
OCEAN HEALTH INDEX™
2016 GLOBAL SCORES

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OCEAN HEALTH INDEX 2016:
Summary of Results for Regions and Territories

As in previous years, this summary includes results for the coastlines and Exclusive Economic Zones (EEZs) of 220 countries and territories. Assessments for the High Seas and the Antarctica region were first done in 2014 and will be repeated periodically, but were not done in 2015 or 2016. Improvements in methods for the 2016 analysis are described goal-by-goal and in the Appendix. Scores range from 0 to 100 and all scores in the global analysis are comparable place-to-place and year-to-year. The Appendix provides further information on how to interpret scores.

Background
The Ocean Health Index, a joint project of Conservation International and the National Center for Ecological Analysis and Synthesis (NCEAS) at UC Santa Barbara, is the first assessment tool that scientifically compares and combines biological, physical, economic and social information to measure how sustainably people are using the ocean. It defines a healthy ocean in this way: 'A healthy ocean sustainably delivers a range of benefits to people now and in the future.' 2016 marks the Index's fifth year of operation. The benefits scored are shown below (Fig. 1).

Methods
Scores are reported here for marine waters under national jurisdiction, namely the coastlines and oceans (out to 200 nm) of all 220 coastal countries and territories. These regions total 40% of the ocean and provide most benefits to people, but also incur most pressures from human activities. Assessments for the other 60%--the High Seas and the Antarctica region-- were not updated this year and are not included.

Each region is scored annually for each goal and subgoal (Fig. 1). Scores are computed based on the goal's status compared to a goal-specific reference point; the trend of its status for the previous 5 years; pressures that reduce status; and actions taken to lessen those pressures. Scores range from 0 to 100. A goal's score is the arithmetic average of its subgoal scores (if any), except for Food Provision, which is the yield-weighted average of scores for Fisheries and Mariculture. Each region's overall score is the arithmetic average of its goal scores. The area-weighted average of those regional scores forms the Index score. An overall score for each goal is calculated as the area-weighted average of scores for that goal obtained by all regions. Comparability of scores allows regions to observe their progress over time, their performance relative to their neighbors, and types of investments that could potentially raise ocean health scores and provide more social, economic and environmental benefits.

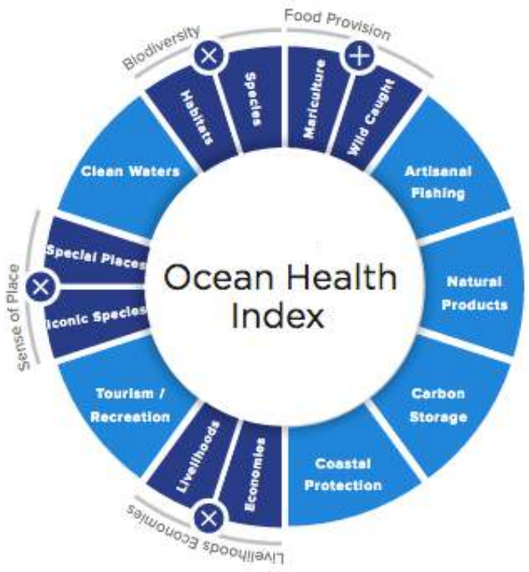

Fig.1. The 10 public goals (and 8 sub-goals) scored by the Ocean Health Index.

Five-Year Results of the Ocean Health Index

Average and median scores overall
The 5-year average (2012-2016) of Index scores for all 220 regions was 71 out of 100. The score has remained nearly unchanged at 71 throughout the study period.

Five-year scores for individual regions
Five-year average scores for individual regions ranged from 91 down to 43. Highest and lowest scoring regions are listed in Tables 1 and 2, respectively.

<u>Highest average scores</u>
Nineteen (19) regions scored 80 or above, but only two exceeded 90 (Table 1). Nine (9) of the regions are remote islands with few or no human inhabitant, showing that unpopulated regions can score well even though the Ocean Health Index emphasizes delivery of ocean benefits to people. High scores by Germany (85, 4th ranked), Seychelles (84, 8th ranked), Australia (81,15th and New Caledonia (81, 17th ranked) showed that populated regions can score well if they have effective systems for social and environmental management.

Rank	Region (population)	Index	Trend
1	Jarvis Island (0)	90.84	-0.06
2	Howland Island and Baker Island (0)	90.59	0.09
3	Palmyra Atoll (0)	86.14	-0.02
4	Germany (~81 million)	85.23	0.00
5	South Georgia and the South Sandwich Is. (30)	84.71	2.29
6	Northern Saint-Martin (~41,000)	83.71	0.18
7	Christmas Island (~2,000)	83.60	0.49
8	Seychelles (~97,000)	83.58	0.82
9	Macquarie Island (20-40)	82.81	-0.53
10	Crozet Islands (18-30)	82.22	-0.34
11	Heard and McDonald Islands (0)	82.17	-0.07
12	Norfolk Island (~1,800)	82.08	-0.47
13	Cocos Islands (600)	81.74	0.46
14	Aruba (~41,000)	81.44	0.23
15	Australia (~24 million)	81.35	-0.85
16	Antigua and Barbuda (~97,000)	81.02	0.10
17	New Caledonia (~266,000)	80.94	0.52
18	Phoenix Islands (Kiribati) (24)	80.31	0.65
19	Kerguelen Islands (45-100)	80.29	0.67

Table 1. Scores and trends for highest scoring regions during the 5 years from 2012-2016. Trend shows the general trajectory of the scores over the past 5 years, e.g. Jarvis Island's trend of -0.06 indicates that the region's score declined by an average of 0.06 points per year for the last 5 years; conversely, Howland and Baker Islands trend of 0.09 reveals an increase of 0.09 points per year during the same period.

Lowest average scores

The 10 regions that scored below 50 all had populations in the millions or tens of millions (Table 2). Nine are in Africa, one in Central America.

Rank	Region (population)	Index	Trend
212	Algeria (~41.7 million)	49.89	-0.21
213	Senegal (~15.6 million)	49.03	0.59
214	Nicaragua (~6.2 million)	49.00	-1.66
215	Guinea Bissau (~1.9 million)	48.54	0.12
216	Democratic Republic of the Congo (~80.6 million)	46.79	0.14
217	Guinea (~13.1 million)	45.76	-0.27
218	Ivory Coast (~23.4 million)	45.56	-0.08
219	Liberia (~4.8 million)	45.37	0.63
220	Sierra Leone (~6.6 million)	43.40	0.19
221	Libya (~6.4 million)	43.33	0.31

Table 2. Scores and trends for lowest scoring regions during the 5 years from 2012-2016.

Regions where overall scores changed fastest

The rate at which scores changed over the five years from 2012-2016 varied among regions. Regions with the 10 highest and 10 lowest trends are listed below. Regions with highest trends were all islands, while 7 of the 10 regions with lowest trends were mainland nations.

Highest scoring trends

The 10 regions with the largest rate of increases in index scores were: Mozambique (2.46), Prince Edward Islands (2.34), Samoa (2.32), South Georgia and the South Sandwich Islands (2.29), Tokelau (2.19), Glorioso Islands (2.05), Solomon Islands (2.03), Tuvalu (2.02), Tonga (1.82) and Maldives (1.79).

Lowest scoring trends

The 10 regions where scores decreased most quickly were: Saba (-2.42), Ukraine (-2.46), Sint Eustatius (-2.46), Saudi Arabia (-2.56), Sint Maarten (-2.56), Norway (-2.58), Finland (-2.62), Equatorial Guinea (-2.98), Estonia (-3.08) and Eritrea (-4.44).

Five-year changes in goal scores

Although the annual Index score has remained at about 71 during 2012- 2016, changes have occurred in scores for some goals (Fig. 2).

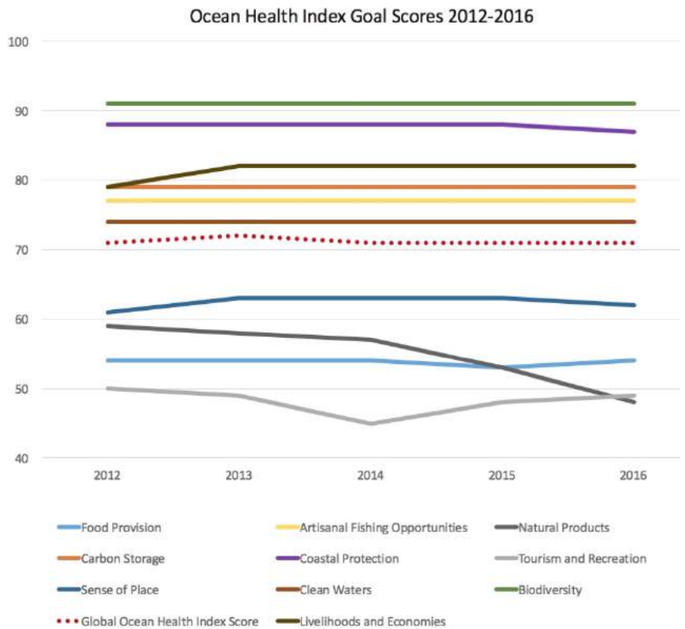

Fig. 2 Global goal scores (solid lines) and Index score (dotted red line) from 2012 to 2016.

Scores for several goals had statistically significant changes during the five years between 2012-2016:

- Lasting Special Places scores improved by an average of 0.5 points per year, probably because many new protected areas have been designated.
- Artisanal Opportunities scores improved by just over 0.15 points per year, perhaps because recovery from the global recession that began in 2008 reduced need slightly.
- Species Condition scores improved very slightly by 0.03 points per year.
- Natural Products declined by over 2.5 points per year on average, though scores for some areas increased. Scores are based on export data reported to FAO, but the reasons for underlying changes are not known.
- Coastal Protection declined by 0.12 points per year. Decrease in sea ice could be responsible for this reduction, since it is the only one of the evaluated coastal habitats (coral reefs, mangrove forests, seagrass beds, salt marshes and sea ice) for which annual data updates are available.
- The Livelihoods & Economies goal showed the most rapid score increase between 2012 and 2013, perhaps reflecting recovery from the recession that began in 2008; but lack of newer data has prevented further updates.

Summary Points

- ❖ The average 5-year score, 71 out of 100, sends a message that the ocean isn't 'dying' as many people think, but that people and marine life will fare much better when we use it in more sustainable ways.
- ❖ Regions with stable and effective governments score much higher than regions where poverty, corruption, war and civil strife are endemic. Achieving ocean health at regional and global scales will depend on improvements in social conditions and quality of governance and management.

2016 Results of the Ocean Health Index

Overall score for 2016
The overall score for all 220 countries and territories was 71. The median score was 68, i.e. an equal number of countries scored above 68 and below it.

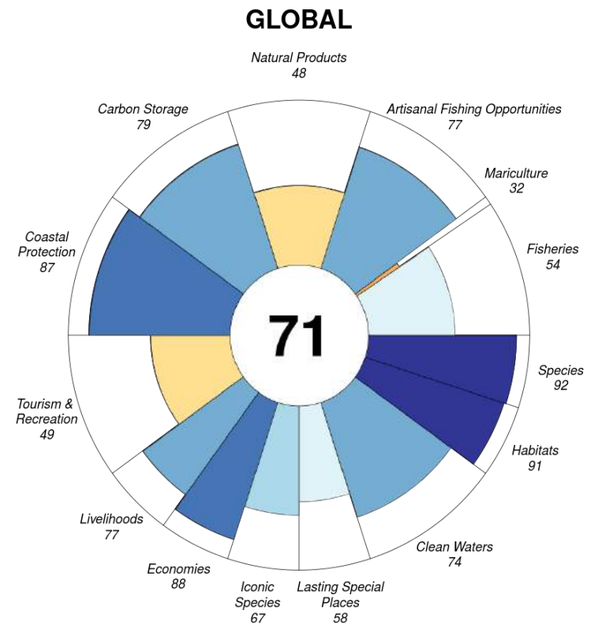

Fig. 3. Petal diagram of 2016 Ocean Health Index scores. Goal scores are represented as colored petals. The outer ring represents the maximum possible score (100) for each goal. The length and width of each petal represents a goal's score and weight, respectively. All goals are weighted equally for the global study. The goal score is the arithmetic average of any subgoal scores, except for Food Provision, which is the yield-weighted average of the scores for Fisheries and Mariculture. Source: NCEAS, 2016.

Summary Points

- ❖ The score of 71 is far from 100, sending a strong message that both people and marine life will fare better when we use the ocean in more sustainable ways.
- ❖ At the same time, a score of 71 is higher than those hearing news about global warming, oil spills, chemical leaks, nuclear accidents, species extinction etc. might expect.
- ❖ The bad news is that many parts of the ocean have suffered harm, some serious. The good news is that the ocean is not dead or dying; further harm can be prevented; and at least some of the harm already done can be reversed.

Scores for continents and other major geographical regions
Scores differed among Earth's major geographical regions. Highest scoring were the many remote regions grouped below as Southern Islands (80). The remaining regions are grouped according to the United Nations geoscheme. Highest scoring regions are highlighted blue, lowest red.

SOUTHERN ISLANDS (80)
AFRICA: Southern (71), Eastern (69), Northern (58), Middle (57) and Western Africa (57)
ASIA: Eastern (70), Southern (69), Western (65) and South-Eastern Asia (64)
EUROPE: Eastern (75), Southern (72), Western (72), and Northern Europe (69);
AMERICAS: North America (72), Caribbean (69), South America (67) and Central America (66)
OCEANIA: Australia and New Zealand (79), Polynesia (75), Micronesia (73), Melanesia (70).

Summary Points

- With some exceptions, large-scale regions with higher standards of living and more stable governments tend to have higher scores.

Scores for individual regions in 2016
Scores for individual regions ranged from 91 (Howland and Baker Island) down to 44 (Libya and Sierra Leone) with geographic distribution shown in Figure 1. With the exceptions of American Samoa and the Glorioso Islands, all of the regions that scored above 80 in 2016 also did so for 2012-2016. Of the 13 lowest scoring regions, all but Eritrea, Lebanon and Republique du Congo were also listed among the regions that scored lowest for 2012-2016.

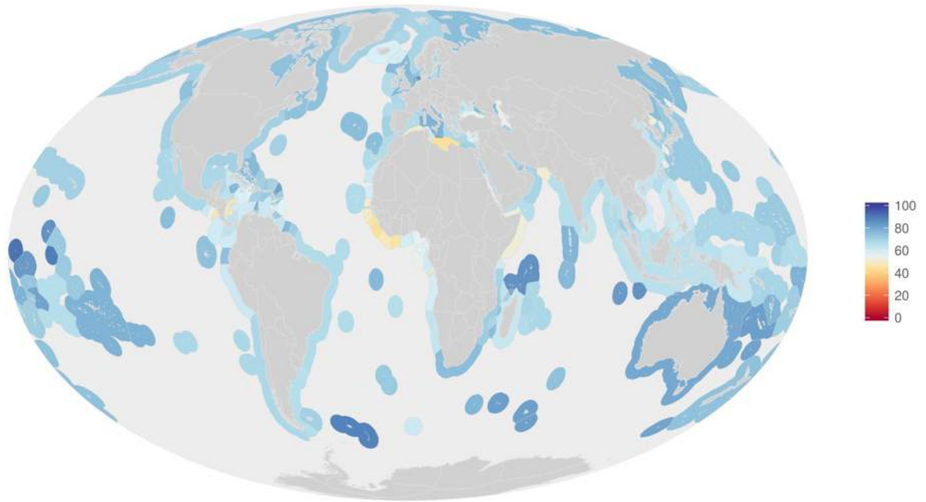

Figure 4. Geographic distribution of scores for the 2016 Ocean Health Index

Highest scores for 2016
Regions scoring above 80 were: Howland Island and Baker Island (91), Jarvis Island (90), South Georgia and the South Sandwich Islands (88); Palmyra Atoll, Germany, Christmas Island and Seychelles (all 85); Northern Saint-Martin (84), Cocos Islands (83); Heard and McDonald Islands, Crozet Is., Phoenix Islands (Kiribati), New Caledonia, Kerguelen Is. (all 82); Macquarie Is., American Samoa, Aruba, Antigua and Barbuda, and Norfolk Island (all 81); Glorioso Is. and Australia (both 80). Germany (85) and Australia (80) were the only regions with populations exceeding one million to score above 80.

Lowest scores for 2016
Thirteen (13) regions scored 50 or below: Eritrea (50), Senegal (50), Lebanon (50), Algeria (50), Republique du Congo (49), Guinea Bissau (49), Liberia (48), Nicaragua (47), Democratic Republic of the Congo (47), Guinea (45), Ivory Coast(45), Libya (44) and Sierra Leone (44). By comparison, 9 regions scored below 50 in 2015 and 20 did so in 2014.

Summary Points

- ❖ As in previous years, remote uninhabited islands scored highest, showing that relatively pristine locations can still score well even though the Ocean Health Index emphasizes benefits to people.

- ❖ Effective governance, good environmental management and attention to social well-being can allow developed, industrialized to score well.

- ❖ Regions that are poor and have a recent history of conflict, dictatorship or other challenges generally score poorly. Those conditions reduce the region's capacity to institute resilience actions that could reduce social and environmental pressures. Rapid score increases in such regions is unlikely until those conditions are overcome.

Highlights of goal and subgoal scores for 2016

Presented below are descriptions of what each goal or subgoal measures, lists of the regions that scored highest and lowest for each one, and information on updates (if any) to data and methods for 2016. All scores are comparable place-to-place and time-to-time, so individual regions can see how their performance compares to those of neighboring regions, observe score progress over time, and investigate types of investments that could perhaps raise scores and gain more social, economic and environmental benefits.

FOOD PROVISION • average score: 54 • range: 3 - 96

Target: Capture and raise the maximum sustainable amount of seafood.

This goal and its two sub-goals are not based solely on the quantity of food produced, but instead on how close each region is to the optimal sustainable production of the seafood available for it to potentially catch or raise. The goal score is the yield-weighted average of scores for Wild Caught Fisheries and Mariculture sub-goals, described below. The Fisheries score usually dominates because regions generally catch much more seafood from wild stocks than they raise by mariculture.

Highest scores

Tuvalu (96), Nauru (96), Palau (95), Oecussi Ambeno (91), Mayotte (90), Phoenix Islands (Kiribati) (90), Solomon Islands (89,) Maldives (89), Seychelles (88), and Estonia, Juan de Nova Is., Howland Island and Baker Is., and Micronesia (all 87).

Lowest scores

Barbados (18), Amsterdam and St. Paul Is. (17), Mauritania (17), Guinea (17), Western Sahara (16), Singapore (16), Wake Is. (13), Turks and Caicos (9), Jan Mayen (7) and Buvet Is. (3).

Twelve (12) reporting areas, including both inhabited and nearly uninhabited islands did not have scores for this goal. They are: Phoenix Group, Northern Saint-Martin, Glorioso Islands, Curacao, Saba, Bonaire, Line Group, Sint Eustatius, Juan de Nova Island, Bassas da India, Ile Europa and Oecussi Ambeno.

Summary Points

- ❖ The low average score, 54, indicates that the ocean's potential for food is not being realized to full human benefit now and that full benefit of its resources will not be available in the future without more effective management and planning.

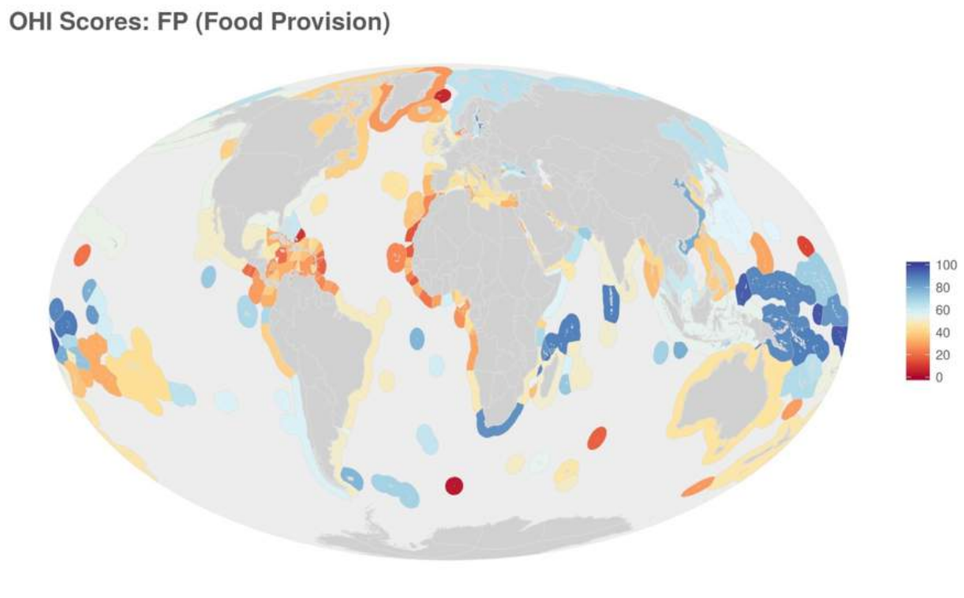

Fig. 4. Geographical distribution of scores for the Food Provision goal in 2016. Maps showing geographical distributions for this and all other goal and subgoal scores can be found here

Fisheries sub-goal • average score: 54 • range: 3 - 96

Methodological improvements for 2016. Data on catches was improved by using Sea Around Us data provided as rasters at a 0.5 degree grid level and in categories such as commercial, subsistence, etc. Those new data provided better information for taxonomic identification of catches and also identified more instances of "marine fishes not identified," which is an indicator of poor management. Data from formal stock assessments included in the RAM database are used when possible. A simplified method of calculating B/Bmsy was used. No additional years of data beyond 2010 were available.

Target: Capture the maximal sustainable amount of seafood.

Reference point: The population biomass (B, the live weight of fish in the ocean) of each landed stock is compared to the biomass that can deliver the stock's maximum sustainable yield (BMSY). MSY is the largest amount that can be caught from the population year after year. The goal is for all stocks to have B within 5% of the value that produces MSY (BMSY). Scores are penalized for overfishing (B > BMSY) and underfishing (B < BMSY) with increasingly penalties for larger departures of B from BMSY. Underfishing is penalized only half as much as overfishing.

Distant water catches are allocated to the regions where the fish were caught, so all scores reflect the condition of fisheries in the region listed.

Fisheries sub-goal (continued)
A score of 100 indicates that a region's marine fisheries are sustainably catching a total amount of fish that is as large as it can be without jeopardizing future catches.

A low score indicates either that seafood is being caught in an unsustainable manner or that regions are not maximizing the potential to catch as much as sustainably possible within their marine waters.

Regions that deliberately reduce their catch below MSY level for conservation reasons lose points on this sub-goal, but may gain points on conservation-related goals such as Biodiversity or Sense of Place.

Catches not identified to species are penalized, with larger penalties for less precise identifications. Penalties were reduced in 2016, because the geometric mean used to estimate average stock condition already magnifies any penalties.

Highest scores
Tuvalu (96), Nauru (96), Palau (95), Mayotte (91), Oecussi Ambeno (91), Phoenix Islands (Kiribati) (90), Finland (90), Maldives (89), Seychelles (88) and Solomon Islands (88).

Lowest scores
El Salvador (19), Amsterdam Island and Saint Paul Island (18), Mauritania (17), Barbados (17), Western Sahara (16), Guinea (16), Wake Island (12), Turks and Caicos Islands (9), Jan Mayen (6) and Bouvet Island (3).

The Food Provision score is obtained from the yield-weighted average of the Fisheries and Mariculture subgoal scores, so the Fisheries score usually dominates the calculation since most regions catch so much more seafood from wild stocks than they raise by mariculture.

Summary Points

- Poor data compromise accurate Fisheries assessments in many regions.
- Improved data can changes scores substantially. For example, we wondered why Anguilla's Fisheries score jumped from 3 in 2015 to 42 in 2016. The reason turned out to be that new research by the Sea Around Us catch reconstruction project revised the estimate for the catch on which Anguilla's score is based from 308 metric tons to 1,800 metric tons. Equally important, only 15% of the catch was classified as "Marine fishes not identified," compared to 63% previously. Having a large proportion of catch listed as "not identified" incurs a substantial penalty.
- Fisheries can thrive and become much more sustainable in regions with good management.

Mariculture sub-goal · average score: 32 · range: 0 - 100
Methodological improvements for 2016. An additional year of FAO data was included. Population estimates were improved with higher resolution spatial data.

Target: Harvest the maximal sustainable amount of farm-raised seafood (tonnes) per coastal inhabitant (i.e. within the 50 KM coastal strip), making the assumption that production depends on the presence of coastal communities that can provide the labor force, coastal access, infrastructures and economic demand to support the development of mariculture facilities. Each region's harvest is compared to a reference point set at the 95th percentile of harvests for all regions over all previous years of data. That reference point helps to correct for the fact that regional status values are highly skewed. Regions are scored on how closely their harvests are to that reference point. Any regions with yields equal to or above that value receive a status score of 100.

A high score can mean that a region is sustainably harvesting as close to the maximum amount of farmed seafood as possible based on its own potential. A low score can indicate one of two things – that seafood is being farmed in an unsustainable manner or that a region is not maximizing its potential to farm fish and other marine animals in its coastal territory.

The current score, 27, indicates that most regions are not sustainably producing the amounts of farmed seafood that they potentially could.

Highest scores
Chile, China, Ecuador, Faeroe Is., New Zealand, Norway and Russia (all 100); Iceland (99), Belize (94) and Canada (72). Salmonids are the main species raised in the cold water regions listed.

Lowest scores
Aruba, Bahamas, Bonaire, Cook Islands, Curacao, Eritrea, Estonia, Falkland Islands, Kenya, Kuwait, Libya, Micronesia, Nigeria, Puerto Rico and Virgin Islands of the United States, Qatar, Samoa, Seychelles, Solomon Islands, Uruguay, and Yemen , all of which scored zero (0).

Forty (40) additional countries scored between 0 and 1, namely Algeria, Argentina, Bahrain, Bosnia and Herzegovina, Colombia, Dominican Republic, East Timor, El Salvador, Fiji, Gambia, Gilbert Islands (Kiribati), Guadeloupe and Martinique, Guyana, Israel, Jamaica, Lebanon, Madagascar, Mauritius, Mayotte, Morocco, Mozambique, Nauru, Northern Mariana Islands and Guam, Oman, Pakistan, Papua New Guinea, Reunion, Romania, Saudi Arabia, Senegal, South Africa, Sri Lanka, Suriname, Tanzania, Tonga, Turks and Caicos Islands, Tuvalu, Ukraine, United Arab Emirates and Vanuatu.

Seventy-four (74) regions have never reported any mariculture production, so were not scored. That group includes many remote and uninhabited or sparsely inhabited island regions, but it also includes some places where mariculture might be possible.

Summary Points

- The many low scores and large number of regions with no mariculture indicate that many regions are not maximizing their sustainable potential to farm seafood.
- Significant global gains could be obtained by further development or improved management of this industry.

ARTISANAL FISHING OPPORTUNITIES · average score: 77 · range: 42 - 100
Methodological improvements for 2016. An additional year of data was included and a slightly different version of World Bank data was used to control for inflation. The reference point for "need" data was changed to be the 95th quantile among regions rather than the maximum value.

Target: Opportunities are available for households, cooperatives or small firms (as opposed to large, commercial companies) to meet local food needs by fishing. Artisanal fisheries use relatively small fishing vessels (if any) to make relatively short fishing trips. Catches are used mainly for local consumption or trade.

Reference point: Opportunities for artisanal fishing to meet the need, as estimated by per capita GDP corrected by purchasing power parity (PPPpcGDP). Correction by purchasing power parity controls for the different costs of living and prices in different regions relative to the U.S. dollar. Regions with low PPPpcGDP are assumed to have greater needs for artisanal fishing.

Highest scores
11 regions scored 100 (alphabetically): Bermuda, Brunei, Cayman Is., Ireland, Kuwait, Norway, Qatar, Saudi Arabia, Singapore, United Arab Emirates and United States of America.

Several of these regions (Brunei, Kuwait, Qatar, Saudi Arabia Singapore and the United Arab Emirates) score high because they had among the highest PPPpcGDP in the world for 2015 according to the World Bank, so theoretically they have little financial need for this kind of fishing whether people do it or not. Qatar has the world's highest PPPpcGDP, $143,788. The global average value is $15,470. The high scoring industrialized nations, Norway, Ireland and the United States also have reasonably high PPPpcGDP ($61,472, $56, 654 and $56,654, respectively) as well as long coastlines that could accommodate what needs there are and policies that guarantee good access to fishing opportunities.

Lowest scores
Ivory Coast (46), Solomon Is. (45), Cameroon ((45): Mozambique, Madagascar, Comoro Is. and Benin (all 44); Togo (43) Guinea (43) and Liberia (42). All have very low PPPpcGDP and high need for Artisanal fishing opportunities.

Summary Points

- The average score, 77, suggests that most regions may not be meeting the apparent economic need for their citizen's to be able to carry out small-scale fishing for subsistence, barter or commercial purposes (mainly local markets).

- More direct information on the number of people dependent on artisanal fishing, their opportunities and access to local fisheries, and the availability of seafood for them to catch would improve the quality of assessment for this goal.

NATURAL PRODUCTS · average score: 48 · range: 0 - 100
Methodological improvements for 2016. Two additional years of FAO data were added. Fishery scores were better integrated as a sustainability component for fish oil production.

Target: Harvest maximum sustainable amount of non-food products

Reference point: Global data were available for metric tonnes of exports of six products: ornamental fish for aquariums, fish oil, seaweeds, shells, sponges and coral products. The reference point for each product is 35% below the maximum value (2008 USD) ever exported from that region. The 35% buffer protects against the possibility that the maximum value resulted from over-harvesting. The goal score is the weighted average of scores for any of the six values available in the region.

Highest scores
New Caledonia (100), Suriname (100) and Mozambique (100), India (99), Iran (98), French Polynesia (97), Trinidad and Tobago (97); and Italy, South Korea, Slovenia, Germany, Poland, Lithuania and Latvia (all 96).

Lowest scores
Seventeen (12) regions scored 0 because they had some Natural Products trade in the recent past, but not in the most recent available data:. They were: Algeria, Brunei, Cyprus, Dominica, Equatorial Guinea, Faeroe Islands, Honduras, Mayotte, Montenegro, Republique du Congo, Sao Tome and Principe, Saudi Arabia. Five regions scored between 0 and 1: Bonaire, Greenland, Saba, Sint Eustatius and Sint Maarten; and 16 scored 5 or less: El Salvador, Eritrea, Brazil, Ghana and Cuba (all 5); Singapore, Chile and Gilbert Islands (Kiribati) (all 4); North Korea, Libya and Namibia (all 3); Saint Lucia, Jamaica and Guatemala (all 2); Saint Vincent and the Grenadines (1) and Barbados (1). Ninety-two (92) regions had no scores for this goal because they had no reported exports of natural products at any time.

The large number of countries with very low scores or no scores at all suggests that at least some regions might increase production either in categories scored by the Ocean Health Index or for other non-food marine products.

Summary Points

- The low average score, 48, indicates that most regions are not gaining all the benefits they could from sustainable harvest of any of the six scored resources present in their location, either because of unsustainable harvesting methods or under-harvesting of potential resources.

- The large number of regions with very low scores or no scores at all suggests that at least some regions could increase production either in categories scored by the Ocean Health Index or for other non-food marine products.

CARBON STORAGE · average score: 79 · range: 10 - 100
Methodological improvements for 2016. No new data were available and there were no changes in methods. However, important changes were made last year (2015) to weight the different amounts of carbon sequestered by different habitats with new data from Laffoley and Grimsditch (2009). Weighting factors are: Saltmarsh (210), Mangroves (139) and Seagrass (83). Also, a new global data layer (Hamilton and Casey 2014) for mangroves replaced data previously used, providing much higher spatial (30 m raster cell) and temporal resolution.

Target: Reduce global warming by conserving coastal habitats---mangrove forests, seagrass beds, salt marshes---that sequester carbon for long periods.

Reference point: Maintain or restore the extent and condition of coastal carbon-storing habitats (mangrove forests, seagrass beds, salt marshes) to their ~1980 values.

Highest scores
24 reporting areas scored 100, including both developed and developing regions. Alphabetically they are: Antigua and Barbuda, Aruba, Bahamas, Bangladesh, Belgium, Benin, Cuba, Denmark, Estonia, French Guiana, Germany, Ghana, Guadeloupe and Martinique, Morocco, N. Saint-Martin, Netherlands, Puerto Rico and Virgin Is. of the U.S., Russia, Saba, Seychelles, Sint Eustatius, Sint Maarten, South Africa and Suriname. Ten (10) of the regions are in the general Caribbean area, five (six counting Russia) are in Europe. .

Lowest scores
Ten regions scored below 35: Liberia (34), Senegal (34), Guinea, Sierra Leone, and Ivory Coast (33), Guinea Bissau (31), Democratic Republic of the Congo (30), Barbados (27), Dominica (27) and Nicaragua (10).

Seventy-two (72) regions were not scored because the habitats evaluated for carbon storage do not exist there.

Summary Points

- High scoring regions have conserved their mangrove forests, seagrass beds and salt marshes to the extent and condition prevailing in about 1980.
- The average score, 79, indicates that the condition of those habitats has declined in most regions since that time.
- Loss of coastal habitats not only increases the rate of global warming, but also exposes people and property to flooding from storm waves, reduces biodiversity, compromises fisheries through loss of areas for nursery, shelter and fishing, and may harm prospects for tourism and recreation as well as benefits associated with Sense of Place.

COASTAL PROTECTION · average score: 87 · range: 24 - 100
Methodological improvements for 2016. An updated year of data was added for Sea Ice, but no other new data were available. No changes to methods were made in 2016. Important changes made in 2015 avoid penalizing regions with healthy habitats that do not provide high coastal protection, such as seagrass. Status is now based on the relative health of the habitats that provide shoreline protection weighted by their area and protectiveness rank. Protectiveness ranks based on work by InVEST are: mangroves (4), corals (4), sea ice (4), salt marshes (3) and seagrasses (1). Higher ranks values are better. The area of each habitat type is multiplied by its protective rank and the ratio of its current extent to its reference extent. Those products are summed for all habitats present. That sum is divided by the sum of the products of the area of each type of habitat multiplied by its protective rank to yield the Coastal Protection score, as shown in the equation below:

$$x_{cp} = \frac{\sum_{i=1}^{k}(h_k \, x \, w_k \, x \, A_k)}{\sum_{i=1}^{k}(w_k \, x \, A_k)} \qquad \text{where,} \quad h = \frac{C_c}{C_r}$$

C is the condition at current (c) and reference (r) time points, w is the rank weight of the habitat's protective ability, and A is the area within a region for each k habitat type.

Target: Maintain or restore extent and condition of coastal habitats that protect against storm waves and flooding (coral reefs, mangrove forests, seagrass beds, salt marshes, sea ice) to their ~1980 values.

Reference points: The extent and condition of five of the protective biological habitats (tropical coral reefs, mangrove forests, seagrass beds, salt marshes) is compared to their values in about 1980. At the recommendation of the National Snow and Ice Data Center (Cavalieri et al. 2014) the reference point for sea ice was changed in 2015 to be from the start of the data (1979) until the year 2000 (rather than until the current year).

Highest scores
These 24 regions scored 100 because they have conserved their tropical coral reefs, mangrove forests, seagrass beds and salt marshes to the extent and condition prevailing in about 1980: Aruba, Bangladesh, Belgium, Benin, Bonaire, British Indian Ocean Territory, Curacao, Denmark, French Guiana, French Polynesia, Ghana, Howland Island and Baker Island, Japan, Line Group, Netherlands, Phoenix Group, Pitcairn, Saba, Sint Eustatius, Sint Maarten, South Africa, Suriname, Tuvalu, and Wallis and Futuna.

Lowest scores
Ivory Coast (33), Guinea (31), Sierra Leone (31); Democratic Republic of the Congo, Guinea Bissau, Nicaragua and Senegal (all 30); Lithuania (29), Dominica (27) and Belize (24).

Fifty (50) regions were not scored because the habitats providing coastal protection did not exist there.

Summary Points

- Maintaining or improving the extent and condition of biological habitats can add many years of protection from erosion and flooding damage to people and property caused by storm ways.
- Poor conservation of coastal habitats is increasing the risks to people and property from storm waves. Faster rates of sea level rise caused by global warming compound this risk.

Summary Points (cont)

- ❖ Maintaining or improving the extent and condition of biological habitats can add many years of protection from erosion and flooding damage to people and property caused by storm ways.
- ❖ Unfortunately, most regions cannot independently take action at a scale that could maintain or increase sea ice. That can only be achieved by the combined actions of many regions to reduce greenhouse gas emissions.
- ❖ It is important to emphasize that coastal habitats cannot fully protect low-lying areas if long-term sea level rise is severe.
- ❖ Loss of coastal habitats not only increases the risk of flooding, but also contributes to global warming, reduces biodiversity, compromises fisheries through loss of areas for nursery, shelter and fishing, and may harm prospects for tourism and recreation as well as benefits associated with Sense of Place.

LIVELIHOODS & ECONOMIES • average score in 2014: 82 • range: 3 - 100
Note: This goal could not be updated either in 2015 or 2016, so scores are essentially the same as in 2014.

Methodological improvements for 2016. None. The Livelihoods subgoal is based on job and wage data. Unfortunately, in 2015 the International Labor Organization's central statistical database (ILOSTAT) stopped providing wage data at the resolution required by the OHI model. We are searching for a replacement data sources. The subgoal's jobs component has also been problematic, as it evaluates five job sectors (tourism, commercial fishing, mariculture, wave and tidal energy, marine mammal watching), but new data were only available for tourism jobs. These limitations on the Livelihoods subgoal limited the value of updating the full Livelihoods & Economies goal even though data were available to update most aspects of the Economies subgoal. Goal and subgoal scores will be updated as soon as new data sources can be found. In the meantime, information below describes the method used and scores obtained in 2014.

Target: This goal aims to maintain the economic health of the marine workforce and coastal communities by maintaining coastal and ocean-dependent livelihoods (indicated by jobs), livelihood quality (indicated by relative wages) and productive coastal economies (indicated by revenues).

Reference point: The goal is for a region to have no net loss of jobs, wages or revenue in its marine sector. Jobs and revenue use a temporal reference point. Jobs must keep pace with growth in employment rates or sustain losses no greater than national increases in unemployment rates; and revenue must keep pace with growth in the region's GDP or suffer losses no greater than the national declines in GDP. The reference point for a region's wages uses a spatial reference point—that is, regional wages are compared to those in all other regions-- but always adjusted to the wages in non-marine sectors and to purchasing power of the local currency.

The reason for a 'no net loss' reference point is that we have no way on knowing whether it would be desirable for marine jobs, wages and revenues to increase faster than for other sectors. In an independent assessment a region or territory could set its own reference point based on faster marine sector growth, but that would not be appropriate for global assessment of all regions.

Nine (9) marine sectors are evaluated, including: Aquarium fishing, Commercial fishing, Mariculture, Marine mammal watching, Ports and harbors, Ship and boat building, Tourism, Transportation and shipping, Wave and tidal energy. Mineral extraction, including gas, oil, mining and others is not included as it cannot be sustainable, by definition, since even if carefully done, material is extracted faster than it can be replenished naturally.

The average score, 82, suggested that marine sectors are not keeping up with the overall economy in terms of jobs, wages and livelihoods. Several factors could be involved, including more rapid expansion of jobs and wages in non-marine industries including technology as well as lack of global data on marine sectors beyond the six evaluated in this study. In addition to an improved model, future evaluation of this goal will benefit from improved data, including global data on wages and development of global databases for other marine employment sectors.

<u>Highest scores (2014)</u>
37 regions that scored 100: Albania, Algeria, Aruba, Bangladesh, Belize, Cape Verde, Cayman Islands, Chile, Ecuador, Gambia, Georgia, Greenland, Guatemala, Israel, Kuwait, Liberia, Mayotte, Morocco, Mozambique, New Zealand, Oman, Panama, Papua New Guinea, Sao Tome and Principe, Saudi Arabia, Senegal, Slovenia, Solomon Islands, South Africa, Sweden, Syria, Tanzania, Tonga, Turkey, Tuvalu, United Arab Emirates, Uruguay and Vanuatu. Twenty-two (22) other regions scored between 95 and 99.

<u>Lowest scores (2014)</u>
French Guiana and Cook Islands (47), Philippines (45), Saint Helena (44), Samoa (43), Falkland Islands (40), East Timor (27), Saint Vincent and the Grenadines (27), Equatorial Guinea (13) and Eritrea (3).

Sixteen (16) essentially uninhabited islands were not for either sub-goal of this goal because they did not have jobs, wages or revenue. They were: Amsterdam and Saint Paul Is., Bassas da India, Bouvet Is., Clipperton Is., Crozet Is., Heard and McDonald Is., Howland Is. and Baker Is., Ile Europa, Ile Tromelin, Jarvis Is., Johnston Atoll, Kerguelen Is., Macquarie Island, Palmyra Atoll, Prince Edward Islands, and South Georgia and the South Sandwich Islands.

Summary Points

- ❖ New sources of data are necessary to evaluate this goal.

Livelihoods sub-goal • average score in 2014: 77• range: 0 - 100
Note: This goal could not be updated either in 2015 or 2016, so scores are essentially the same as in 2014.

Target: The goal is to maintain the number and quality of jobs in marine sectors.

Reference point: Livelihoods includes two equally important sub-components, the number of jobs and the average annual wages, each with its own reference point. The reference point for jobs—which is a proxy for livelihood quantity- is a moving target temporal comparison such that the number of jobs in a region's marine sectors should keep up with the number of jobs in all economic sectors, adjusted for unemployment. The reference point for wages—which is a proxy for livelihood quality-- is a spatial comparison in which a region's marine sector wages are compared with the highest value observed across all reporting regions. Wages are purchasing power parity (ppp) corrected and expressed in constant year US$.

Livelihoods sub-goal (cont).
Regions where employees of marine sectors are poorer than the rest of the labor force and where the number of jobs in marine sectors has been decreasing can be expected to score less on livelihoods.

Highest scores (2014)
54 regions that scored 100. They were broadly distributed geographically as well as by per-capita income and level of development. They are: Albania, Algeria, Antigua and Barbuda, Aruba, Bangladesh, Belize, Cape Verde, Cayman Islands, Chile, Democratic Republic of the Congo, Ecuador, French Polynesia, Gambia, Gibraltar, Greenland, Grenada, Guatemala, Haiti, Iran, Iraq, Israel, Kuwait, Liberia, Maldives, Mayotte, Morocco, Mozambique, Myanmar, Namibia, New Caledonia, New Zealand, Nigeria, Oman, Panama, Papua New Guinea, Saint Pierre and Miquelon, Sao Tome and Principe, Saudi Arabia, Senegal, Seychelles, Slovenia, Solomon Islands, South Africa, Sweden, Syria, Tanzania, Togo, Tonga, Turkey, Tuvalu, United Arab Emirates, Uruguay, Vanuatu and Yemen.

Twenty-seven (27) others scored 90 or above: American Samoa, Georgia, Guadeloupe and Martinique, Kenya, Cuba, Northern Saint-Martin, Egypt, Montserrat, Sint Maarten, Mauritania, Suriname, Guinea Bissau, Western Sahara, Turks and Caicos Islands, Glorioso Islands, Norfolk Island, Cocos Islands, Christmas Island, Djibouti, Juan de Nova Island, China, Comoro Islands, Singapore, Somalia, North Korea, Australia, South Korea.

Lowest scores (2014)
Twelve regions scored 40 or below: Guyana (40), Gabon (39), India and Anguilla (38), Cook Islands (36), Saint Kitts and Nevis (35), Libya (35), Benin (33), Saint Vincent and the Grenadines (32), Equatorial Guinea (7), Samoa (3) and Eritrea (0).

Economies sub-goal · average score in 2014: 88· range: 0 - 100
Note: This goal could not be updated either in 2015 or 2016, so scores are essentially the same as in 2014.

Target: The goal is to maintain economically productive coastal communities.

Reference point: The reference point is a moving temporal comparison for revenue such that revenue from marine sectors within a region should keep up with revenue from all economic sectors year over year. A region should have no net loss of revenue from its marine sector over time and revenue must keep pace with growth in the region's GDP or sustain losses no greater than the national declines in GDP. Updated revenue data were used for the tourism sector, aquarium fish trade, and mariculture.

Highest scores (2014)
90 regions that scored 100; and 41 that scored between 90 and 99. All of these nations suffered little or no loss of marine-related revenue compared to revenue from all economic sectors. They are listed at www.oceanhealthindex.org. The large number of high scoring regions indicates that marine related revenue in most regions has kept up with the revenue from all sectors.

Lowest scores (2014)
Canary Islands, Micronesia and Northern Mariana Islands and Guam (all 49), North Korea (48), Philippines (47), French Polynesia (46), Peru (45), Iceland (44), Marshall Islands (41), Maldives (41), Niue (33), Guadeloupe and Martinique (33), French Guiana (32), Saint Helena (26), Guinea Bissau (26), Saint Vincent and the Grenadines (22), Equatorial Guinea (19), Falkland Islands (18), Eritrea (7) and East Timor (0).

Sixteen uninhabited islands were not scored.

TOURISM & RECREATION · average score: 49 · range: 0 - 100
Methodological improvements for 2016. A new year of data from the World Economic Forum was added as well as a new year of data on travel warnings. Changes made in 2015 were continued, including use of data from the World Travel and Tourism Council that estimated the number of people employed in a region's tourism and recreation sector (hotels, airports, airlines, travel agents and leisure and services that deal directly with tourists) and the total labor force. The 2016 assessment refined a method developed in 2015 to incorporate U.S. State Department travel advisory warnings into scores as indicators of the overall quality of governance that contributes to regions ' ability to support a vibrant tourism industry. Travel advisories were categorized by urgency of warning ('risk', 'avoid unnecessary travel', and 'avoid all travel') and were weighted differently (penalties of 25%, 75%, and 100% respectively). Penalties for region-specific warnings (within a region) were assessed at half the weight.

Target: Tourism and recreation are important parts of a vibrant coastal economy, so the goal is to attract the maximal sustainable number of tourists to coastal areas.

Reference point: The goal measures the proportion of the total labor force engaged in the coastal tourism and travel sector, factoring in unemployment and sustainability. This method attempts to capture both international and domestic tourism. All regions where tourism and travel employment made up 9.5% or more of the total labor force received a perfect score. This value was set by rank-ordering the regions and giving all regions above the 90th percentile a score of 100. Long-term sustainability of tourism was estimated by the World Economic Forum's Travel and Tourism Competitiveness Index.

Highest scores
22 regions that scored 100: Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bonaire, British Virgin Is., Cape Verde, Curacao, Fiji, Greece, Maldives, Malta, N. Saint-Maarten, Saba, Saint Lucia, Seychelles, Sint Eustatius, Sint Maarten, Turks And Caicos Is. and Vanuatu.

Lowest scores
25 regions that scored 10 or below: Venezuela (10), Iran (9); Bangladesh, Angola, Kenya, Algeria and Republique du Congo (all 8); Suriname (7), Guinea (7), Cameroon (6), Sudan (6), Papua New Guinea (4), Gabon (4), Nigeria (3), Pakistan (3), Democratic Republique du Congo (2) and North Korea, Somalia, Yemen, Libya, Ukraine, Turkey, Syria, Lebanon and Iraq (all 0).

Sixteen (16) essentially uninhabited islands had no score for Tourism & Recreation: Amsterdam Island and Saint Paul Island, Bassas da India, Bouvet Island, Clipperton Island, Crozet Islands, Heard and McDonald Islands, Howland Island and Baker Island, Ile Europa, Ile Tromelin, Jarvis Island, Johnston Atoll, Kerguelen Islands, Macquarie Island, Palmyra Atoll, Prince Edward Islands, South Georgia and the South Sandwich Islands.

Summary Points

- The low average score for Tourism and Recreation, 49, and the many very low scores suggest that most regions could obtain substantially greater benefits for this goal.

- The score could be an underestimate if data on employment in the travel and tourism sector do not capture all such workers.

- A likely reason for this goal's low scores is the number of regions that have recently suffered from poverty, political turmoil, natural disasters, civil strife, war, dictatorship or other volatile conditions that make tourism unhealthy, unsafe or unappealing while also making it difficult to provide the infrastructure that might support increased tourism.

SENSE OF PLACE • average score: 62 • range: 22 - 100
Methodological improvements for 2016. New data and methods are described below in the subgoal sections.

Target: Preserve features of coastal marine areas with special cultural, spiritual or aesthetic significance for inhabitants, visitors or others. This goal uses the status of Iconic Species and Lasting Special Places sub-goals to evaluate the importance given to Sense of Place and the intangible, but essential benefits it provides. To score highly on this goal, populations of a region's iconic species had to be at low risk of extinction and the proportion of its near shore coastline (inland to 1 km) and waters (seaward to 3 nm) in protection had to be near 30%. Protected places included nature reserves, UNESCO World Heritage marine sites, national parks, cultural reserves and the United Nations list of protected places.

Highest scores
Estonia (98), Latvia (98), Poland (98), Lithuania (98), Denmark (96), Germany (95), Norfolk Is. (94), Australia (92), French Guiana (89) and Northern Saint-Martin (87). These regions are an interesting mix of six historical eastern and western European countries, a continental-sized island a small remote Pacific island with a colorful past and many endemic species, and a French island territory in the Caribbean.

Lowest scores
13 regions that scored 30 or below: North Korea, Saint Helen, Qatar and Line Is. (Kiribati) (all 30); Sudan, Syria and Yemen (all 29), Eritrea (28), Tokelau (28), Bahrain (25), Jordan (25), Iraq (24) and Bouvet Is. (22).

Summary Points

- Though intangible and difficult to measure, the benefits assessed in the Sense of Place goal provide very important personal, cultural and psychological benefits to the quality of life for individuals, communities and nations

- The mediocre average goal score, 62, indicates that most regions are not sufficiently valuing or protecting Sense of Place in ways that could enrich the cultural, spiritual and aesthetic lives of their citizens and visitors.

- There is urgent need for improved global and regional data specifically tailored to this goal, which would add substantial value to its assessment.

Iconic Species sub-goal • average score: 67 • range: 37-96
Methodological improvements for 2016. An additional year of data was added from both IUCN and Aquamaps, a database that maps the distribution of nearly 25,000 species. Another important improvement is that Trend is now calculated using historical changes in the IUCN risk category rather than relying on IUCN population trend data.

Target: Maintain abundant populations of all marine iconic species in the region with the reference point that all iconic species present should be at minimal risk of extinction ('least concern' in IUCN Red List).

Highest scores
Finland (96); Estonia, Latvia, Poland and Lithuania (all 95); Denmark (91), Germany (90), Sweden (90) and Norfolk Island (88).

Lowest scores
Cambodia (51), Amsterdam and St. Paul Islands (51), Kerguelen Is. (51), Crozet Is. (51), Bahrain (50), Prince Edward Islands (50), Iraq (47), Bouvet Is. (45), Heard and McDonald Islands (45) and Monaco (37).

Summary Points

- More information is necessary to document which species have iconic importance in various regions and cultures; and to describe their particular spiritual, traditional, aesthetic or other intangible roles.

Lasting Special Places sub-goal • average score: 58 • range: 0 - 100
Methodological improvements for 2016. An additional year of data on the location and extent of marine protected areas was added from the World Database on Protected Areas (WDPA) along with improvements to estimates of offshore and inland areas.

Target: Protect aspects of the coast that are important to cultural, spiritual and aesthetic appreciation.

Reference point: Few regions have official lists of places (if any) protected for their intangible cultural and spiritual importance, especially for various subcultures or ethnic groups. Therefore the Index uses places protected for other purposes to represent them, including coastal terrestrial protected areas, marine protected areas, UNESCO World Heritage marine sites, national parks and cultural reserves and the United Nations list of protected places. The proxy reference for lasting special places is for 30% of the coastline from 3 nm seaward to 1 km landward to be in protected status.

Highest scores
54 regions that scored 100. The list includes uninhabited, developing and developed areas. They are: Amsterdam Island and Saint Paul Island, Argentina, Australia, Belgium, Belize, Brazil, British Indian Ocean Territory, Bulgaria, Canary Islands, Crozet Islands, Denmark, Dominican Republic, Ecuador, Estonia, France, French Guiana, Germany, Gibraltar, Glorioso Islands, Guadeloupe and Martinique, Guinea Bissau, Heard and McDonald Islands, Honduras, Howland Island and Baker Island, Ile Europa, Ireland, Italy, Jan Mayen, Japan, Jarvis Island, Johnston Atoll, Kerguelen Islands, Latvia, Lithuania, Macquarie Island, Mauritania, Mayotte, Namibia, Netherlands, Nicaragua, Norfolk Island, Northern Saint-Martin, Palmyra Atoll, Phoenix Islands (Kiribati), Poland, Prince Edward Islands, Romania, Slovenia, South Georgia and the South Sandwich Is., Spain, Suriname, Tanzania, United Kingdom and Wake Island.

Another 11 regions scored 90 or above. They are: Greenland (99) and Croatia (99), El Salvador (98), Mexico (98), Portugal (97), Malta (95); Senegal, Chile and Russia (all 92); Guatemala (91) and Republique du Congo (91).

Lowest scores
15 regions that scored below 5, including: Micronesia, Maldives and British Virgin Islands (all 4); Haiti (3), Tonga (3), Sierra Leone (2) and Montenegro, Samoa, Tunisia, Singapore and Ghana (all 1). An additional 39 regions scored 0. Listed alphabetically they are: Anguilla, Aruba, Bahrain, Bassas da India, Benin, Bouvet Island, Cape Verde, Clipperton Island, Cocos Islands, Comoro Islands, Cook Islands, Djibouti, Eritrea, Falkland Islands, Gilbert Islands (Kiribati), Ile Tromelin, Iraq, Jordan, Juan de Nova Island, Liberia, Libya, Line Islands (Kiribati), Montserrat, Nauru, Niue, North Korea, Pitcairn, Qatar, Saint Helena, Saint Kitts and Nevis, Sint Eustatius, Somalia, Sudan, Syria, Togo, Tokelau, Tristan da Cunha, Wallis and Futuna, and Yemen.

Summary Points

- Though many regions scored very well, the large number that did not shows how much work needs to be done globally to achieve the important personal, cultural and psychological benefits that this subgoal can provide.

- There is urgent need for improved global data specifically tailored to this goal, that is, are there areas beyond those already measured which should be protected for spiritual, traditional, aesthetic or other important intangible reasons. Such data would add substantial value to assessment of this goal.

CLEAN WATERS • average score: 74 • range: 20-100
Methodological changes for 2016. The nutrients component incorporated an additional year of FAO data on fertilizer usage. The chemical pollution component incorporated an additional year of FAO data on pesticide use, but no other data updates were available. The Trend for the trash component is now calculated directly from trash data, rather than from proxy data on population. Those data were introduced in 2015 using a dataset (Eriksen et al. 2014) that provides higher resolution and richer information on the kinds of debris in all parts of both the ocean and coastlines.

Target: There should be zero pollution from chemicals, nutrients, pathogens and trash. Results for chemicals and nutrients are estimated using production values for agricultural chemicals and fertilizers and flow dispersion models. Pathogens are evaluated using information on the percentage of coastal populations in each reason that are served by sanitary waste treatment facilities. Trash is assessed using data on the occurrence of plastic along waters and coastlines.

Highest scores
Heard and McDonald Is. (100), South Georgia and the South Sandwich Is. (99), Falklands Is. (99), Kerguelan Is. (99), Bouvet Is (99), Macquarie Is. (98), Jarvis Is. (98), Phoenix Is (Kiribati) (97), Howland Is. and Baker Is. (97), Crozet Is. (97) and Line Islands (Kiribati) 95.

Lowest scores
Belgium (32), Benin (29), Lebanon (29), India (29), Togo (28), Slovenia (28), Monaco (24) and Gibraltar (20).

Summary Points

- Direct measurements of the amounts of chemicals, nutrients and pathogens contained in marine waters are only available in a few regions. Estimates made using models and proxy data incur considerable uncertainty.

- The average Clean Water score, 74, may be higher than the public would expect given recent media attention to pollution from sources such as the Deep Horizon oil spill and Fukushima tsunami and nuclear disaster. The harmful effects of those serious regional events are not large enough to influence all oceans and regions, so they are not captured in global data. However, information on their effects could certainly influence the results of independent regional assessments.

BIODIVERSITY • average score: 91 • range: 73 - 99

Methodological improvements for 2016. Improvements are described below in subgoal sections.

Target: Conserve species and habitats that form the rich variety of marine life with reference points that (1) a region's marine species, as assessed by the IUCN or GMAS (Global Marine Species Assessment) are at minimal risk of extinction; and (2) the extent and condition of assessed marine habitats that support biodiversity--- tropical coral reefs, mangrove forests, seagrass beds, salt marshes, subtidal soft-bottom habitats and sea ice edge---should not have decreased since about 1980.

Highest scores
Saint Helena, Ascension Is., Saba, Tristan de Cunha, Madeira, French Guiana, Sint Eustatius and Sint Maarten (all 99); Heard and McDonald Islands, Macquarie Is., Amsterdam and St. Paul Islands, Cocos Is., Kerguelen Is., British Indian Ocean Territory, French Guiana, Norfolk Is., Chile, Bonaire and Aruba (all 98).

Lowest scores
Gabon, Guinea Bissau, Pakistan, Mauritania and Sierra Leone (all 77); Senegal (76), Ivory Coast (75), Democratic Republic of the Congo (75), Iceland (74) and Jan Mayen (74).

Summary Points

- With the exception of French Guiana and Chile, the highest scoring regions were all islands, many remote with few or no human inhabitants, but several with sizeable populations

- The average score, 91, might seem unexpectedly high given media coverage and public attention to the plight of endangered species and the likelihood that population growth, land use changes, climate change and other human-caused pressures are causing what has been termed "Earth's 6th great mass extinction." Remember, however, that Habitats are compared to their reference values in ~1980 (1979-2000 for sea ice), so changes seen have occurred in only about three decades. Similarly, criteria for IUCN estimates of extinction risk include population changes over 10 years or three generations (whichever is longer), so changes seen usually also represent short time periods. Given those considerations, the score of 91 is not as comforting as it might seem.

Species sub-goal • average score: 92 • range: 78-98
Methodological improvements for 2016. An additional year of IUCN and Aquamaps data were incorporated, including information on bird species (which generally increased scores because several widespread bird species are doing well. A new threshold was used for determining presence of absence of species in Aquamaps data.

Reference Point: All Species present should be at minimal risk of extinction ('least concern' status in the IUCN "Red List"). The 2015 analysis was able to use updated IUCN and GMSA data for 5,606 species, including information for some subpopulations, thereby increasing the resolution of measurement for this subgoal.

Highest scores
68 regions scored 95 or above: Anguilla, Aruba, Ascension, Bahamas, Barbados, Bermuda, Bonaire, British Virgin Islands, Cayman Islands, Curacao, Dominica, French Guiana, Guadeloupe and Martinique, Madeira, Montserrat, Northern Saint-Martin, Saba, Saint Helena, Sint Eustatius, Sint Maarten, Turks and Caicos Islands (all 98); Norfolk Island, Belize, Grenada, Portugal, Azores, Canary Islands, Tristan da Cunha, Antigua and Barbuda, Christmas Island, Saint Vincent and the Grenadines, Cocos Islands (all 97); Poland, Bassas da India, Dominican Republic, Honduras, Sweden, Panama, Puerto Rico, Saint Kitts and Nevis, Heard and McDonald Islands, British Indian Ocean Territory, Costa Rica, Chile, Cuba, Ireland, New Zealand (all 96); and Australia, Bouvet Island, Brazil, Canada, Cape Verde, Colombia, Estonia, Faeroe Islands, Falkland Islands, Finland, France, Germany, Greenland, Iceland, Jamaica, Kerguelen Islands, Lithuania, Macquarie Islands, South Georgia and the South Sandwich Islands and United Kingdom (all 95).

Most of the highest scoring regions were islands or island nations, many with small populations, but some with large ones, including New Zealand (more 4.5 million) and Cuba (more than 11 million). The highest scoring non-island regions were Ireland and Sweden (both 96) and Canada, Chile, Finland, Panama and Poland (all 95).

Lowest scores
Eritrea, East Timor, Libya and Singapore (all 82); Cambodia, Oecussi Ambeno, Sudan and Myanmar (all 81); and Iraq (80).

Habitats sub-goal • average score: 91 • range: 54-100
Methodological improvements for 2016. No data updates were available for any of the biological habitats. An additional year of sea ice edge data was obtained from the National Snow and Ice Data Center. There were no changes to methods.

Reference point: The extent and condition of habitats that support large numbers of species and for which global data are available should at least be equal to their values in about 1980. Six habitats had sufficient global data to permit evaluation: tropical coral reefs, mangrove forests, seagrass beds, salt marshes, subtidal soft-bottom habitats and sea ice edge. Regions are only scored for habitats that normally exist within their EEZ. The Crozet Islands, Monaco and Bouvet Island were not scored because none of the evaluated habitats exist there.

Highest scores
34 regions scored 100: Albania, Ascension, Bangladesh, British Indian Ocean Territory, Bulgaria, Chile, Croatia, Cyprus, French Guiana, Greece, Heard and McDonald Islands, Howland Island and Baker Island, Jarvis Island, Kerguelen Islands, Lebanon, Libya, Macquarie Island, Madeira, Montenegro, Namibia, Norfolk Island, Pitcairn, Romania, Saba, Saint Helena, Saint Pierre and Miquelon, Sao Tome and Principe, Sint Eustatius, Sint Maarten, Slovenia, Suriname, Tristan da Cunha, Tunisia, and Wallis and Futuna.

Lowest scores
Mauritania (64), Belize (63), Sierra Leone (63), Dominica (62), Democratic Republic of the Congo (62), Senegal (60), Poland (60), Ivory Coast (58), Jan Mayen (54) and Iceland (54).

Summary Points

- Low scores for the extent and condition of habitats would likely depress scores for the species condition subgoal, accelerating the decline in future scores for the Biodiversity goal.

- Loss of coastal habitats not only harms biodiversity, but also increases the risk of flooding, contributes to global warming, compromises fisheries through loss of areas for nursery, shelter and fishing, and may harm prospects for tourism and recreation as well as benefits associated with Sense of Place.

Habitats sub-goal • average score: 91 • range: 54-100
Methodological improvements for 2016. No data updates were available for any of the biological habitats. An additional year of sea ice edge data was obtained from the National Snow and Ice Data Center. There were no changes to methods.

Reference point: The extent and condition of habitats that support large numbers of species and for which global data are available should at least be equal to their values in about 1980. Six habitats had sufficient global data to permit evaluation: tropical coral reefs, mangrove forests, seagrass beds, salt marshes, subtidal soft-bottom habitats and sea ice edge. Regions are only scored for habitats that normally exist within their EEZ. The Crozet Islands, Monaco and Bouvet Island were not scored because none of the evaluated habitats exist there.

<u>Highest scores</u>
34 regions scored 100: Albania, Ascension, Bangladesh, British Indian Ocean Territory, Bulgaria, Chile, Croatia, Cyprus, French Guiana, Greece, Heard and McDonald Islands, Howland Island and Baker Island, Jarvis Island, Kerguelen Islands, Lebanon, Libya, Macquarie Island, Madeira, Montenegro, Namibia, Norfolk Island, Pitcairn, Romania, Saba, Saint Helena, Saint Pierre and Miquelon, Sao Tome and Principe, Sint Eustatius, Sint Maarten, Slovenia, Suriname, Tristan da Cunha, Tunisia, and Wallis and Futuna.

<u>Lowest scores</u>
Mauritania (64), Belize (63), Sierra Leone (63), Dominica (62), Democratic Republic of the Congo (62), Senegal (60), Poland (60), Ivory Coast (58), Jan Mayen (54) and Iceland (54).

Summary Points

- Low scores for the extent and condition of habitats would likely depress scores for the species condition subgoal, accelerating the decline in future scores for the Biodiversity goal.

- Loss of coastal habitats not only harms biodiversity, but also increases the risk of flooding, contributes to global warming, compromises fisheries through loss of areas for nursery, shelter and fishing, and may harm prospects for tourism and recreation as well as benefits associated with Sense of Place.

With Appreciation

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Additional Information

Explore more

- Further information at www.oceanhealthindex.org, includes an interactive Data Explore that shows how scores are constructed and allows users to test 'what if' scenarios.
- Data, scientific publications, and detailed scientific information are at www.ohi-science.org, including tools for developing an independent assessment.
- A color-coded table of scores for all regions
- Maps of all scores
- A color-coded carpet plot showing overall and goal scores for all regions from 2012-2016
- Flower plots of goal scores for every region
- A table of status Trends from 2012-2015
- An interactive Google plot where you can explore correlations between goals, look at change over time, compare country scores, etc.

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a **healthy** ocean sustainably delivers a range of benefits to people both now and in the future

www.oceanhealthindex.org
www.ohi-science.org