

Litter Index Calculations for the Baltic Sea.

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1 Data

The data have been analyzed in R using [3] and [1]. The number of litter items have not been recorded for all hauls historically (only weight). The models using numbers and probability of encounter (which are derived from the models using numbers) are thus based on smaller data sets. The number of hauls available for both types of response are listed in the tables below.

	1	4
2011	95	99
2012	152	182
2013	202	168
2014	151	180
2015	209	201
2016	238	205
2017	268	215
2018	302	286
2019	302	210
2020	289	272
2021	316	277

Table 1: Weight: Number of hauls by year and quarter

	DE	DK	EE	LT	LV	PL	RU	SE
2011	0	194	0	0	0	0	0	0
2012	51	203	0	0	0	0	0	80
2013	104	192	0	0	0	0	0	74
2014	115	146	0	0	0	0	0	70
2015	107	169	9	2	14	31	0	78
2016	116	95	10	10	41	95	0	76
2017	108	91	10	11	49	136	0	78
2018	111	205	10	9	56	118	16	63
2019	98	157	6	12	44	127	0	68
2020	108	222	8	12	37	106	0	68
2021	103	235	7	0	43	119	14	72

Table 2: Weight: Number of hauls by year and country

	DE	DK	EE	LT	LV	PL	RU	SE
TVL	0	998	0	0	284	732	30	727
TVS	1021	911	60	56	0	0	0	0

Table 3: Weight: Number of hauls by gear and country

	1	4
DE	508	513
DK	973	936
EE	0	60
LT	28	28
LV	155	129
PL	377	355
RU	30	0
SE	453	274

Table 4: Weight: Number of hauls by country and quarter

	1	4
2012	42	121
2013	105	63
2014	97	75
2015	97	139
2016	228	196
2017	245	169
2018	289	265
2019	296	210
2020	289	254
2021	316	263

Table 5: Numbers: Number of hauls by year and quarter

	DE	DK	EE	LT	LV	PL	RU	SE
2012	51	52	0	0	0	0	0	60
2013	104	0	0	0	0	0	0	64
2014	115	0	0	0	0	0	0	57
2015	107	15	9	3	14	31	0	57
2016	116	95	10	10	41	95	0	57
2017	108	91	10	11	49	67	0	78
2018	111	205	10	9	56	84	16	63
2019	98	157	6	12	44	121	0	68
2020	108	204	8	12	37	106	0	68
2021	103	221	7	0	43	119	14	72

Table 6: Numbers: Number of hauls by year and country

	DE	DK	EE	LT	LV	PL	RU	SE
TVL	0	648	0	0	284	623	30	644
TVS	1021	392	60	57	0	0	0	0

Table 7: Numbers: Number of hauls by gear and country

	1	4
DE	508	513
DK	533	507
EE	0	60
LT	28	29
LV	155	129
PL	335	288
RU	30	0
SE	415	229

Table 8: Numbers: Number of hauls by country and quarter

	Litter name	C.TS	C.TS.REV	Type	SUP	Fishing.related
1	Plastic	A	A	Plastic		
2	Plastic bottle	A1	A1	Plastic	Yes	
3	Plastic sheet	A2	A2	Plastic	Yes	
4	Plastic bag	A3	A3	Plastic	Yes	
5	Plastic caps	A4	A4	Plastic	Yes	
6	Plastic fishing line (monofilament)	A5	A5	Plastic		Yes
7	Plastic fishing line (entangled)	A6	A6	Plastic		Yes
8	Synthetic rope	A7	A7	Plastic		Yes
9	Fishing net	A8	A8	Plastic		Yes
10	Plastic cable ties	A9	A9	Plastic		
11	Plastic strapping band	A10	A10	Plastic		
12	Plastic crates and containers	A11	A11	Plastic	Yes	
13	Plastic diapers	B1	A12	Plastic	Yes	
14	Sanitary towel/tampon	B6	A13	Plastic	Yes	
15	Other plastic	A12	A14	Plastic		
16	Sanitary waste (unspecified)	B		Plastic	Yes	
17	Cotton buds	B2		Plastic	Yes	
18	Cigarette butts	B3		Plastic	Yes	
19	Condoms	B4		Plastic	Yes	
20	Syringes	B5		Plastic	Yes	
21	Other sanitary waste	B7		Plastic	Yes	
22	Metals	C	B	Metal		
23	Cans (food)	C1	B1	Metal		
24	Cans (beverage)	C2	B2	Metal		
25	Fishing related metal	C3	B3	Metal		
26	Metal drums	C4	B4	Metal		
27	Metal appliances	C5	B5	Metal		
28	Metal car parts	C6	B6	Metal		
29	Metal cables	C7	B7	Metal		
30	Other metal	C8	B8	Metal		
31	Rubber	D	C	Rubber		
32	Boots	D1	C1	Rubber		
33	Balloons	D2	C2	Rubber	Yes	
34	Rubber bobbins (fishing)	D3	C3	Rubber		Yes
35	Tyre	D4	C4	Rubber		
36	Glove	D5	C5	Rubber		
37	Other rubber	D6	C6	Rubber		
38	Glass/Ceramics	E	D	Glass		
39	Jar	E1	D1	Glass		
40	Glass bottle	E2	D2	Glass		
41	Glass/ceramic piece	E3	D3	Glass		
42	Other glass or ceramic	E4	D4	Glass		
43	Natural products	F	E	Natural		
44	Wood (processed)	F1	E1	Natural		
45	Rope	F2	E2	Natural	Yes	
46	Paper/cardboard	F3	E3	Natural		
47	Pallets	F4	E4	Natural		
48	Other natural products	F5	E5	Natural		
49	Miscellaneous	G	F	Other		
50	Clothing/rags	G1	F1	Other		
51	Shoes	G2	F2	Other		
52	Other	G3	F3	Other		

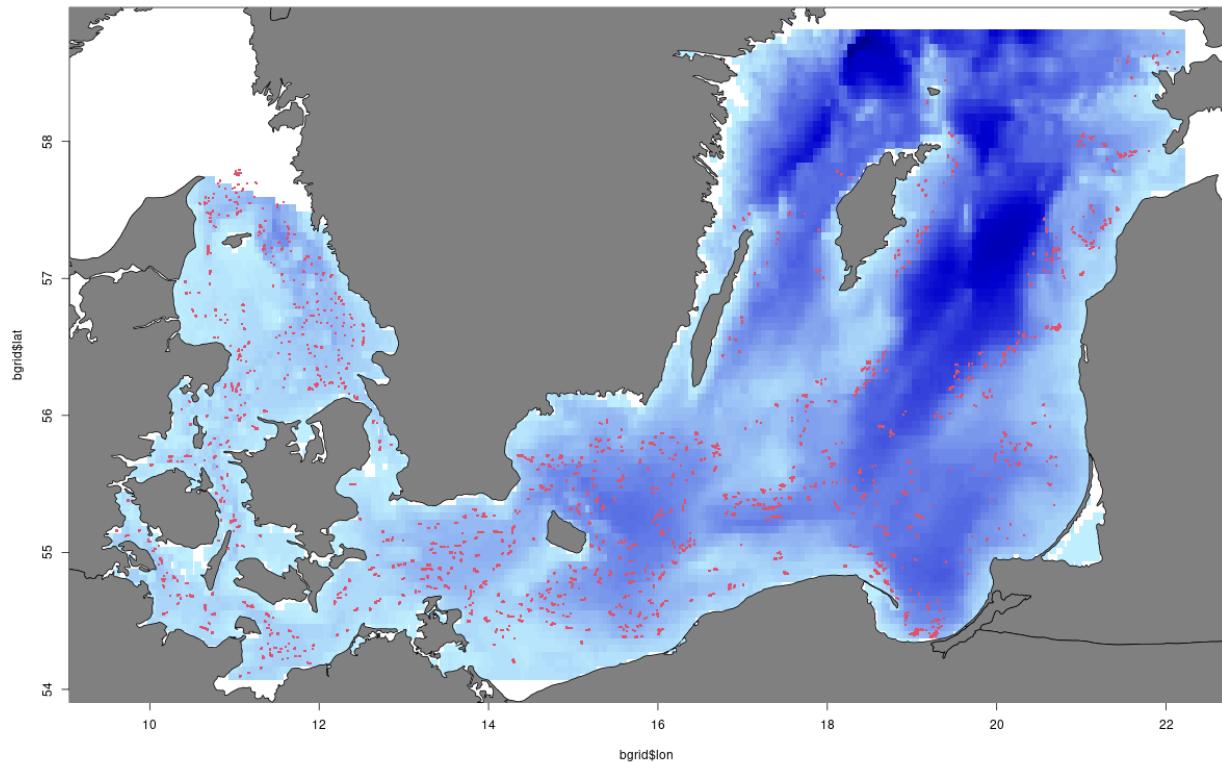


Figure 1: Bathymetric map. Red points are trawl hauls. This map is used as the spatial prediction grid for all standardized maps and indices.

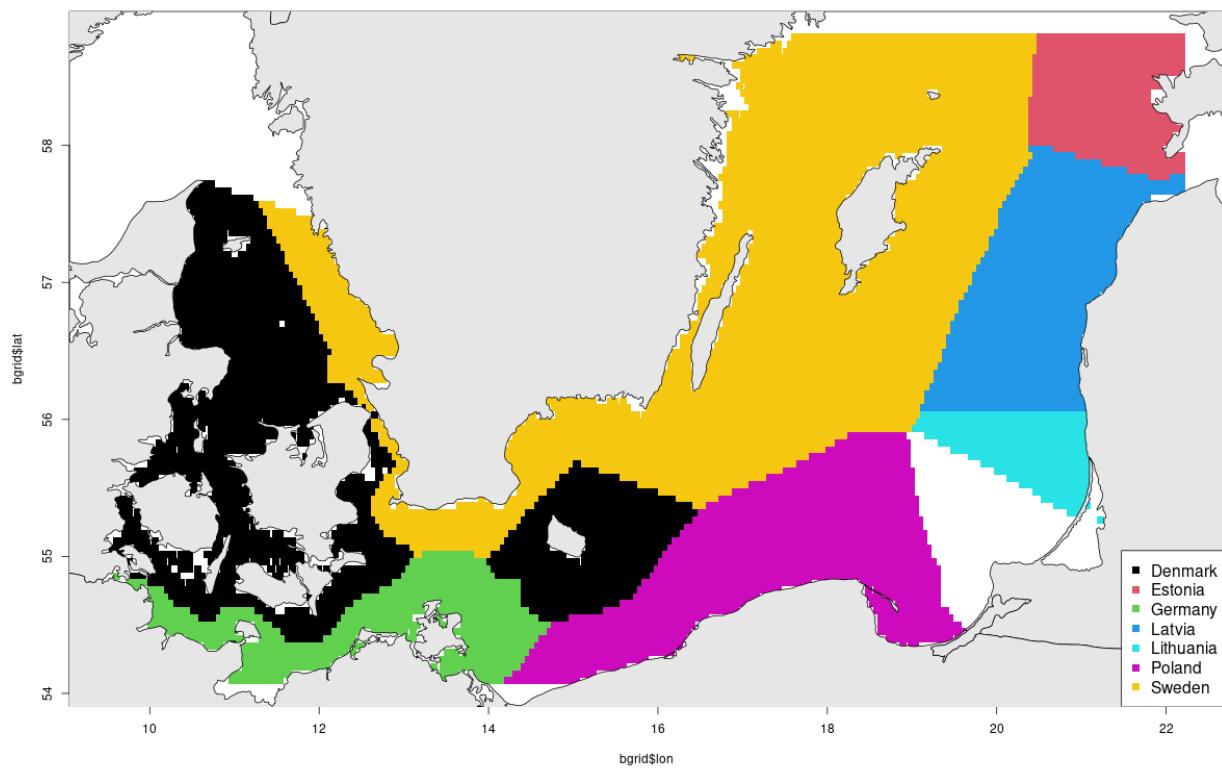


Figure 2: Map of EEZs

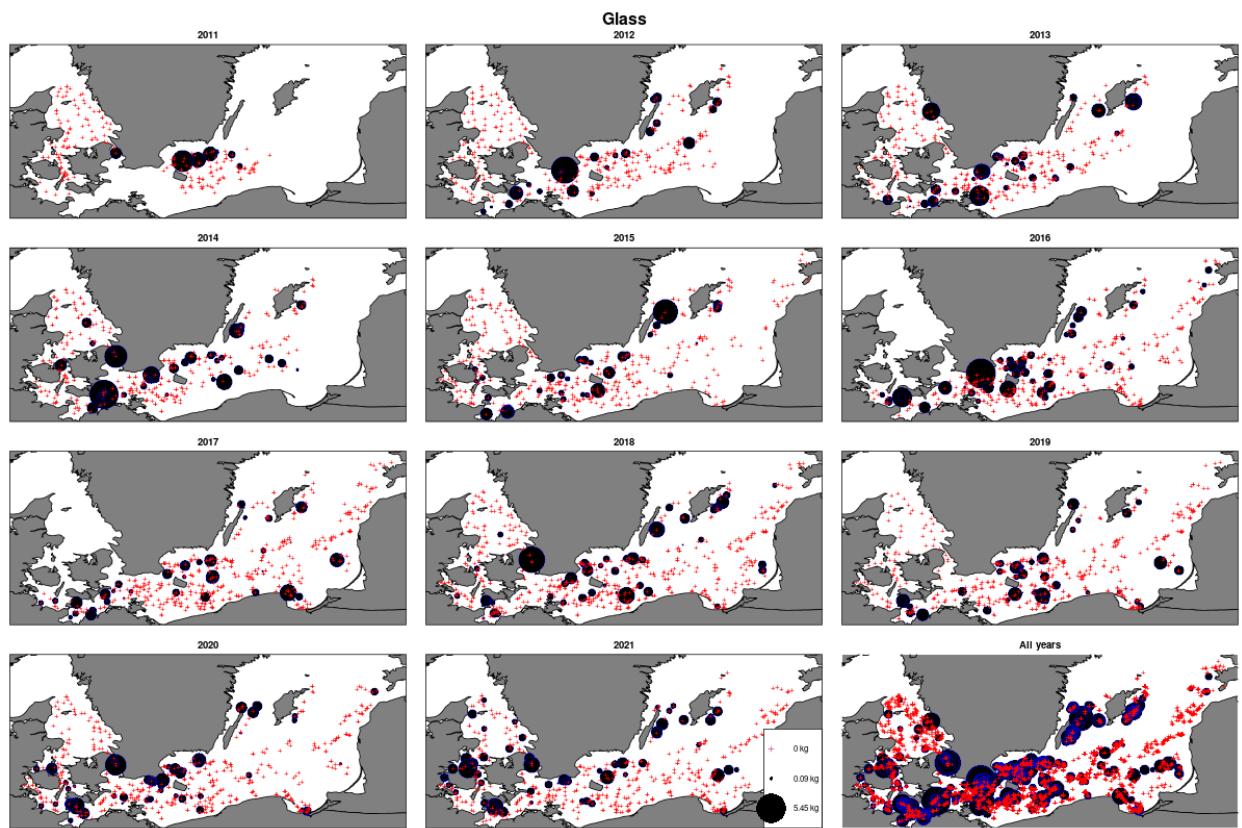


Figure 3: Litter pr. haul. The black bubbles are given a thin blue edge to distinguish overlap.

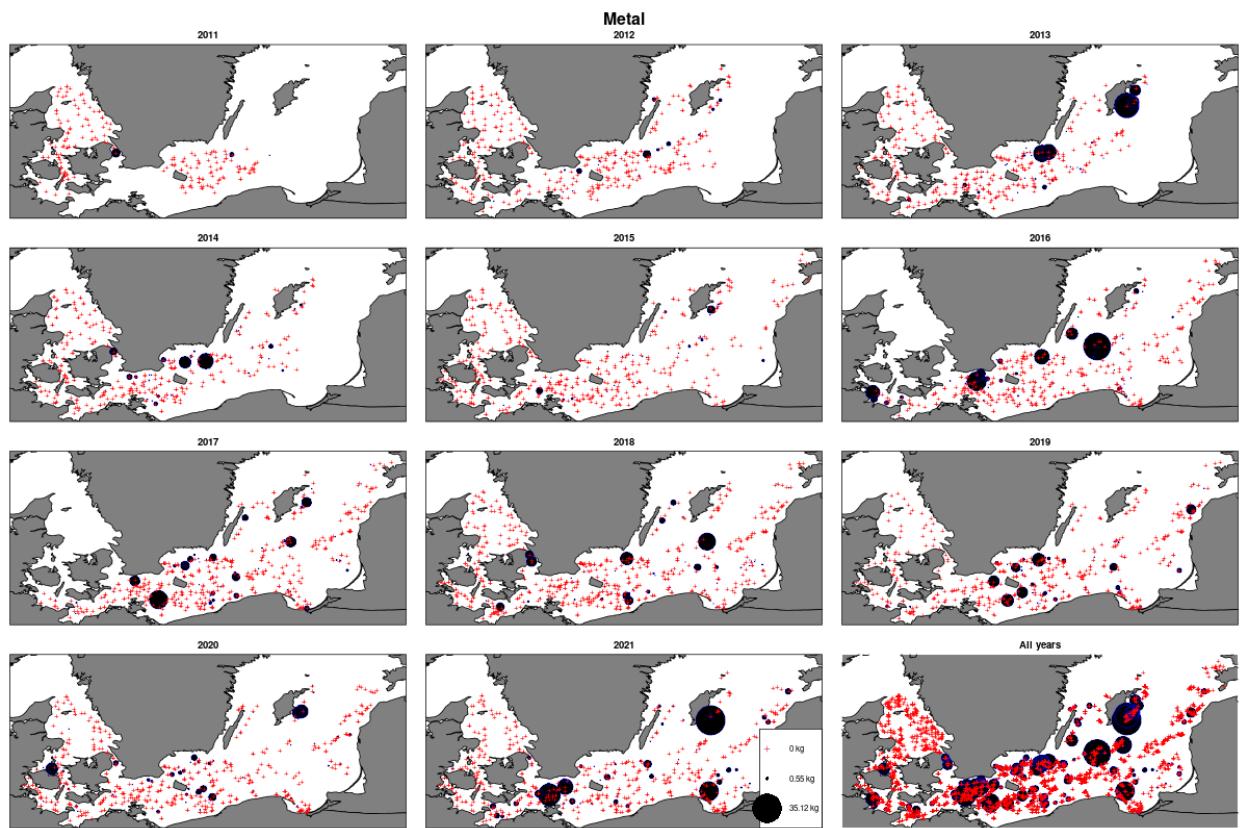


Figure 4: Litter pr. haul. The black bubbles are given a thin blue edge to distinguish overlap.

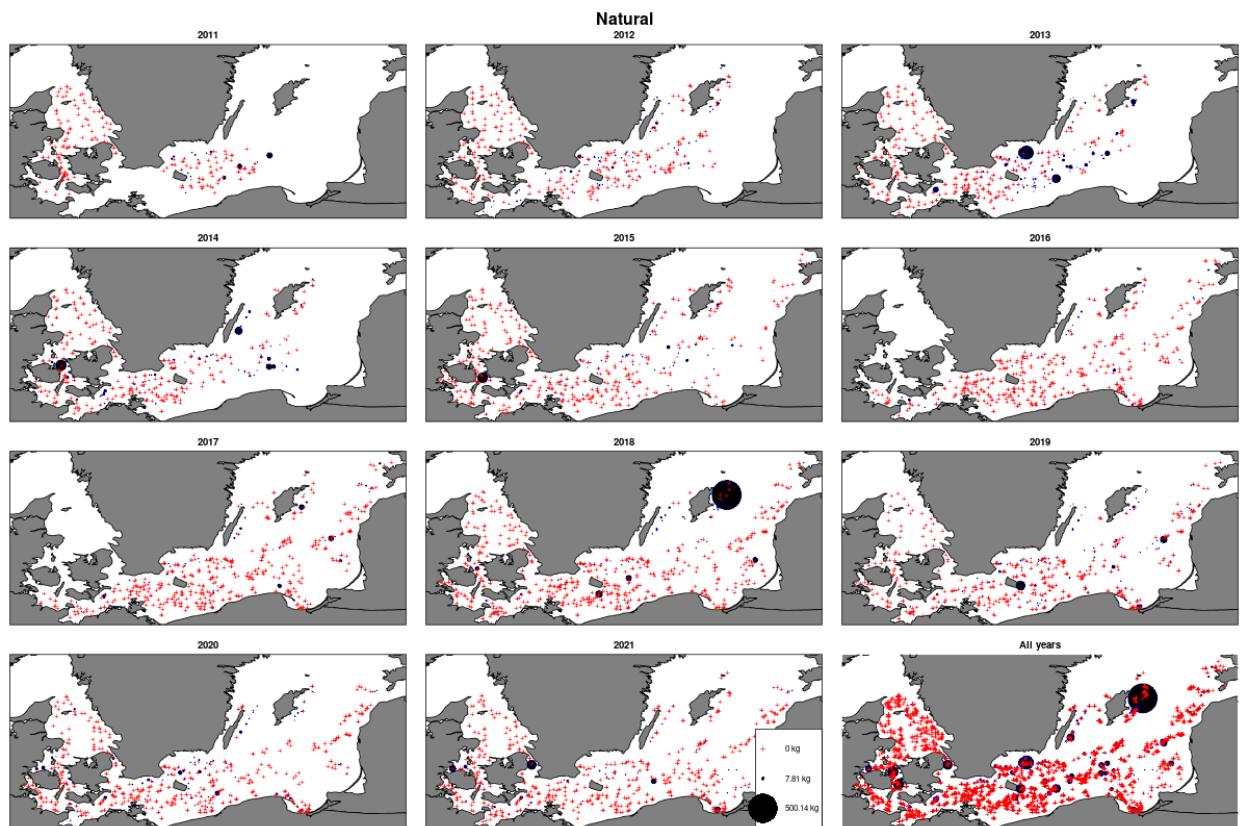


Figure 5: Litter pr. haul. The black bubbles are given a thin blue edge to distinguish overlap.

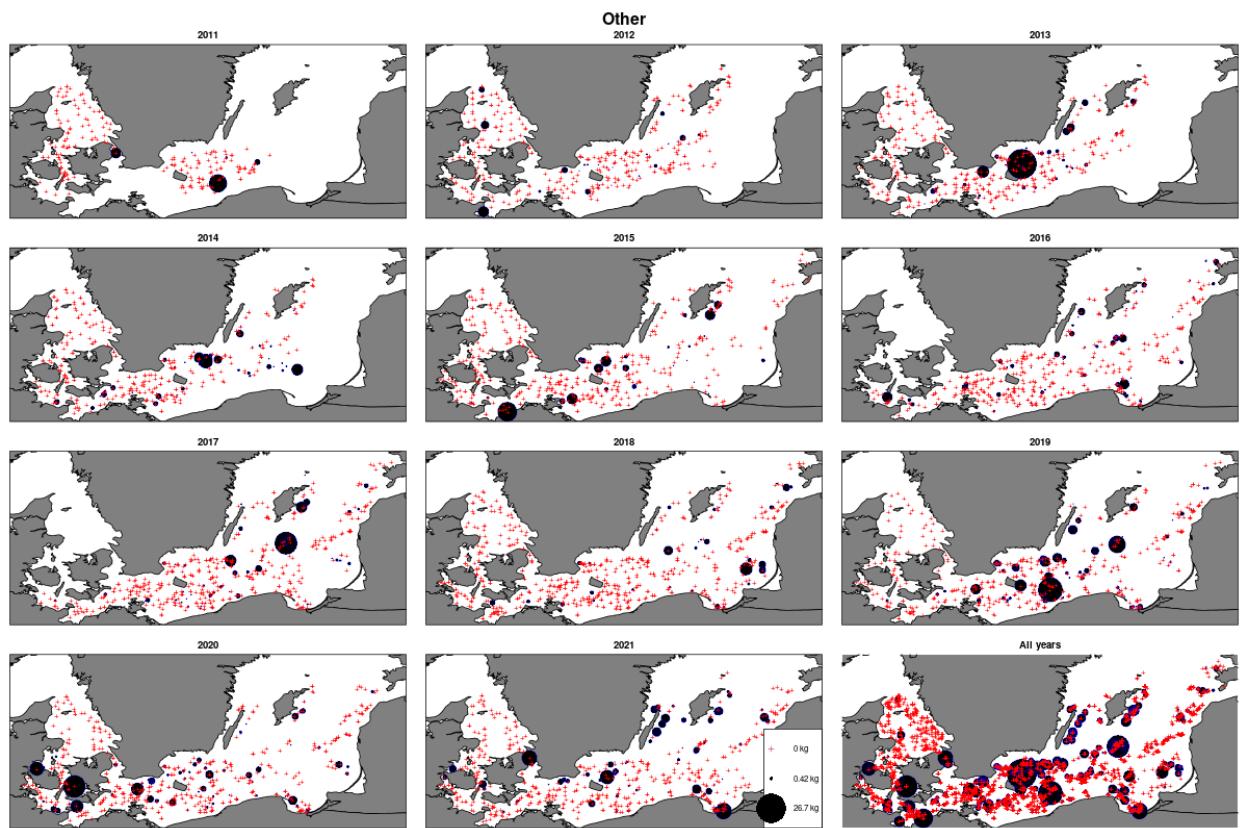


Figure 6: Litter pr. haul. The black bubbles are given a thin blue edge to distinguish overlap.

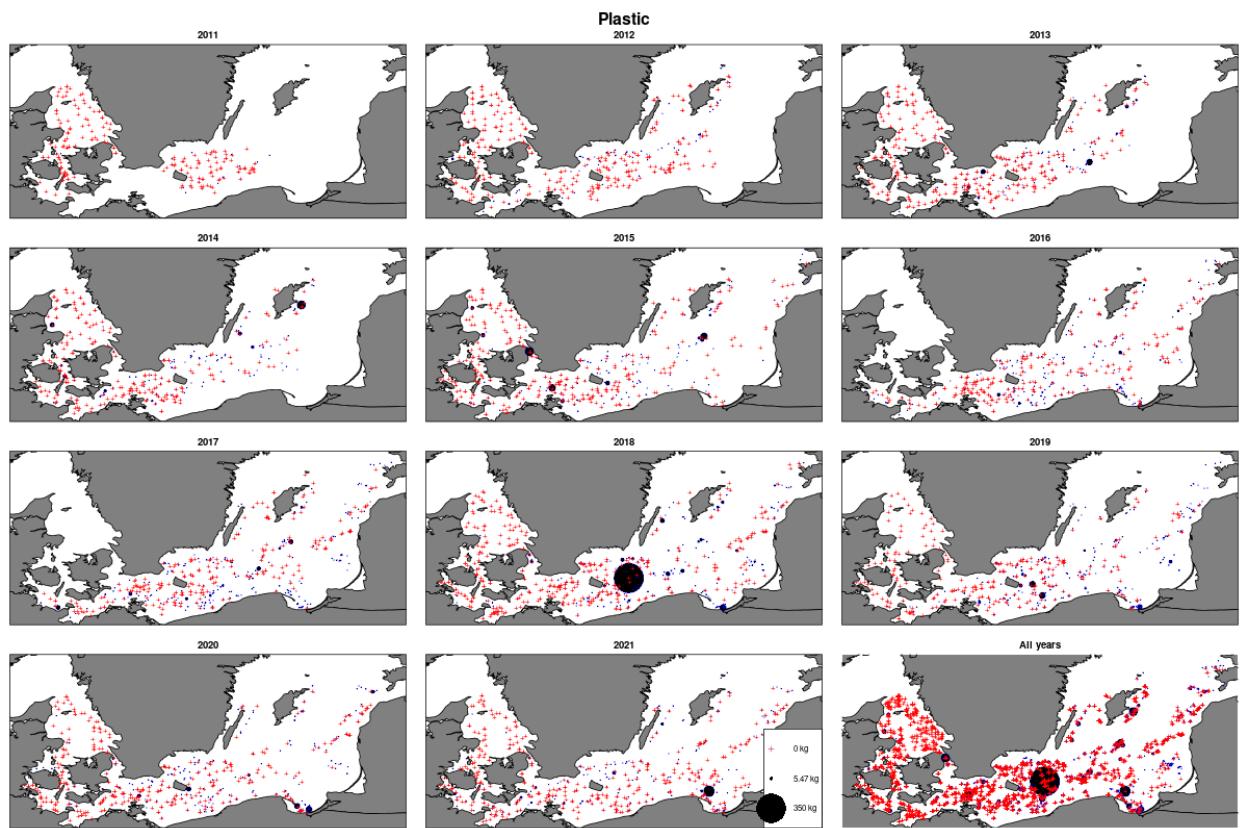


Figure 7: Litter pr. haul. The black bubbles are given a thin blue edge to distinguish overlap.

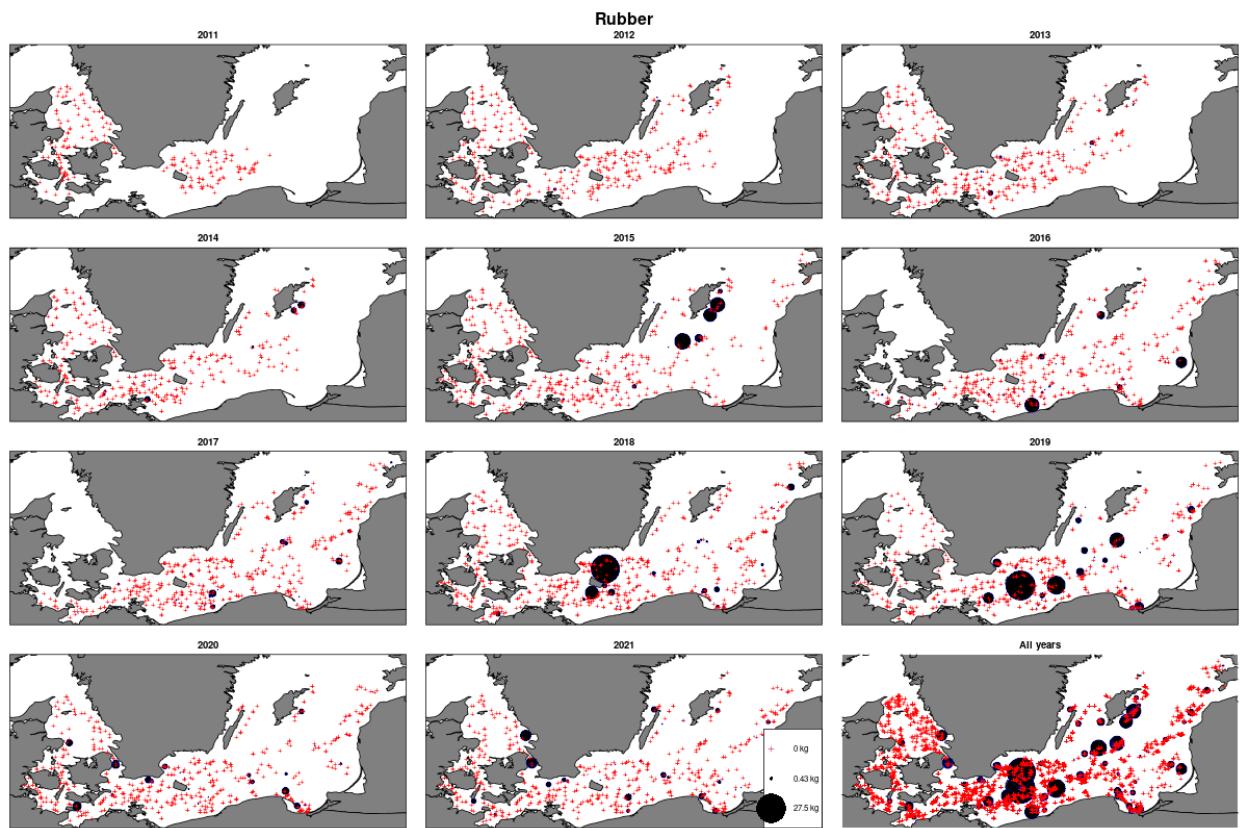


Figure 8: Litter pr. haul. The black bubbles are given a thin blue edge to distinguish overlap.

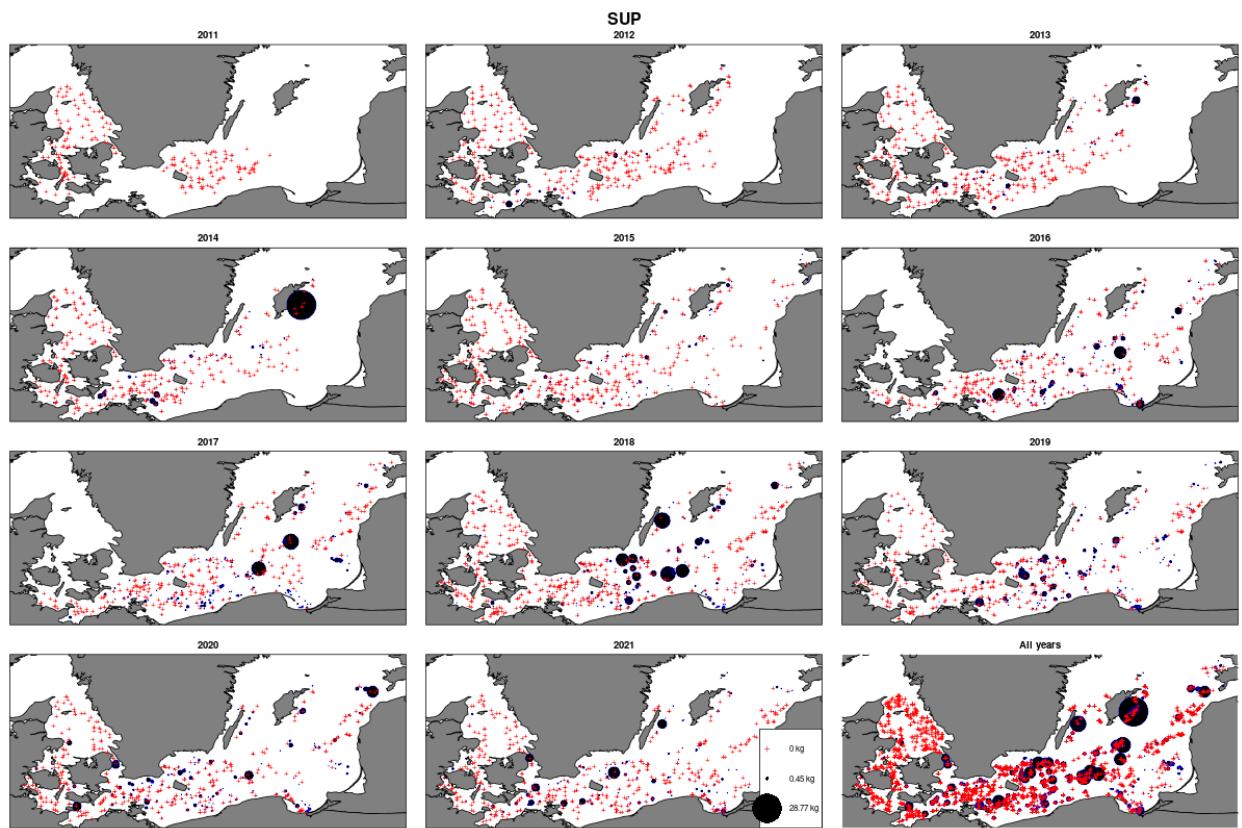


Figure 9: Litter pr. haul. The black bubbles are given a thin blue edge to distinguish overlap.

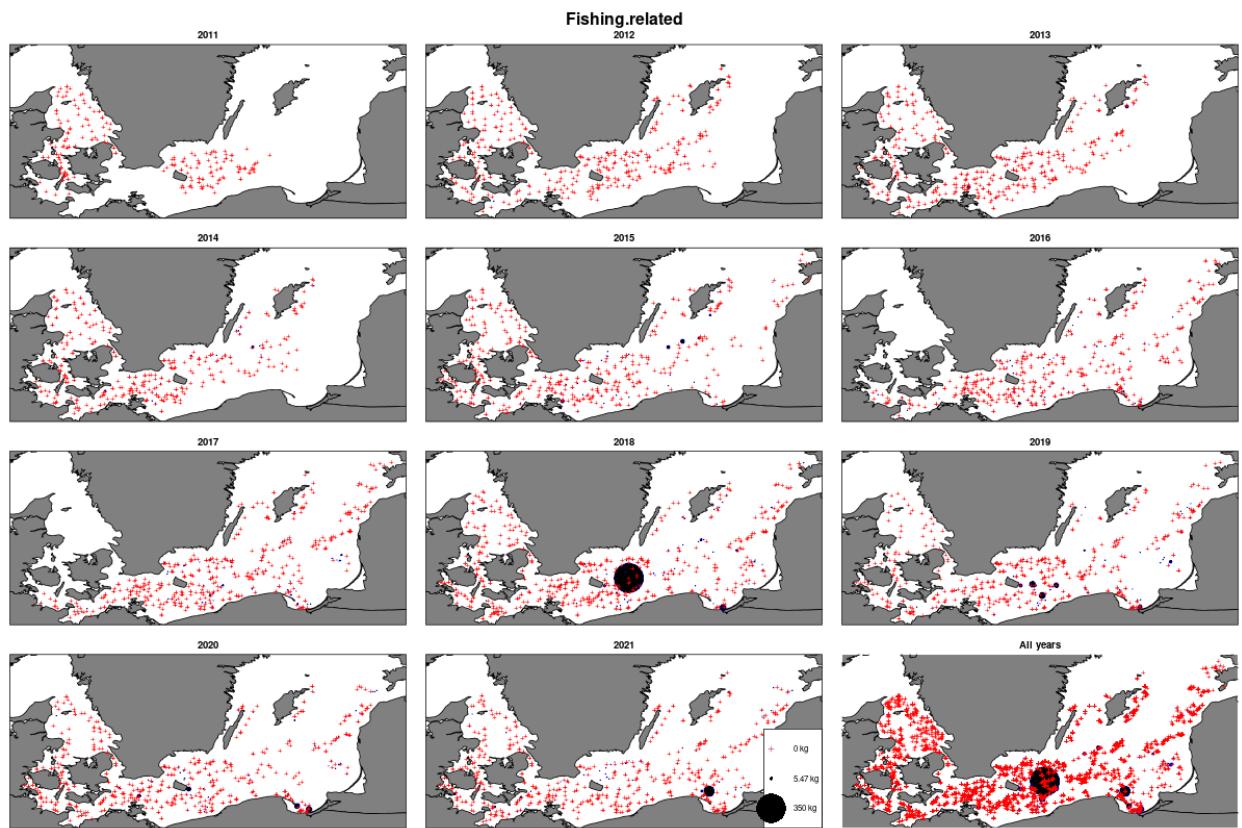


Figure 10: Litter pr. haul. The black bubbles are given a thin blue edge to distinguish overlap.

2 Survey Indices

Survey indices are calculated using the methodology described in [2]. Three models are fitted for each type of litter. The following equations describe the models:

$$g(\mu_i) = f_1(\text{time}_i) + f_1(\text{lon}_i, \text{lat}_i) + \log(\text{effort}_i) \quad (1)$$

$$g(\mu_i) = \text{Year}_i + f_1(\text{lon}_i, \text{lat}_i) + \log(\text{effort}_i) \quad (2)$$

$$g(\mu_i) = \alpha \text{time}_i + f_1(\text{lon}_i, \text{lat}_i) + \log(\text{effort}_i) \quad (3)$$

The models differ in how the time effect is specified. The first model uses a smooth time effect, the second model uses independent year effects, whereas the last model estimates a log-linear time effect (overall trend, α). An offset is used for the effect of effort ($\log(\text{effort}_i)$), i.e. the coefficient is not estimated but taken to be 1, which corresponds to the assumption that the catch is proportional to effort. All splines used are Duchon splines with first derivative penalization.

The swept area for a 30 min haul is assumed to be 68184 m² for the TVS gear and 87163 m² for the TVL (approx. 0.78 ratio, [4]).

The models are fitted using both numbers and mass as the response variable. For models using mass only the Tweedie distribution (compound Poisson-Gamma) is considered, because it is simpler and easier to work with, and has a more consistent interpretation when sampling effort is not constant (see e.g. [5]). For models using numbers the negative binomial distribution is used. Maps and EEZ specific estimates are only shown for the models using mass. All indices using are standardized to a unit of kg / km² or numbers / km².

3 Results

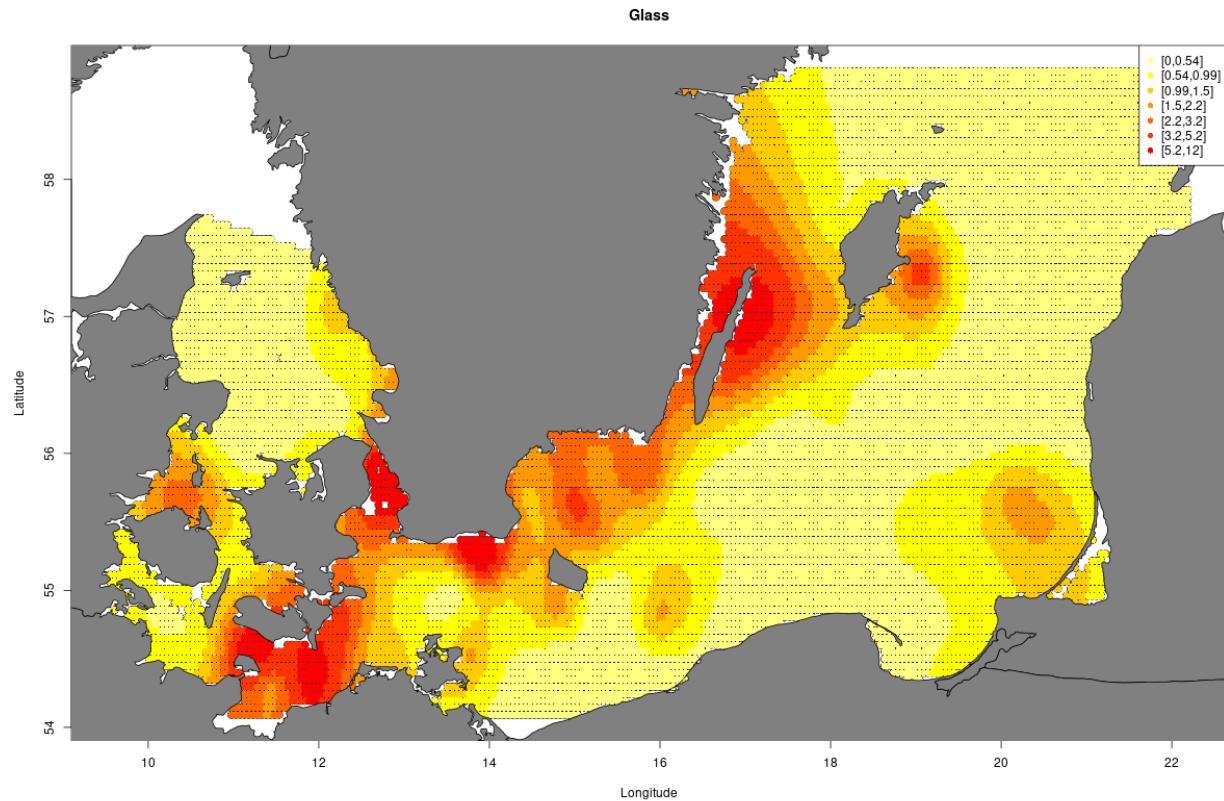


Figure 11: Distribution map. Note that the unit is relative litter abundance (1 = average).

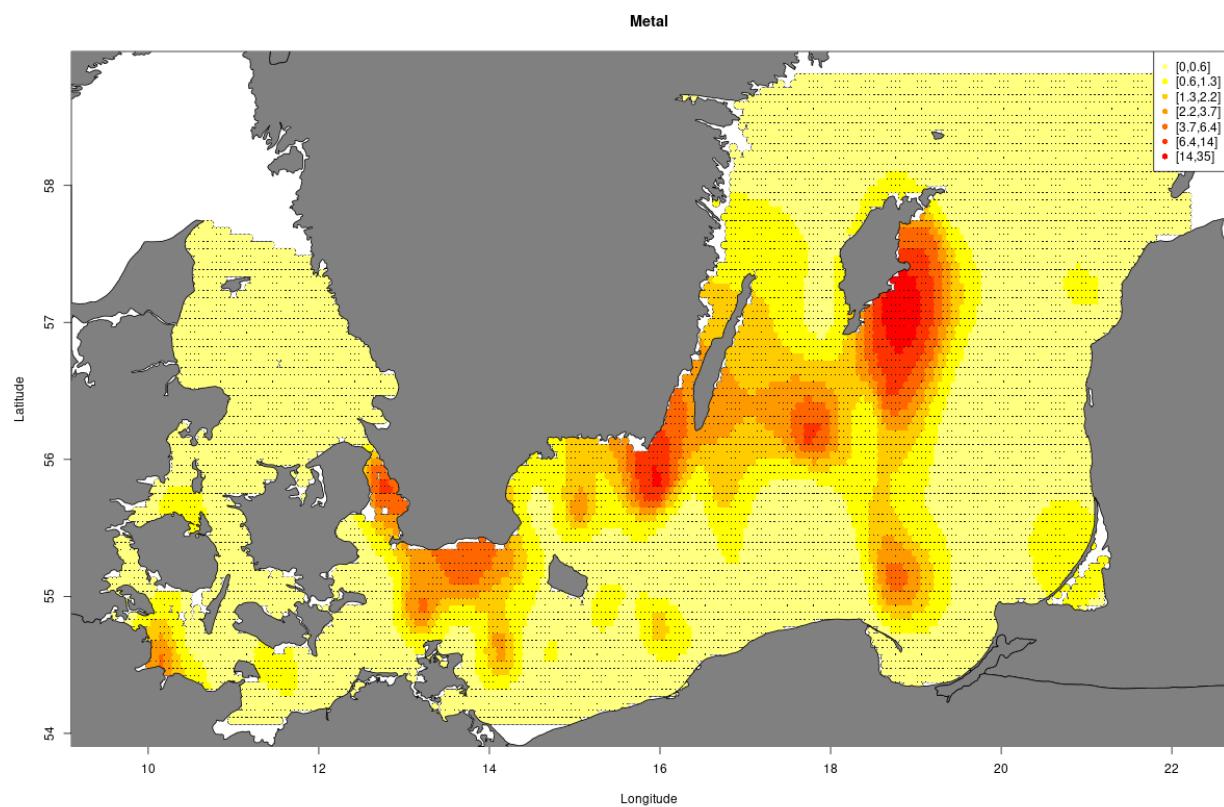


Figure 12: Distribution map (mass).

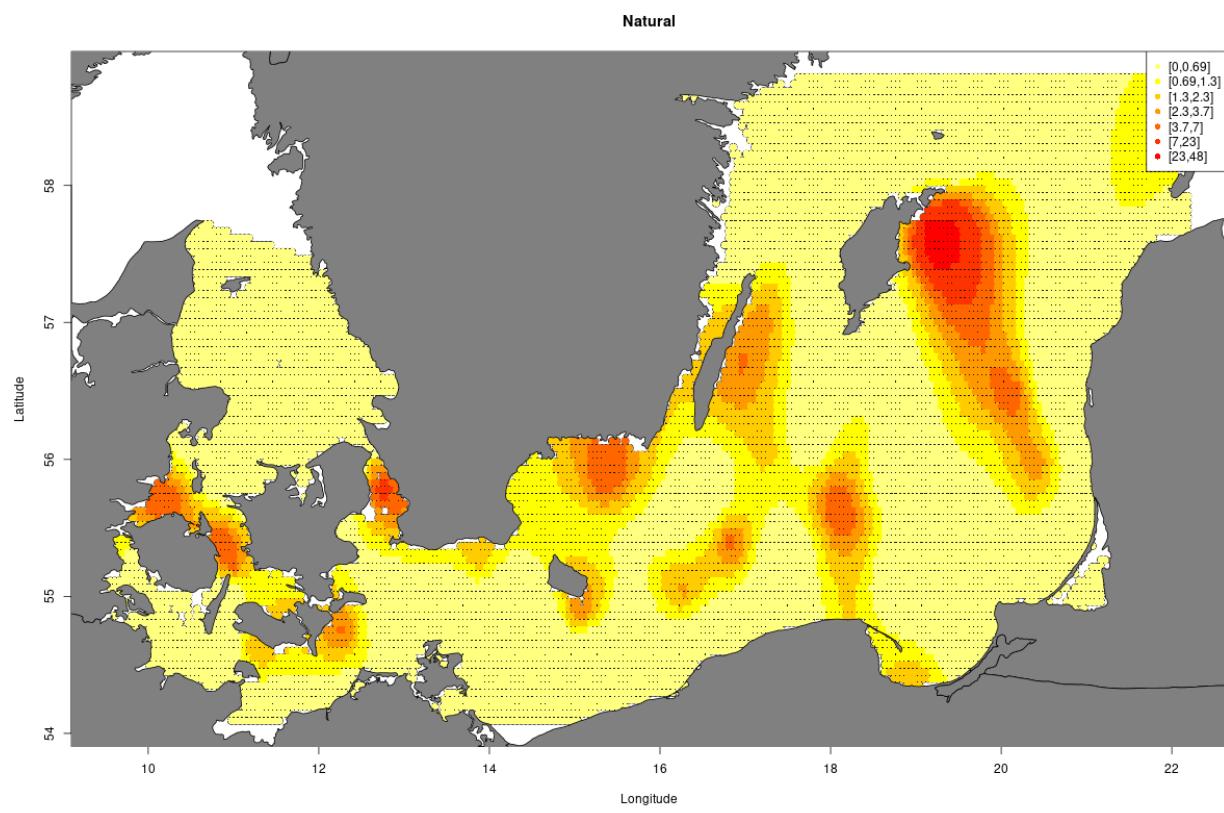


Figure 13: Distribution map (mass).

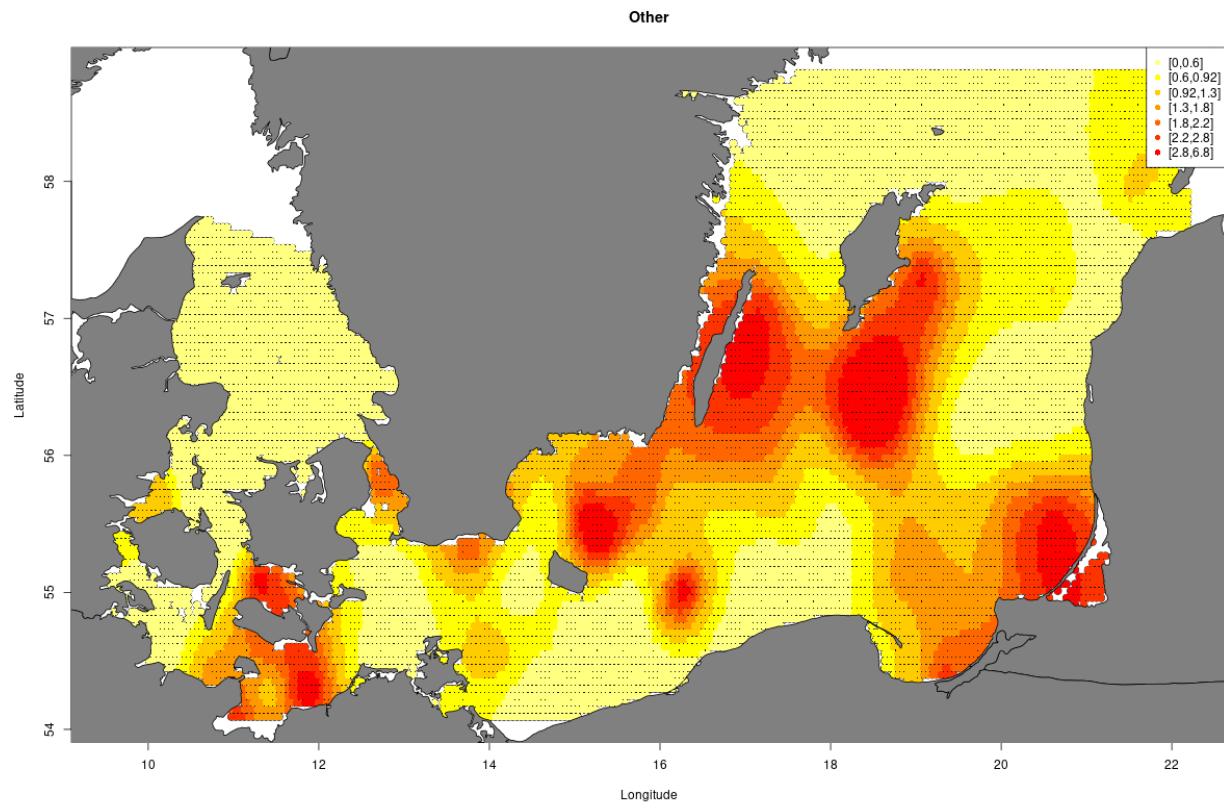


Figure 14: Distribution map (mass).

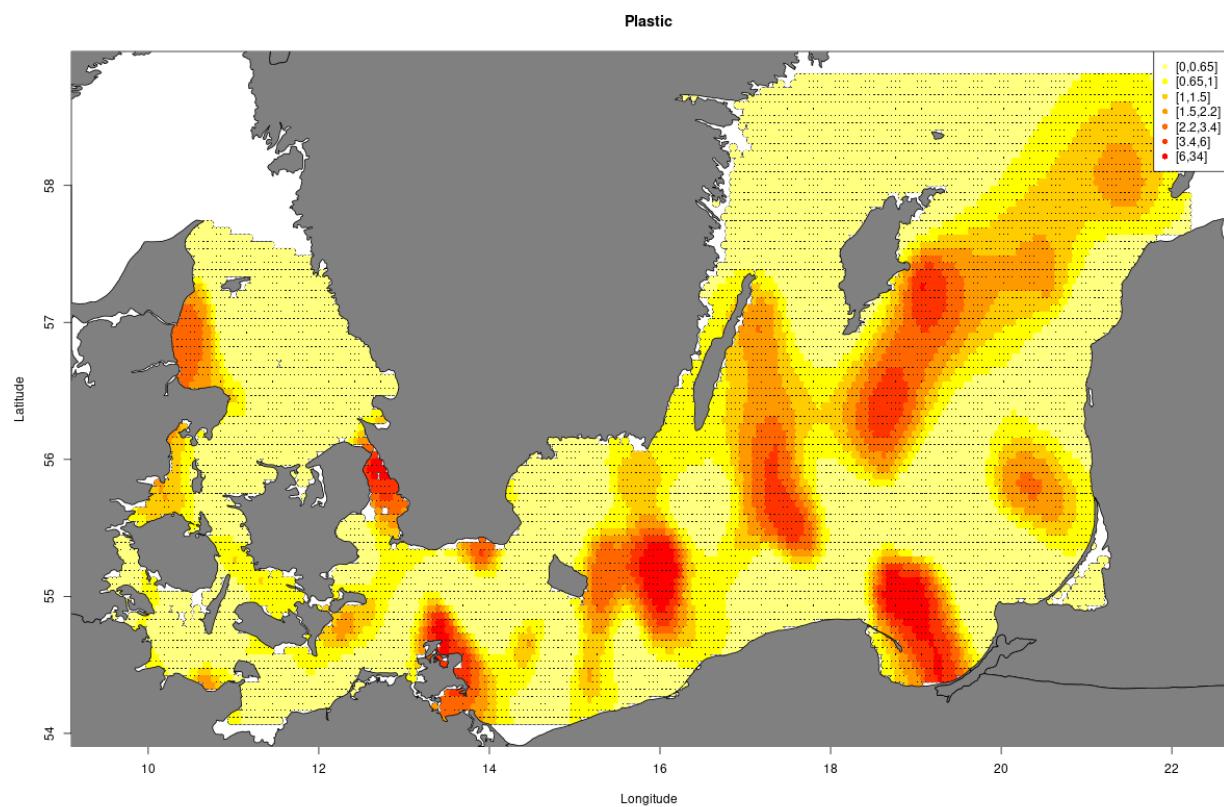


Figure 15: Distribution map (mass).

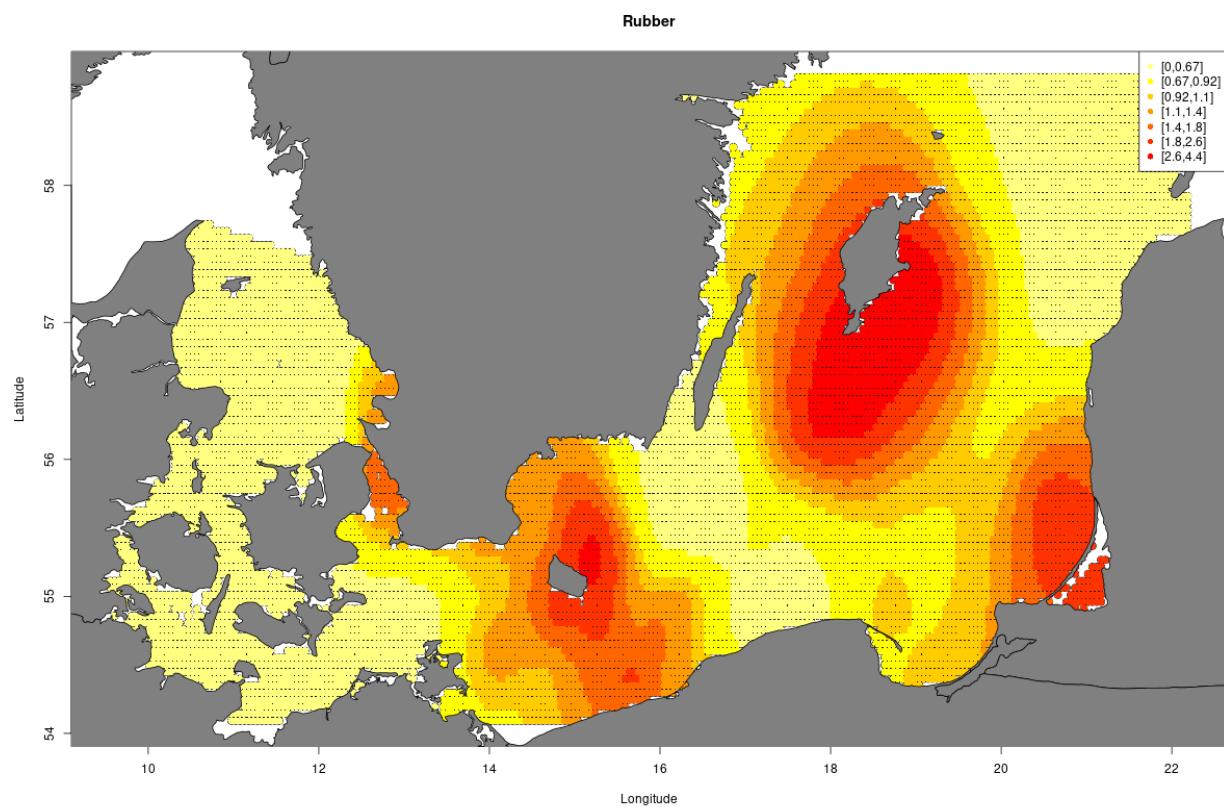


Figure 16: Distribution map (mass).

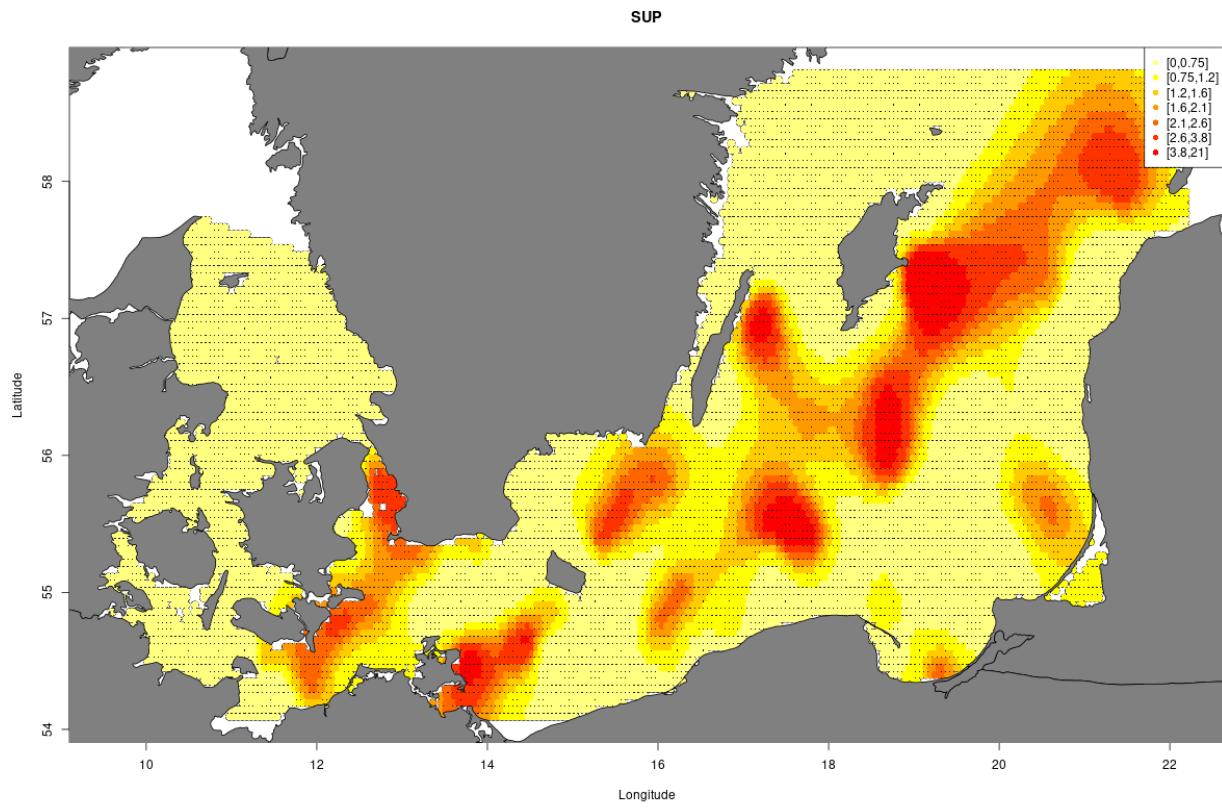


Figure 17: Distribution map (mass).

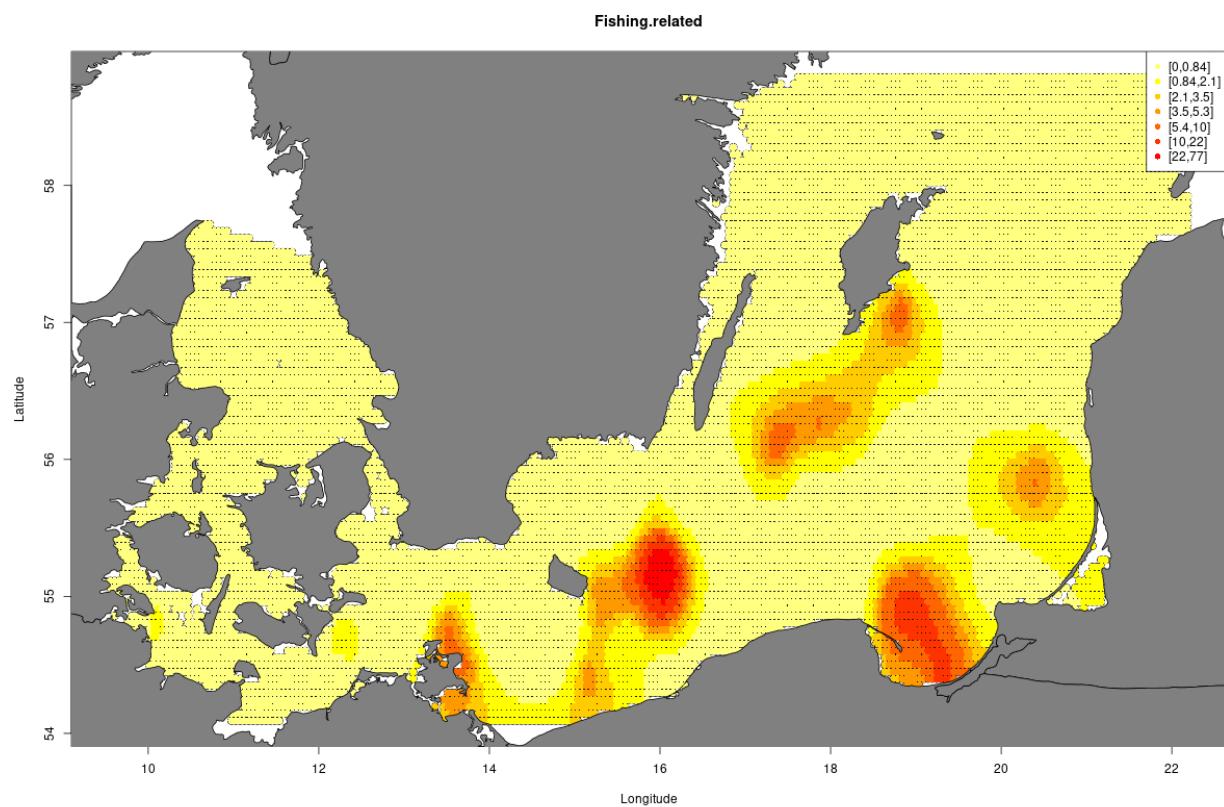


Figure 18: Distribution map (mass).

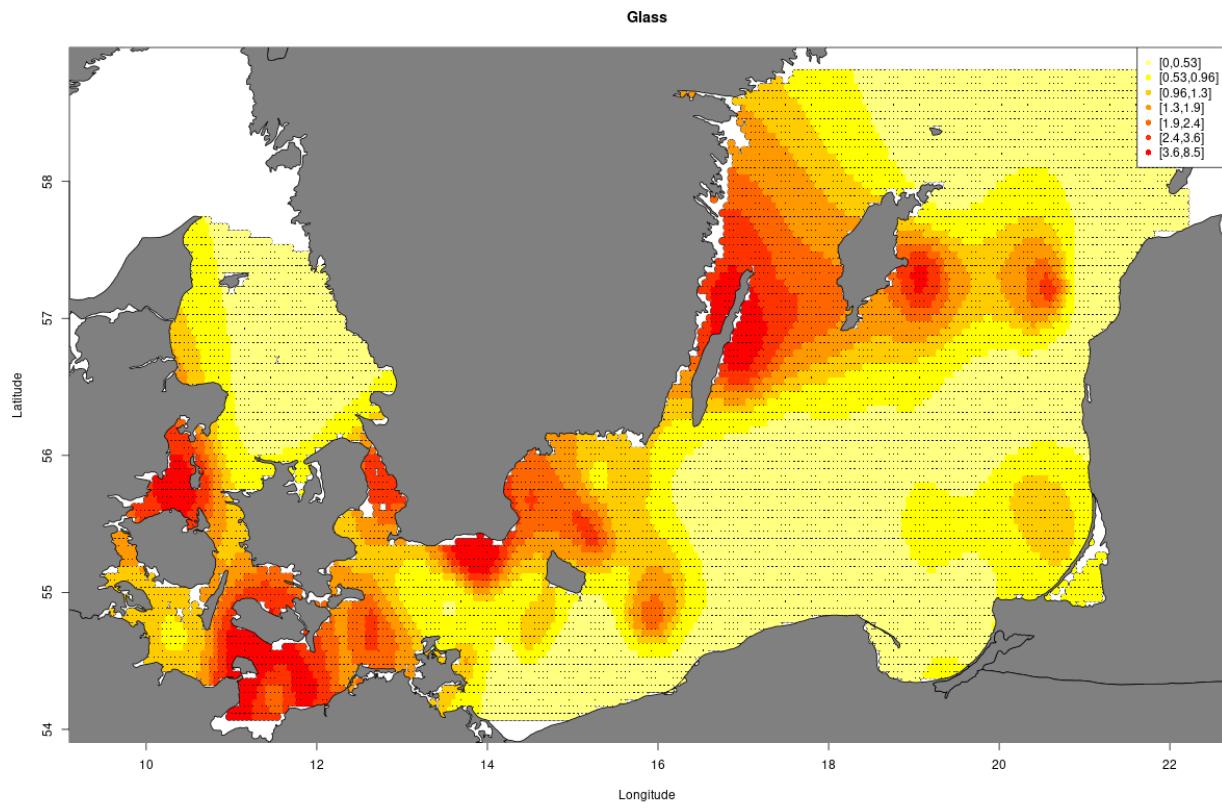


Figure 19: Distribution map (numbers)

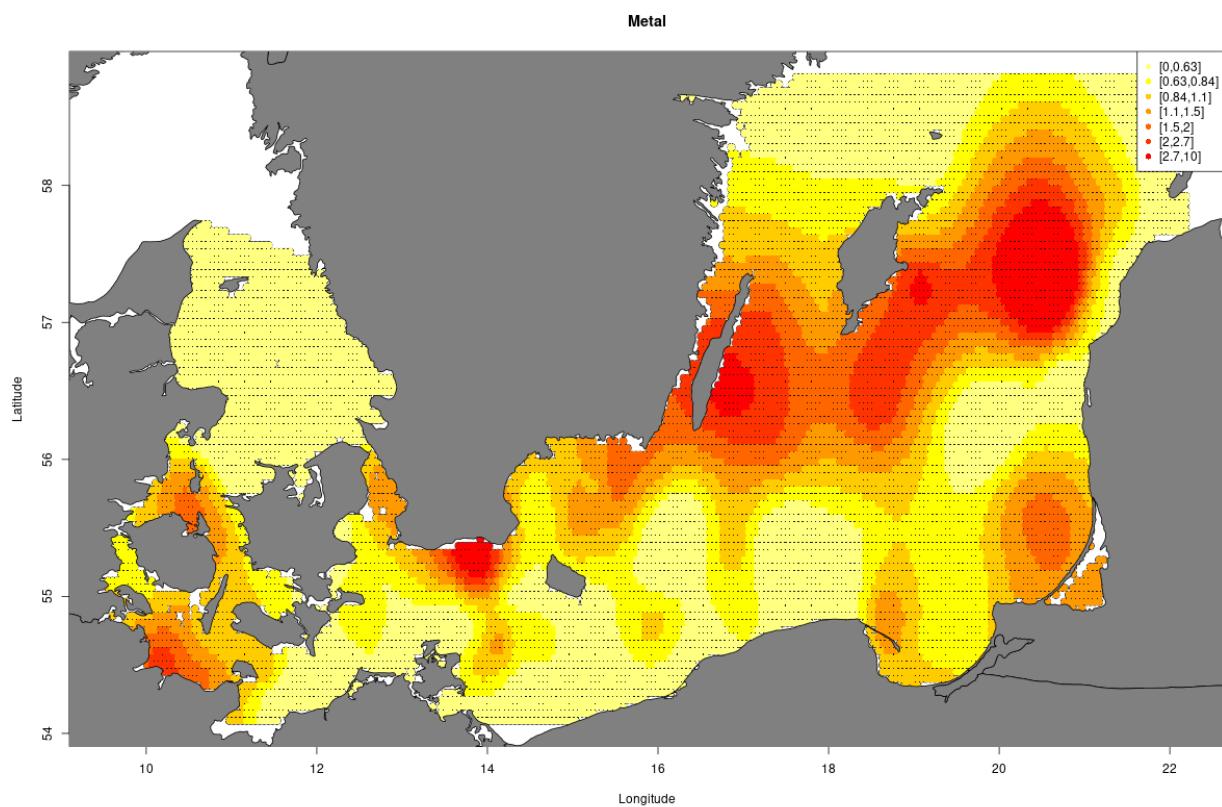


Figure 20: Distribution map (numbers)

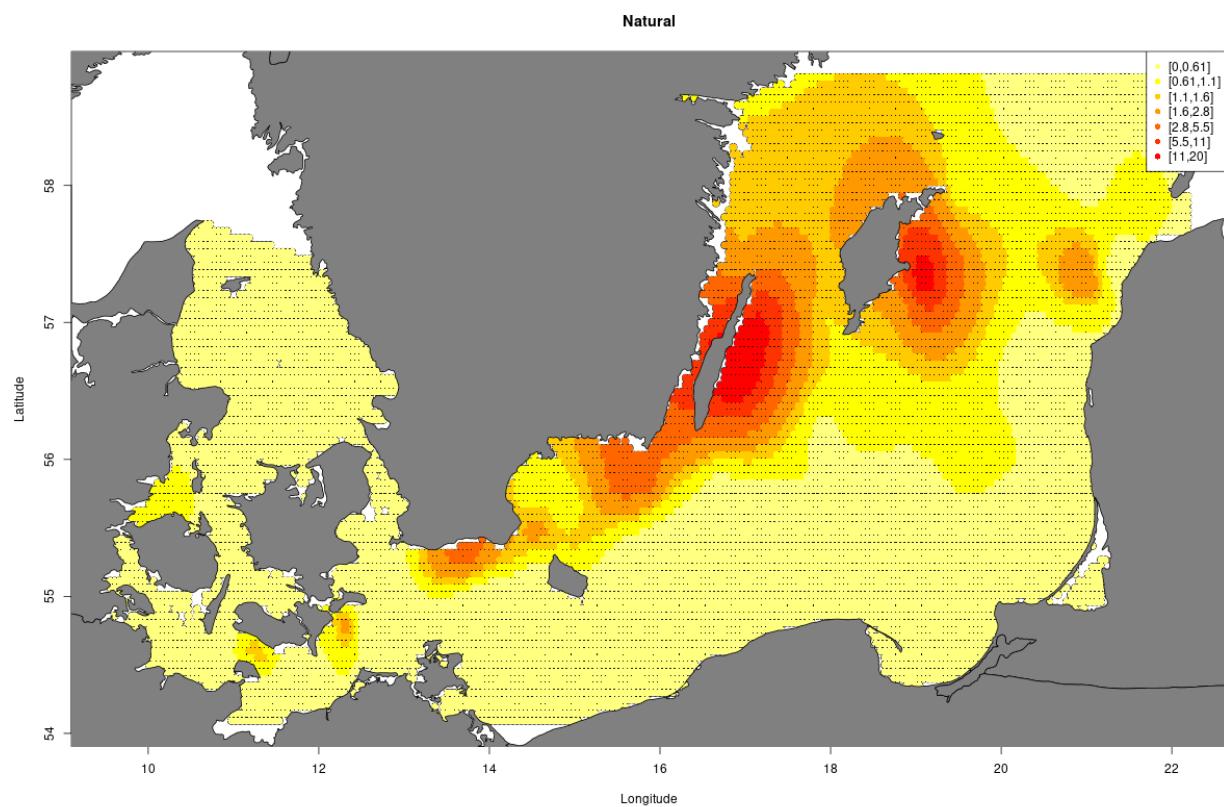


Figure 21: Distribution map (numbers)

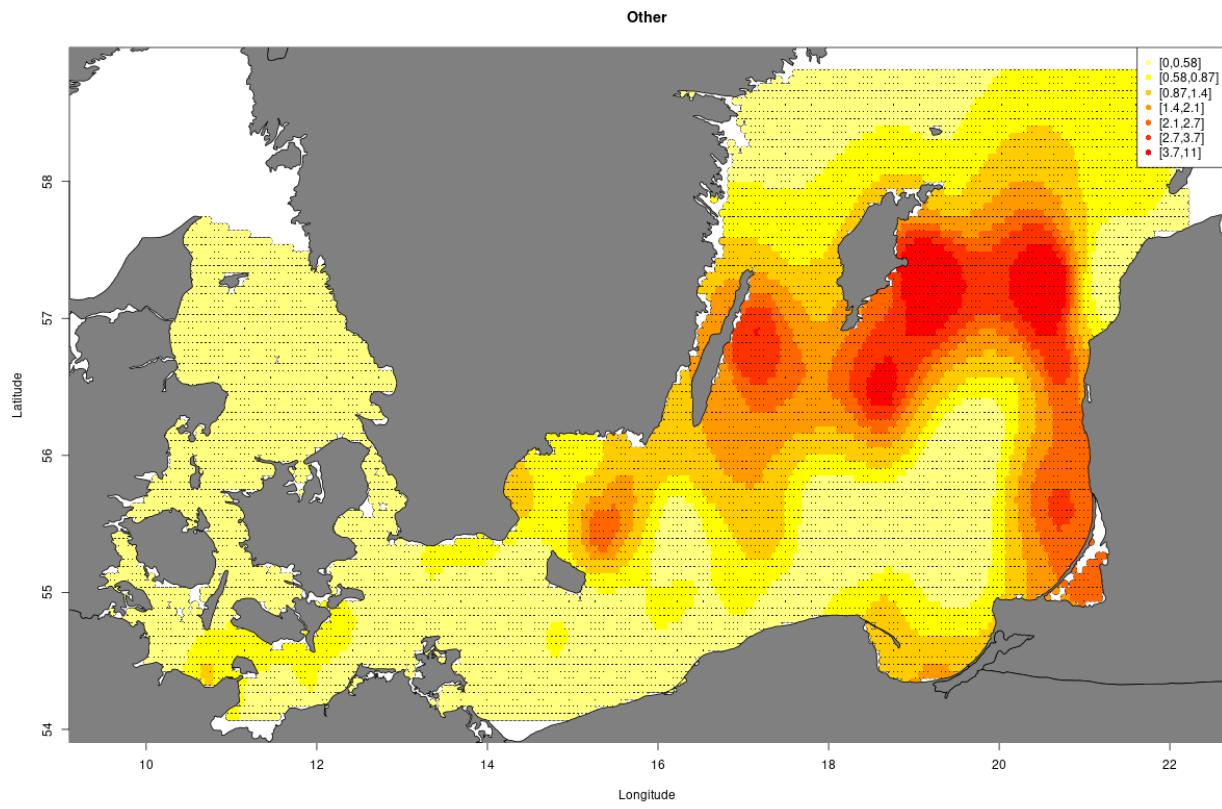


Figure 22: Distribution map (numbers)

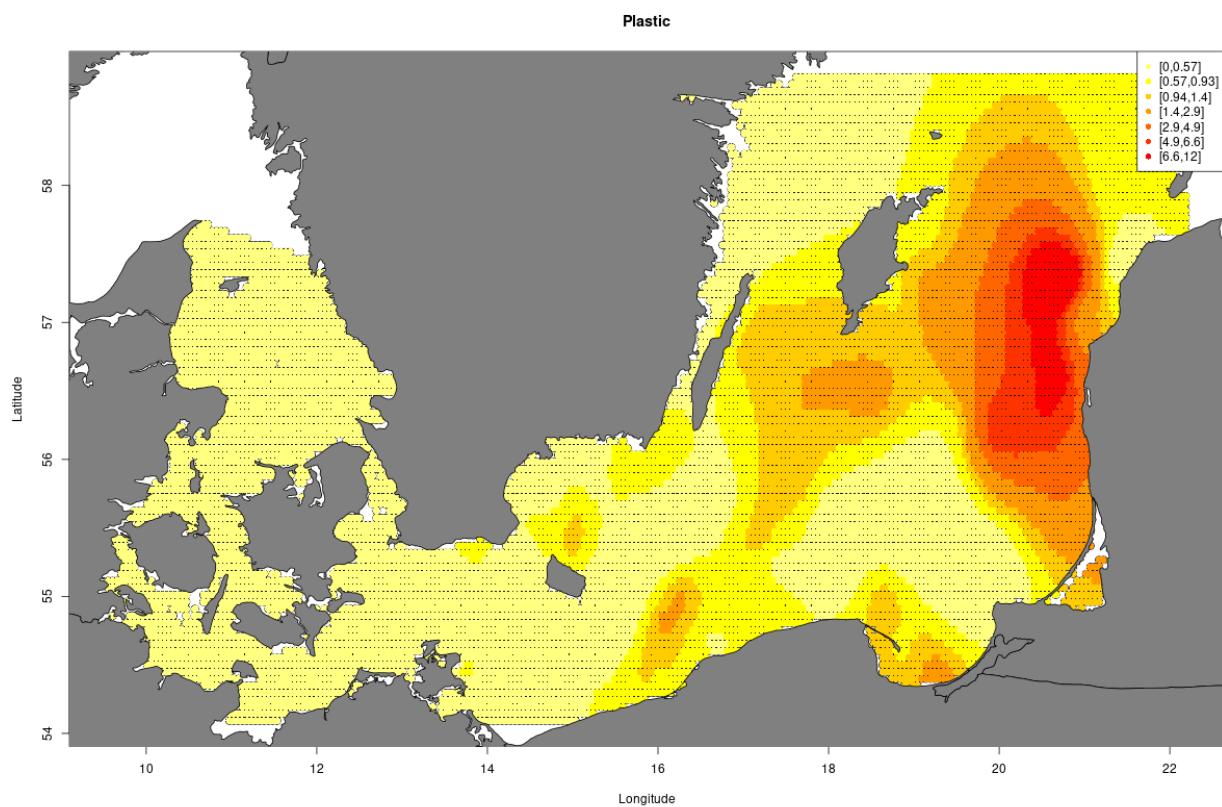


Figure 23: Distribution map (numbers)

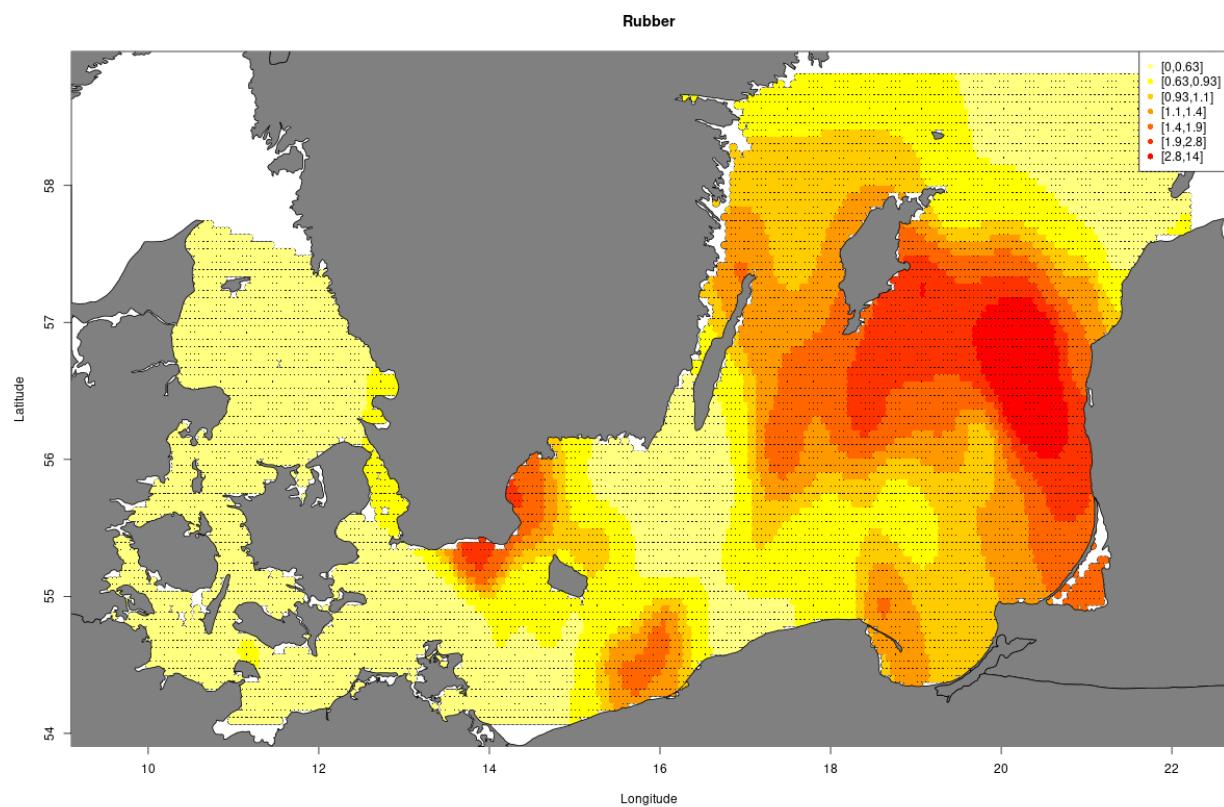


Figure 24: Distribution map (numbers)

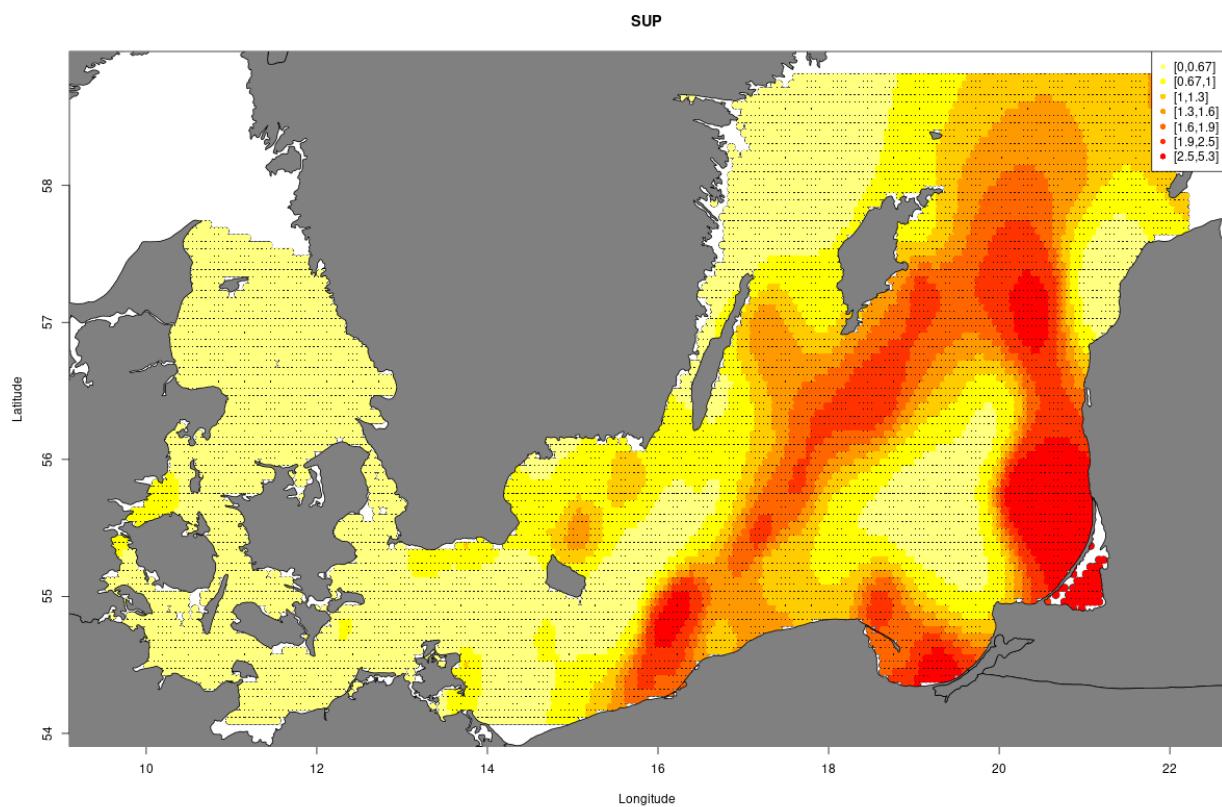


Figure 25: Distribution map (numbers)

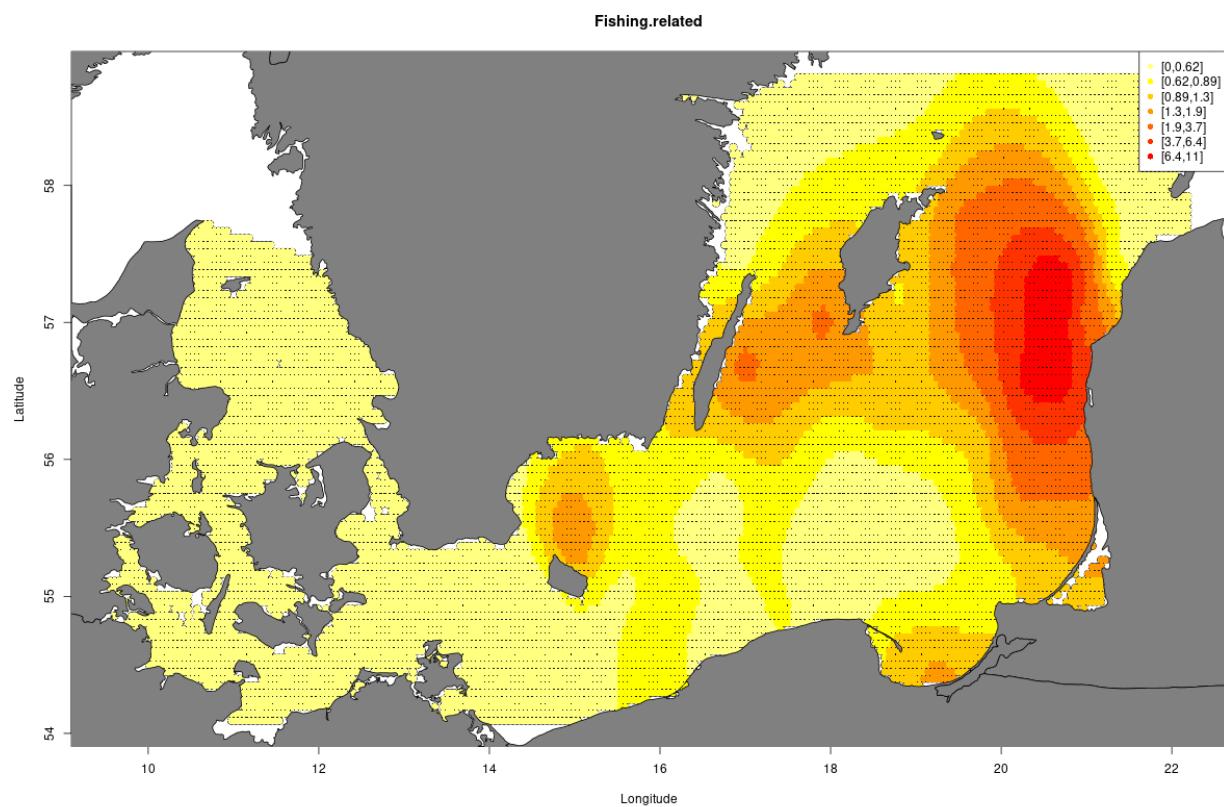


Figure 26: Distribution map (numbers)

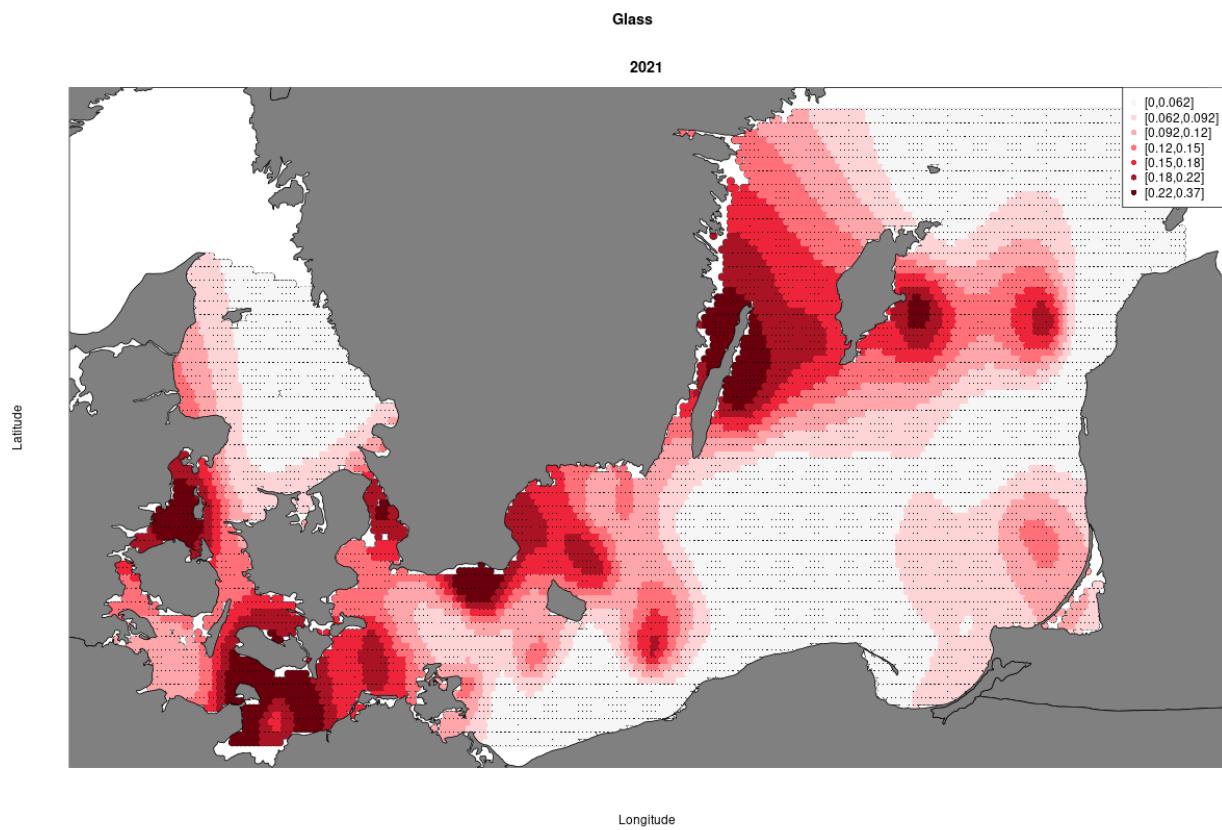


Figure 27: Probability of encounter for a standard haul (30 min TVL).

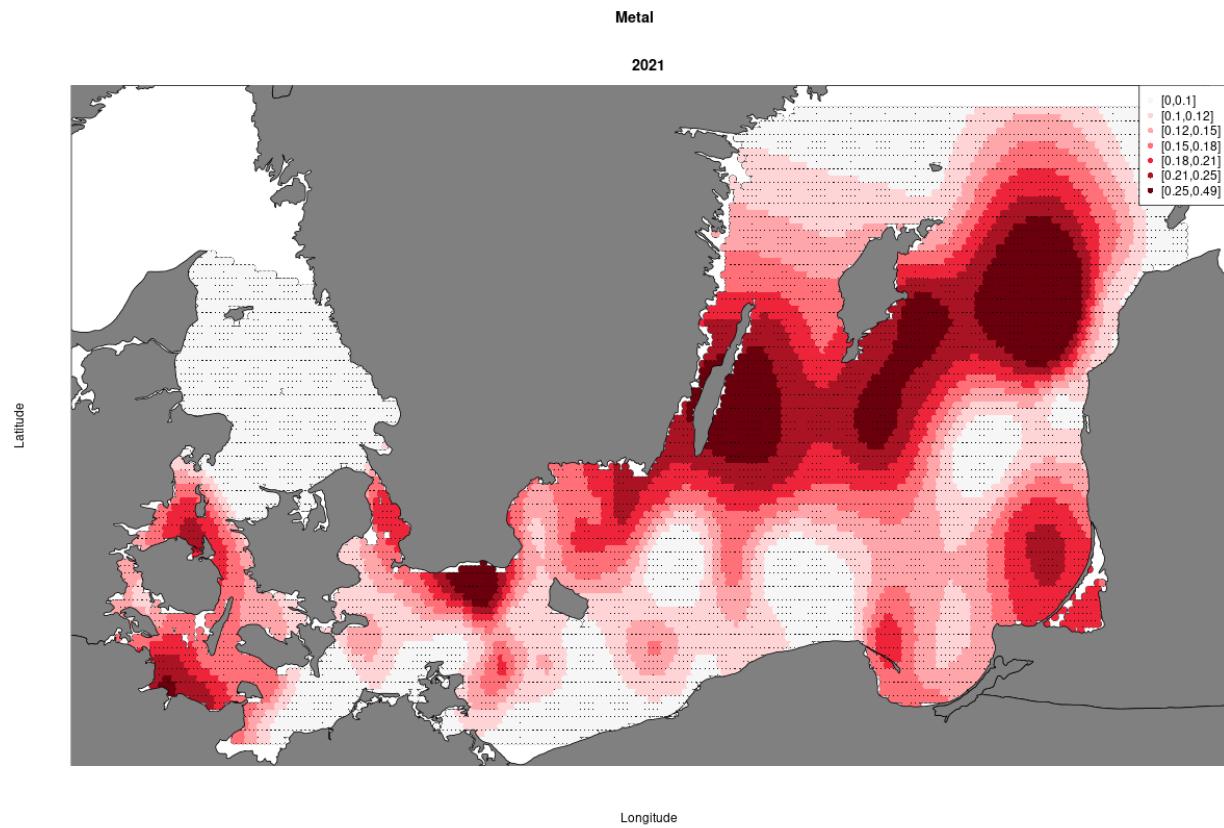


Figure 28: Probability of encounter for a standard haul (30 min TVL).

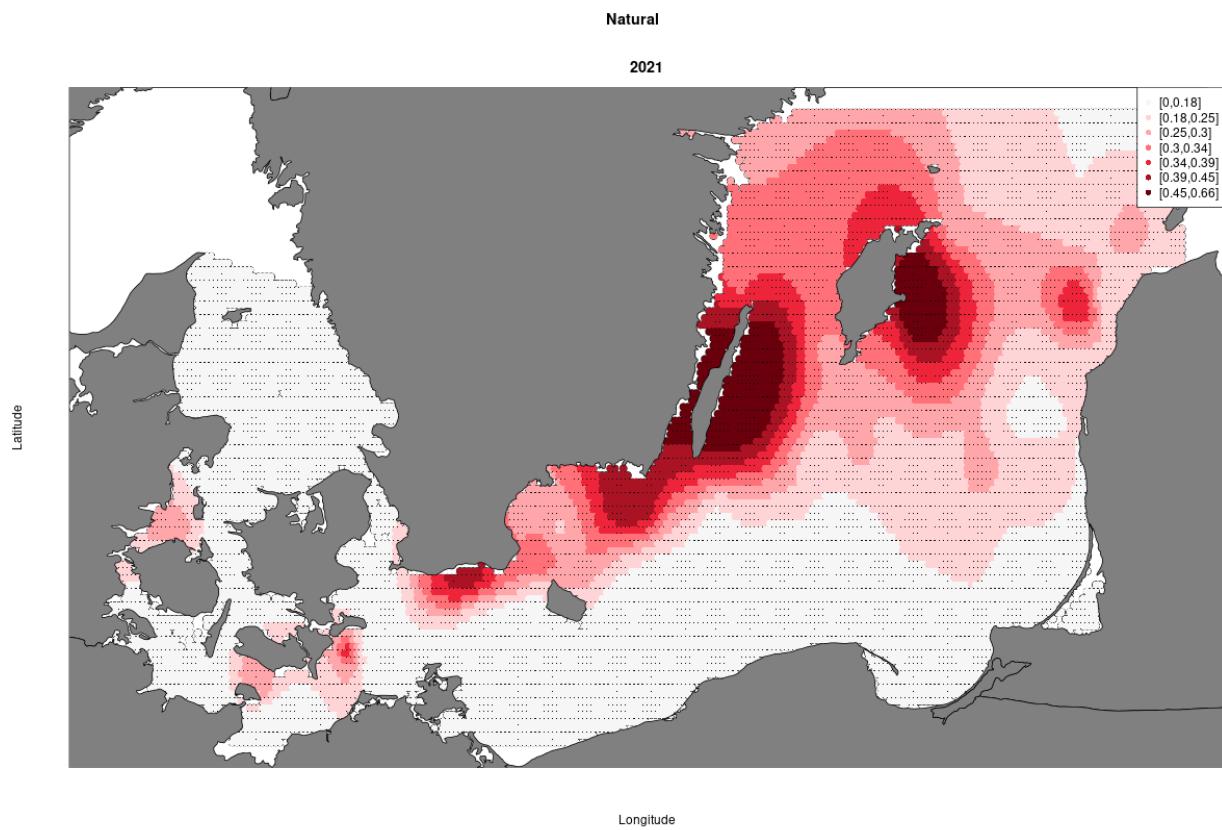


Figure 29: Probability of encounter for a standard haul (30 min TVL).

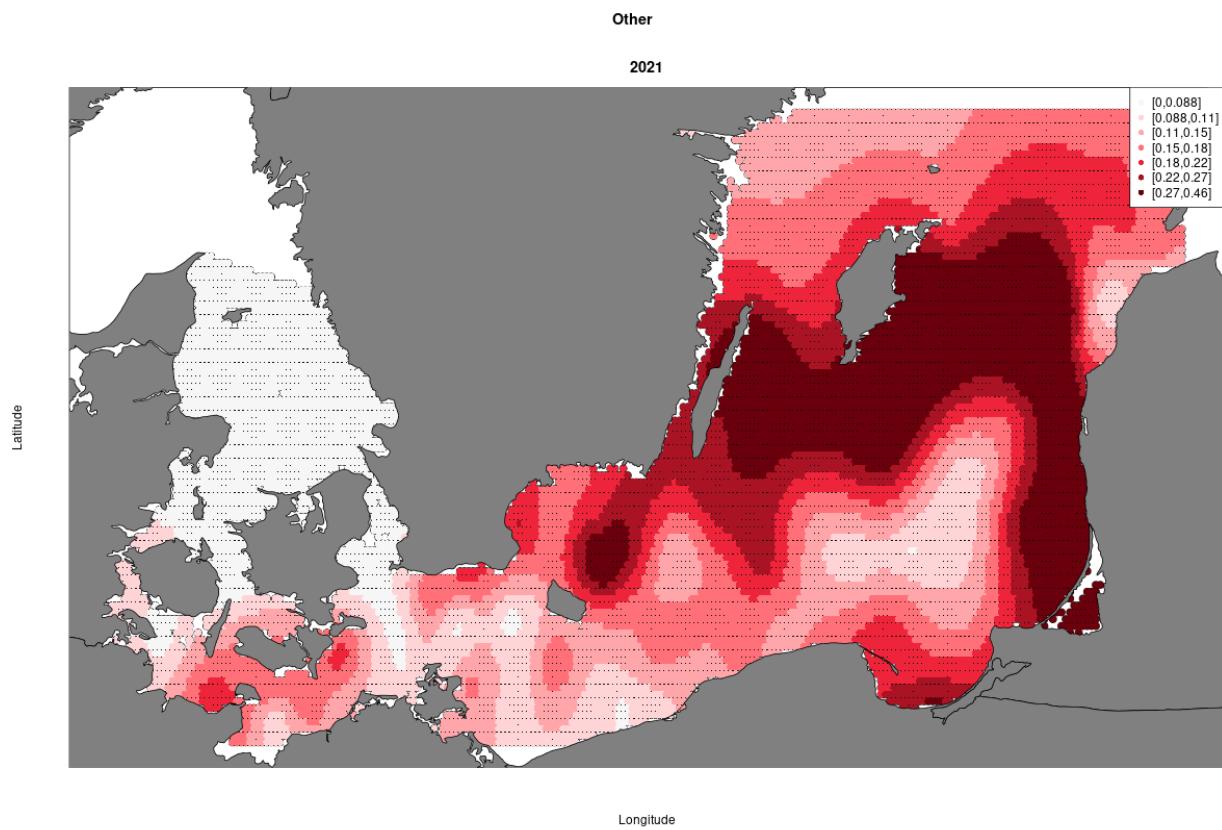


Figure 30: Probability of encounter for a standard haul (30 min TVL).

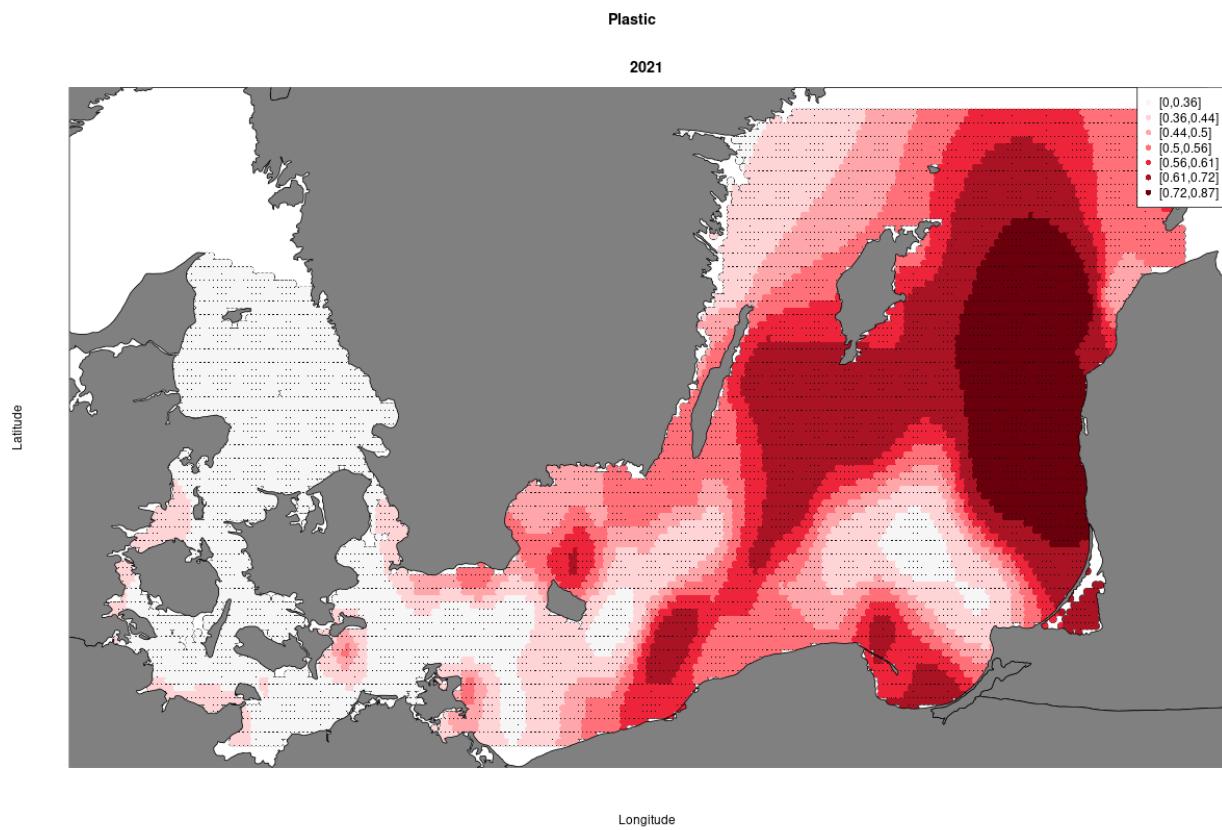


Figure 31: Probability of encounter for a standard haul (30 min TVL).

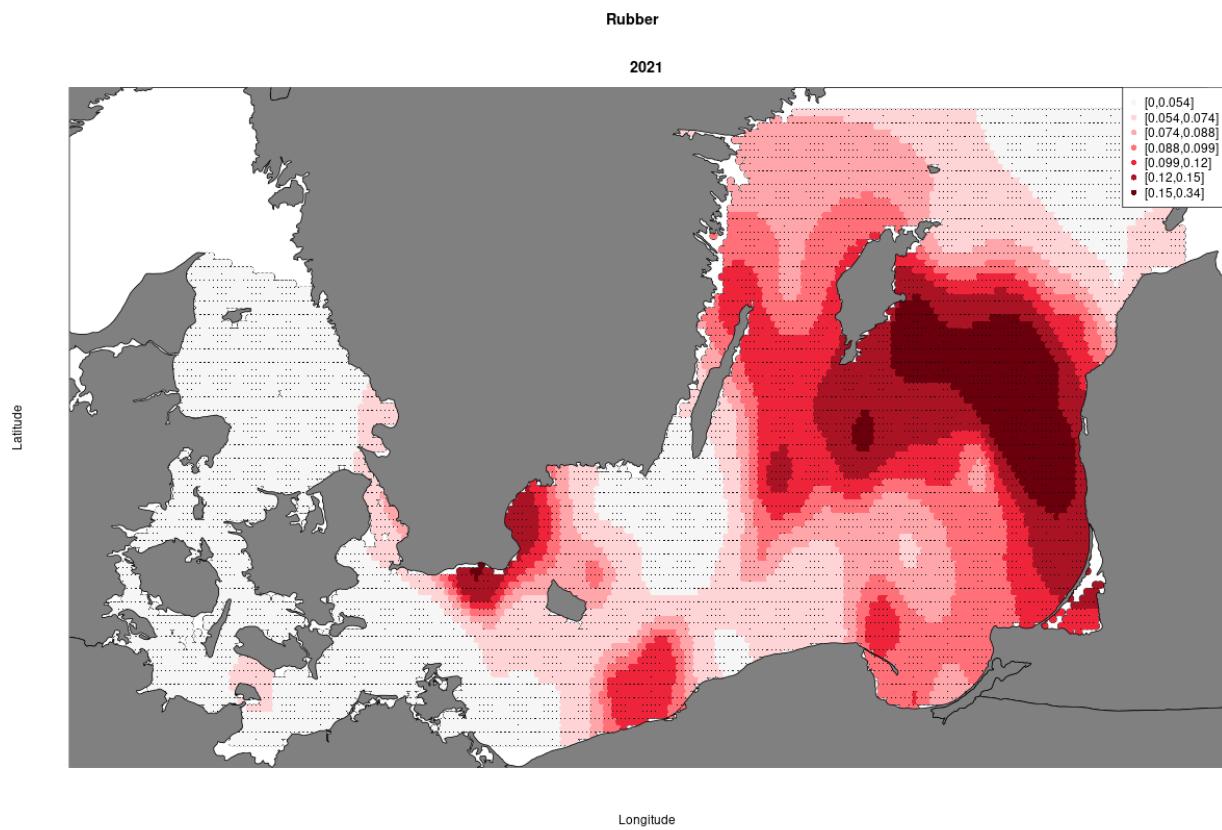


Figure 32: Probability of encounter for a standard haul (30 min TVL).

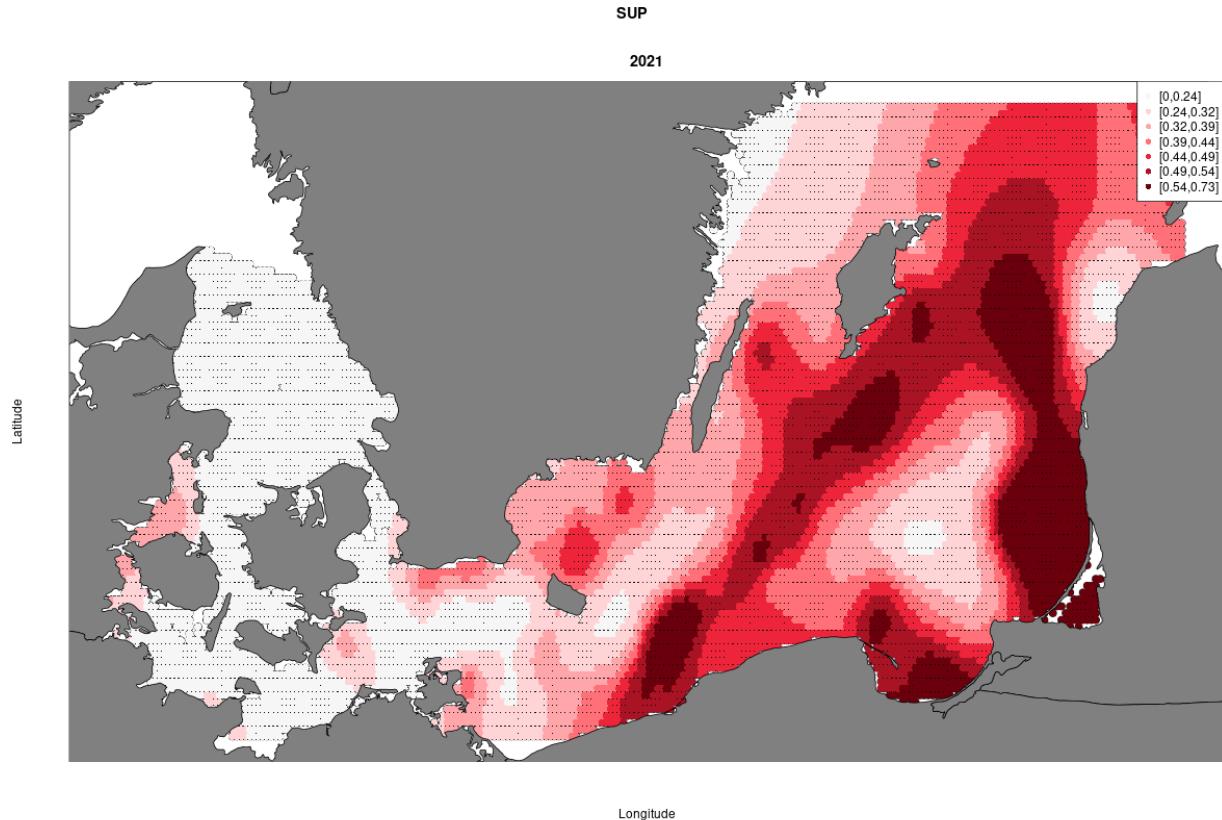


Figure 33: Probability of encounter for a standard haul (30 min TVL).

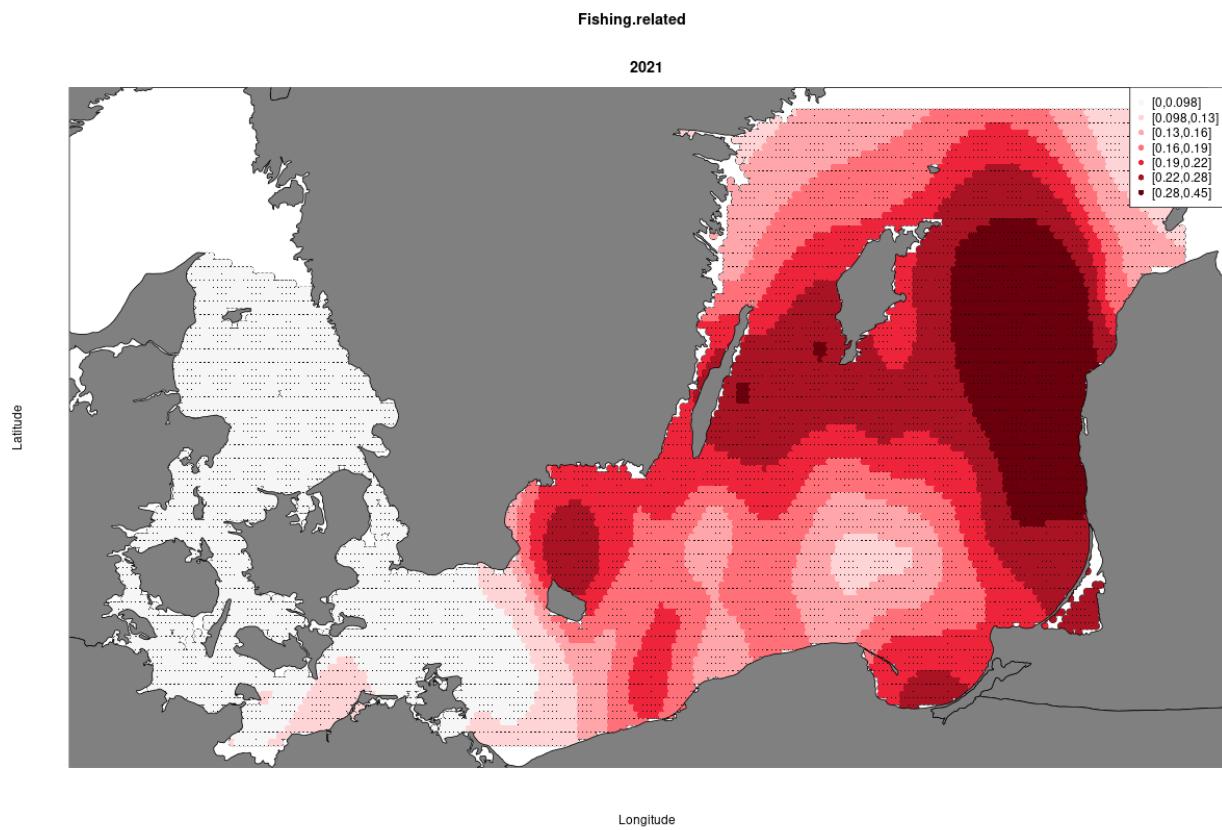


Figure 34: Probability of encounter for a standard haul (30 min TVL).

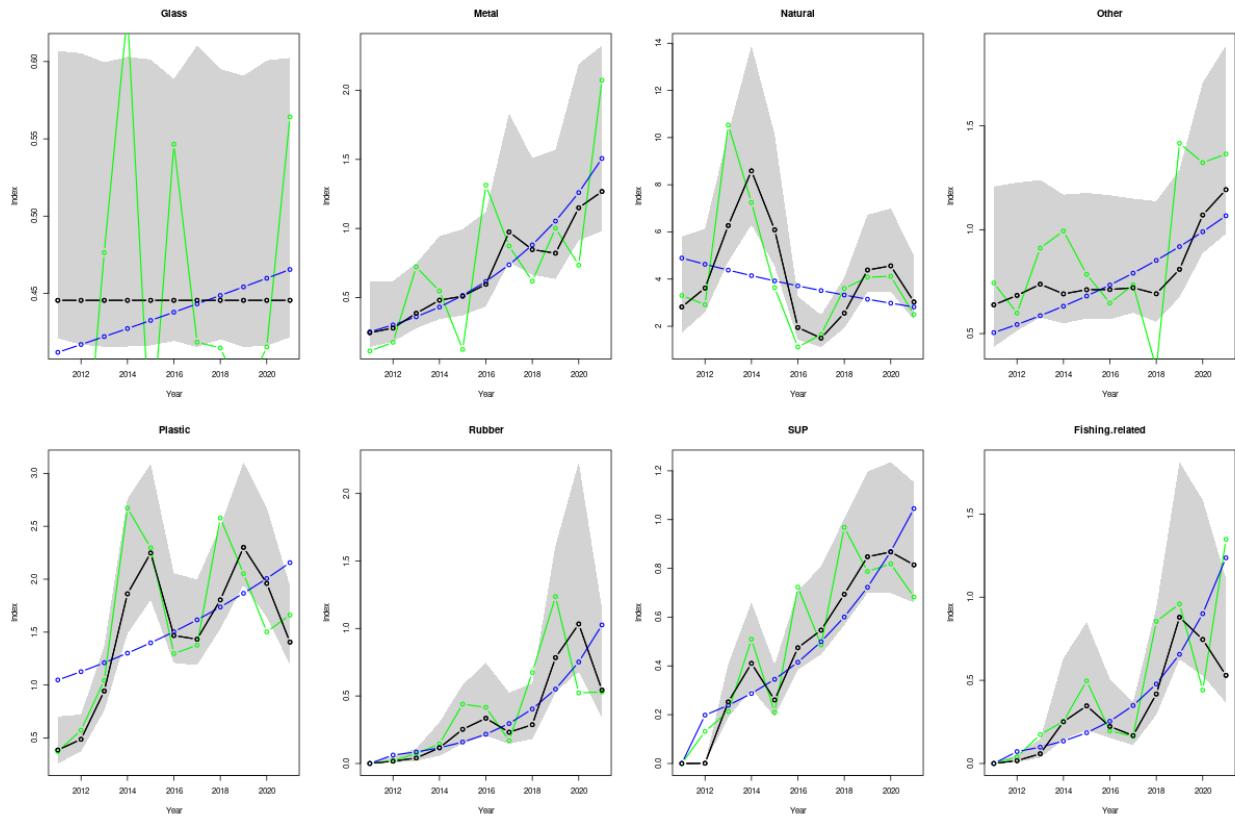


Figure 35: All litter indices and all models (mass). Black is model 1, green is model 2, and blue is model 3. Shaded area is 95% confidence area of model 1. Units are kg / km² in all plots.

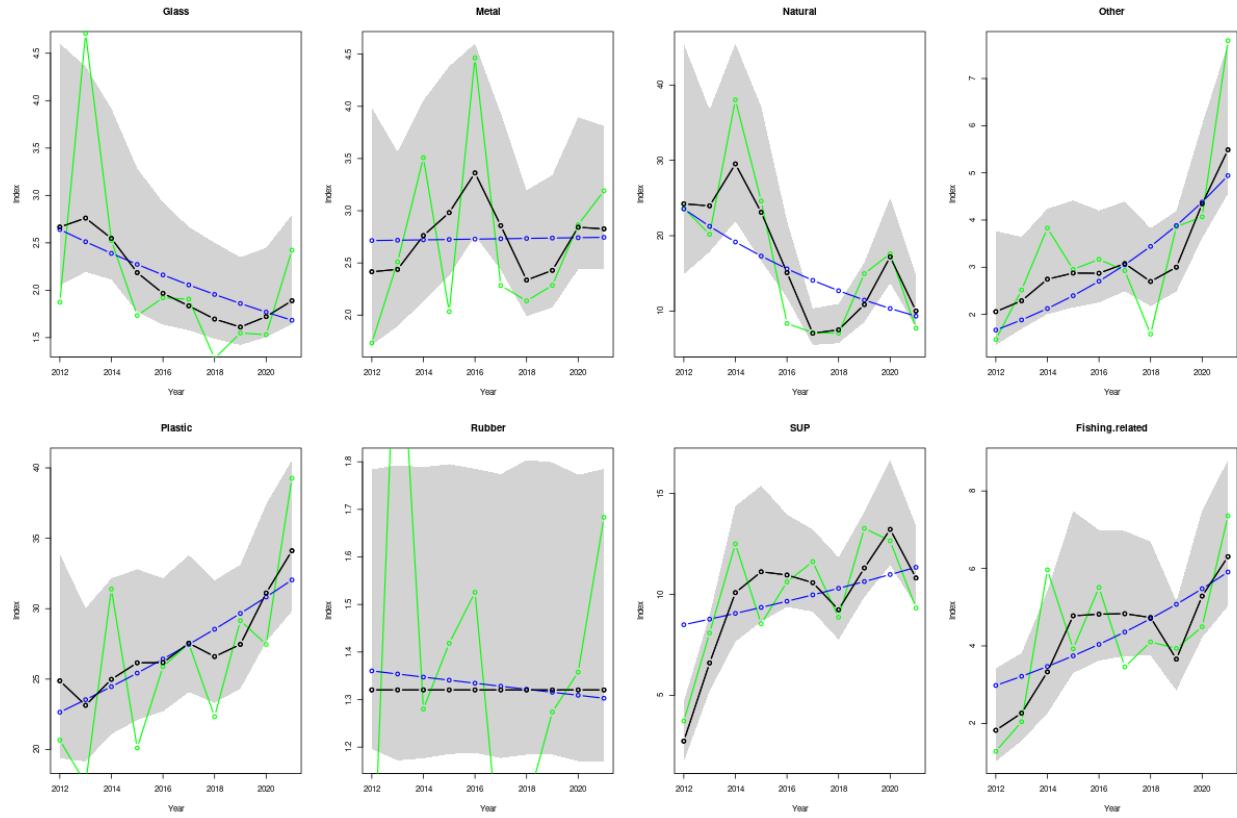


Figure 36: All litter indices and all models (numbers). Black is model 1, green is model 2, and blue is model 3. Shaded area is 95% confidence area of model 1. Units are numbers / km² in all plots.

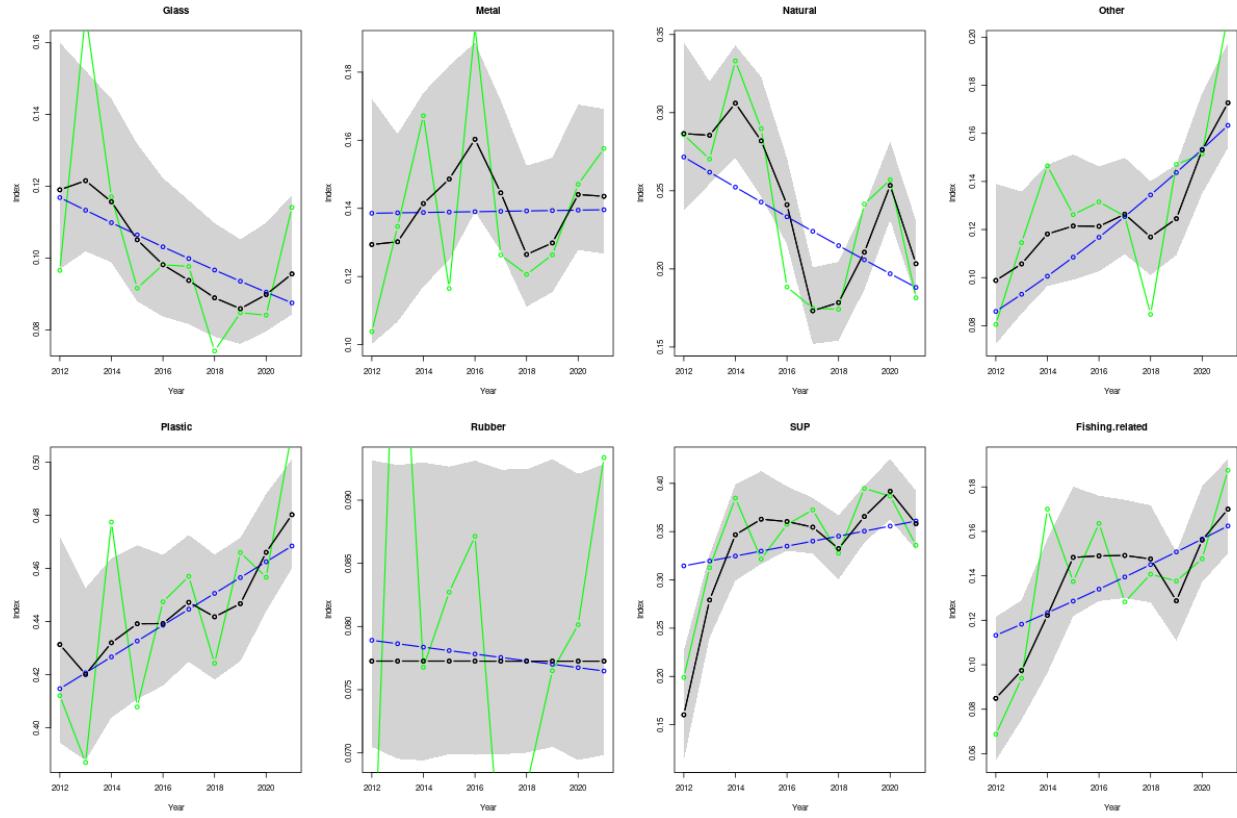


Figure 37: All litter indices and all models (probability of encounter). Black is model 1, green is model 2, and blue is model 3. Shaded area is 95% confidence area of model 1. Units are probability per standard haul (30 min TVL) in all plots.

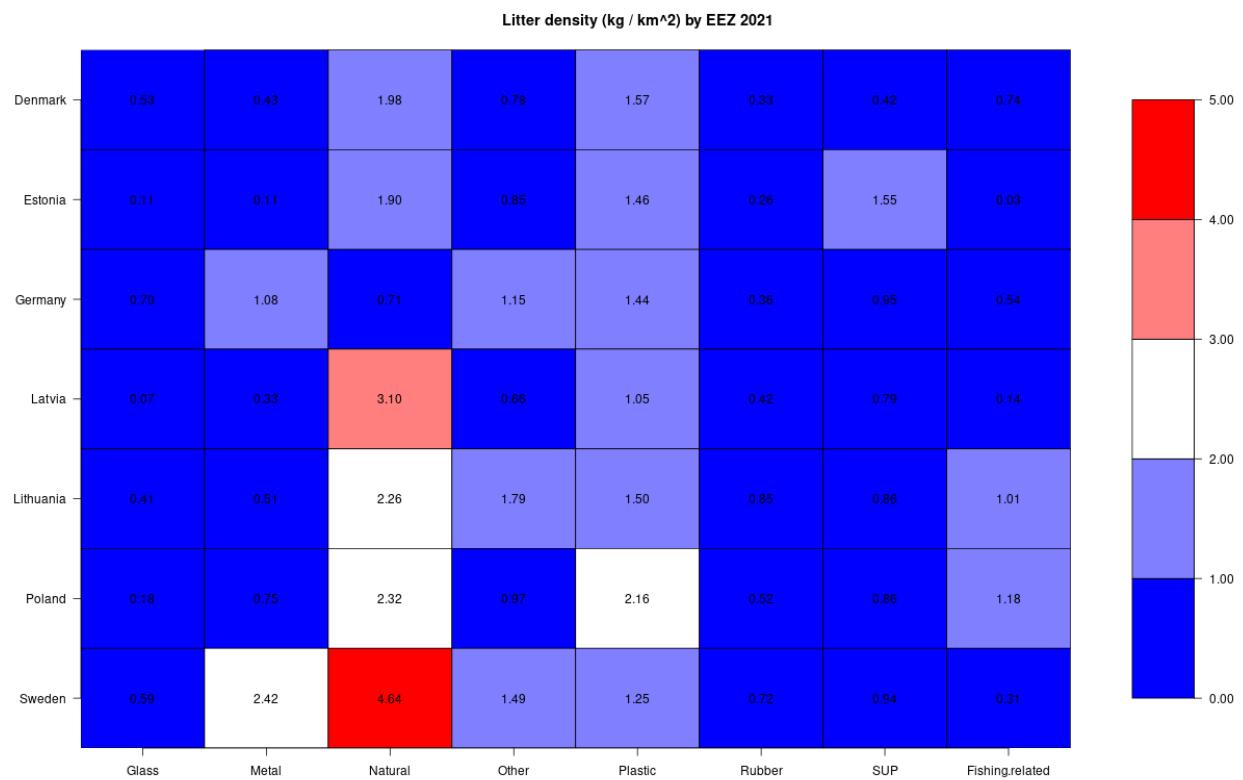


Figure 38: Litter density by EEZ (weight)



Figure 39: Uncertainty of litter density estimates by EEZ (weight)

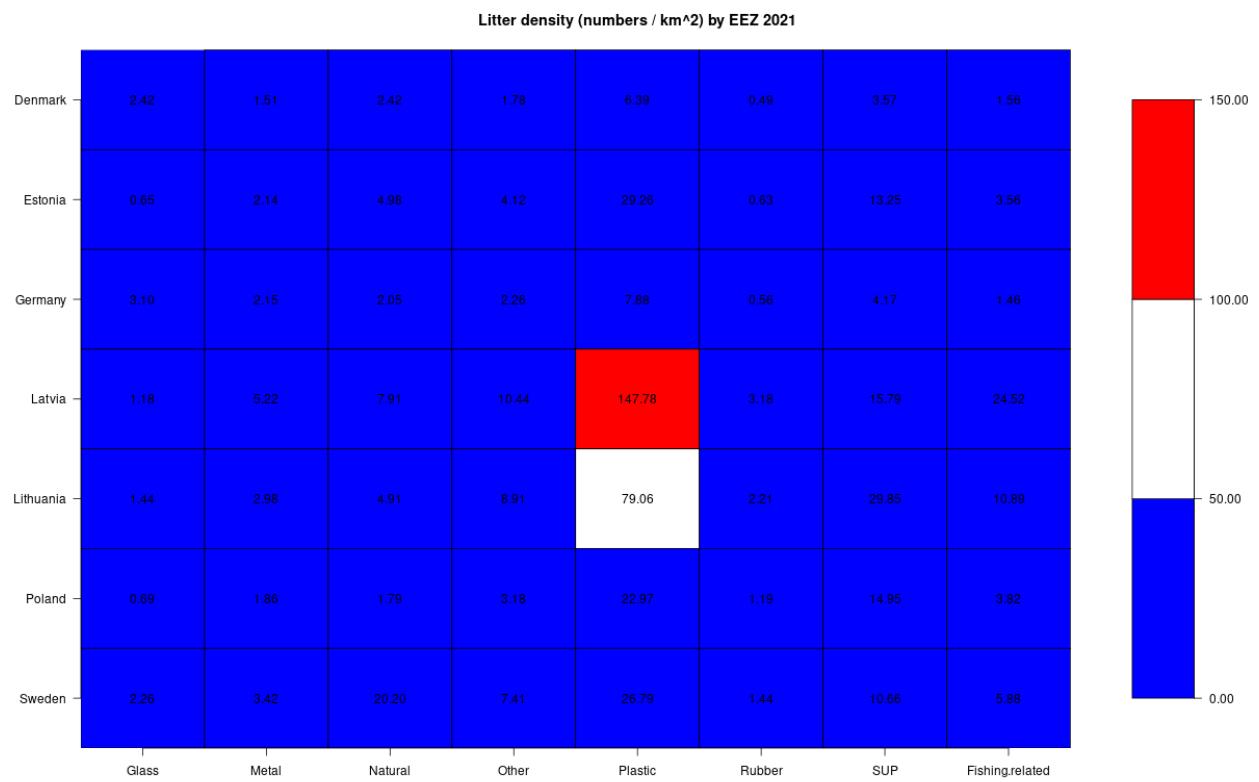


Figure 40: Litter density by EEZ (numbers)

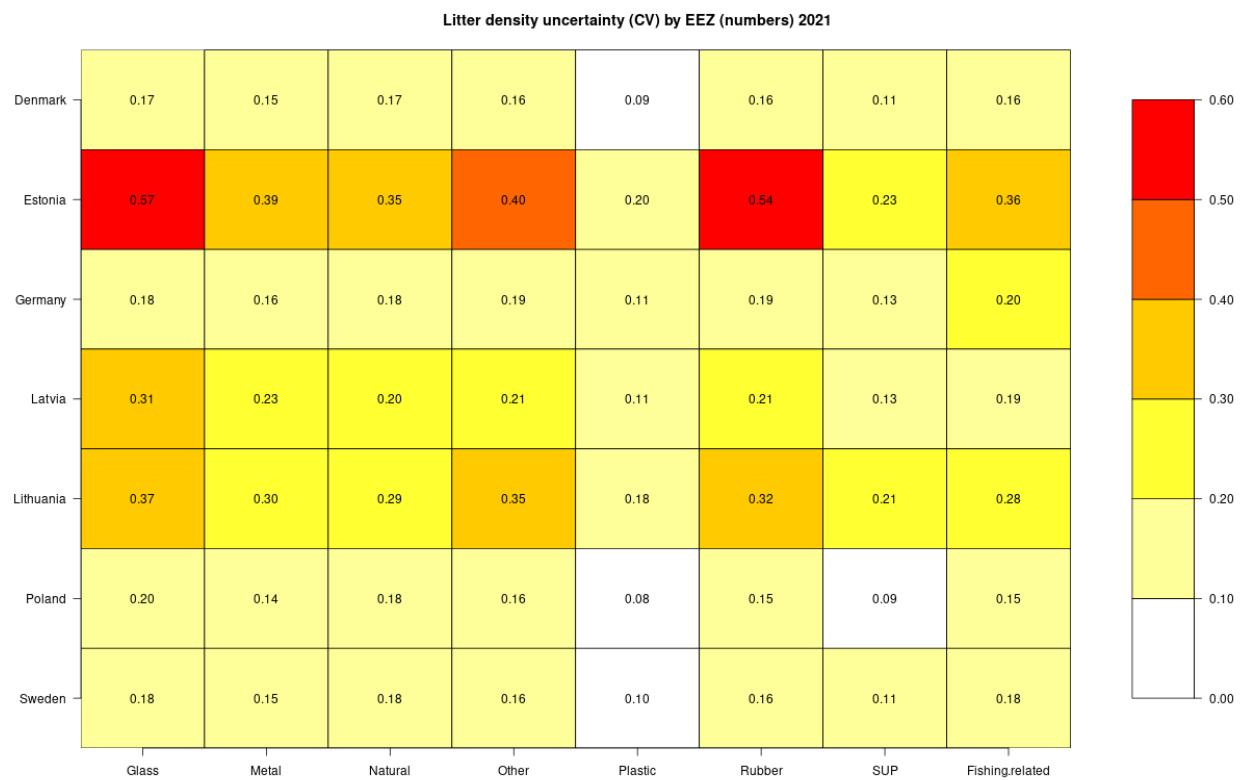


Figure 41: Uncertainty of litter density estimates by EEZ (numbers)

3.1 Model summaries (mass)

\$Glass

```
Family: Tweedie(p=1.412)
Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) -14.97435 0.07349 -203.8 <2e-16 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df F p-value
s(ctime) 0.001536 10 0.000 0.704
s(lon,lat) 58.921051 127 2.805 <2e-16 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) = 0.0823 Deviance explained = 26.6%
-ML = 1069.2 Scale est. = 2.4522 n = 4819
```

\$Metal

```
Family: Tweedie(p=1.741)
Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) -15.22309 0.09683 -157.2 <2e-16 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df F p-value
s(ctime) 5.14 10 3.853 <2e-16 ***
s(lon,lat) 70.48 127 3.680 <2e-16 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) = 0.0183 Deviance explained = 30.9%
-ML = 1138.6 Scale est. = 13.175 n = 4819
```

\$Natural

```
Family: Tweedie(p=1.701)
Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) -13.91088 0.07048 -197.4 <2e-16 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

```

Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
          edf Ref.df      F p-value
s(ctime)    7.754     10 7.806 <2e-16 ***
s(lon,lat) 89.312    127 7.130 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0069  Deviance explained =   37%
-ML =  2177  Scale est. = 8.6734   n = 4819

$Other

Family: Tweedie(p=1.688)
Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -14.36780  0.07822 -183.7 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
          edf Ref.df      F p-value
s(ctime)    3.138     10 1.206 0.00143 **
s(lon,lat) 52.773    127 1.705 < 2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.00785  Deviance explained = 17.3%
-ML = 1326.1  Scale est. = 10.522   n = 4819

$Plastic

Family: Tweedie(p=1.761)
Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -14.01639  0.04754 -294.8 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
          edf Ref.df      F p-value
s(ctime)    7.776     10 8.287 <2e-16 ***
s(lon,lat) 101.987    127 9.321 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) = -0.000709  Deviance explained = 30.5%
-ML = 1355.7  Scale est. = 4.8775   n = 4819

$Rubber

Family: Tweedie(p=1.73)

```

```

Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) -15.491     0.125    -124   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df      F p-value
s(ctime)    6.329     10 7.218   <2e-16 ***
s(lon,lat) 22.162    127 0.583   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.00508  Deviance explained =  20%
-ML = 719.76  Scale est. = 21.902   n = 4819

$SUP

Family: Tweedie(p=1.69)
Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) -15.7078    0.0658   -238.7   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df      F p-value
s(ctime)    9.748     10 24.93   <2e-16 ***
s(lon,lat) 89.682    127 6.78   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.00776  Deviance explained =  31%
-ML = 855.23  Scale est. = 3.2685   n = 4819

$Fishing.related

Family: Tweedie(p=1.782)
Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) -16.5755    0.1165  -142.3   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df      F p-value
s(ctime)    7.754     10 11.192   <2e-16 ***

```

```

s(lon,lat) 67.733    127  4.422 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.00347  Deviance explained = 45.9%
-ML = 696.09  Scale est. = 16.507   n = 4819

=====
$Glass

Family: Tweedie(p=1.411)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) -15.19070  0.35055 -43.334 <2e-16 ***
Year2012     -0.17620  0.42817 -0.412  0.681
Year2013      0.27726  0.40530  0.684  0.494
Year2014      0.55856  0.40427  1.382  0.167
Year2015     -0.03505  0.41501 -0.084  0.933
Year2016      0.41456  0.40468  1.024  0.306
Year2017      0.14757  0.40905  0.361  0.718
Year2018      0.13862  0.39649  0.350  0.727
Year2019      0.05787  0.40431  0.143  0.886
Year2020      0.14011  0.39534  0.354  0.723
Year2021      0.44639  0.39000  1.145  0.252
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
  edf Ref.df      F p-value
s(lon,lat) 59.05    127 2.802 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.0832  Deviance explained = 27.3%
-ML = 1065.2  Scale est. = 2.4245   n = 4819

$Metal

Family: Tweedie(p=1.736)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) -17.06332  0.58792 -29.023 < 2e-16 ***
Year2012     0.44821  0.69403  0.646  0.518437
Year2013     1.86004  0.65500  2.840  0.004534 **
Year2014     1.58344  0.67141  2.358  0.018395 *
Year2015     0.09749  0.68580  0.142  0.886968
Year2016     2.45931  0.64007  3.842  0.000123 ***
Year2017     2.05028  0.64067  3.200  0.001382 **
Year2018     1.70567  0.63790  2.674  0.007523 **
Year2019     2.18902  0.63636  3.440  0.000587 ***
Year2020     1.87849  0.63735  2.947  0.003221 **
Year2021     2.91569  0.62706  4.650  3.41e-06 ***
---

```

```

Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
    edf Ref.df      F p-value
s(lon,lat) 71.08     127 3.505 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.0445  Deviance explained = 32.4%
-ML = 1124.1  Scale est. = 12.535   n = 4819

$Natural

Family: Tweedie(p=1.698)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -13.91085   0.31155 -44.650 < 2e-16 ***
Year2012     -0.12422   0.38012  -0.327  0.74385
Year2013      1.16003   0.35471   3.270  0.00108 **
Year2014      0.78573   0.36927   2.128  0.03340 *
Year2015      0.09741   0.36937   0.264  0.79201
Year2016     -1.08244   0.38491  -2.812  0.00494 **
Year2017     -0.69620   0.37339  -1.865  0.06231 .
Year2018      0.08732   0.35397   0.247  0.80515
Year2019      0.21099   0.35570   0.593  0.55311
Year2020      0.22106   0.35287   0.626  0.53104
Year2021     -0.27864   0.35945  -0.775  0.43828
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
    edf Ref.df      F p-value
s(lon,lat) 89.38     127 7.054 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.0107  Deviance explained = 37.2%
-ML = 2163.9  Scale est. = 8.5463   n = 4819

$Other

Family: Tweedie(p=1.685)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -14.53637   0.41818 -34.761 <2e-16 ***
Year2012     -0.21636   0.51058  -0.424  0.672
Year2013      0.20379   0.49418   0.412  0.680
Year2014      0.29031   0.50650   0.573  0.567
Year2015      0.05440   0.49397   0.110  0.912
Year2016     -0.13851   0.49340  -0.281  0.779
Year2017     -0.01258   0.48596  -0.026  0.979
Year2018     -0.80429   0.48982  -1.642  0.101
Year2019      0.64407   0.47023   1.370  0.171

```

```

Year2020      0.57601   0.46936   1.227    0.220
Year2021      0.60711   0.46796   1.297    0.195
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
          edf Ref.df   F p-value
s(lon,lat) 53.4     127 1.7 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.00825  Deviance explained = 18.3%
-ML = 1318.1  Scale est. = 10.228    n = 4819

$Plastic

Family: Tweedie(p=1.76)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -15.4368   0.2686 -57.467 < 2e-16 ***
Year2012      0.4295   0.3235   1.328 0.184267
Year2013      1.0301   0.3122   3.299 0.000976 ***
Year2014      1.9700   0.3119   6.316 2.93e-10 ***
Year2015      1.8185   0.3029   6.004 2.07e-09 ***
Year2016      1.2474   0.3062   4.074 4.70e-05 ***
Year2017      1.3066   0.3024   4.320 1.59e-05 ***
Year2018      1.9343   0.2938   6.584 5.09e-11 ***
Year2019      1.7064   0.2972   5.742 9.93e-09 ***
Year2020      1.3944   0.2973   4.690 2.82e-06 ***
Year2021      1.4946   0.2968   5.035 4.95e-07 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
          edf Ref.df   F p-value
s(lon,lat) 102.2     127 9.275 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.00108  Deviance explained = 30.8%
-ML = 1340.6  Scale est. = 4.8233    n = 4819

$Rubber

Family: Tweedie(p=1.734)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -456.56    41.42  -11.02 <2e-16 ***
Year2012      438.75    41.43   10.59 <2e-16 ***
Year2013      439.89    41.42   10.62 <2e-16 ***
Year2014      440.60    41.42   10.64 <2e-16 ***
Year2015      441.71    41.42   10.66 <2e-16 ***
Year2016      441.65    41.42   10.66 <2e-16 ***

```

```

Year2017    440.76    41.42   10.64   <2e-16 ***
Year2018    442.13    41.42   10.67   <2e-16 ***
Year2019    442.74    41.42   10.69   <2e-16 ***
Year2020    441.88    41.42   10.67   <2e-16 ***
Year2021    441.89    41.42   10.67   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
      edf Ref.df   F p-value
s(lon,lat) 14.74     127 0.362 3.42e-07 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.00466  Deviance explained = 17.8%
-ML =  708.3  Scale est. = 22.641  n = 4819

$SUP

Family: Tweedie(p=1.688)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -384.49     35.77  -10.75   <2e-16 ***
Year2012     367.85     35.77   10.28   <2e-16 ***
Year2013     368.33     35.77   10.30   <2e-16 ***
Year2014     369.21     35.77   10.32   <2e-16 ***
Year2015     368.32     35.77   10.30   <2e-16 ***
Year2016     369.56     35.77   10.33   <2e-16 ***
Year2017     369.16     35.77   10.32   <2e-16 ***
Year2018     369.85     35.77   10.34   <2e-16 ***
Year2019     369.64     35.77   10.33   <2e-16 ***
Year2020     369.68     35.77   10.34   <2e-16 ***
Year2021     369.50     35.77   10.33   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
      edf Ref.df   F p-value
s(lon,lat) 88.43     127 6.532  <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0171  Deviance explained = 30.8%
-ML = 830.73  Scale est. = 3.2263  n = 4819

$Fishing.related

Family: Tweedie(p=1.784)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -932.46     14.31  -65.15   <2e-16 ***
Year2012     913.77     14.32   63.81   <2e-16 ***
Year2013     915.24     14.32   63.92   <2e-16 ***

```

```

Year2014    915.62    14.32   63.95 <2e-16 ***
Year2015    916.29    14.32   64.00 <2e-16 ***
Year2016    915.36    14.32   63.94 <2e-16 ***
Year2017    915.18    14.32   63.92 <2e-16 ***
Year2018    916.83    14.32   64.05 <2e-16 ***
Year2019    916.95    14.32   64.05 <2e-16 ***
Year2020    916.17    14.32   64.00 <2e-16 ***
Year2021    917.29    14.31   64.08 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
          edf Ref.df   F p-value
s(lon,lat) 68.1    127 4.533 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.00308  Deviance explained = 46.4%
-ML = 680.48  Scale est. = 16.402   n = 4819

=====
$Glass

Family: Tweedie(p=1.412)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -39.65069  42.69067 -0.929   0.353
ctime        0.01223   0.02116   0.578   0.563

Approximate significance of smooth terms:
          edf Ref.df   F p-value
s(lon,lat) 59.06    127 2.819 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.0814  Deviance explained = 26.7%
-ML = 1069.1  Scale est. = 2.4522   n = 4819

$Metal

Family: Tweedie(p=1.741)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -375.9727   59.7281 -6.295 3.36e-10 ***
ctime        0.1788    0.0296   6.041 1.65e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
          edf Ref.df   F p-value
s(lon,lat) 70.6    127 3.782 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

R-sq.(adj) =  0.0182  Deviance explained = 30.4%
-ML = 1135.8  Scale est. = 13.255    n = 4819

$Natural

Family: Tweedie(p=1.705)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 97.49366   41.28361   2.362  0.01824 *
ctime       -0.05516    0.02047  -2.695  0.00706 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
        edf Ref.df      F p-value
s(lon,lat) 88.86     127 6.934 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0147  Deviance explained = 34.5%
-ML = 2190.4  Scale est. = 9.0863    n = 4819

$Other

Family: Tweedie(p=1.688)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -165.43503   53.21860  -3.109  0.00189 **
ctime        0.07489    0.02638   2.839  0.00454 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
        edf Ref.df      F p-value
s(lon,lat) 53.61     127 1.714 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.00869  Deviance explained = 17.1%
-ML = 1325.3  Scale est. = 10.528    n = 4819

$Plastic

Family: Tweedie(p=1.764)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error t value Pr(>|t|)
```

```

(Intercept) -159.57007 30.83269 -5.175 2.37e-07 ***
ctime         0.07217   0.01528   4.722 2.40e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
    edf Ref.df      F p-value
s(lon,lat) 102.7     127 9.748 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) = -0.00306  Deviance explained = 29.4%
-ML = 1364.8  Scale est. = 4.9872    n = 4819

$Rubber

Family: Tweedie(p=1.735)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -642.98821  85.87736 -7.487 8.32e-14 ***
ctime        0.31112   0.04256   7.311 3.09e-13 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
    edf Ref.df      F p-value
s(lon,lat) 22.83     127 0.687 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.000239  Deviance explained = 17.1%
-ML = 720.59  Scale est. = 23.314    n = 4819

$SUP

Family: Tweedie(p=1.691)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -387.94317  34.41123 -11.27 <2e-16 ***
ctime        0.18470   0.01705   10.83 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
    edf Ref.df      F p-value
s(lon,lat) 89.35     127 7.191 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) = -0.00834  Deviance explained = 27.8%
-ML = 875.71  Scale est. = 3.4013    n = 4819

$Fishing.related

```

```

Family: Tweedie(p=1.786)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -655.61737   72.76934 -9.010 <2e-16 ***
ctime        0.31680    0.03606   8.785 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
          edf Ref.df      F p-value
s(lon,lat) 69.91     127 4.831 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) = -0.00136  Deviance explained = 44.6%
-ML = 696.7  Scale est. = 17.154  n = 4819

```

3.2 Model summaries (numbers)

```
===== Models on numbers =====
$Glass

Family: Negative Binomial(0.181)
Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -13.44970 0.06961 -193.2 <2e-16 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value
s(ctime) 2.70 10 9.475 0.00379 **
s(lon,lat) 58.63 127 278.196 < 2e-16 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) = 0.065 Deviance explained = 31.6%
-ML = 1152.3 Scale est. = 1 n = 3759

$Metal

Family: Negative Binomial(0.267)
Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -13.07562 0.05699 -229.4 <2e-16 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value
s(ctime) 3.723 10 9.261 0.0175 *
s(lon,lat) 55.833 127 231.028 <2e-16 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) = 0.0515 Deviance explained = 22.6%
-ML = 1378.5 Scale est. = 1 n = 3759

$Natural

Family: Negative Binomial(0.191)
Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -12.41046 0.05722 -216.9 <2e-16 ***
```

```

---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
    edf Ref.df Chi.sq p-value
s(ctime)    7.435      10  91.23 <2e-16 ***
s(lon,lat) 70.617     127 735.60 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0745  Deviance explained = 50.5%
-ML = 2285.6  Scale est. = 1          n = 3759

$Other

Family: Negative Binomial(0.182)
Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
    Estimate Std. Error z value Pr(>|z|)
(Intercept) -13.08815   0.06756 -193.7 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
    edf Ref.df Chi.sq p-value
s(ctime)    4.506      10  36.93 <2e-16 ***
s(lon,lat) 55.591     127 310.86 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.043  Deviance explained = 32.5%
-ML = 1431.5  Scale est. = 1          n = 3759

$Plastic

Family: Negative Binomial(0.473)
Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
    Estimate Std. Error z value Pr(>|z|)
(Intercept) -11.26801   0.03415  -330 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
    edf Ref.df Chi.sq p-value
s(ctime)    4.103      10  17.2 0.000264 ***
s(lon,lat) 82.048     127 1256.3 < 2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0629  Deviance explained =  43%
-ML = 3960.6  Scale est. = 1          n = 3759

$Rubber

```

```

Family: Negative Binomial(0.185)
Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -13.88096 0.07991 -173.7 <2e-16 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value
s(ctime) 0.001385 10 0.001 0.665
s(lon,lat) 37.428180 127 149.291 <2e-16 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) = 0.0107 Deviance explained = 25.1%
-ML = 803.69 Scale est. = 1 n = 3759

$SUP

Family: Negative Binomial(0.504)
Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -11.88856 0.03813 -311.8 <2e-16 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value
s(ctime) 7.804 10 48.7 <2e-16 ***
s(lon,lat) 73.908 127 649.5 <2e-16 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) = 0.123 Deviance explained = 28%
-ML = 2931.2 Scale est. = 1 n = 3759

$Fishing.related

Family: Negative Binomial(0.163)
Link function: log

Formula:
A1 ~ s(ctime, k = 11, bs = "ds", m = c(1, 0)) + s(lon, lat, bs = "ds",
m = c(1, 0.5), k = 128) + offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -13.0169 0.0676 -192.5 <2e-16 ***
---
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value

```

```

s(ctime)    5.351      10  24.43 2.59e-05 ***
s(lon,lat) 38.950     127 323.83  < 2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0313  Deviance explained = 35.9%
-ML = 1457.1  Scale est. = 1          n = 3759

=====
$Glass

Family: Negative Binomial(0.19)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -13.45597   0.28374 -47.423 <2e-16 ***
Year2013     0.92154   0.35877   2.569  0.0102 *
Year2014     0.29770   0.37567   0.792  0.4281
Year2015    -0.07804   0.37382  -0.209  0.8346
Year2016     0.02452   0.33857   0.072  0.9423
Year2017     0.01687   0.33498   0.050  0.9598
Year2018    -0.38055   0.33559  -1.134  0.2568
Year2019    -0.19073   0.33373  -0.572  0.5676
Year2020    -0.20214   0.33059  -0.611  0.5409
Year2021     0.25673   0.32227   0.797  0.4257
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value
s(lon,lat) 58.39     127   277 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0743  Deviance explained = 32.5%
-ML = 1143.6  Scale est. = 1          n = 3759

$Metal

Family: Negative Binomial(0.278)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -13.5229   0.2674 -50.577 < 2e-16 ***
Year2013     0.3708   0.3544   1.046  0.29543
Year2014     0.7056   0.3421   2.063  0.03913 *
Year2015     0.1602   0.3436   0.466  0.64100
Year2016     0.9466   0.2966   3.192  0.00141 **
Year2017     0.2760   0.3080   0.896  0.37013
Year2018     0.2097   0.3050   0.687  0.49179
Year2019     0.2769   0.3040   0.911  0.36247
Year2020     0.5034   0.2997   1.680  0.09298 .
Year2021     0.6108   0.2971   2.056  0.03981 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

```

```

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value
s(lon,lat) 55.18     127  225.8 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0569  Deviance explained = 23.2%
-ML =    1369  Scale est. = 1          n = 3759

$Natural

Family: Negative Binomial(0.195)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -11.73828   0.20952 -56.026 < 2e-16 ***
Year2013     -0.15848   0.29229  -0.542   0.5877
Year2014      0.47509   0.28662   1.658   0.0974 .
Year2015      0.03967   0.27252   0.146   0.8843
Year2016     -1.04073   0.25853  -4.026  5.68e-05 ***
Year2017     -1.19964   0.25833  -4.644  3.42e-06 ***
Year2018     -1.20744   0.25498  -4.735  2.19e-06 ***
Year2019     -0.45773   0.24582  -1.862   0.0626 .
Year2020     -0.29520   0.24432  -1.208   0.2269
Year2021     -1.12080   0.25278  -4.434  9.26e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value
s(lon,lat) 70.77     127  761.5 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0816  Deviance explained = 50.8%
-ML = 2270.9  Scale est. = 1          n = 3759

$Other

Family: Negative Binomial(0.191)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -13.94961   0.30929 -45.103 < 2e-16 ***
Year2013      0.53717   0.41281   1.301   0.19317
Year2014      0.95726   0.39756   2.408   0.01605 *
Year2015      0.69749   0.38096   1.831   0.06712 .
Year2016      0.76729   0.34713   2.210   0.02708 *
Year2017      0.68852   0.34668   1.986   0.04703 *
Year2018      0.07319   0.35774   0.205   0.83789
Year2019      0.96485   0.33937   2.843   0.00447 **
Year2020      1.01755   0.34029   2.990   0.00279 **
Year2021      1.66852   0.33307   5.010   5.46e-07 ***
---

```

```

Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
    edf Ref.df Chi.sq p-value
s(lon,lat) 54.74     127   302.4 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.0447  Deviance explained = 33.7%
-ML = 1416.6  Scale est. = 1          n = 3759

$Plastic

Family: Negative Binomial(0.48)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -11.54076   0.14823 -77.857 < 2e-16 ***
Year2013    -0.16117   0.21402 -0.753 0.451409
Year2014     0.41843   0.20317  2.059 0.039449 *
Year2015    -0.02743   0.19225 -0.143 0.886556
Year2016     0.22541   0.17064  1.321 0.186523
Year2017     0.28689   0.17013  1.686 0.091735 .
Year2018     0.07771   0.16959  0.458 0.646789
Year2019     0.34425   0.16746  2.056 0.039804 *
Year2020     0.28471   0.16857  1.689 0.091234 .
Year2021     0.64196   0.16630  3.860 0.000113 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
    edf Ref.df Chi.sq p-value
s(lon,lat) 81.42     127   1196 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.0854  Deviance explained = 43.3%
-ML = 3948.6  Scale est. = 1          n = 3759

$Rubber

Family: Negative Binomial(0.192)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -14.3507   0.3797 -37.796 <2e-16 ***
Year2013     0.9869   0.4766  2.071  0.0384 *
Year2014     0.4342   0.5129  0.847  0.3973
Year2015     0.5366   0.4636  1.157  0.2471
Year2016     0.6096   0.4239  1.438  0.1504
Year2017     0.1391   0.4377  0.318  0.7506
Year2018     0.2594   0.4278  0.606  0.5442
Year2019     0.4294   0.4232  1.014  0.3104
Year2020     0.4930   0.4226  1.167  0.2433
Year2021     0.7079   0.4160  1.702  0.0888 .

```

```

---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
    edf Ref.df Chi.sq p-value
s(lon,lat) 35.69     127    143  <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0115  Deviance explained = 25.4%
-ML = 799.73  Scale est. = 1          n = 3759

$SUP

Family: Negative Binomial(0.511)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -12.8926   0.1949 -66.146 < 2e-16 ***
Year2013      0.7738   0.2555   3.029 0.002457 **
Year2014      1.2094   0.2457   4.923 8.51e-07 ***
Year2015      0.8289   0.2353   3.524 0.000426 ***
Year2016      1.0463   0.2142   4.884 1.04e-06 ***
Year2017      1.1363   0.2139   5.312 1.08e-07 ***
Year2018      0.8660   0.2143   4.040 5.34e-05 ***
Year2019      1.2690   0.2107   6.024 1.70e-09 ***
Year2020      1.2213   0.2118   5.766 8.09e-09 ***
Year2021      0.9165   0.2133   4.297 1.73e-05 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
    edf Ref.df Chi.sq p-value
s(lon,lat) 73.21     127   640.6 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.128  Deviance explained = 27.8%
-ML = 2918.3  Scale est. = 1          n = 3759

$Fishing.related

Family: Negative Binomial(0.166)
Link function: log

Formula:
A1 ~ Year + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -14.2400   0.3647 -39.044 < 2e-16 ***
Year2013      0.4683   0.5005   0.936 0.349500
Year2014      1.5397   0.4491   3.428 0.000608 ***
Year2015      1.1209   0.4309   2.601 0.009291 **
Year2016      1.4600   0.3944   3.702 0.000214 ***
Year2017      0.9945   0.3989   2.493 0.012658 *
Year2018      1.1654   0.3944   2.955 0.003128 **
Year2019      1.1237   0.3938   2.853 0.004325 **
Year2020      1.2568   0.3942   3.188 0.001433 **

```

```

Year2021      1.7496     0.3886   4.503 6.71e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
    edf Ref.df Chi.sq p-value
s(lon,lat) 38.1     127  306.9 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0399  Deviance explained =  36%
-ML = 1448.1  Scale est. = 1          n = 3759

=====
$Glass

Family: Negative Binomial(0.178)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) 87.52981  50.08083  1.748   0.0805 .
ctime       -0.05003   0.02482 -2.016   0.0438 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
    edf Ref.df Chi.sq p-value
s(lon,lat) 59.3     127  286.6 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0623  Deviance explained = 31.3%
-ML = 1152.3  Scale est. = 1          n = 3759

$Metal

Family: Negative Binomial(0.261)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -15.603571  42.377373 -0.368   0.713
ctime        0.001256   0.020998   0.060   0.952

Approximate significance of smooth terms:
    edf Ref.df Chi.sq p-value
s(lon,lat) 56.28     127   236 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0483  Deviance explained =  22%
-ML = 1378.9  Scale est. = 1          n = 3759

$Natural

Family: Negative Binomial(0.18)

```

```

Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) 195.34390 40.62848 4.808 1.52e-06 ***
ctime       -0.10291  0.02013 -5.111 3.20e-07 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value
s(lon,lat) 70.67     127   736.8 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0616  Deviance explained = 48.1%
-ML = 2297.9  Scale est. = 1          n = 3759

$Other

Family: Negative Binomial(0.181)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -256.4025    47.4310  -5.406 6.45e-08 ***
ctime        0.1206     0.0235   5.131 2.88e-07 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value
s(lon,lat) 56.04     127   313.2 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0452  Deviance explained = 31.9%
-ML = 1430.6  Scale est. = 1          n = 3759

$Plastic

Family: Negative Binomial(0.471)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -89.08652   25.31140  -3.520 0.000432 ***
ctime        0.03856    0.01254   3.075 0.002108 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value

```

```

s(lon,lat) 82.48    127   1283 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.0576  Deviance explained = 42.8%
-ML = 3959.7  Scale est. = 1          n = 3759

$Rubber

Family: Negative Binomial(0.185)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -4.201136  58.133800 -0.072   0.942
ctime        -0.004797  0.028805 -0.167   0.868

Approximate significance of smooth terms:
      edf Ref.df Chi.sq p-value
s(lon,lat) 37.52    127 149.7 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.0104  Deviance explained = 25.2%
-ML = 803.68  Scale est. = 1          n = 3759

$SUP

Family: Negative Binomial(0.488)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -76.62177  27.55073 -2.781  0.00542 **
ctime        0.03208   0.01365  2.350  0.01876 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Approximate significance of smooth terms:
      edf Ref.df Chi.sq p-value
s(lon,lat) 74.58    127 665 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.115  Deviance explained = 26.7%
-ML = 2935.2  Scale est. = 1          n = 3759

$Fishing.related

Family: Negative Binomial(0.159)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:

```

```
Estimate Std. Error z value Pr(>|z|)  
(Intercept) -166.48177 48.56992 -3.428 0.000609 ***  
ctime 0.07605 0.02406 3.160 0.001576 **  
---  
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1  
  
Approximate significance of smooth terms:  
edf Ref.df Chi.sq p-value  
s(lon,lat) 39.55 127 332.7 <2e-16 ***  
---  
Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1  
  
R-sq.(adj) = 0.0295 Deviance explained = 35%  
-ML = 1457 Scale est. = 1 n = 3759
```

3.3 Model summaries (trend models using data from 2015 and onwards)

```
=====
Trend models (2015 onwards) =====
=====
Mass =====
$Glass

Family: Tweedie(p=1.155)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error t value Pr(>|t|)    
(Intercept) -60.73065   62.62910  -0.970   0.332    
ctime        0.02338    0.03102   0.754   0.451    
                                                        
Approximate significance of smooth terms:
            edf Ref.df   F p-value    
s(lon,lat) 64.97     127 3.292 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0945  Deviance explained = 29.5%
-ML = 971.78  Scale est. = 2.1177  n = 3256

$Metal

Family: Tweedie(p=1.161)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error t value Pr(>|t|)    
(Intercept) 18.02948   53.09766  0.340   0.734    
ctime       -0.01541    0.02630  -0.586   0.558    
                                                        
Approximate significance of smooth terms:
            edf Ref.df   F p-value    
s(lon,lat) 61.83     127 3.57 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0724  Deviance explained = 23.4%
-ML = 1248  Scale est. = 2.0763  n = 3256

$Natural

Family: Tweedie(p=1.414)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error t value Pr(>|t|)    
(Intercept) 119.53275   55.65428  2.148   0.0318 *  
ctime       -0.06541    0.02757  -2.373   0.0177 *  
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

```

Approximate significance of smooth terms:
edf Ref.df   F p-value
s(lon,lat) 67.27    127 7.558 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.208  Deviance explained = 45.1%
-ML = 1857  Scale est. = 5.6454  n = 3256

$Other

Family: Tweedie(p=1.364)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) -321.05611  63.78924 -5.033 5.09e-07 ***
ctime        0.15253   0.03159   4.828 1.44e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df   F p-value
s(lon,lat) 57.71    127 3.908 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0604  Deviance explained = 33.5%
-ML = 1394  Scale est. = 4.3504  n = 3256

$Plastic

Family: Tweedie(p=1.472)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error t value Pr(>|t|)
(Intercept) -199.94920  34.72844 -5.758 9.35e-09 ***
ctime        0.09348   0.01720   5.435 5.90e-08 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df   F p-value
s(lon,lat) 77.66    127 12.81 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0747  Deviance explained = 41.3%
-ML = 3857.9  Scale est. = 3.8438  n = 3256

$Rubber

Family: Tweedie(p=1.103)
Link function: log

```

```

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -93.38404   72.21671 -1.293   0.196
ctime        0.03934   0.03577  1.100   0.272

Approximate significance of smooth terms:
          edf Ref.df      F p-value
s(lon,lat) 55.5     127 3.539 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0436  Deviance explained = 29.3%
-ML = 742.27  Scale est. = 1.6876    n = 3256

$SUP

Family: Tweedie(p=1.248)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 18.32174   32.93318  0.556   0.578
ctime       -0.01493   0.01631 -0.915   0.360

Approximate significance of smooth terms:
          edf Ref.df      F p-value
s(lon,lat) 74.68     127 6.395 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.125  Deviance explained = 27.1%
-ML = 2734.7  Scale est. = 2.4648    n = 3256

$Fishing.related

Family: Tweedie(p=1.417)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -218.40199   65.15975 -3.352 0.000812 ***
ctime        0.10177   0.03227  3.153 0.001629 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
          edf Ref.df      F p-value
s(lon,lat) 43.38     127 3.876 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0421  Deviance explained = 33.8%
-ML = 1491  Scale est. = 5.2113    n = 3256

```

```

===== Numbers =====
$Glass

Family: Negative Binomial(0.197)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) -47.61090   73.28888 -0.650   0.516
ctime        0.01688   0.03630   0.465   0.642

Approximate significance of smooth terms:
            edf Ref.df Chi.sq p-value
s(lon,lat) 53.2    127  228.9 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.0665  Deviance explained = 29.2%
-ML = 930.77  Scale est. = 1           n = 3256

$Metal

Family: Negative Binomial(0.228)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) 30.82176   61.63556  0.500   0.617
ctime       -0.02174   0.03053  -0.712   0.476

Approximate significance of smooth terms:
            edf Ref.df Chi.sq p-value
s(lon,lat) 48.96    127   182 <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

R-sq.(adj) =  0.0417  Deviance explained = 21.6%
-ML = 1177.2  Scale est. = 1           n = 3256

$Natural

Family: Negative Binomial(0.169)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept) 76.00158   60.96918  1.247   0.213
ctime       -0.04386   0.03020  -1.452   0.146

Approximate significance of smooth terms:
            edf Ref.df Chi.sq p-value
s(lon,lat) 64.17    127  513.8 <2e-16 ***

```

```

---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.169  Deviance explained = 42.4%
-ML = 1752.5  Scale est. = 1          n = 3256

$Other

Family: Negative Binomial(0.184)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -322.40260   65.99799 -4.885 1.03e-06 ***
ctime        0.15320    0.03269   4.687 2.77e-06 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value
s(lon,lat) 53.96     127  311.3 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.048  Deviance explained =  35%
-ML = 1259.1  Scale est. = 1          n = 3256

$Plastic

Family: Negative Binomial(0.459)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
Estimate Std. Error z value Pr(>|z|)
(Intercept) -98.38779  35.11993 -2.801  0.00509 **
ctime        0.04317   0.01740   2.482  0.01307 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Approximate significance of smooth terms:
edf Ref.df Chi.sq p-value
s(lon,lat) 78.86     127  1177 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0552  Deviance explained = 43.9%
-ML = 3496.5  Scale est. = 1          n = 3256

$Rubber

Family: Negative Binomial(0.167)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

```

```

Parametric coefficients:
              Estimate Std. Error z value Pr(>|z|)
(Intercept) -32.959819   82.242188  -0.401   0.689
ctime        0.009467    0.040736   0.232   0.816

Approximate significance of smooth terms:
            edf Ref.df Chi.sq p-value
s(lon,lat) 31.18     127 118.1 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.00638  Deviance explained = 24.2%
-ML = 696.28  Scale est. = 1          n = 3256

$SUP

Family: Negative Binomial(0.492)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
              Estimate Std. Error z value Pr(>|z|)
(Intercept) -8.227457  37.620473 -0.219   0.827
ctime        -0.001788   0.018634 -0.096   0.924

Approximate significance of smooth terms:
            edf Ref.df Chi.sq p-value
s(lon,lat) 70.61     127 622.8 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.117  Deviance explained =  28%
-ML = 2609.6  Scale est. = 1          n = 3256

$Fishing.related

Family: Negative Binomial(0.165)
Link function: log

Formula:
A1 ~ ctime + s(lon, lat, bs = "ds", m = c(1, 0.5), k = 128) +
  offset(log(EFFORT))

Parametric coefficients:
              Estimate Std. Error z value Pr(>|z|)
(Intercept) -102.39725  65.01653 -1.575   0.115
ctime        0.04431    0.03220   1.376   0.169

Approximate significance of smooth terms:
            edf Ref.df Chi.sq p-value
s(lon,lat) 39.15     127 327.8 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

R-sq.(adj) =  0.0259  Deviance explained =  36%
-ML = 1324.6  Scale est. = 1          n = 3256

```

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