# SDG14

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2023-02-07

Import packages and set things up

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Unable to display output for mime type(s): text/html
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<IPython.core.display.HTML object>
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### Country names dict

### Define general functions

### SDG Official Data

SDG14 metadata can be found here

| Indicator | SeriesCode | SeriesDescription |
|---|---|---|
| | EN_MAR_BEALITSQ | Beach litter per square kilometer (Number) |
| | EN_MAR_BEALIT_BP | Beach litter originating from national land-based sources that ends in |
| | EN_MAR_BEALIT_BV | Beach litter originating from national land-based sources that ends in |
| | EN_MAR_BEALIT_EXP | Exported beach litter originating from national land-based sources (T |
| 14.1.1 | EN_MAR_BEALIT_OP | Beach litter originating from national land-based sources that ends in |
| | EN_MAR_BEALIT_OV | Beach litter originating from national land-based sources that ends in |
| | EN_MAR_CHLANM | Chlorophyll-a anomaly, remote sensing (%) |
| | EN_MAR_CHLDEV | Chlorophyll-a deviations, remote sensing (%) |
| | EN_MAR_PLASDD | Floating plastic debris density (count per km2) |

| Indicator | SeriesCode | SeriesDescription |
|---|---|---|
| 14.2.1 | EN_SCP_ECSYBA | Number of countries using ecosystem-based approaches to managing |
| 14.3.1 | ER_OAW_MNACD | Average marine acidity (pH) measured at agreed suite of representati |
| 14.4.1 | ER_H2O_FWTL | Proportion of fish stocks within biologically sustainable levels (not ov |
| 14.5.1 | ER_MRN_MPA | Average proportion of Marine Key Biodiversity Areas (KBAs) covere |
| 14.6.1 | ER_REG_UNFCIM | Progress by countries in the degree of implementation of internationa |
| 14.7.1 | EN_SCP_FSHGDP | Sustainable fisheries as a proportion of GDP |
| 14.a.1 | ER_RDE_OSEX | National ocean science expenditure as a share of total research and d |
| 14.b.1 | ER_REG_SSFRAR | Degree of application of a legal/regulatory/policy/institutional frame |
| 14.c.1 | ER_UNCLOS_IMPLE | Score for the implementation of UNCLOS and its two implementing |
| | ER_UNCLOS_RATACC | Score for the ratification of and accession to UNCLOS and its two im |

**Check official data by indicator**

| TimePeriod<br>GeoAreaName | 2019 | 2020 | 2021 |
|---|---|---|---|
| Belgium | 7.794000 | 8.139600 | 7.8710 |
| Estonia | 7.783000 | 7.916000 | 7.7255 |
| Finland | 8.223464 | NaN | NaN |
| France | 8.023000 | NaN | NaN |
| Netherlands | 7.904056 | NaN | NaN |
| Spain | 8.036000 | NaN | NaN |
| Sweden | 8.082261 | 8.117167 | NaN |
| United Kingdom | 7.988000 | NaN | NaN |

```
Missing countries:
 Germany
Denmark
Ireland
Lithuania
Latvia
Poland
Portugal
```

**14.1**

**(a) Index of coastal eutrophication**

We use: 1. Gross Nutrient Balance. Target defined by top 3 countries 2. Marine waters affected by eutrophication. Target defined by top 3 countries

### Gross nutrient balance (kg/ha), Eurostat

Source

```
Negative values in dataset replaced with 0
Indicator values for  nitro
No missing countries
Indicator values for  phospho
No missing countries
```

| TIME_PERIOD<br>geo | 2012 | 2016 | 2018 |
|---|---|---|---|
| Belgium | 9.829956 | NaN | NaN |
| Denmark | 16.866507 | NaN | NaN |
| Estonia | 50.238095 | NaN | NaN |
| Finland | 29.614035 | 29.676512 | 24.252874 |
| France | 59.858156 | 29.614035 | 34.477124 |
| Germany | 18.730581 | 20.371711 | 18.057338 |
| Ireland | 40.075973 | 26.001232 | NaN |
| Latvia | 58.611111 | 55.380577 | 53.282828 |
| Lithuania | 48.173516 | NaN | 32.337165 |
| Netherlands | 8.274510 | 7.232219 | 7.176871 |
| Poland | 29.244629 | 31.897203 | 22.761597 |
| Portugal | 32.042521 | 30.121342 | 30.915751 |
| Spain | 41.865079 | 36.068376 | NaN |
| Sweden | 45.085470 | 38.328792 | 23.212321 |
| United Kingdom | 16.076190 | 16.262042 | NaN |

| TIME_PERIOD<br>geo | 2012 | 2016 | 2018 |
|---|---|---|---|
| Belgium | 3.333333 | NaN | NaN |
| Denmark | 2.857143 | NaN | NaN |
| Estonia | 100.000000 | NaN | NaN |
| Finland | 5.405405 | 5.555556 | 3.448276 |
| France | 100.000000 | 6.896552 | 9.523810 |
| Germany | 100.000000 | 100.000000 | 100.000000 |

| TIME_PERIOD<br>geo | 2012 | 2016 | 2018 |
|---|---|---|---|
| Ireland | 1.104972 | 0.921659 | NaN |
| Latvia | 20.000000 | 28.571429 | 5.405405 |
| Lithuania | 2.857143 | NaN | 50.000000 |
| Netherlands | 6.250000 | 4.255319 | 2.898551 |
| Poland | 6.666667 | 25.000000 | 5.000000 |
| Portugal | 4.651163 | 3.571429 | 3.508772 |
| Spain | 4.444444 | 2.898551 | NaN |
| Sweden | 100.000000 | 100.000000 | 4.878049 |
| United Kingdom | 3.333333 | 3.333333 | NaN |

**Marine waters affected by eutrophication**

Source

| TIME_PERIOD<br>geo | 2012 | 2016 | 2022 |
|---|---|---|---|
| Belgium | 100.000000 | 100.000000 | 100.000000 |
| Denmark | 100.000000 | 50.000000 | 0.409836 |
| Estonia | 3.703704 | 5.555556 | 100.000000 |
| Finland | 3.703704 | 2.702703 | 0.781250 |
| France | 100.000000 | 33.333333 | 2.631579 |
| Germany | 100.000000 | 100.000000 | 50.000000 |
| Ireland | 100.000000 | 100.000000 | 16.666667 |
| Latvia | 11.111111 | 7.692308 | 100.000000 |
| Lithuania | 50.000000 | 5.000000 | 100.000000 |
| Netherlands | 100.000000 | 100.000000 | 5.555556 |
| Poland | 25.000000 | 10.000000 | 100.000000 |
| Portugal | 1.923077 | 3.571429 | 0.523560 |
| Spain | 5.882353 | 5.555556 | 1.666667 |
| Sweden | 14.285714 | 4.545455 | 0.149925 |

```
Missing countries:
 United Kingdom
```

### (b) Floating Plastic Debris Density

We use two indicators:

1. Plastic Waste kg/ha. Target defined by top 3 countries

2. Recovery Rate of Plastic Packaging. Target defined by top 3 countries

### 1. Plastic Waste kg/ha

Source

| TIME_PERIOD<br>geo | 2012 | 2016 | 2020 |
|---|---|---|---|
| Belgium | 13.559322 | 12.698413 | 9.302326 |
| Denmark | 42.105263 | 40.000000 | 33.333333 |
| Estonia | 47.058824 | 24.242424 | 25.000000 |
| Finland | 47.058824 | 50.000000 | 33.333333 |
| France | 32.000000 | 27.586207 | 22.222222 |
| Germany | 25.806452 | 24.242424 | 21.621622 |
| Ireland | 30.769231 | 25.806452 | 20.000000 |
| Latvia | 72.727273 | 25.000000 | 13.559322 |
| Lithuania | 47.058824 | 25.806452 | 20.000000 |
| Netherlands | 23.529412 | 25.806452 | 21.621622 |
| Poland | 32.000000 | 23.529412 | 13.559322 |
| Portugal | 47.058824 | 26.666667 | 18.604651 |
| Spain | 33.333333 | 50.000000 | 42.105263 |
| Sweden | 44.444444 | 25.000000 | 24.242424 |
| United Kingdom | 21.621622 | 17.777778 | NaN |

```
No missing countries
```

### 2. Recovery rates for packaging waste, Plastic Packaging

Source

| TIME_PERIOD<br>geo | 2012 | 2016 | 2020 |
|---|---|---|---|
| Belgium | 92.885772 | 99.699399 | 99.599198 |
| Denmark | 99.599198 | 98.296593 | 73.246493 |
| Estonia | 44.088176 | 85.971944 | 87.575150 |
| Finland | 51.102204 | 97.394790 | 99.599198 |
| France | 64.128257 | 64.629259 | 71.943888 |
| Germany | 99.899800 | 100.000000 | 100.000000 |
| Ireland | 74.448898 | 79.859719 | 100.000000 |
| Latvia | 38.777555 | 41.883768 | 47.995992 |
| Lithuania | 38.977956 | 74.549098 | 63.527054 |

| TIME_PERIOD<br>geo | 2012 | 2016 | 2020 |
|---|---|---|---|
| Netherlands | 98.296593 | 95.991984 | 95.090180 |
| Poland | 26.252505 | 54.909820 | NaN |
| Portugal | 39.478958 | 50.000000 | 57.014028 |
| Spain | 53.306613 | 61.923848 | 55.611222 |
| Sweden | 58.216433 | 61.823647 | 50.801603 |
| United Kingdom | 38.176353 | 58.617234 | NaN |

```
No missing countries
```

### 14.2

### Proportion of national exclusive economic zones managed using ecosystem-based approaches

We use two indicators:

1. Progress of implementation of Maritime Spatial Planning. Categorical data
2. OHI Biodiversity. No further transformation

### 1. Progress of implementation of Maritime Spatial Planning

Source

| Country | 2012 | 2016 | 2022 |
|---|---|---|---|
| Belgium | 50.0 | 100.0 | 100.0 |
| Germany | 100.0 | 100.0 | 100.0 |
| Denmark | 25.0 | 25.0 | 100.0 |
| Estonia | 25.0 | 50.0 | 100.0 |
| Spain | 25.0 | 25.0 | 75.0 |
| Finland | 25.0 | 25.0 | 100.0 |
| France | 25.0 | 25.0 | 100.0 |
| Ireland | 25.0 | 25.0 | 100.0 |
| Lithuania | 50.0 | 75.0 | 100.0 |
| Latvia | 50.0 | 50.0 | 100.0 |
| Netherlands | 100.0 | 100.0 | 100.0 |
| Poland | 25.0 | 50.0 | 100.0 |
| Portugal | 25.0 | 50.0 | 100.0 |

| Country | 2012 | 2016 | 2022 |
|---|---|---|---|
| Sweden | 25.0 | 50.0 | 100.0 |
| United Kingdom | 25.0 | 50.0 | 100.0 |

```
No missing countries
```

### 2. OHI Biodiversity

Source

| scenario<br>region_name | 2012 | 2016 | 2022 |
|---|---|---|---|
| Belgium | 75.28 | 72.45 | 71.84 |
| Denmark | 74.24 | 73.46 | 72.39 |
| Estonia | 82.49 | 77.99 | 76.10 |
| Finland | 81.00 | 74.86 | 73.82 |
| France | 72.60 | 71.76 | 74.12 |
| Germany | 75.06 | 72.28 | 71.52 |
| Ireland | 69.19 | 67.30 | 66.23 |
| Latvia | 78.47 | 73.53 | 72.59 |
| Lithuania | 77.68 | 72.18 | 71.80 |
| Netherlands | 68.51 | 67.88 | 67.97 |
| Poland | 69.42 | 67.46 | 66.59 |
| Portugal | 75.57 | 73.36 | 71.87 |
| Spain | 72.16 | 69.76 | 68.17 |
| Sweden | 76.72 | 75.57 | 72.54 |
| United Kingdom | 69.87 | 73.08 | 72.11 |

```
No missing countries
```

### 14.3

Average marine acidity (pH) measured at agreed suite of representative sampling stations.

We use:

1. Estimates of sea surface pH. Target defined by top 3 countries
2. Carbon Emissions per capita. Target defined by top 3 countries

**Reconstructed estimates of sea surface pH assessed with GLODAPv2.2021**

Source Copernicus

| | 2012 | 2016 | 2021 |
|---|---|---|---|
| Belgium | 98.416817 | 98.372463 | 98.339183 |
| Germany | 98.233476 | 98.223317 | 98.103500 |
| Denmark | 98.363012 | 98.343317 | 98.238829 |
| Estonia | 97.613476 | 98.026768 | 97.609902 |
| Spain | 98.562378 | 98.445439 | 98.370024 |
| Finland | 97.765500 | 97.981232 | 97.717159 |
| France | 98.629780 | 98.511951 | 98.424024 |
| Ireland | 98.740963 | 98.616902 | 98.506000 |
| Lithuania | 96.980007 | 97.417059 | 97.082190 |
| Latvia | 97.096866 | 97.692573 | 97.198626 |
| Netherlands | 98.596902 | 98.471293 | 98.394500 |
| Poland | 96.469329 | 97.056435 | 96.550528 |
| Portugal | 98.583268 | 98.497232 | 98.378049 |
| Sweden | 97.437732 | 97.776390 | 97.489500 |
| United Kingdom | 98.674927 | 98.567567 | 98.460122 |

```
No missing countries
```

## 2. Carbon emissions per capita

Several sources (see code)

| TIME_PERIOD<br>geo | 2012 | 2016 | 2021 |
|---|---|---|---|
| Belgium | 37.734121 | 39.459259 | 41.833681 |
| Denmark | 47.376240 | 51.718478 | 68.103705 |
| Estonia | 26.783744 | 27.085479 | 45.744259 |
| Finland | 36.906728 | 40.406167 | 51.708163 |
| France | 61.806654 | 66.847742 | 75.572829 |
| Germany | 34.783657 | 35.997628 | 43.288290 |
| Ireland | 41.662118 | 39.922992 | 46.737265 |
| Latvia | 93.965364 | 93.972191 | 91.681403 |
| Lithuania | 76.334698 | 77.951383 | 72.164336 |
| Netherlands | 34.459622 | 34.839212 | 42.925952 |
| Poland | 42.102450 | 42.241700 | 41.185795 |
| Portugal | 72.420665 | 69.650043 | 88.751684 |

| TIME_PERIOD<br>geo | 2012 | 2016 | 2021 |
|---|---|---|---|
| Spain | 58.295610 | 61.088196 | 72.095049 |
| Sweden | 70.390420 | 77.794760 | 95.307931 |
| United Kingdom | 47.256895 | 59.384996 | NaN |

```
No missing countries
```

### 14.4

Proportion of fish stocks within biologically sustainable levels

We use two indicators:

1. FMSY/F: catch-weighted average
2. B/BMSY: catch-weighted average

### 1. FMSY/F

Data compiled partially manually

Source of FMSY and F is /stockAssesmentYEAR

Source of country catches is /OfficialNominalCatches and stockAssessment["year"] PDFs.

| Year | 2012 | 2016 | 2022 |
|---|---|---|---|
| Belgium | 84.278853 | 89.253671 | 97.182818 |
| Estonia | 95.038299 | 82.573446 | 77.562646 |
| Finland | 99.177365 | 91.229736 | 82.840916 |
| France | 91.013767 | 93.548510 | 93.938257 |
| Germany | 81.283936 | 87.261924 | 90.831432 |
| Ireland | 71.053790 | 62.685203 | 86.770330 |
| Latvia | 94.318542 | 89.406109 | 81.381134 |
| Lithuania | 91.787307 | 83.126001 | 82.901621 |
| Netherlands | 85.883804 | 88.278969 | 93.834910 |
| Poland | 89.263580 | 89.580011 | 74.853470 |
| Portugal | 78.732711 | 84.161276 | 94.842807 |
| Spain | 92.064992 | 88.531210 | 91.937691 |
| Sweden | 91.475417 | 78.225767 | 74.962550 |
| United Kingdom | 98.135098 | 95.872798 | 90.761277 |
| Denmark | 95.419499 | 85.849679 | 88.529445 |

```
No missing countries
```

### 2. B/BMSY

Data collected partially manually

Source of BMSY and B is /stockAssesmentYEAR

Source of country catches is /OfficialNominalCatches and stockAssessment["year"] PDFs.

| Year | 2012 | 2016 | 2022 |
|---|---|---|---|
| Belgium | 91.982255 | 94.662804 | 91.871386 |
| Estonia | 99.839423 | 99.933347 | 95.679809 |
| Finland | 99.843072 | 99.941251 | 95.909145 |
| France | 97.115681 | 96.936702 | 96.369335 |
| Germany | 90.088417 | 93.281519 | 93.439957 |
| Ireland | 92.130861 | 85.437192 | 89.825424 |
| Latvia | 97.564685 | 99.565412 | 97.360783 |
| Lithuania | 92.382483 | 99.191985 | 96.254817 |
| Netherlands | 92.736442 | 89.856357 | 96.706294 |
| Poland | 96.568884 | 98.135256 | 92.284320 |
| Portugal | 98.746282 | 97.786405 | 98.794184 |
| Spain | 99.443829 | 96.930800 | 96.504370 |
| Sweden | 96.430034 | 97.171833 | 91.413094 |
| United Kingdom | 96.715727 | 95.636901 | 97.260299 |
| Denmark | 96.031151 | 95.816545 | 95.730634 |

```
No missing countries
```

### 14.5

Coverage of protected areas in relation to marine area

We consider two indicators:

1. Coverage of Natura 2000 areas in relation to marine areas. Top defined by top 3 countries
2. Average proportion of Marine Key Biodiversity Areas (KBAs) covered by protected areas (%). No further transformation

### 1. Marine protected areas (% of territorial waters)

Source

| Country | Area_km2 |
|---|---|
| Belgium | 3495 |
| Denmark | 105021 |
| Estonia | 36451 |
| Finland | 81553 |
| France | 345240 |
| Germany | 56763 |
| Ireland | 427039 |
| Latvia | 28353 |
| Lithuania | 6832 |
| Netherlands | 64328 |
| Poland | 29982 |
| Portugal | 1728718 |
| Spain | 1007673 |
| Sweden | 155347 |
| United Kingdom | 731309 |

| year<br>Country | 2012 | 2016 | 2021 |
|---|---|---|---|
| Belgium | 100.000000 | 100.000000 | 100.000000 |
| Denmark | 60.473620 | 60.473620 | 60.473620 |
| Estonia | 61.763280 | 61.763280 | 61.763280 |
| Finland | 29.183476 | 29.183476 | 33.278972 |
| France | 40.225157 | 40.247364 | 100.000000 |
| Germany | 100.000000 | 100.000000 | 100.000000 |
| Ireland | 5.360166 | 8.007856 | 8.005514 |
| Latvia | 20.315311 | 51.575965 | 51.587721 |
| Lithuania | 32.933255 | 76.258782 | 76.258782 |
| Netherlands | 61.139784 | 78.156738 | 85.271318 |
| Poland | 80.459387 | 80.448269 | 80.559447 |
| Portugal | 0.507891 | 6.148101 | 8.182171 |
| Spain | 3.515029 | 27.920433 | 28.009086 |
| Sweden | 20.023989 | 43.406052 | 43.485444 |
| United Kingdom | 33.704859 | 57.729359 | NaN |

```
No missing countries
```

### Average proportion of Marine Key Biodiversity Areas (KBAs) covered by protected areas (%)

Source: official SDG 14 data

| TimePeriod<br>GeoAreaName | 2012 | 2016 | 2022 |
|---|---|---|---|
| Belgium | 96.49980 | 96.84682 | 96.85317 |
| Denmark | 86.66340 | 86.74673 | 86.74673 |
| Estonia | 97.60969 | 97.60982 | 97.62768 |
| Finland | 59.78557 | 60.80889 | 60.85425 |
| France | 62.51162 | 76.43594 | 81.88238 |
| Germany | 74.06325 | 74.51850 | 80.79027 |
| Ireland | 75.92082 | 75.97923 | 83.16451 |
| Latvia | 96.16348 | 96.16360 | 96.16360 |
| Lithuania | 65.53137 | 83.51997 | 83.51997 |
| Netherlands | 93.31337 | 96.64630 | 96.64630 |
| Poland | 87.25113 | 87.25113 | 87.31556 |
| Portugal | 68.28585 | 70.43105 | 70.76779 |
| Spain | 62.51987 | 85.84322 | 85.86279 |
| Sweden | 56.67376 | 59.73273 | 60.46026 |
| United Kingdom | 80.23372 | 80.43096 | 81.23336 |

```
No missing countries
```

### 14.6

Degree of implementation of international instruments aiming to combat illegal, unreported and unregulated fishing

We use two indicators:

1. High-risk subsidies relative to total fishing subsidies. Target defined by top 3 countries
2. IUU Fishing Index
3. TAC/Catch.

### 1. High-risk subsidies relative to total fishing subsidies

Source

| Year<br>Country | 2012 | 2016 | 2019 |
|---|---|---|---|
| Belgium | 1.139037 | 2.272171 | NaN |
| Denmark | 0.698986 | 0.715540 | 0.772050 |
| Estonia | 7.391742 | 100.000000 | 3.199879 |
| France | 1.033066 | NaN | NaN |
| Germany | NaN | 4.147636 | NaN |
| Ireland | NaN | 9.167110 | NaN |
| Latvia | NaN | 100.000000 | 100.000000 |
| Lithuania | 1.498189 | 11.784437 | 1.451992 |
| Netherlands | 9.666849 | 3.594301 | 1.575328 |
| Poland | 0.441716 | 0.280389 | 0.356007 |
| Portugal | 1.130799 | 0.323543 | 0.479279 |
| Spain | 10.216785 | 3.002641 | 4.131087 |
| Sweden | 0.716534 | 0.632158 | 0.989415 |
| United Kingdom | 3.810226 | 4.267987 | 2.925930 |

```
Missing countries:
 Finland
```

### 3. IUU Fishing Index

Source

| Year<br>Country | 2019 | 2021 |
|---|---|---|
| Belgium | 100.000000 | 64.031078 |
| Denmark | 51.245497 | 65.768667 |
| Estonia | 70.952143 | 70.952143 |
| Finland | 53.277658 | 64.031078 |
| France | 54.608684 | 61.476344 |
| Germany | 51.245497 | 70.952143 |
| Ireland | 58.866791 | 70.952143 |
| Latvia | 90.295268 | 70.952143 |
| Lithuania | 51.245497 | 54.146791 |
| Netherlands | 46.306308 | 51.245497 |
| Poland | 72.707739 | 70.952143 |
| Portugal | 47.352555 | 70.194173 |
| Spain | 54.608684 | 48.688266 |
| Sweden | 70.952143 | 70.952143 |
| United Kingdom | 47.352555 | 41.915876 |

| Year<br>Country | 2019 | 2021 |
|---|---|---|

```
No missing countries
```

### 2. TAC/Catch

Data extracted partially manually.

Source of TAC is stockAssessment["year"] PDFs.

Source of country catches is /OfficialNominalCatches and stockAssessment["year"] PDFs.

| Year | 2012 | 2016 | 2022 |
|---|---|---|---|
| Belgium | 78.480130 | 95.507005 | 97.255892 |
| Estonia | 98.404500 | 99.435507 | 96.478689 |
| Finland | 98.942568 | 99.843818 | 92.122689 |
| France | 84.168757 | 91.279043 | 97.873527 |
| Germany | 97.890177 | 96.075084 | 96.254821 |
| Ireland | 95.739977 | 94.352001 | 97.971417 |
| Latvia | 99.389419 | 99.008097 | 96.696104 |
| Lithuania | 98.155150 | 98.005229 | 95.209801 |
| Netherlands | 92.986309 | 95.043900 | 97.158599 |
| Poland | 99.762408 | 98.797493 | 94.911954 |
| Portugal | 96.065583 | 97.542063 | 98.963306 |
| Spain | 81.619492 | 94.504539 | 98.517713 |
| Sweden | 96.705334 | 98.484897 | 95.600203 |
| United Kingdom | 95.734499 | 93.625841 | 98.166726 |
| Denmark | 94.385126 | 96.196738 | 96.258764 |

```
No missing countries
```

### 14.7

Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries

We use two indicators:

1. 'Livelihoods & economies' Index as per Baltic Health Index (BHI)
2. 'Tourism' Index as per BHI

### 1. 'Livelihoods & economies' Index

Divided into:

1. Economies: Gross Value Added (GVA) annual growth rate of marine sectors against 1.5% target
2. Livelihoods: Two subindicators: GVA/Hours Worked & FTE Employees/Coastal population

Source Blue Economy

#### Economies

| Year<br>country | 2012 | 2016 | 2020 |
|---|---|---|---|
| Belgium | 96.873934 | 21.658872 | 21.297335 |
| Denmark | 4.504192 | 22.266304 | 61.905965 |
| Estonia | 52.767271 | 48.123759 | 54.687999 |
| Finland | 35.661048 | 73.708100 | 30.287035 |
| France | 32.382788 | 28.159942 | 0.247155 |
| Germany | 38.803670 | 64.176248 | 5.469456 |
| Ireland | 87.952005 | 100.000000 | 28.923979 |
| Latvia | 97.411580 | 2.196562 | 19.610579 |
| Lithuania | 37.153807 | 61.513965 | 42.140579 |
| Netherlands | 84.178366 | 21.389797 | 40.346288 |
| Poland | 62.903198 | 59.160696 | 80.944135 |
| Portugal | 61.985137 | 96.467062 | 9.280987 |
| Spain | 3.312837 | 85.334154 | 0.000000 |
| Sweden | 43.109175 | 71.468051 | 14.636507 |
| United Kingdom | 100.000000 | 20.980994 | 0.000000 |

```
No missing countries
```

#### Livelihoods

| Year<br>Member State | 2012 | 2016 | 2020 |
|---|---|---|---|
| Belgium | 73.226756 | 70.153897 | 79.084103 |
| Estonia | 13.004557 | 13.749318 | 18.786201 |
| Finland | 26.215711 | 27.738387 | 27.423564 |
| Germany | 36.439759 | 42.221763 | 48.441349 |

| Year<br>Member State | 2012 | 2016 | 2020 |
|---|---|---|---|
| Ireland | 23.178746 | 24.868589 | 22.363956 |
| Latvia | 7.777087 | 8.912797 | 13.547465 |
| Lithuania | 9.675183 | 15.099927 | 19.144132 |
| Netherlands | 100.000000 | 64.869507 | 46.389875 |
| Poland | 19.237395 | 20.772320 | 27.250130 |
| Portugal | 14.911299 | 16.776657 | 17.068778 |
| Spain | 25.501543 | 23.418572 | 26.326202 |
| Sweden | 30.692363 | 34.465893 | 36.985960 |
| United Kingdom | 86.269042 | 52.194932 | 67.755189 |

```
Missing countries:
 Denmark
France
```

| year<br>country_name | 2012 | 2016 | 2020 |
|---|---|---|---|
| Belgium | 8.301720 | 7.469303 | 7.612006 |
| Denmark | 15.210299 | 16.648394 | 16.145873 |
| Estonia | 73.518596 | 62.530963 | 41.382950 |
| Finland | 17.422097 | 14.952275 | 11.662557 |
| France | 15.224464 | 14.087975 | 12.409121 |
| Germany | 53.966767 | 60.393138 | 61.643754 |
| Ireland | 5.668473 | 8.099165 | 8.990206 |
| Latvia | 23.222019 | 26.817885 | 22.008593 |
| Lithuania | 73.725091 | 79.037007 | 91.062719 |
| Netherlands | 20.941432 | 12.987307 | 15.318658 |
| Poland | 36.379926 | 34.737284 | 35.336342 |
| Portugal | 15.794767 | 18.095508 | 17.850648 |
| Spain | 23.014225 | 24.831960 | 18.070642 |
| Sweden | 10.492028 | 11.198808 | 10.685918 |
| United Kingdom | 10.121654 | 9.924725 | NaN |

```
No missing countries
```

### 2. Tourism: GVA/nights spents

| Year<br>country | 2012 | 2016 | 2020 |
|---|---|---|---|
| Belgium | 45.334240 | 38.058850 | 41.541088 |
| Denmark | 81.889205 | 93.267237 | 100.000000 |
| Estonia | 58.620529 | 58.491705 | 75.930535 |
| Finland | 65.419935 | 79.994586 | 55.925323 |
| France | 47.093545 | 47.012451 | 42.348381 |
| Germany | 70.673069 | 71.550445 | 85.368497 |
| Ireland | NaN | 85.079465 | 100.000000 |
| Latvia | 38.809039 | 53.736533 | 47.795775 |
| Lithuania | 33.817135 | 52.212723 | 48.222261 |
| Netherlands | 39.665778 | 40.625908 | 31.666511 |
| Poland | 60.057201 | 41.072395 | 27.725916 |
| Portugal | 53.680933 | 57.461233 | 67.520145 |
| Spain | 53.868019 | 56.316363 | 44.842960 |
| Sweden | 62.006181 | 75.725888 | 74.427793 |
| United Kingdom | 59.320101 | 39.530034 | NaN |

```
No missing countries
```

### 14.a

Proportion of total research budget allocated to research in the field of marine technology

We use two indicators:

1. Official UNSD indicator ER_RDE_OSEX. Target is top 3 countries
2. SAD/TAC: Catch-weighted TAC relative to Scientific Advice

### 1. Ocean science expenditure ER_RDE_OSEX

Several sources

Note: ER_RDE_OSEX data comes from Global Ocean Science Report (GOSR) 2020, and goes from 2013 to 2017. Data for 2009-2012 data is available in the UNstats archive (download csv for 29-Mar-19)

| Year<br>country | 2013 | 2016 | 2017 |
|---|---|---|---|
| Belgium | 0.310608 | 0.233153 | 0.221183 |
| Finland | 6.119042 | 6.207167 | 6.142723 |

| Year<br>country | 2013 | 2016 | 2017 |
|---|---|---|---|
| France | 65.177100 | NaN | 43.513303 |
| Germany | 4.346289 | 3.390835 | 3.315717 |
| Ireland | NaN | NaN | 100.000000 |
| Netherlands | 3.818245 | 3.248525 | 3.598533 |
| Poland | 1.229127 | 0.853481 | 0.823581 |
| Portugal | NaN | 100.000000 | NaN |
| Spain | 68.138571 | 100.000000 | 100.000000 |
| United Kingdom | 100.000000 | 94.759160 | 100.000000 |

```
Missing countries:
 Denmark
Estonia
Lithuania
Latvia
Sweden
```

## 2. SAD/TAC

Data extracted partially manually.

Source of TAC and SAD is stockAssessment["year"] PDFs.

Source of country catches is /OfficialNominalCatches and stockAssessment["year"] PDFs.

If a country fishes only on fish stocks where assignment of TAC follows scientific advice, it would score 100

| Year | 2012 | 2016 | 2022 |
|---|---|---|---|
| Belgium | 98.292746 | 97.071052 | 96.615720 |
| Estonia | 92.753209 | 86.254153 | 90.900148 |
| Finland | 99.440656 | 97.749144 | 95.619503 |
| France | 90.323954 | 91.459570 | 92.379607 |
| Germany | 90.655052 | 85.395915 | 87.737917 |
| Ireland | 98.126385 | 87.353687 | 75.753058 |
| Latvia | 91.715604 | 82.541315 | 91.324412 |
| Lithuania | 96.064711 | 84.378674 | 88.919591 |
| Netherlands | 95.566376 | 88.761011 | 89.214834 |
| Poland | 94.916995 | 80.769729 | 86.833090 |
| Portugal | 98.862330 | 94.596274 | 91.951678 |
| Spain | 91.262037 | 84.589603 | 88.343857 |

| Year | 2012 | 2016 | 2022 |
|---|---|---|---|
| Sweden | 90.155366 | 89.159207 | 87.337151 |
| United Kingdom | 79.451505 | 81.326929 | 82.954885 |
| Denmark | 84.660093 | 77.694543 | 84.036427 |

```
No missing countries
```

### 14.b

Degree of application of a legal/regulatory/policy/institutional framework which recognizes and protects access rights for small-scale fisheries

We use two indicators:

1. OHI Artisanal Fishing Opportunities Index: No further transformation
2. Percentage of Fish Species Threatened: No further transformation

### 1. OHI 'Artisanal opportunities' Index

Source

| scenario<br>region_name | 2012 | 2016 | 2022 |
|---|---|---|---|
| Belgium | 79.51 | 78.43 | 78.66 |
| Denmark | 70.50 | 76.03 | 74.63 |
| Estonia | 89.39 | 90.36 | 99.24 |
| Finland | 84.67 | 83.31 | 77.45 |
| France | 77.09 | 77.59 | 78.61 |
| Germany | 73.21 | 72.73 | 73.23 |
| Ireland | 69.90 | 73.52 | 73.52 |
| Latvia | 87.40 | 88.85 | 99.01 |
| Lithuania | 88.71 | 89.95 | 97.63 |
| Netherlands | 55.01 | 55.29 | 60.35 |
| Poland | 87.82 | 74.67 | 77.61 |
| Portugal | 77.81 | 64.99 | 66.08 |
| Spain | 73.45 | 71.37 | 73.08 |
| Sweden | 94.77 | 95.51 | 97.37 |
| United Kingdom | 81.35 | 84.41 | 79.79 |

```
No missing countries
```

### 2. Percentage of Fish Species Threatened

Source

Analysis done in iucnRedList.ipynb

| year<br>name | 2012 | 2016 | 2022 |
|---|---|---|---|
| Belgium | 77.777778 | 87.786260 | 84.967320 |
| Denmark | 83.516484 | 89.944134 | 86.138614 |
| Estonia | 80.952381 | 89.473684 | 90.243902 |
| Finland | 81.818182 | 89.189189 | 90.000000 |
| France | 88.135593 | 93.216080 | 91.332611 |
| Germany | 77.611940 | 87.022901 | 82.894737 |
| Ireland | 86.592179 | 93.750000 | 91.885965 |
| Latvia | 77.272727 | 87.804878 | 88.636364 |
| Lithuania | 77.272727 | 87.500000 | 88.372093 |
| Netherlands | 83.132530 | 91.489362 | 89.047619 |
| Poland | 76.923077 | 87.234043 | 86.274510 |
| Portugal | 89.573460 | 94.731065 | 92.578125 |
| Spain | 89.938398 | 94.646465 | 92.513863 |
| Sweden | 77.272727 | 87.121212 | 84.027778 |
| United Kingdom | 86.729858 | 93.827160 | 91.337100 |

```
No missing countries
```

### 14.c

Number of countries making progress in ratifying, accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments that implement international law, as reflected in the United Nations Convention on the Law of the Sea

We use two indicators:

1. Participation in agreements of the International Marine Organization (IMO Participation Rate). No further transformation

### 1. Participation in agreements of the International Marine Organization

Source

| Country | 2012 | 2016 | 2021 |
|---|---|---|---|
| Belgium | 78.431373 | 76.470588 | 90.196078 |
| Denmark | 80.392157 | 86.274510 | 92.156863 |
| Estonia | 76.470588 | 78.431373 | 82.352941 |
| Finland | 76.470588 | 78.431373 | 90.196078 |
| France | 84.313725 | 84.313725 | 96.078431 |
| Germany | 80.392157 | 82.352941 | 88.235294 |
| Ireland | 66.666667 | 68.627451 | 68.627451 |
| Latvia | 80.392157 | 80.392157 | 82.352941 |
| Lithuania | 58.823529 | 62.745098 | 64.705882 |
| Netherlands | 84.313725 | 86.274510 | 92.156863 |
| Poland | 80.392157 | 84.313725 | 86.274510 |
| Portugal | 68.627451 | 76.470588 | 86.274510 |
| Spain | 86.274510 | 86.274510 | 88.235294 |
| Sweden | 82.352941 | 90.196078 | 94.117647 |
| United Kingdom | 78.431373 | 78.431373 | 78.431373 |

```
No missing countries
```

## Indicators aggregation

Given our ratio-scale full comparable indicators,$I_{it}$, meaningful aggregation of $N$ indicators into a composite indicator $CI_t$ is obtained according to social choice theory by applying a generalized mean:

$$CI_t(\alpha_{it}, I_{it}, \sigma) = \left( \sum_{i=1}^{N} \alpha_{it} I_{it}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \quad \text{for} \quad t = 2012, 2016, 2021 (\text{or most recent})$$

with weights $\alpha_{it} > 0$ and $0 \leq \sigma \leq \infty$. The parameter $\sigma$ is used to quantify the elasticity of substitution between the different indicators. High (low) values of $\sigma$ imply good (poor) substitution possibilities which means that a high score in one indicator can (cannot) compensate a low score in another indicator. Consequently, high and low values of $\sigma$ correspond to concepts of weak and strong sustainability, respectively. Depending on $\sigma$, one can obtain a full class of specific function forms for the composite indicator.

We define:

$\sigma_{Target} = 0.5$ and $\sigma_{Target} = 10$

### Target level aggregation

### Goal Level Aggregation (Monte Carlo simulation)

Code source is in the composite.py file

```
CPU times: user 19.2 s, sys: 4.16 ms, total: 19.2 s
Wall time: 19.2 s
```

## Progress assessment

```
{'divide': 'warn', 'over': 'warn', 'under': 'ignore', 'invalid': 'warn'}
```

| | Country | Slope | Intercept | Rvalue | Pvalue | Stderr |
|---|---|---|---|---|---|---|
| 0 | Belgium | -0.165177 | 410.831174 | 0.069701 | 0.381595 | 0.670321 |
| 1 | Denmark | 0.610405 | -1158.714460 | 0.151814 | 0.386430 | 1.011044 |
| 2 | Estonia | 1.467129 | -2887.786365 | 0.263440 | 0.327063 | 0.865248 |
| 3 | Finland | 0.710325 | -1370.097317 | 0.063184 | 0.348336 | 0.532169 |
| 4 | France | 0.641057 | -1223.960924 | 0.291571 | 0.234033 | 1.181515 |
| 5 | Germany | 0.109802 | -149.265850 | 0.136830 | 0.366686 | 0.926220 |
| 6 | Ireland | 0.278099 | -490.381043 | 0.237817 | 0.197020 | 0.846996 |
| 7 | Latvia | 0.733923 | -1406.003104 | 0.142230 | 0.330611 | 1.303405 |
| 8 | Lithuania | 1.049761 | -2048.124439 | 0.246228 | 0.314357 | 0.896504 |
| 9 | Netherlands | -0.300283 | 676.042944 | 0.246888 | 0.272813 | 0.904405 |
| 10 | Poland | 0.727603 | -1402.720108 | -0.004115 | 0.247569 | 0.613606 |
| 11 | Portugal | 0.971222 | -1893.285099 | 0.192914 | 0.210846 | 0.463763 |
| 12 | Spain | 0.741538 | -1428.585380 | 0.098117 | 0.345197 | 1.119423 |
| 13 | Sweden | 0.824298 | -1593.598566 | 0.079965 | 0.252301 | 0.539738 |
| 14 | United Kingdom | 0.007181 | 57.615156 | 0.097329 | 0.321493 | 0.603858 |

## Plots

### Box plots

```
Unable to display output for mime type(s): application/vnd.plotly.v1+json, text/html
```

```
Unable to display output for mime type(s): application/vnd.plotly.v1+json, text/html
```

### Weak vs. Strong Sustainability

```
Unable to display output for mime type(s): application/vnd.plotly.v1+json, text/html
```

```
Unable to display output for mime type(s): application/vnd.plotly.v1+json, text/html
```

```
Unable to display output for mime type(s): application/vnd.plotly.v1+json, text/html
```

### Status vs. Progress

```
Unable to display output for mime type(s): application/vnd.plotly.v1+json, text/html
```

### Results vs OHI & BHI

```
PearsonRResult(statistic=-0.1962758227908415, pvalue=0.6413253073648895)
```

```
PearsonRResult(statistic=-0.13469174756194333, pvalue=0.6322276746563491)
```

```
Unable to display output for mime type(s): application/vnd.plotly.v1+json, text/html
```

## LaTeX table

## Trash bin

### 2. Carbon emissions per capita

Several sources (see code)

### 1. Greenhouse gas emissions under the Effort Sharing Decision (ESD)

Several sources (see code)

### 2. Carbon emissions per capita

Several sources (see code)

Alternative (dif-ref) score for ESD (measuring this way does not make a lot of sense to me)

**1. Fishing Subsidies relative to Landings**

Several sources

**OHI Habitat subgoal (Biodiversity)**

**EEZ as per eea.europa.eu**

**MPAs as defined by IUCN**

**Measures under the Marine Strategy Framework Directive (DROPPED)**