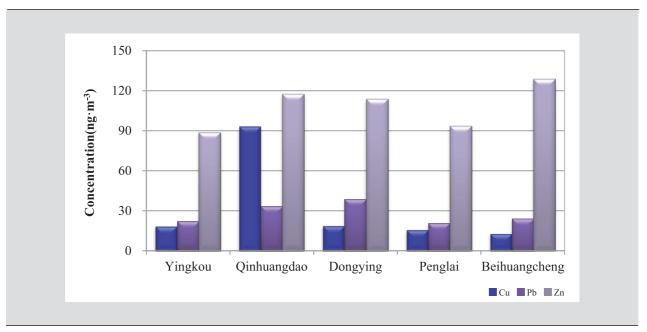
In 2020, marine atmospheric pollutant deposition was monitored at stations of Yingkou, Qinhuangdao, Dongying, Penglai and Beihuangcheng in the Bohai Sea.

Pollutants in Atmospheric Aerosols in the Bohai Sea The concentration of nitrate in aerosol was $1.2\sim2.8~\mu g/m^3$, with the highest value appearing at Dongying station and the lowest value appearing at Yingkou station. The concentration of ammonium was $1.1\sim3.3~\mu g/m^3$, with the highest

value appearing at Dongying station and the lowest value appearing at Yingkou station; The concentration of copper in aerosol was 12.9 ~93.0 ng/m³, with the highest value appearing at Qinhuangdao station and the lowest value appearing at Beihuangcheng station. The concentration of lead in aerosol was 20.7~38.6 ng/m³, with the highest value appearing at Dongying station and the lowest value appearing at Penglai station. The concentration of zinc in aerosol was 88.6~128.8 ng/m³, with the highest value appearing at Beihuangcheng station and the lowest value appearing at Yingkou station.



Concentrations of nitrate and ammonium in aerosols at various monitoring stations in the Bohai Sea in 2020

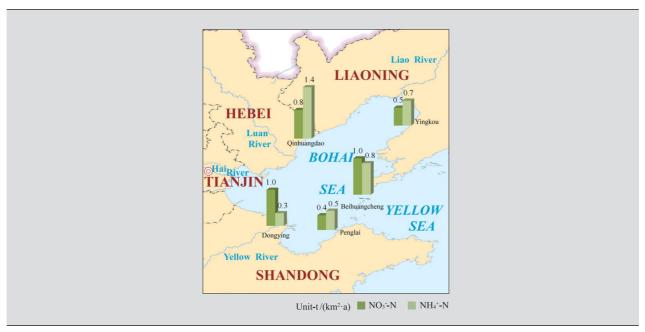


Concentrations of copper, lead and zinc in aerosol at various monitoring stations in the Bohai Sea in 2020

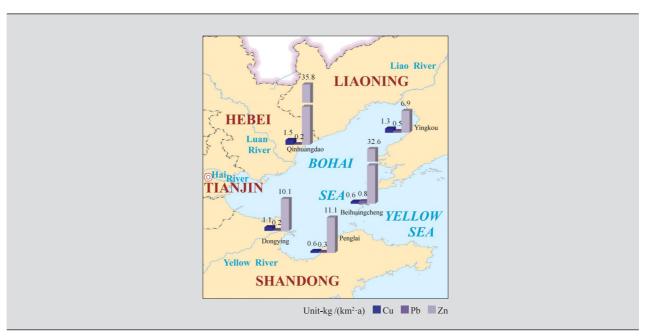
Compared with 2015, the monitored pollutants in atmospheric aerosols in the Bohai Sea declined in 2020, and concentrations of ammonium, nitrate, lead and copper decreased by 60.8%, 45.5%, 36.8%, and 2.9%, respectively. During the 13th Five-year Plan period, the concentrations of pollutants in atmospheric aerosols in the Bohai Sea trended to decline.

Wet Deposition Flux of Atmospheric Pollutants in the Bohai Sea The wet deposition flux of nitrate in the Bohai Sea was 0.4~1.0 t/(km²·a), with the highest value appearing at Beihuangcheng and Dongying station, and the lowest value appearing at Penglai station. The wet deposition flux of ammonium was 0.3~1.4 t/(km²·a), with

the highest value appearing at Qinhuangdao station, and the lowest value appearing at Dongying station. The wet deposition flux of copper was 0.6~1.5 kg/(km²·a), with the highest value appearing at Qinhuangdao station, and the lowest value appearing at Penglai and Beihuangcheng station. The wet deposition flux of lead was 0.2~0.8 kg/(km²·a), with the highest value appearing at Beihuangcheng station, and the lowest value appearing at Dongying and Qinhuangdao station. The wet deposition flux of zinc was 6.9~35.8 kg/(km²·a), with the highest value appearing at Qinhuangdao station, and the lowest value appearing at Yingkou station.

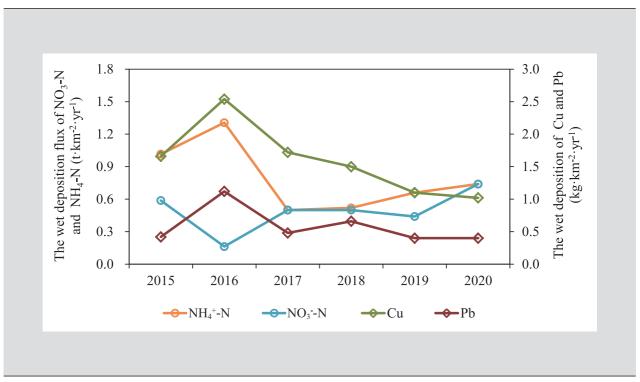


Wet deposition fluxes of nitrate and ammonium at various monitoring stations in the Bohai Sea in 2020



Wet deposition fluxes of copper, lead and zinc at various monitoring stations in the Bohai Sea in 2020

Compared with 2015, the overall wet deposition flux of atmospheric pollutants in the Bohai Sea decreased in 2020, and the wet deposition fluxes of copper, ammonium salt and lead decreased by 38.6%, 27.1% and 4.8%, respectively. During the 13th Five-year Plan period, the wet deposition flux of atmospheric pollutants in the Bohai Sea trended to decline.



Variation in wet deposition fluxes of atmospheric pollutants in the Bohai Sea from 2015 to 2020

3.4 Marine Litter and Microplastics

3.4.1 Marine Litter

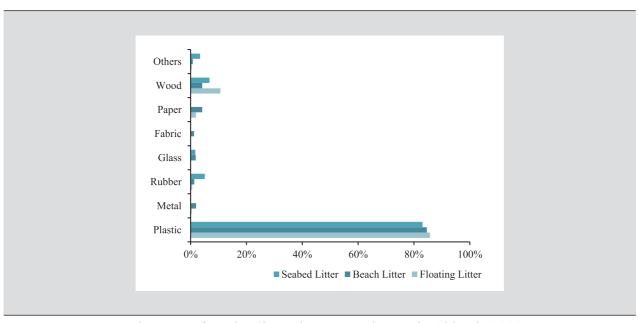
In 2020, marine litter was monitored in 49 coastal areas. The monitoring contents included the types and densities of litter in surface waters, on beaches, and on seabed.

Litter in Surface waters The average quantity density of floating litter by visual surveys was 27 items/km². The average quantity density of floating litter by trawling surveys was 5,363 items/km², with the average weight density of 9.6 kg/km². Plastics were the most common items and accounted for 85.7 % of the total amount, followed by wood, which accounted for 10.6%. Most plastic litters included foams, plastic

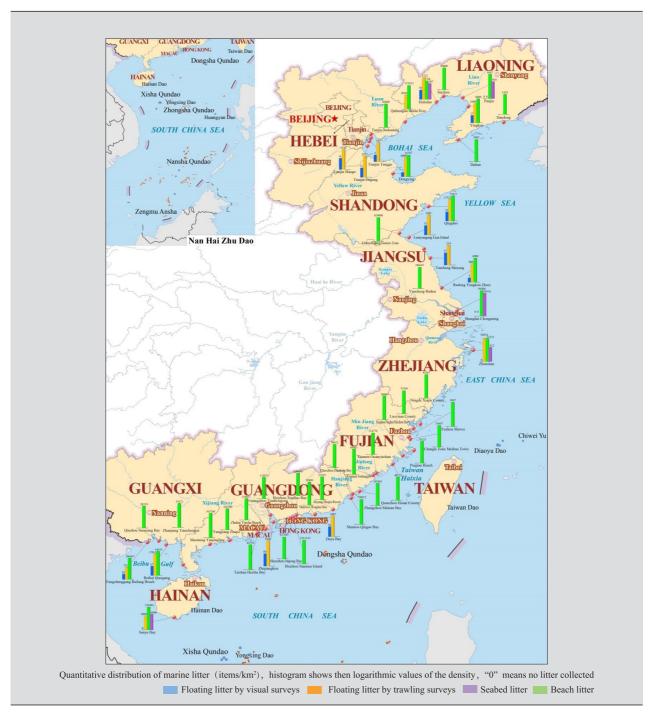
bottles, and fragments.

Beach Litter The average quantity density of beach litter was 216,689 items/km², with an average weight density of 1,244 kg/km². Plastics were the most common items and accounted for 84.6% of the total amount, followed by wood and paper, both accounting for 4.1%. Most plastic litters included cigarette filters, foams, fragments, and plastic products (such as bags, ropes, and caps).

Seabed Litter The average quantity density of seabed litter was 7,348 items/km², with an average weight density of 12.6 kg/km². Plastics were the most common items and accounted for 83.1% of the total amount, followed by wood, which accounted for 6.8%. Most plastic litters included ropes, fragments, and bags.



Main types of marine litter along coastal areas in China in 2020



Quantitative distribution of marine litter along coastal areas in China in 2020

During the 13th Five-year Plan period, the quantity density of marine debris in coastal areas were fluctuated.

3.4.2 Marine Microplastics

In 2020, microplastics in surface waters were monitored at 5 sections in the Yellow Sea, East China sea and South China sea.

The average density of microplastics in surface waters was 0.27 items/m³, and the highest density was 1.41 items/m³. The average densities of microplastics in the Yellow Sea, East China Sea

and South China Sea were 0.44 items/m³, 0.32 items/m³, and 0.15 items/m³ respectively. Most of the microplastics were fibers, flakes, fragments, and lines, and their components were mainly polyethylene terephthalate, polypropylene, and polyethylene.



Density distribution of marine microplastics in monitored surface waters in 2020

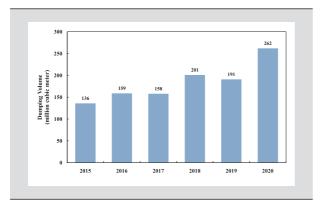
4 Environmental Status of Ocean Dumping Zones and Oil/Gas Exploration Zones

4.1 Ocean Dumping Zones

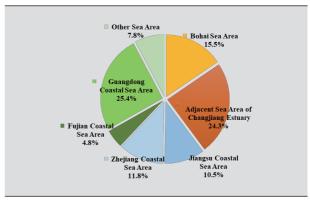
The total volume of waste and other matter for ocean dumping in 2020 amounted to 261.57 million m³, increasing by 37% compared with the previous year. The main dumping was cleansing and dredged materials. The water and sediment qualities in the dumping zones and their adjacent sea areas monitored met the environmental protection requirements for marine functional zones. The water depth as well as the water and the sediment qualities of the dumping zones remained stable compared with those in the previ-

ous year. The dumping did not have apparent impact on the ecology and environment of the adjacent sea areas and other marine activities.

Compared with 2015, the total volume of waste and other matter for ocean dumping nearly doubled. During the 13th Five-year Plan period, the total volume of waste and other matter for ocean dumping trended to increase. The dumping activities were mainly distributed in Yangtze Estuary and Guangdong Coast. The water depth and the ecological environment quality of the dumping zones and their adjacent sea areas remained basically stable.



Volume of waste and other matter dumped at seas of China from 2015 to 2020



Proportion of dumping volume at different sea areas in 2020



Distribution of dumping zones in 2020

4.2 Oil/Gas Exploration Zones

In 2020, the volumes of produced water, domestic sewage, drilling muds and drilling cutting discharged into seas from offshore oil/gas platforms were 217.23 million m³, 925,000 m³, 97,000 m³ and 141,000 m³ respectively. The volumes of produced water and domestic sewage discharged into seas slightly increased from those of the previous year. The volume of drilling muds discharged into seas remained basically the same as the previous year. The volume of drilling cutting discharged into seas decreased over last year.

The volumes of produced water and domestic sewage discharged into seas increased by 21.8% and 73.7% compared with those in 2015. The volumes of drilling muds and drilling cutting discharged into seas increased by 3.5 times and 2.1 times those of 2015, respectively.

During the 13th Five-year Plan period, the annual average volumes of produced water, domestic sewage, drilling muds and drilling cutting discharged into seas were 194.81 million m³, 805,000 m³, 63,000 m³ and 103,000 m³ respec-

tively. The volumes of produced water, domestic sewage and drilling muds discharged into seas trended an overall increase. The volume of drilling cutting discharged into seas declined since peaking in 2019.

In 2020, the marine environmental status of the offshore oil/gas exploration zones and their adjacent sea areas in the Bohai Sea were monitored. The results showed that the proportion of seawater meeting the Seawater Quality Standard Grade I decreased in the offshore oil/gas exploration zones and their adjacent sea areas of the Bohai Sea, where the mercury and cadmium content in seawater met the Seawater Quality Standard Grade I. In some offshore oil/gas exploration zones and their adjacent sea areas, COD or petroleum content in seawater did not meet the Seawater Quality Standard Grade II. The sediment quality reached Marine Sediment Quality Standard Grade I. Generally, the water and sediment qualities of the offshore oil/gas exploration zones and their adjacent sea areas basically met the environmental protection requirements for the marine functional zones.

Volume of pollutants discharged into seas from offshore oil/gas platforms from 2015 to 2020

Compared with 2015, COD, petroleum and cadmium content in seawater in the offshore oil/gas exploration zones of the Bohai Sea remained stable overall, while mercury content significantly decreased. The sediment qualities remained stable.

During the 13th Five-year Plan period, the marine environmental quality in the offshore oil/gas

exploration zones of the Bohai Sea remained stable overall, which met the environmental protection requirements for the marine functional zones. On the whole, the proportion of seawater meeting the Seawater Quality Standard Grade I in the offshore oil/gas exploration zones and their adjacent sea areas of the Bohai Sea trended to increase.

5 Environmental Quality of Marine Fishery Areas

In 2020, monitoring programs were implemented in 39 fishery areas, including spawning grounds, feeding grounds, migration routes, aquaculture areas, aquatic reserves and aquatic germplasm resources reserves as well as 60 coastal fishing ports, covering 5.488 million hectares.

The dominant pollution indicators that exceeded the seawater quality standards were inorganic nitrogen and active phosphate in important fishery areas, including spawning grounds, feeding grounds, migration routes and aquatic reserves. The proportions of areas meeting the seawater quality standards for content of inorganic nitrogen, active phosphate, petroleum, and COD accounted for 23.2%, 41.1%, 95.2% and 85.4% of the total monitored areas respectively. Compared with the previous year, the proportions of areas with exceeding inorganic nitrogen, active phosphate and petroleum increased, while which with exceeding COD decreased.

The dominant pollution indicator that exceeded the standard in the water bodies of the key marine aquaculture areas was inorganic nitrogen. The proportion of water areas meeting the standard value for content of inorganic nitrogen, active phosphate, petroleum and COD were 53.4%, 66.8%, 89.9% and 99.4% of the total monitored areas respectively. Compared with the previous year, the proportions of areas with exceeding petroleum increased, while which with exceeding

organic nitrogen, active phosphate and COD decreased.

The total monitored area for 7 National Aquatic Germplasm Resources Conservation Areas (marine) was 281,000 hectares. The dominant pollution indicator was inorganic nitrogen. The proportion of areas meeting the standard value for content of inorganic nitrogen, active phosphate, petroleum, and COD were 20%, 55.2%, 86.3% and 82.1% of the total monitored areas respectively.

Sediments in the 26 key marine fishery areas were in Good condition. The proportions of areas meeting the standards for content of petroleum, copper, zinc, lead, cadmium, mercury, arsenic and chromium, accounted for 99.8%, 98.5%, 99.6%, 100%, 98.4%, 100%, 100% and 90.0% of the total monitored areas respectively.

Among 60 monitored coastal fishing port along the Yellow-Bohai Sea, East Sea and South China Sea, the proportion of fishing ports with content of inorganic nitrogen, active phosphate, COD and petroleum meeting the standard value were 60.0%, 65.0%, 91.7% and 96.7%, respectively. The proportions of fishing ports meeting the standards for content of petroleum, copper, zinc, lead, cadmium, mercury, arsenic and chromium in sediment accounted for 91.4%, 94.9%, 100%, 98.3%, 100%, 100%, 100% and 100%, respectively.

6 Red Tide and Green Tide

6.1 Red Tide

A total of 31 red tide events were recorded in sea areas under jurisdiction of China, with a cumulative area of 1,748 km², including 2 events of toxic red tides observed in Tianjin Coast and Shenzhen Bay of Guangdong separately with a cumulative area of 81 km².

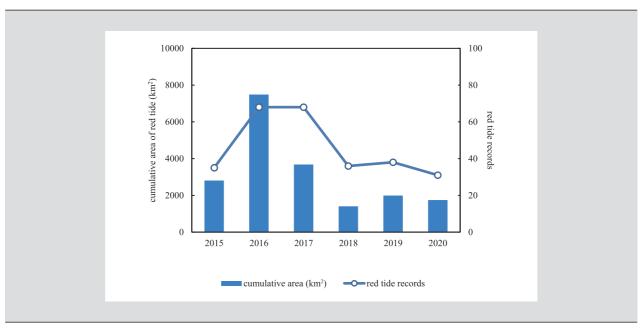
Red tides recorded in sea areas under jurisdiction of China in 2020

Province	Time	Sea Area	Dominant Species	Toxicity	Cumulative Area(km²)
Zhejiang	April 28 — May 20	Nanji—Dongtou— East Wenling	Prorocentrum donghaiense	No	380
Zhejiang	April 29— May 27	Shipu—Yushan	Prorocentrum donghaiense	No	380
Guangdong	May 3-5	Shenzhen Bay	Heterosigma akashiwo (Toxic) Skeletonema costatum	Yes	6
Zhejiang	May 14—19	South Pishan of Yuhuan, Taizhou	Prorocentrum donghaiense	No	110
Zhejiang	May 14—19	Southeast Mt Jigu of Wenling	Prorocentrum donghaiense	No	100
Zhejiang	August 14—18	East Is Zhujiajian	Rhizosolenia setigera	No	300
Tianjin	August 21 — November 12	Coastal area of Tianjin	Skeletonema costatum Cochlodinium polykrikoides (Toxic) Scrippsiella trochoidea Ceratium furca Akashiwo sanguinea Pseudo-nitzschia delicatissima Pseudo-nitzschia pungens	Yes	75

^{*}Listed only red tides events of toxic or exceeding 100km² for cumulative area

During the 13th Five-year Plan period, both the recorded events and cumulative area of red tide

trended to decline.



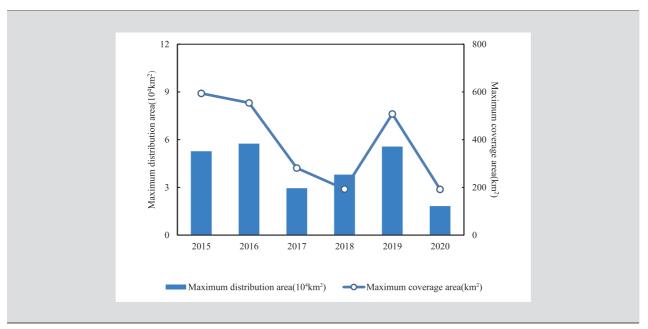
Records of the frequency and cumulative area of red tide events from 2015 to 2020

6.2 Green Tide

A green tide event with the dominated algae of *Ulva prolifera* occurred in the Yellow Sea during April to July 2020 and reached the maximum distribution area as 18,237 km² and maximum coverage area as 192 km² on June 23 and

15, respectively.

Compared to the average of recent 5 years, the distribution area of *Ulva prolifera* Tide in 2020 decreased by 54.9%, with the maximum biomass of which decreased from 1.508 million tons to 0.68 million tons and the sustaining time decreased by 30 days.



Maximum distribution and coverage areas of *Ulva prolifera* tides in the Yellow Sea from 2015 to 2020

7 Actions and Measures

7.1 Remarkable results have been achieved in the battle for comprehensive management of the Bohai Sea

Resolutely implement the decision and deployment by the CPC Central Committee and the State Council to "win the battle against pollution prevention", establish and improve the ecological environment governance and supervision mechanism of land and sea coordination from high to low, and departmental coordination, and also work together to win the battle against the comprehensive control of the Bohai Sea. Promote breakthrough progress in improving the ecological environment quality of the Bohai Sea.

The five core objectives and tasks of the comprehensive management of the Bohai Sea have been successfully concluded. In 2020, the proportion of good water quality (Grade I and II) in the coastal waters of the Bohai Sea reached 82.3% (73% as the target), increased by 4.4% compared with 2019. Water qualities inferior to Category V of the 10 national monitoring sea-entering river sections in the "Inferior Wiping" action plan were all eliminated. The inspection and remediation of the sewage outlets into the sea achieved "should and done", and over 18,000 sewage outlets into the sea were found. By the end of December, the scale of coastal wetland restoration reached 8,891 hectares (no less than 6,900 hectares as the target), and the remediation and restoration of the coastline reached 132 kilometers (70 kilometers as the target).

Major breakthroughs have been made in land-source pollution control, which has achieved full coverage monitoring of more than 140 main sea-entering rivers around the Bohai Sea. No national sections of sea-entering rivers were inferior to category V on average, except one (Wuli River) which was dried off. The "1+12" coastal cities have basically achieved full coverage of fixed pollution source discharge permits, and monitored industrial direct-discharged sea pollution sources with daily discharges of more than 100 tons achieved stable discharge up to standards.

The classification and management of pollution sources in the sea area is progressing in an orderly manner. Cleanup of illegal and non-compliance with zoning control requirements of marine aquaculture and upgrading of environmental protecting floater for marine aquaculture have been completed. A thorough investigation of the Bohai Fishing Port as well as the construction of facilities for ship pollutant receiving, transshipping and disposal have been accomplished. A "marine sanitation" system was established in all coastal cities to promote the formation of a long-term mechanism for the treatment and supervision of marine litter pollution.

Ecological protection and restoration actions have taken effect. Multi-departmental joint supervision and inspection and special law enforcement actions were carried out. Sea reclamation was strictly controlled, and illegal sea sand mining as well as other illegal use of sea were severely cracked down. The protection and restoration of marine fishery resource strengthened, while the total number of marine fishing motorized fishing vessels and total power decreased by 21.4% and 12.9% respectively. In 2020, three provinces and one city around the Bohai Sea proliferated and released 19.7 billion units of aquatic species seedlings, and created 11 national marine pasture demonstration areas among Bohai region. Continue to carry out the supervision and regular scheduling of the Bohai Sea wetland and shoreline restoration projects, and exceeded the target of restoration.

The investigation and remediation of marine environmental risks proceeded smoothly. Environmental emergency risk assessment and environmental emergency response plan filing were completed for more than 7,800 companies involving hazardous chemicals and heavy metals. Regional environmental emergency risk assessment and government environmental emergency response plan revision basically were completed. Special inspections of risks such as offshore oil platforms, oil and gas pipelines, and land terminals was completed, the oil spill risk assessment completed for Bohai offshore oil exploration and development, and the construction of the national offshore oil fingerprint database was initiated. In addition, the third pilot marine pollution baseline survey was launched in Liaodong Bay.

7.2 Reinforce supervision of marine engineering and ocean dumping

In 2020, MEE strictly supervised the environmental access of marine engineering projects, and firmly implemented the mandate of complete prohibition of sea reclamation except for national major projects. The efficiency of review and approval process for environment impact assessment (EIA) for marine engineering was improved, and green passage was established to expedite the approval process for national major projects. Provisions of the Ministry of Ecology and Environment on the Approval Procedures for Environment Impact Report (Form) on Construction Projects were issued, thereby optimizing the EIA approval procedures for marine engineering. Classified Administration Catalogue of Environment Impact Assessment for Construction Projects was released as well, adding marine ecological restoration as new EIA project type and reinforcing supervision of mariculture, sewage disposal project, etc.

Ocean dumping supervision and public services were strengthened. 8 additional dumping zones were approved and established. Capacity assessments were carried out for dumping zones. Therefore, construction and operation of port and shipping projects were guaranteed. New technologies such as AIS and satellite remote sensing were deployed to strengthen the off-site supervision of marine ecology and environment in particular for offshore oil exploration and exploitation and sea reclamation projects.

7.3 Strengthening ecological protection and restoration of coastal wetlands

The first is to strengthen the protection and restoration of mangroves. The Ministry of Natural Resources and the State Forestry and Grassland Administration jointly issued Special Action Plan for Mangroves Protection and Restoration (2020-2025) (Natural Resources Development [2020] No.135). The second is to organize local governments to complete the ecological restoration mission of the comprehensive management of the Bohai Sea. The third is to actively implement the requirements of the third meeting of the Central Finance and Economics Committee, and to steadily promote coastal protection and restoration projects. The Ministry of Natural Resources, the Ministry of Water Resources, the National Development and Reform Commission, and the Ministry of Finance jointly issued Coastal Zone Protection and Restoration Project Work Plan (Natural Resources Office [2020] No. 509). To strengthen the construction of technical standards, 21 technical standards were compiled for the investigation and assessment of coastal ecosystems such as mangroves, salt marshes, coral reefs, seagrass beds, as well as ecological disaster reduction and restoration, all of which are issued and implemented in the form of group standards.

7.4 Control reclamation strictly

The first is to strengthen the supervision of suspected illegal encirclement and reclamation. The Ministry of Natural Resources organizes resource departments at all levels to carry out high-frequency supervision by comprehensively using varying supervision methods, promptly discovering, stopping and transferring cases of suspected illegal use of sea, regularly publicly reporting suspected illegal use of sea, and large-scale illegal reclamation nationwide activities have been effectively curbed.

The second is to strictly review the newly added reclamation projects. In accordance with Notice of the State Council on Strengthening the Protection of Coastal Wetlands and Strict Management and Control of Enclosure and Reclamation" (Guo Fa [2018] No. 24), to adhere ecological priority, conservation and intensiveness, new projects were strictly reviewed involving sea reclamation and land reclamation, and maximize control of reclamation sea area. In 2020, the Ministry of Natural Resources, together with the National Development and Reform Commission, reviewed and approved two additional reclamation projects, which are the Shenzhen Airport Third Runway Expansion Project, and the first phase of the China General Nuclear Power Group Zhejiang San'ao Nuclear Power Plant.

The third is to guide and urge local governments to carry out the ecological protection and restoration of the problem areas left over by the reclamation history. In accordance with the solutions to the historical problems left over from the sea reclamation filed by the Ministry of Natural Resources, the natural resources (marine) authorities of coastal provinces (autonomous regions and municipalities) resolutely demolish those that have severely damaged the marine ecological environment; for those that have no significant impact on the marine ecological environment, natural restoration was adhered to be the major implement while artificial restoration as the auxiliary. Accelerate the ecological protection and restoration measures such as dyke removal, shoreline restoration, island restoration, coastal wetland restoration, and ecological seawall construction.

7.5 Steadily promote the protection and restoration of fishery resources

First, the fishery resource protection system further improved. In order to strengthen the protection of fishery resources, the management was further regulated for special fishing in the ocean, and issued a notice on special fishing permits and fishing auxiliary vessel permits during the summer of 2020. The first implementation of special franchised fishing for prawns has

achieved good results. Organization and implement quota fishing pilot projects continued, and the goal of all coastal provinces to carry out quota fishing pilot projects was achieved.

Second, the benefits of proliferation and release of aquatic organisms are prominent. In 2020, driven by central funds, more than 1.1 billion Yuan were invested by all localities on proliferation and releasing funds, carrying out more than 2,500 proliferation and releasing activities, and releasing more than 43.0 billion units of aquatic biological seedlings. Among them, 545 million Yuan was invested in the release of marine species, and 31.8 billion units of marine aquatic species such as swimming crabs, prawns, flounders, and red snappers were released. While achieving good ecological and economic benefits, it has received extensive attention and positive responses from all walks of life.

Third, the construction of marine ranches is progressing steadily. In 2020, 26 national-level marine pasture demonstration areas were built, and the total number of national-level marine pasture demonstration areas reached 136. Annual evaluation of 42 national marine ranch demonstration areas was completed. The marine ranch construction expert advisory committee established the first batch of 29 scientific and technological team workstations. They guided and released 6 group standards for marine ranch, including Technical Specification for Quality Evaluation of Artificial Reef Construction Projects. Pilot projects were supported for the construction of modern marine pastures in Shandong and Hainan.

Data Sources and Explanations for Assessment

The Bulletin of the Marine Ecology and Environment Status of China in 2020 was jointly compiled by the Ministry of Ecology and Environment, Ministry of Natural Resources, Ministry of Transport and Ministry of Agriculture and Rural Affairs, and National Forestry and Grassland Administration. The Bulletin was published by the Ministry of Ecology and Environment.

In 2020, data on marine environmental quality, marine ecological status, status of main pollution sources into the sea, environmental status of ocean dumping zones and oil/gas exploration zones were provided by the Ministry of Ecology and Environment. Data on red tide and green tide were provided by the Ministry of Natural Resources. Data on the environmental quality of marine natural fishery areas were provided by the "National Fishery Ecological Environment Monitoring Network" led by the Ministry of Agriculture and Rural Affairs. Data on oil spills from ships, marine fishery eco-environment protection and management, and marine nature reserves construction and management, were provided by the Ministry of Transport, the Ministry of Agriculture and Rural Affairs and National Forestry and Grassland Administration respectively.

The assessment of the seawater quality and eutrophication status of the sea areas under jurisdiction of China was based on the data collected from national monitoring sites in the summer. Indicators to measure the water quality include inorganic nitrogen (nitrite, nitrate, ammonia nitrogen), active phosphate, petroleum, COD, pH. Indicators to assess eutrophication status include COD, inorganic nitrogen and active phosphate. The overall assessment is based on *Seawater Quality Standard (GB 3097-1997)*, and the methodology adopted is guided by *The Technical Regulations for Seawater Quality Evaluation (Trial) (Marine Environmental Character No. 25 [2015])* and *Specification for offshore environmental monitoring (HJ 442-2020)*.

The assessment of the water quality of nearshore sea areas and major gulfs was based on the data collected from national monitoring sites in the spring, summer and autumn. The assessment indexes include pH, DO, COD, inorganic nitrogen, active phosphorus, petroleum, copper, mercury, cadmium and lead. The evaluation was based on *Seawater Quality Standard (GB 3097-1997)*, and *Technical Regulations for Seawater Quality Evaluation (Trial) (Marine Environmental Character No. 25 [2015])*

The assessment of marine sediments quality was based on the data collected from national monitoring sites in summer. The assessment indexes include sulfide, petroleum, organic carbon, mercury, cadmium, lead, arsenic, copper, zinc, chromium, DDTs and PCBs as required indicators and HCHs as optional. The evaluation was

based on Technical Regulations for Marine Sediment Quality Evaluation (Trial) (Marine Environmental Character No. 26 [2015]) and Specification for offshore environmental monitoring (HJ 442-2020).

The evaluation of the radioactivity level of the marine environment is based on monitoring data from the coastal waters of China, the surrounding waters of nuclear power plants and the waters of the Western Pacific. The evaluation indicators include: uranium, thorium, radium-226, tritium, strontium-90, cesium-137, and gamma spectrum analysis (including cesium-134, manganese-54, zirconium-95 and other artificial radionuclides) in seawater; potassium-40, radium-226, tritium, carbon-14, strontium-90, cesium-137 and gamma spectrum analysis (including cesium-134, manganese-54, zirconium-95 and other artificial radionuclides) in marine organism; and strontium-90 and gamma spectrum analysis (including cesium-134, manganese-54, zirconium-95 and other artificial radionuclides) in submarine sediments and intertidal soils. The evaluation is based on Seawater Quality Standards (GB 3097-1997) and Restricted Concentration Standards of Radioactive Substances in Foods (GB 14882-1994), using comparative analysis methods for evaluation.

The assessment indexes of the water quality of ocean beaches include fecal coliform, flotsam, petroleum, color, smell and taste, and red tide. The assessment method was based on *Seawater Quality Standard (GB 3097-1997)*, and *Guideline for Marine Bathing Beach Monitoring and*

Assessment (HY/T 0276-2019) .

The typical marine ecosystem health assessment is conducted based on its monitoring data. The estuary, bay and mudflat ecosystems were monitored during July to September, and the coral reef, mangrove and seagrass bed ecosystems monitored during April to September. The health assessment of typical marine ecosystems was based on the following five indicator categories: water environment, sediment environment, biological toxical residue, habitat and biological community. These categories could be used to evaluate the health status of typical ecosystems, including the estuary, bay, mudflat and coral reef, mangrove and seagrass bed. The assessment method was based on The Specifications for Marine Survey (GB/T 12763-2007), the Specifications for Marine Monitoring (GB 17378-2007), and the Guidance for the Assessment of Coastal Marine Ecosystem Health (HY/T 087-2005). The status of coastal wetlands including change in area is monitored through satellite remote sensing, with data collected from remote sensing images with a resolution higher than 2 meters. Information is extracted based on the 7th Chapter of Technical Specifications on Marine Monitoring on Satellite Remote Sensing Technology and Methodology (HY/T 147.7-2013).

The assessment indexes of the protection target in marine natural reserve include species of waterbirds, density and biomass of lancelet, amount of Chinese white dolphin, species of mangroves, coverage of living coral and area of shell bank, using comparative analysis methods for evaluation with date monitored this and last year. The assessment method was based on *Technical Criterion for Ecosystem Status Evaluation(HJ* 192-2015).

The assessment indexes of coastal wetland include wetland area, species of birds and species of plants. The assessment method was based on Technical specification for coastal wetland eco-monitoring (HY/T 080-2005), the 7th Chapter of Technical Specifications on Marine Monitoring on Satellite Remote Sensing Technology and Methodology (HY/T 147.7-2013), Technical guidelines for biodiversity monitoring-birds (HJ 710.4-2014), **Technical** specification eco-monitoring of mangrove ecosystem (HY/T 081-2005) and Technical guidelines for biodiversity monitoring—terrestrial vascular plants (HJ 710.1-2014).

The seawater quality evaluation indexes of sea-entering rivers include pH, DO, permanganate index, COD, BOD₅, ammonia nitrogen, TP, copper, zinc, fluoride, selenium, arsenic, mercury, cadmium, hexavalent chromium, lead, cyanide, volatile phenol, petroleum, anionic surfactant and sulfide. Evaluation was conducted according to Environmental Quality Standards for Surface Water (GB 3838-2002) and Assessment of Environmental Quality for Surface Water (Trial) (Marine Environmental Character No. 22 [2011]).

The evaluation indexes of water pollution sources directly discharged into the sea include all indicators applied to the current regulation over sewage outlets. The evaluation was conducted according to the standards of corresponding sewage outlets. The evaluation indexes of marine atmospheric pollutant deposition include nitrate, ammonium, copper, lead and zinc. The evaluation was conducted based on *Technical Specifications for Assessment of Atmospheric Deposition Flux of Pollutants to Maritime Areas (Trial) (Marine Environmental Character No. 30 [2015])*.

The environmental assessment for marine litter was based on *Technical Regulations for Monitoring and Evaluating Marine Debris (Trial)* (Marine Environmental Character No. 31 [2015]). The environmental assessment for marine microplastics was based on *Technical Regulations for Monitoring Marine Microplastics (Trial)* (Marine Environmental Character No. 13 [2016]).

The environmental assessment for marine dumping zones covers water depth, water quality, sediment quality, and benthic organisms. The assessment was based on Seawater Quality Standard (GB 3097-1997), Marine Sediment Quality (GB 18668-2002), National Marine Functional Zoning (2011–2020), Technical Directives for the Division of Marine Functional Zonation (GB/T 17108-2006) and Technical Regulations for Monitoring Marine Dumping Areas.

The environmental assessment for the offshore oil/gas exploration zones covers petroleum, COD, mercury, and cadmium in seawater and organic carbon, petroleum, mercury, and cadmium in sediment. The assessment was based on the *Technical Guidelines for Environmental Impact Assessment of Marine Engineering (GB/T 19485-2014)*, National Marine Functional Zoning (2011–2020), Technical Directives for the Division of Marine Functional Zoning (GB/T

17108-2006), Seawater Quality Standard (GB 3097-1997) and Marine Sediment Quality (GB 18668-2002).

The water quality assessment indicators for important marine fishery waters include petroleum, non-ionic ammonia, volatile phenol, copper, zinc, lead, cadmium, mercury, chromiumand arsenic. The assessment was based on *Fisheries Water Quality Standards (GB 11607-1989)* Those indicators that are not included in the mentioned Standards are assessed based on *Marine Water Quality Standards (GB 3097-1997)*. Assessment over the conditions of spawning

grounds and feeding grounds for fish and shrimp, aquatic biological nature reserves and aquatic germplasm resource protected areas Grade I standard and other regions followed Grade II standard.

The national statistics used in this bulletin does not include those of Taiwan Province, Hong Kong Special Administrative Region and Macao Special Administrative Region, except those data on administrative division and national territory area.

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Contributors to the 2020 Bulletin of the Marine Ecology and Environment Status of China

Ministry of Ecology and Environment

Ministry of Natural Resources

Ministry of Transport

Ministry of Agriculture and Rural Affairs

National Forestry and Grassland Administration