Supplement

Cargo ($R^2 = 0.8726$); Tanker ($R^2 = 0.9148$); Passenger ($R^2 = 0.8794$); Dredger ($R^2 = 0.9482$); Tug (Length ≤ 40m) ($R^2 = 0.9625$); Tug (Length > 40m); Patrol ($R^2 = 0.9349$); Others ($R^2 = 0.8458$). Main engine power (kW) versus L^2V^3.
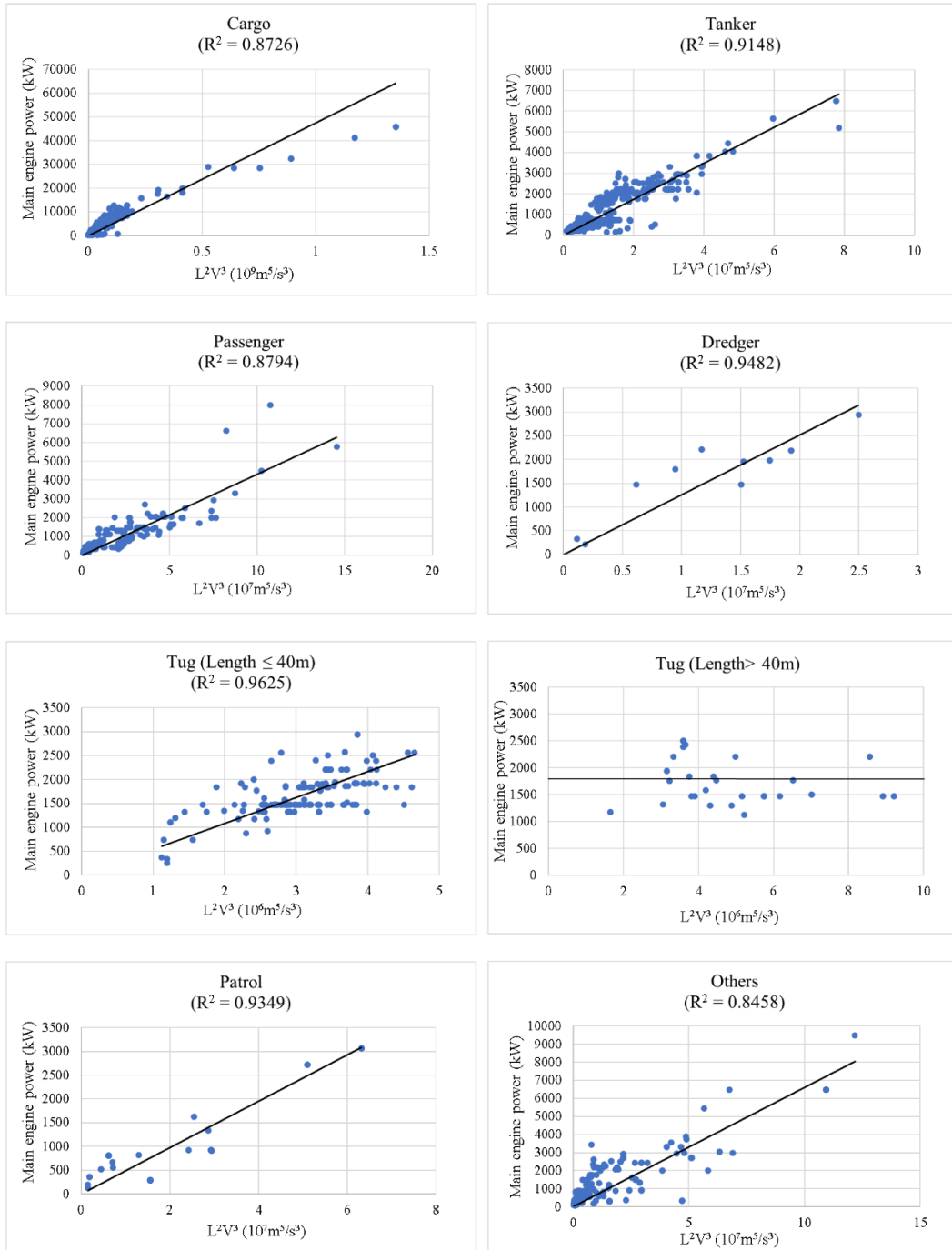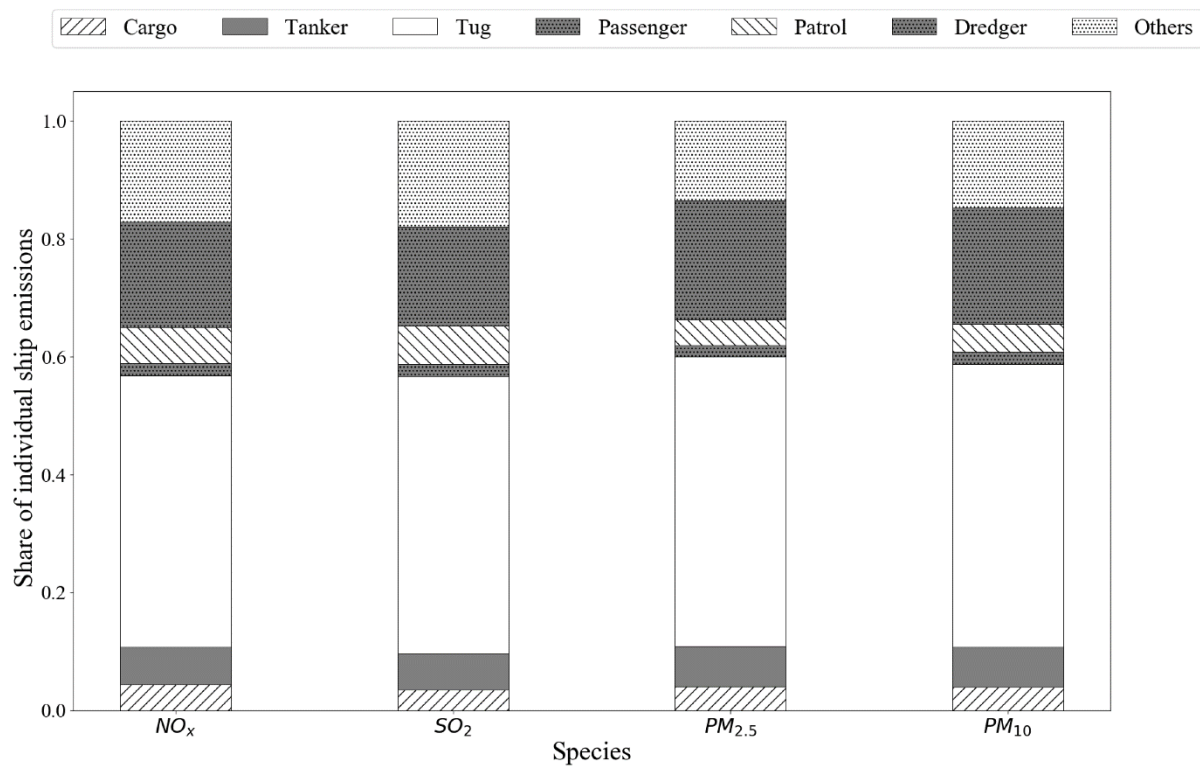
Figure S1. Fitted linear relationship between main engine power and the square of the vessel's length multiplied by the cube of the real-time speed (y-axis gives the main engine power, x-axis shows $L^2 \times v_{MAX}^3$).

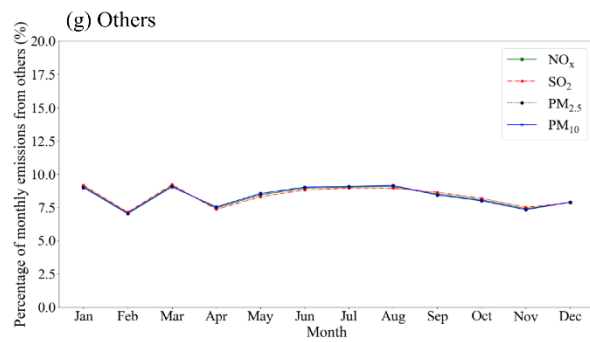**Figure S2. Individual ship emissions of four pollutant species for different types of ships**
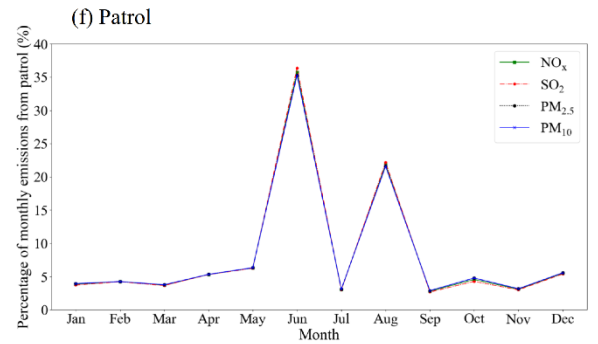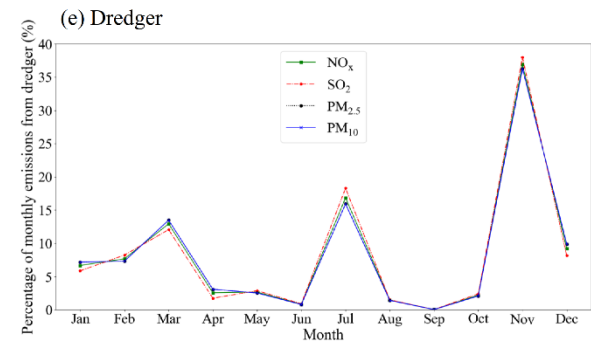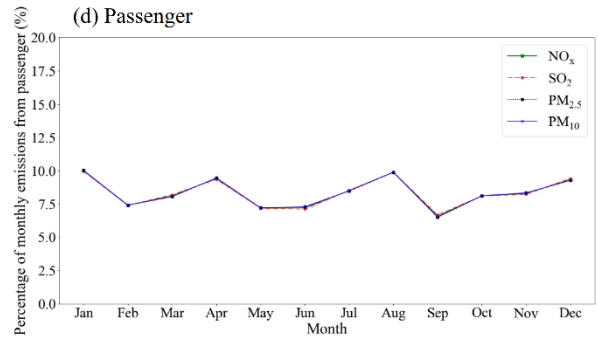
(a) Cargo

(b) Tanker

(c) Tug

(d) Passenger
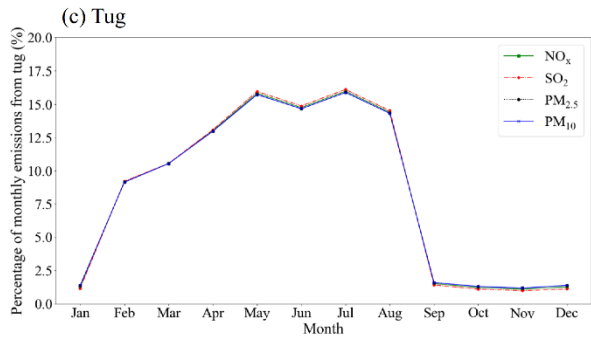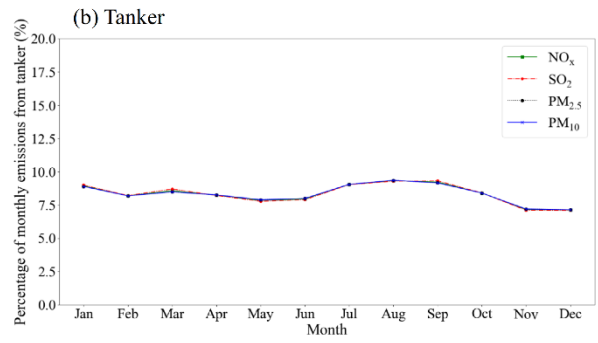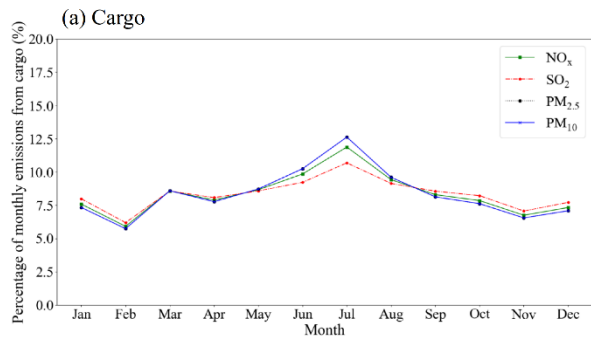
(e) Dredger

(f) Patrol

(g) Others

Figure S3. Monthly changes in the emissions from different types of ships
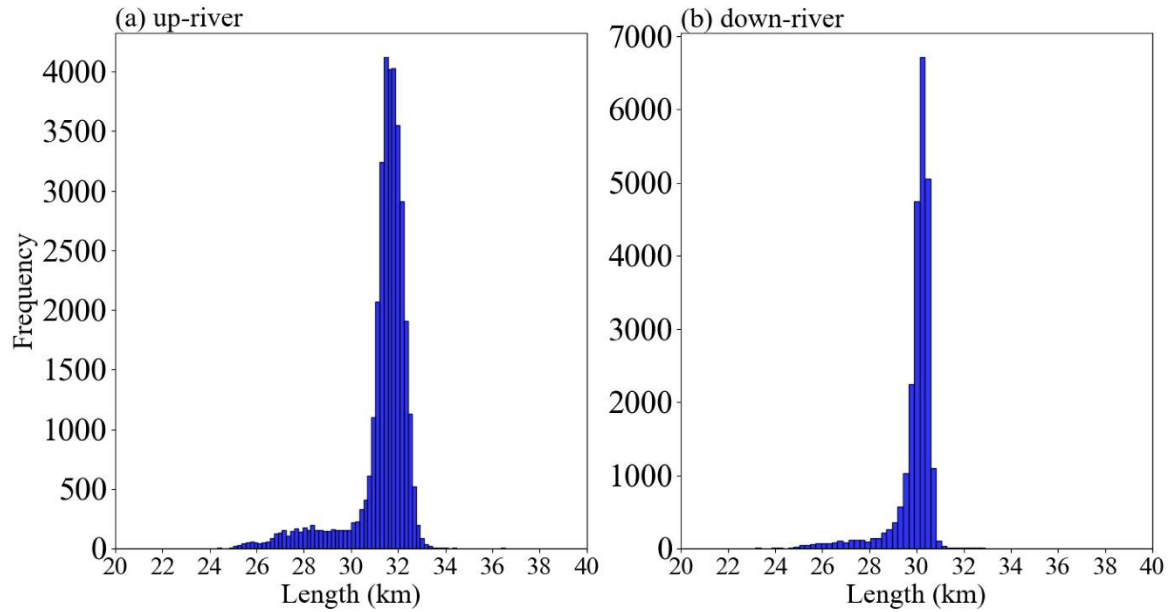
Figure S4. Vessel distance sailing frequency charts derived from AIS for downstream and upstream directions

Table S1. Low load adjustment multipliers (f_{LLAM}) for main engine emission factors

Load	NO_x	SO_2	$PM_{2.5}$	PM_{10}
0.01	11.47	1	19.17	19.17
0.02	4.63	1	7.29	7.29
0.03	2.92	1	4.33	4.33
0.04	2.21	1	3.09	3.09
0.05	1.83	1	2.44	2.44
0.06	1.6	1	2.04	2.04
0.07	1.45	1	1.79	1.79
0.08	1.35	1	1.61	1.61
0.09	1.27	1	1.48	1.48

0.10	1.22	1	1.38	1.38
0.11	1.17	1	1.3	1.3
0.12	1.14	1	1.24	1.24
0.13	1.11	1	1.19	1.19
0.14	1.08	1	1.15	1.15
0.15	1.06	1	1.11	1.11
0.16	1.05	1	1.08	1.08
0.17	1.03	1	1.06	1.06
0.18	1.02	1	1.04	1.04
0.19	1.01	1	1.02	1.02
0.20	1	1	1	1

Table S2. Ship traffic volume in each month from September 2018 to August 2019 (Unit: Ships)

Types	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cargo	48834	35154	51960	50698	53759	47567	48372	46242	46524	47137	44777	49989
Tanker	8577	7091	8082	8299	7925	7809	8419	8237	7855	7995	8211	8388
Passenger	706	695	718	708	672	635	603	540	744	623	650	677
Tug	1007	943	1137	1012	1049	1075	1018	984	938	988	946	1031
Dredger	71	5	58	75	23	5	12	5	1	7	39	45
Patrol	541	479	478	457	478	423	429	417	450	506	472	522
Other	933	655	1008	981	1006	882	909	906	848	897	877	1030
Total	60669	45022	63441	62230	64912	58396	59762	57331	57360	58153	55972	61682