Observations and documentation of seafloor litter in the Nordic seas

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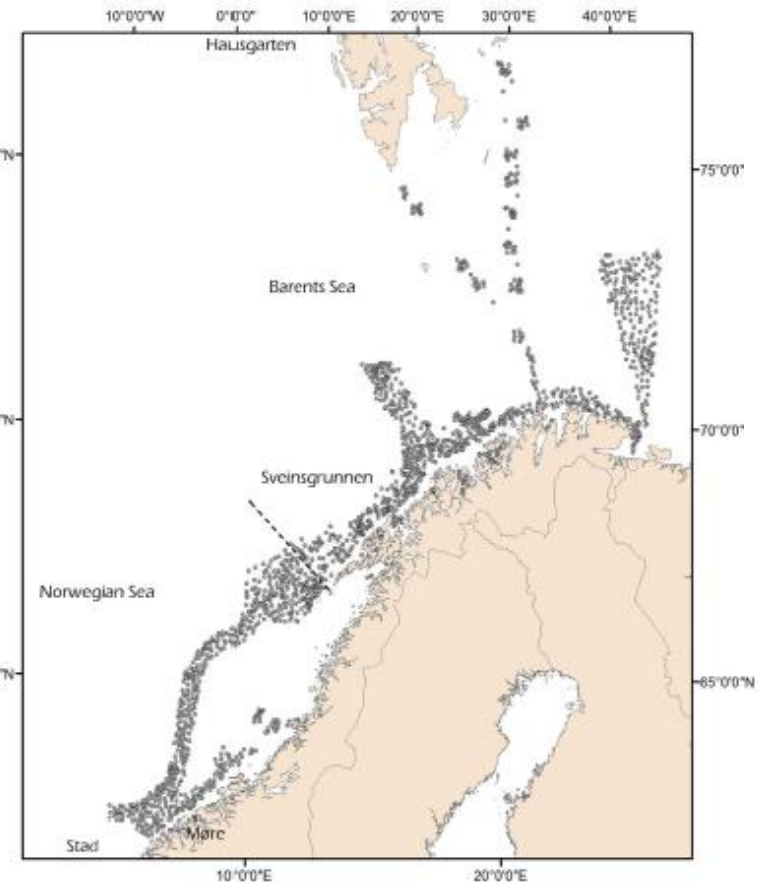
circular ocean
18-19 April 2018

Litter - a huge international problem
5-10 million tons each year

Manila Bay Photo: EPA/RITCHIE B. TONGO

Litter on the seafloor



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Marine litter in the Nordic Seas: Distribution composition and abundance

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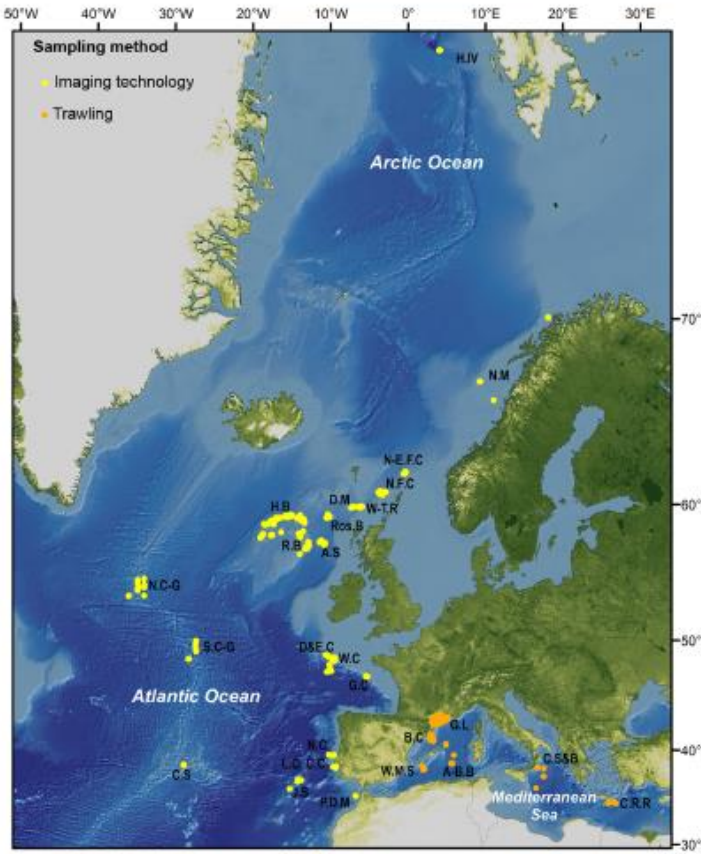
Mareano data 2006-17
1778 video transects



OPEN ACCESS Freely available online

Pham et al. 2014

PLOS ONE

Marine Litter Distribution and Density in European Seas, from the Shelves to Deep Basins

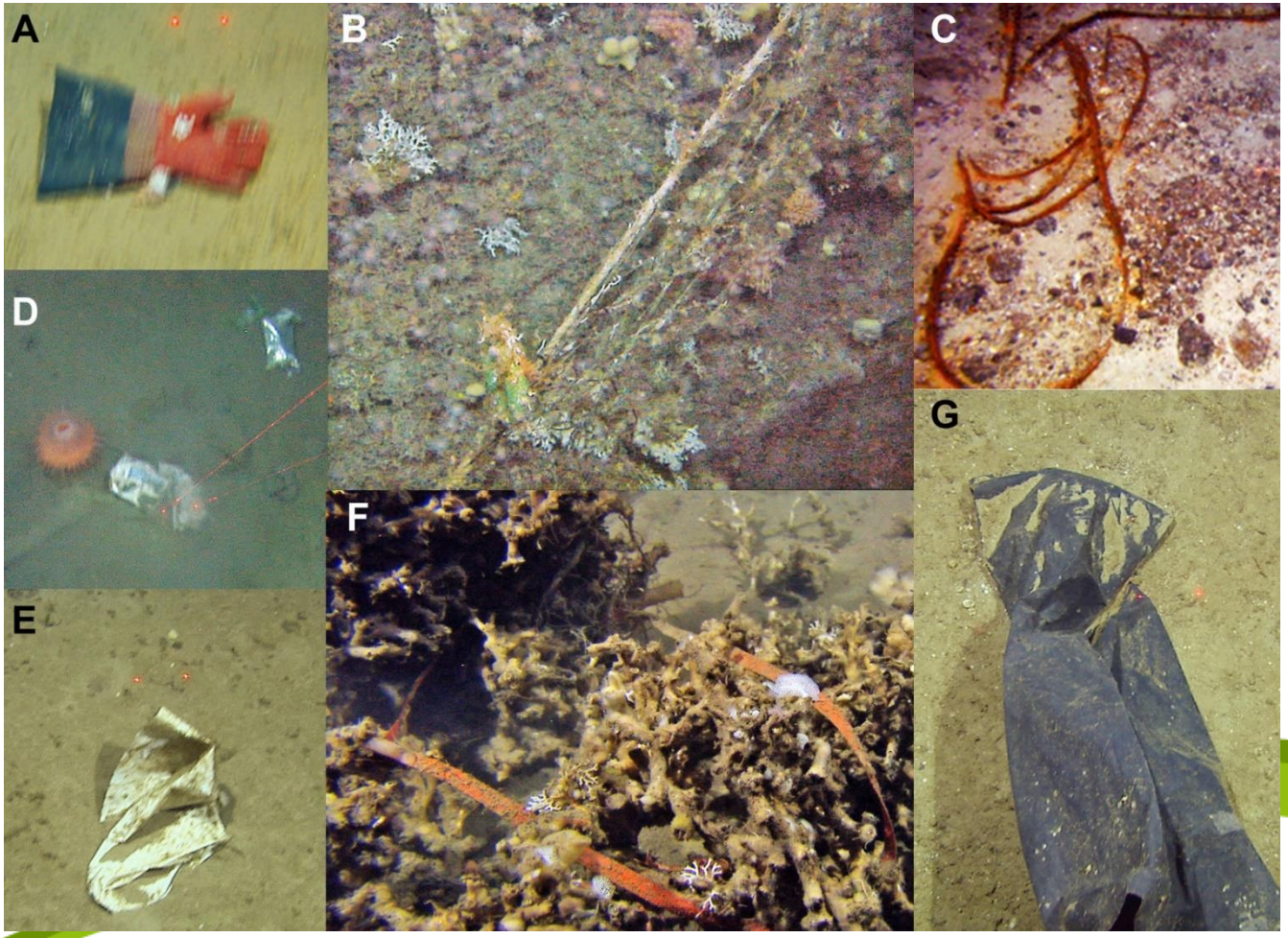
Christopher K. Pham[1,2*], Eva Ramirez-Llodra[3,4], Claudia H. S. Alt[5], Teresa Amaro[6], Melanie Bergmann[7], Miquel Canals[8], Joan B. Company[3], Jaime Davies[9], Gerard Duineveld[10], François Galgani[11], Kerry L. Howell[9], Veerle A. I. Huvenne[12], Eduardo Isidro[1,2], Daniel O. B. Jones[12], Galderic Lastras[8], Telmo Morato[1,2], José Nuno Gomes-Pereira[1,2], Autun Purser[13], Heather Stewart[14], Inês Tojeira[15], Xavier Tubau[8], David Van Rooij[16], Paul A. Tyler[5]

www.mareano.no

1999-2011, 32 location
374 videos and 214 trawls

Litter categories

OSPAR categories: Ceramics & glass, metal, wood, fabric, paper, hard plastic, soft plastic, rubber, fishing gear (wire, net, line), other



Examples of litter observed on the seafloor in the Nordic Seas: A. rubber glove, B. gill net, C. trawl wire, D. Drinking cartons, E: soft plastic, F: Plastic straps, G: Plastic bag

Quantifying litter

Recording numbers: Plastic and glass decomposes into fragments

Noting weight: Amount of litter of different weight (heavy wire contrasting light plastic is not comparable. The EU MSFD states that for litter surveys numbers should be recorded and it is only recommended that weight is registered. Ideally both should be registered for in trend surveys

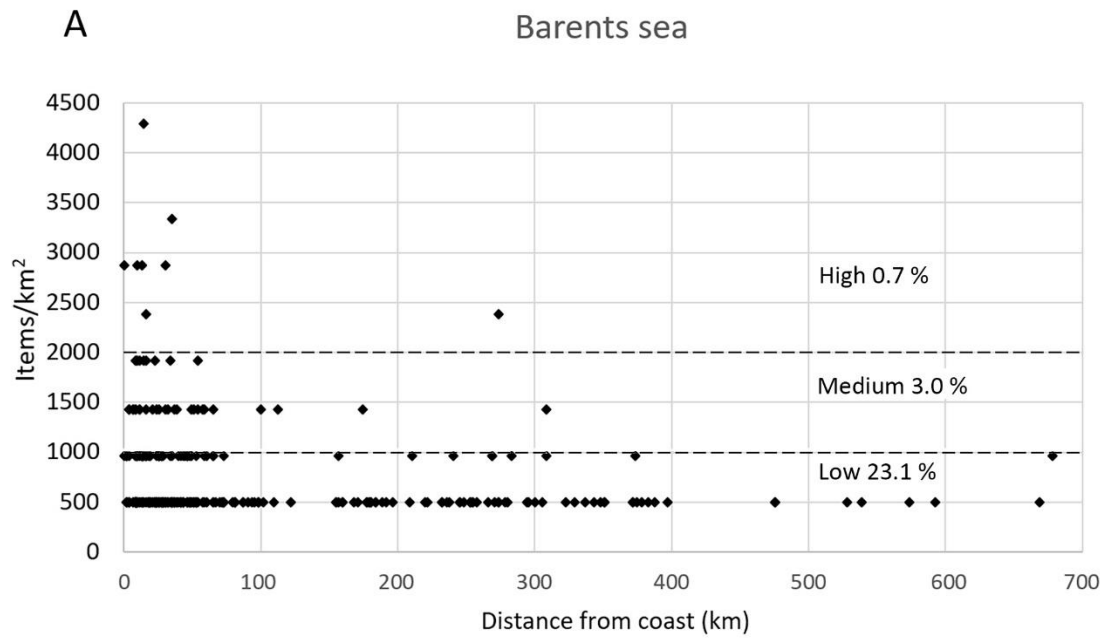
Mareano Video material

Year	No of cruises	Barents Sea	Norwegian Sea	Sum No of stations
2006	1	72		73
2007	2	141		143
2008	2	164		166
2009	1	133	1	135
2010	2	158	30	190
2011	3	32	169	204
2012	2		203	205
2013	3	98	123	224
2014	3	130	41	174
2015	2	58	79	139
2016	1	95		96
2017	1	51		52
Sum	23	1132	646	1778

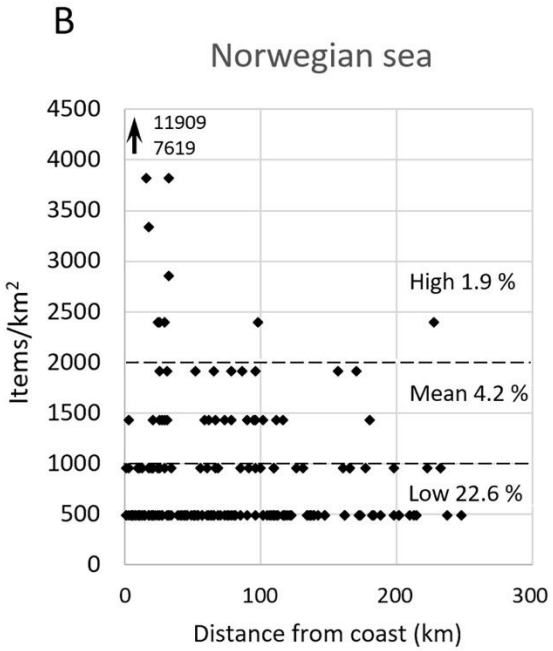
Categories of litter and assumed average weight

	Weight per item (kg)
Ceramic and glass	0.4
Ceramic	*0.3*
Glass	*0.5*
Metal	1.0
Organic materials	0.4
Wood	*0.5*
Fabric	*0.5*
Paper	*0.3*
Plastics	0.4
Hard plastic	*0.5*
Soft plastic	*0.3*
Rubber	0.3
Fishing gear	1.0
Unspecified	0.5

Observed items/km^2



Highest value 4400 items/km^2
~1% has densities >2000

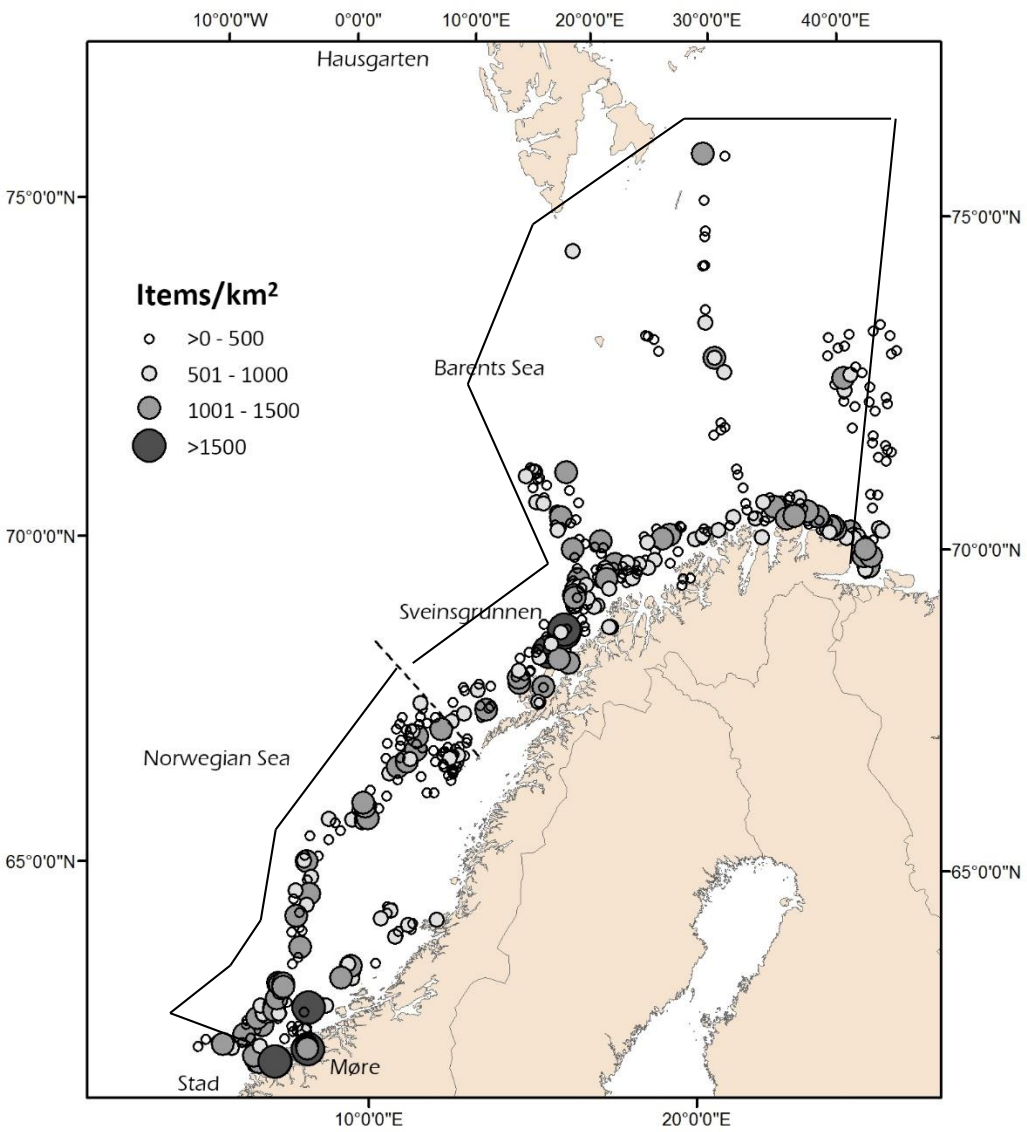


Highest value 12000 items/km^2
~2% has density > 2000

Limits for density of litter is from European studies (Pham et al. 2014).

High> 2000
Mean 1000-2000
Low < 1000

Distribution of litter



Amount of litter

	Area km²	Offshore items/km²	Totalt number	Weight (tons)
Barents Sea	523 600	194	101 578 400	79 000
Norwegian Sea	141 500	211	30 000 000	23 000
European shelf		200		

	No. Stations	No. with litter	% with litter	Observed area (m^2)	No. of litter items	Items/km^2	kg/km^2
BARENTS SEA							
Coast							
<100	13	4	31	27300	7	256	220
100-200	35	11	31	73500	29	395	302
200-500	71	19	27	149100	31	208	160
Offshore							
<100	54	11	20	113400	13	115	101
100-400	726	189	26	1524600	283	186	144
400-700	102	31	30	214200	49	229	187
700-900	48	15	31	100800	21	208	175
900-1200	35	12	34	73500	29	395	252
1200-1500	22	4	18	46200	11	238	162
1500-1800	7	3	43	14700	3	204	136
1800-2700	19	4	21	39900	4	100	75
Barents Sea Total	1132	303	27	2377200	480	230	174
Coast total	119	34	29	249900	67	286	227
Offshore total	1013	269	27	2127300	413	209	154
NORWEGIAN SEA							
Coast							
100-200	6	5	83	12600	22	1746	1667
200-500	10	7	70	21000	77	3667	3352
Offshore							
<100	16	3	19	33600	5	149	149
100-400	379	123	32	798000	203	255	205
400-700	154	25	16	323400	46	142	102
700-900	32	5	16	67200	6	89	60
900-1200	10	2	20	21000	2	95	71
1200-1500	10	5	50	21000	6	286	190
1500-1800	9	3	33	18900	3	159	79
1800-2700	20	7	35	42000	8	190	131
Norwegian Sea Total	646	185	29	1358700	378	678	601
Coast total	16	12	75	33600	99	2706	2510
Offshore total	630	173	27	1325100	279	171	123
Grand Total	**1778**	**488**	**27**	**3735900**	**858**	**230**	**182**

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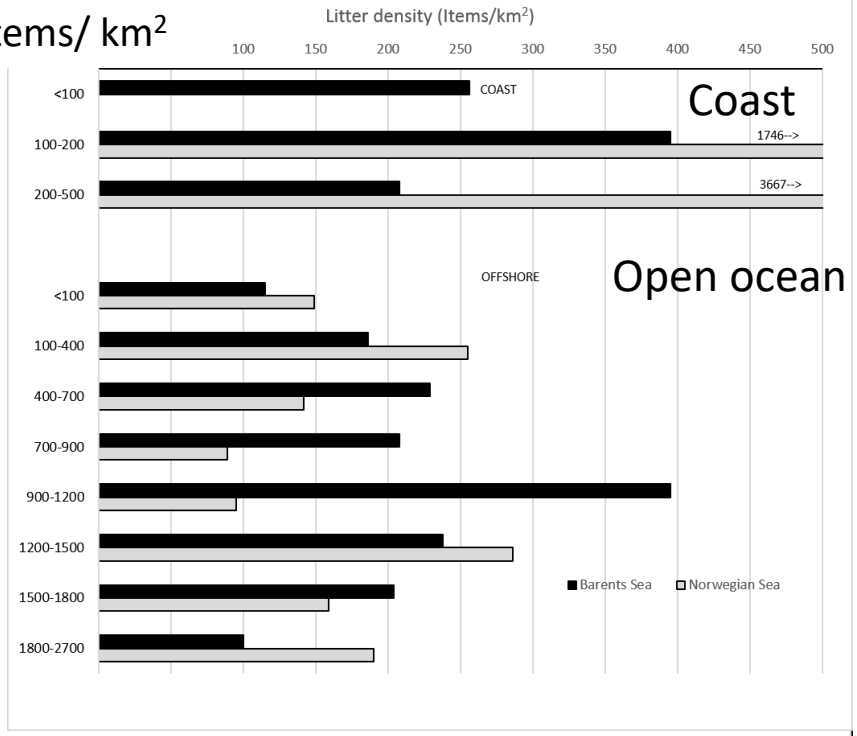
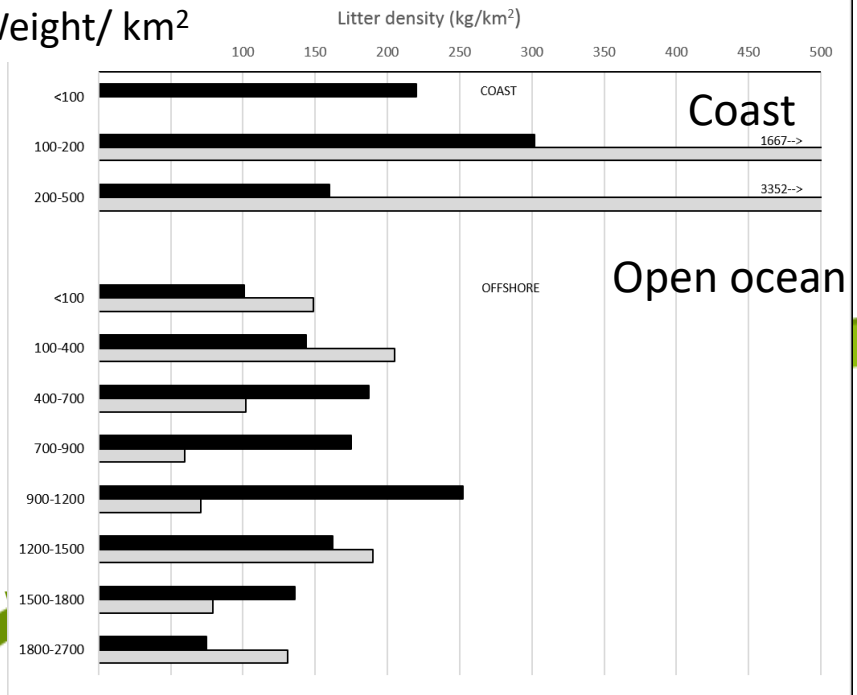
Litter densities in the Barents Sea and the Norwegian Sea at different depth intervals offshore and close to coast.

Items/ km^2



Weight/ km^2



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Numbers and weight of litter
Observed at different depths
At the coast and open ocean

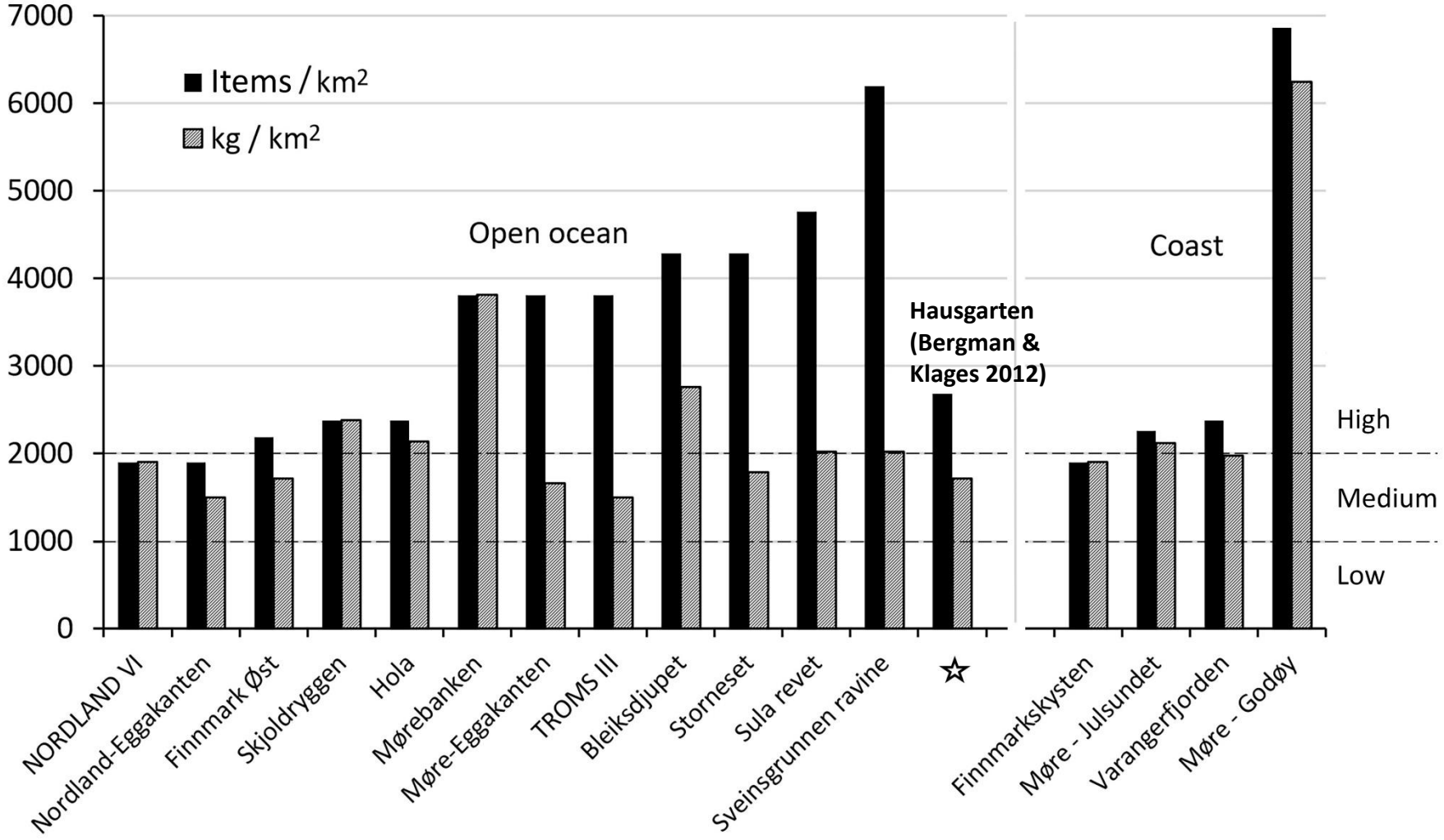
Most litter at 200-500 m on the coast

In open ocean largest densities are > 400 m but high also at 900-1200 m

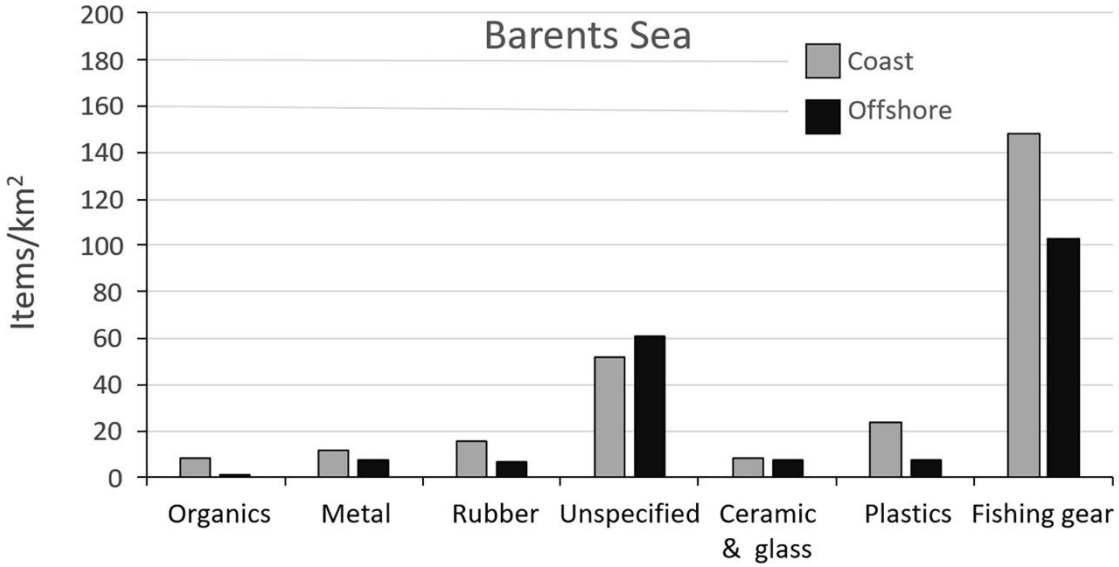
Differences in distribution for litter reported in numbers and as weight
Depend on the occurrence of heavy litter

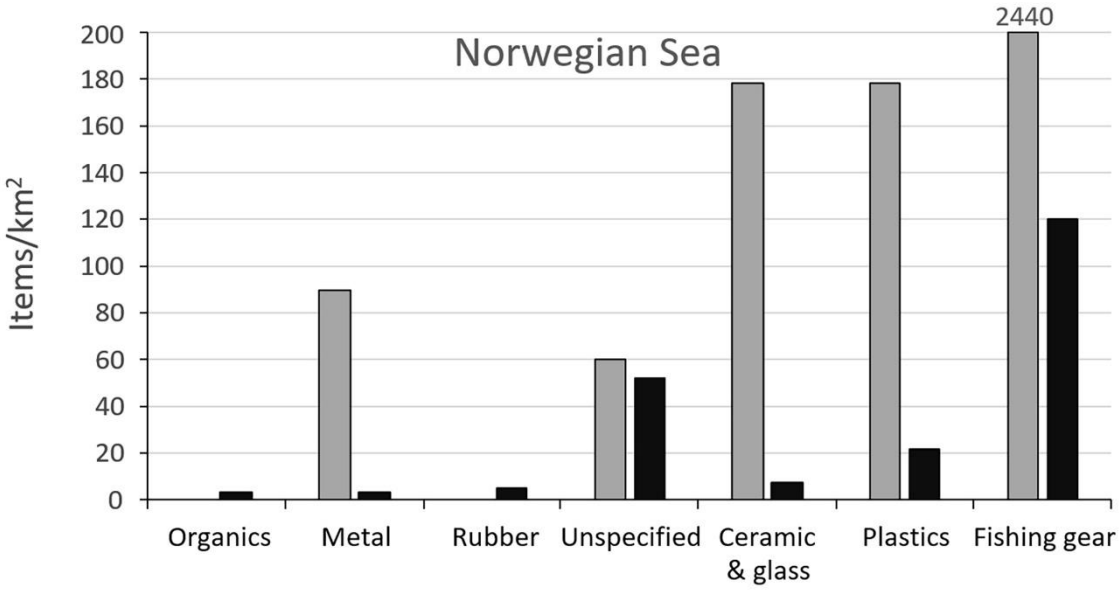
Areas with larges densities of litter

Largest records were from the coast off Møre (6857 items/km^2) and near the banks outside Nordland (6190 items/km^2). Largest densities in Europe is 6620 items/km^2 found in the Lisbon canyon (Pham et al. 2014).



Density of different categories of litter





In general most at the coast

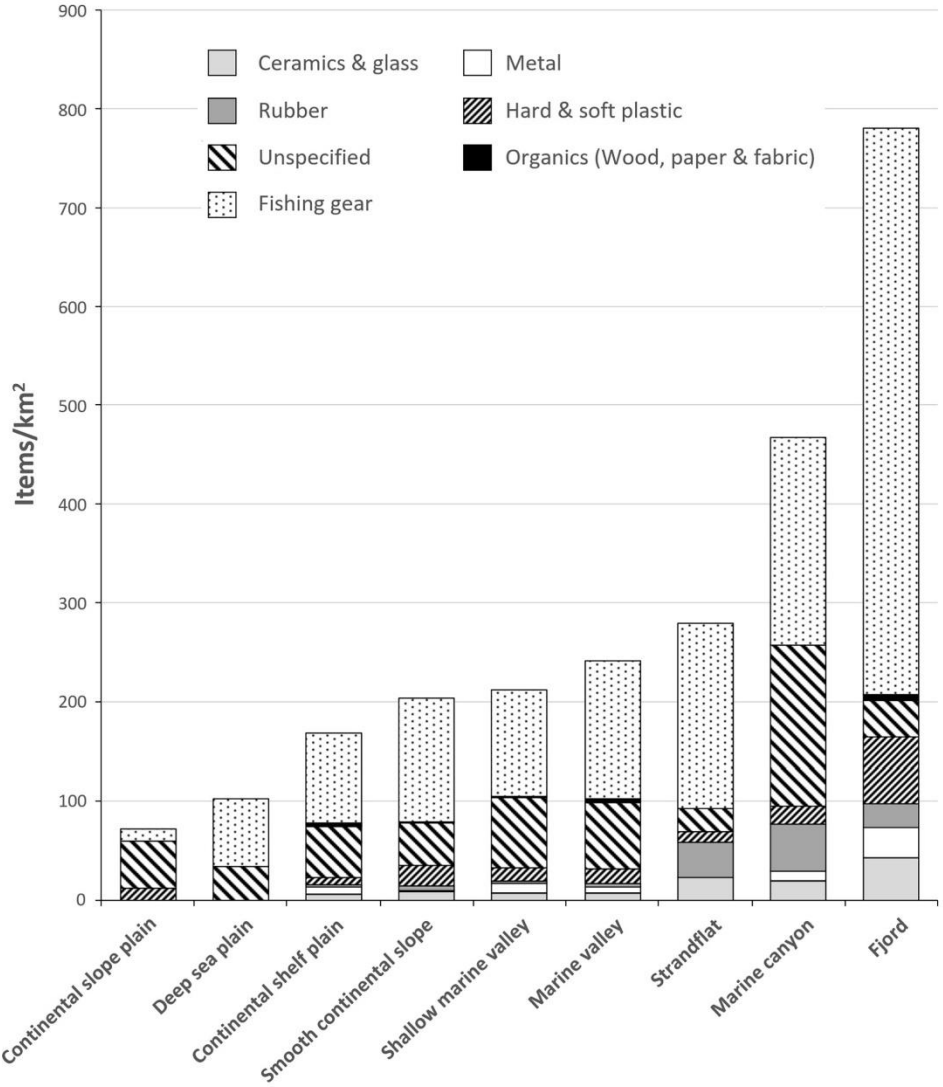
More fishing related litter in the Barents Sea and

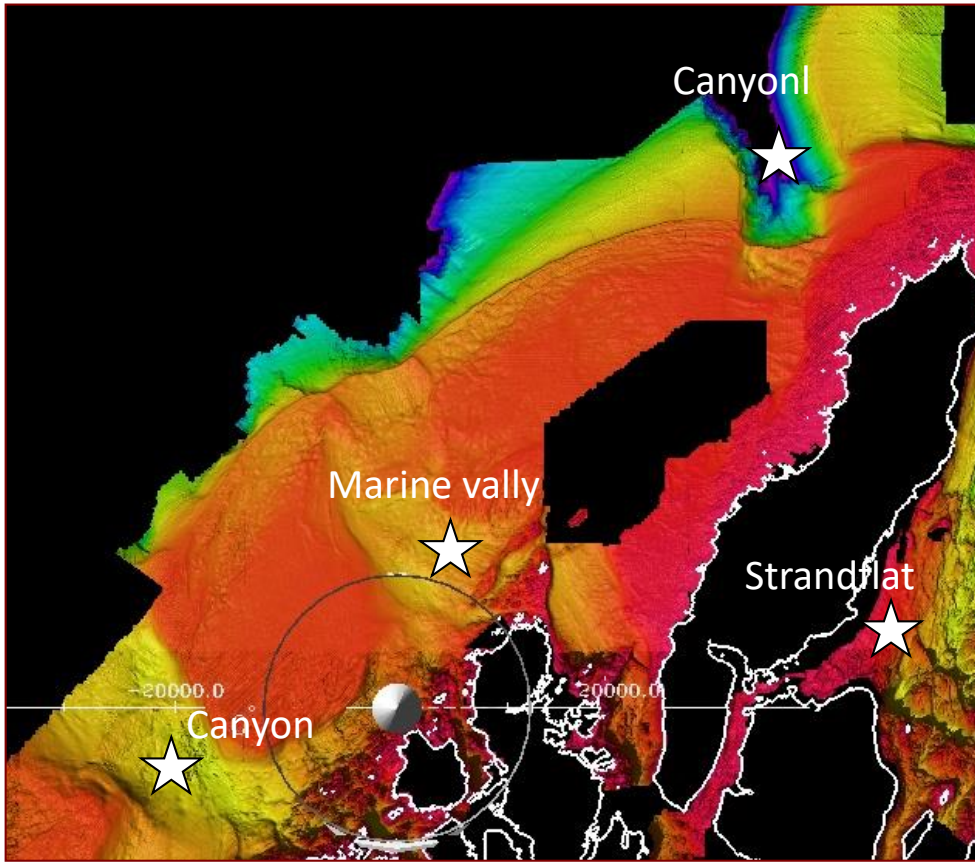
More Ceramic / glass and plastic in the Norwegian Sea

Litter accumulates in certain marine landscapes

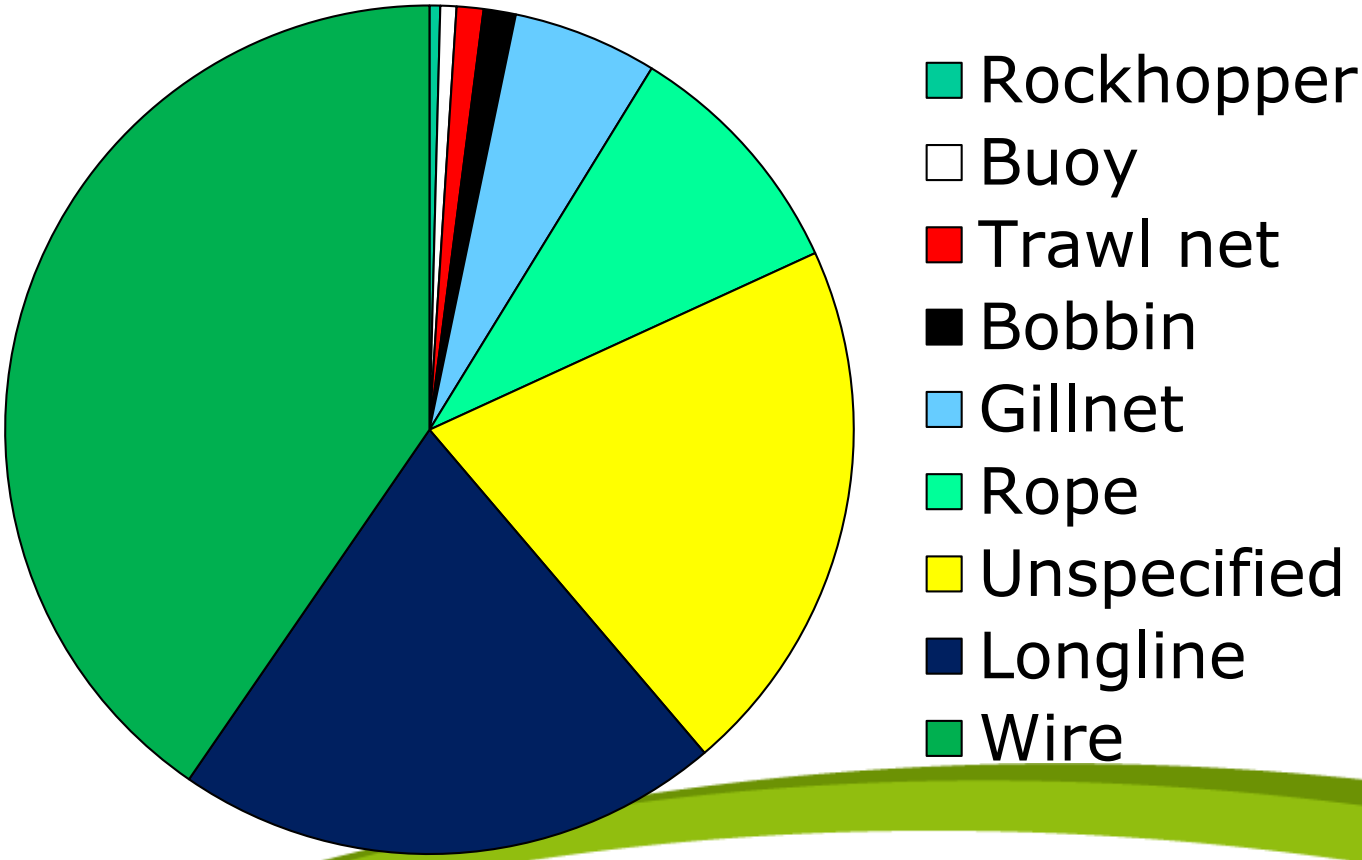
Most in fjords and canyons

Fishing related litter dominates in all landscapes

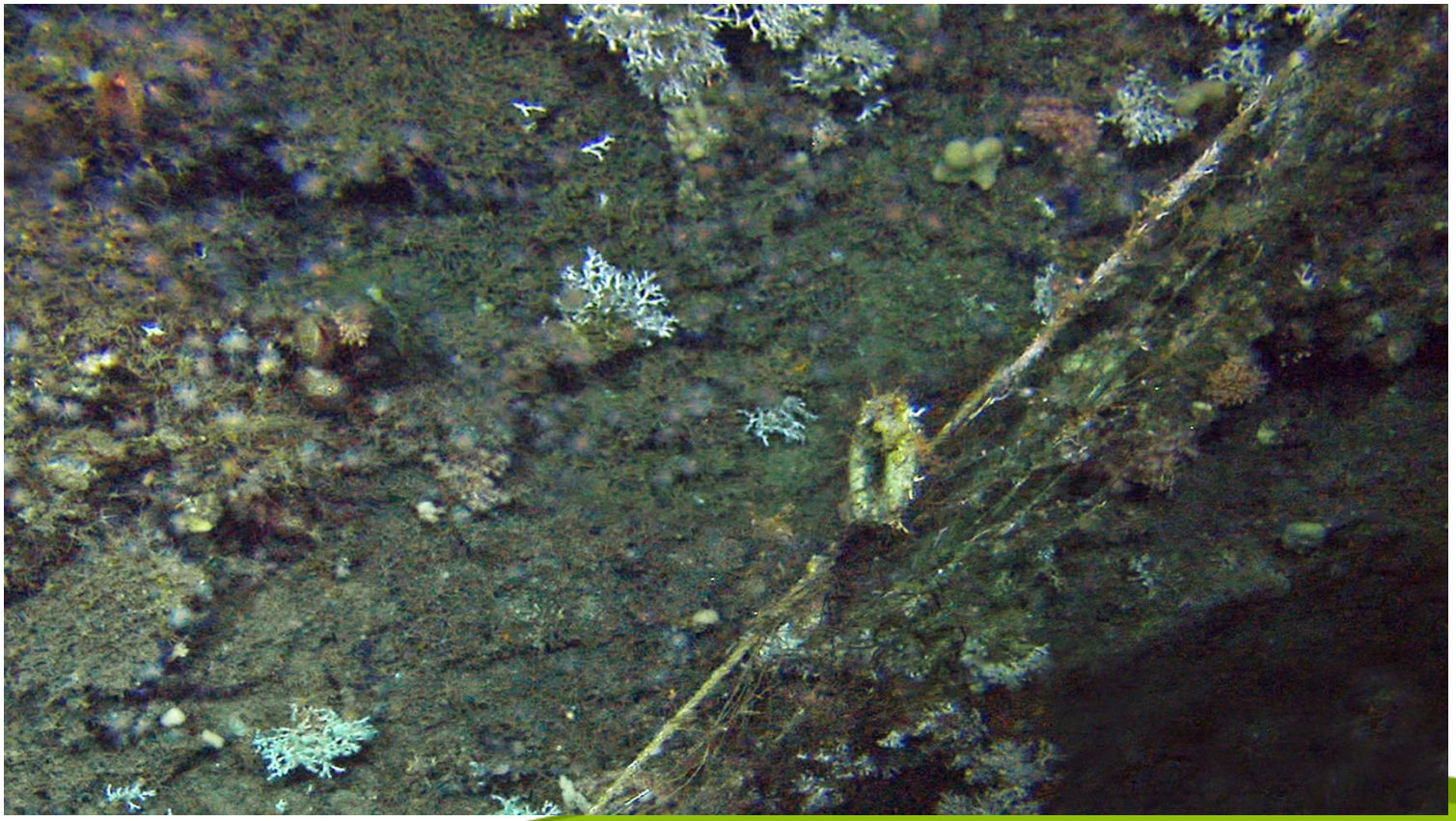




Types of lost fishing gear



Ghost fishing in corals versus negative effects of removal



Gillnet seems to be covered and incorporated in the reef over time

Summery of results

- Total estimated for the Barents Sea is 101 millions items, corresponding to 79 thousand tons

- 27 % of the 1778 video transects contains litter and the main source is fishing gears

- Background value for the mapped area is 230 items/km^2. The corresponding number for European shelf areas is ~200 items/km^2

- Extremely high densities (> 6000 items/km^2) was recorded in coastal areas with large fishing related activity

- Litter accumulates in deep sea landscapes as canyons and in fjords

Litter in east Barents Seat

Does it matter?

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How is the seafloor affected (Seafloor integrity, MSFD)

Hard to evaluate size of damage

-New substrate is introduced: clean and hard surfaces on soft bottom

-Litter containing poison is always problematic

-Net and long lines attached to habitat forming benthos (corals, sponges, etc.) are harmful

-Transport with bottom currents could inflict on bottom organisms

-Old nets can result in ghost fishing

-Nets and other plastic will degrade to microplastic over time

Mitigation

- Cleaning is problematic:

  Recovery of lines and net damages organisms they attach to

- Prevention of littering with relevant handling of litter. Recycling programs for discarded fishing gear.

- Sorting of litter types for recycling.

- Introduction of degradable materials.


Tank you for your atention
Mareano-cruise August 201