# OHI 2017: Updates to data and methods

## Goals status and trend updates

We updated 6 of the 10 goals with additional years of data. The carbon storage and livelihoods and economies goals were not updated because these data are no longer continued and new data sources are unavailable. The natural products goal was not updated because FAO had not released the latest data. The chemical and nutrient pollution components of the clean water goal were not updated because we did not have the resources to process these data.

*New data*

We were able to incorporate new spatial data describing the range of RAM stocks (https://marine.rutgers.edu/~cfree/ram-legacy-stock-boundary-database/), which allowed us to accurately identify the FAO/OHI regions for each stock.

We used a new dataset (Watson 2017) to estimate soft-bottom habitat health (a component of the biodiversity goal). Soft-bottom habitat health is estimated by the prevalence of destructive fishing practices, which is identified in the Watson data by gear type.

Population data used in the mariculture goal has been improved (same data source). The new data are available at 30 arc-second resolution (vs. 2.5 arc-minute) and UN-adjusted for improved accuracy.

*New methods*

We now gapfill RAM B/Bmsy data when a stock is missing more recent years of data.

For the tourism and recreation goal, we discovered that World Economic Forum sustainability data (TTCI) is not compatible across years due to changes in their methods (and no back-calculation of previous year’s scores), so we now only use the most recent year of data for all scenario years.

We corrected an error in the natural product goal that was excluding fish oil from score calculations.

There were some improvements in processing the species condition and iconic species subgoals, however, this had little or no effect on final scores.

## Pressures

We updated 12 of the 20 pressures with additional years of data. The sea surface temperature data had not been updated. Trash and invasive species data are not being updated and we have not found a good replacement. Nutrient and chemical pollution data were updated by FAO but we did not have the resources to process these data. Artisanal high bycatch and subtidal hard-bottom habitat destruction data are not updated, but we can use the Watson catch data, with gear type information, to update these data in the future. Pathogen data have not been updated for two years, and it is unclear whether these data will be updated in the future.

*New data*

Improved fisheries catch data (Watson 2017) were available to calculate commercial (high and low bycatch), artisanal fishery (low bycatch), and destructive soft-bottom pressures. The Watson catch data describes the gear type used for each catch record, which allowed us to better classify high and low bycatch as well as soft-bottom subtidal destructive fishing practices (e.g., dredging).

Population data used to estimate intertidal habitat destruction has been improved (same data source). The new data are available at 30 arc-second resolution (vs. 2.5 arc-minute) and UN-adjusted for improved accuracy.

*New methods*

For the Social Progress Index we use an improved method of gapfilling. Several years of data were added by the data source, and our old method of gapfilling was too labor intensive to apply over multiple years.

## Resilience

We updated 6 of the 14 resilience measures with additional years of data. The other resilience measures were not updated because these data are no longer continued and new data sources are unavailable. This includes the responses to the CBD survey which quantifies region’s measures to protect diversity against pressures such as habitat destruction, mariculture, tourism, and water pollution, global measures of how well regions regulate commercial and artisanal fishing practices (Mora), and mariculture (Trujillo).

*New data*

None.

*New methods*

There were small changes to gapfilling methods. For the Global Competitiveness Index, uninhabited regions are now given an NA score. For the CITES signatories, territories are now given the same score as their administrative country. For the Social Progress Index we improved the gapfilling method so it would be easier and more consistent.

## Behind the scene changes

The following structural changes do not alter scores, but they will make future analyses faster and more accurate, simplify documentation efforts and improve consistency, and make our methods more transparent and replicable.

The metadata for OHI global data is now organized into several relational data tables and RMarkdown files. The relational data tables provide information about each data layer and data source (e.g., name of data layer, description of data, units, location of data and gapfilling files, data preparation). The RMarkdown files provide descriptions and preparation information for the data layers and goals. These files are used to generate content for Methods documents and the website.

We improved the OHI toolbox framework to better deal with multiple year scenarios. The previous method worked well with 2-3 years of data, but after that it became cumbersome and prone to error.

* Each data layer (including pressures and resilience) includes all the years of data to calculate all scenarios (vs. different files for each scenario year).
* Scores for all scenario years are calculated using a single script and folder (vs. separate scripts and folders) and results are included in a single csv file.
* No longer provide a “status\_year” argument in goals.csv. Instead, the year of data that corresponds to each scenario year is identified in a new csv file (conf/scenario\_data\_years.csv).
* Added new functions to select and align data layers based on the scenario year.
* In ohicore the CalculatePressuresAll.R and CalculateResilienceAll.R functions were modified to handle multiple scenario years.

Data used to weight pressure/resilience components for each region are now automatically generated when the ohi-global toolbox is run.

Improvements to spatial data:

* Improved the raster we use to extract spatial data for each OHI region (now use fasterize package)
* Fixed some polygon intersections and other topology issues in the spatial polygon files
* We now source a file in our data preparation scripts to load the most current spatial data to ensure we are consistently using the best data

Wrote additional functions to better process and visualize data:

* Functions to create flower plots, maps, and score comparison among commits
* Functions for trend calculations

Habitat data are now in separate files (rather than one large composite file), which makes more sense because they are comprised of different data and are updated at different intervals.

Table 1: Description of updates to data and models used to calculate the status and trend scores for the global Ocean Health Index.

|  |  |  |  |
| --- | --- | --- | --- |
| **Goal/subgoal**  **(Issues)** | **Updates to data** | **Updates to data preparation or model** | **Notes** |
| Artisanal opportunities | *Need*: Additional year of data  *Opportunity*: None | None | Small changes to source data resulted in small changes to scores. We also had to gapfill fewer regions due to improved World Bank reporting |
| Species condition  (subgoal of biodiversity goal) | Additional year of IUCN, Aquamaps, BirdLife data | Some technical improvements to accessing/analyzing data that had minimal or no impact on scores | Addition of new species to IUCN and AM resulted in some change to score (Total OHI species in 2016 vs 2017 is 7797 vs 9211). Same year of data is used for all scenario years. |
| Habitat  (subgoal of biodiversity goal) | *Sea ice edge*: additional year of data (trend and condition updated)  *Mangrove*: no updates  *Saltmarsh*: no updates  *Seagrass*: no updates  *Coral*: no updates  *Softbottom*: new datasource and 4 additional years of data (trend and condition updated) | Watson fishing data (used to calculate soft-bottom habitat health) includes gear type so we could directly identify destructive fishing practices | There were some changes to habitat scores (typically < 10 points, but a few >40) due to changes in soft-bottom habitat data (new data source and 3 year time shift in data) |
| Fisheries | *Catch*: 4 additional years of SAUP data (2016 data is now calculated with 2013 catch data, rather than 2010)  *B/Bmsy*: Additional year of RAM data; RAM OHI/FAO regions now determined using Free (2017) spatial data; updated catch data for CMSY estimates of B/Bmsy | Spatial data describing RAM stock boundaries improved our assignment of RAM stocks to FAO/OHI regions.  Now gapfill RAM data when there are missing years for a stock | Scores changed due to:  shift in data years (2014 vs. 2010)  revised SAUP data  RAM updates and revisions  Spatial data for RAM allows us to identify the OHI/FAO regions of RAM stocks  RAM data now gapfilled when stock has data but is missing most current years |
| Mariculture (subgoal of food provision goal) | *Production*: 2 additional years of FAO data  *Sustainability*: no updates  *Population*: new year of data with higher resolution data | None | Additional years and improved population data from same source and changes to FAO mariculture data resulted in small changes to scores |
| Coastal protection | *Sea ice shoreline*: additional year of data (trend and condition updated)  *Mangrove*: no updates  *Saltmarsh*: no updates  *Seagrass*: no updates  *Coral*: no updates | None | None |
| Carbon storage | *Mangrove*: no updates  *Saltmarsh*: no updates  *Seagrass*: no updates | None | None |
| Clean waters | *Nutrient pollution*: None  *Chemical pollution*:  Shipping and ports: None  Land-based inorganic: None  Land-based organic: None  *Pathogens:* None  *Trash*: None | None | None |
| Iconic species  (subgoal of sense of place goal) | Additional year of IUCN, Aquamaps, and BirdLife data, however no new assessments for ICO species | Some technical improvements to accessing data that had no impact on scores | No changes to scores because it seems that there were now new assessments for ICO species in source data |
| Lasting special places (subgoal of sense of place) | Additional year of WDPA data | None | Some changes due to changes in source data |
| Natural products | No new data | Correction to how fishery scores are incorporated into model, previously, fish oil was not being included in model | Most region scores were unchanged but a few regions had large changes due to correction |
| Tourism and recreation | *Tourism sustainability*: WEF TTCR updated year  *Employment*: new year of WEF data  *Travel warnings*: new year of data | Discovered that World Economic Forum sustainability data (TTCI) is not compatible across years so we now only use the most recent year of data for all scenario years. | Small changes due to revisions in source data, primarily employment data |
| Livelihoods and economies | None | None | None |

Table 2: Description of updates to data and methods used to calculate the pressure scores for the global Ocean Health Index.

|  |  |  |  |
| --- | --- | --- | --- |
| **Pressure** | **Updates to data** | **Updates to data preparation or model** | **Notes** |
| Social: World Governance Index | Additional year data | None |  |
| Social: Social Progress Index | Additional years of data (and previous back years from 2014 and 2015 now available) | Improved gapfilling method (old method was too labor intensive with additional years of data) | Updates to source data.  Changes to pressure scores < 2 points in most cases |
| Climate change: Ocean acidification | Additional year of data | None |  |
| Climate change: UV | Additional year data | None |  |
| Climate change: Sea level rise | Additional year data | None |  |
| Climate change: Sea surface temperature | None | None |  |
| Pollution: Land-based nutrient pollution | None | None |  |
| Pollution: Chemical pollution | Organic land-based: None  Shipping ports: None  Inorganic land-based: None | None |  |
| Pollution: Trash | None | None |  |
| Pollution: Pathogens | None | None |  |
| Species: Genetic escapes | Additional year data of mariculture data, no updates to probability of invasiveness (Trujillo data) | None |  |
| Species: Targeted harvest | Additional year data | None |  |
| Species: Invasive species | None | None |  |
| Commercial fisheries: high bycatch | Catch: New data source (Watson 2017) and 3 additional years data  NPP: Additional year data | Watson data includes gear type so we could directly categorize high and low bycatch (rather than relying on previous proportions) |  |
| Commercial fisheries: low bycatch | Catch: New fishery data source (Watson 2017) and 3 additional years data  NPP: Additional year data | Watson data includes gear type so we could directly categorize high and low bycatch (rather than relying on previous proportions) |  |
| Artisanal fisheries: low bycatch | Catch: New data source (Watson 2017) and 3 additional years data  NPP: Additional year data | Watson data includes gear type so we could directly categorize high and low bycatch (rather than relying on previous proportions) |  |
| Artisanal fisheries: high bycatch | None | None |  |
| Habitat destruction: soft-bottom subtidal | New data source (Watson 2017) and 3 additional years data | Watson data includes gear type so we could directly identify destructive fishing practices | Small changes to pressure scores due to new data source and 3 year time shift in data) |
| Habitat destruction:  Intertidal (nearshore population used as proxy) | Additional years of data (data now goes to 2020).  Improved data from same source. | Source data now at 30 arc-second resolution (vs. 2.5 arc-minute) and UN-adjusted | Small changes to pressure scores (<5) due to using 2017 data vs. 2015 and improved population data from the same source |
| Habitat destruction: subtidal hard-bottom | None | None |  |

Table 3: Description of updates to data and methods used to calculate the resilience scores for the global Ocean Health Index.

|  |  |  |  |
| --- | --- | --- | --- |
| **Resilience** | **Updates to data** | **Updates to data preparation or model** | **Notes** |
| Coastal marine protected areas (3nm and eez) | Additional year of data | None |  |
| Species condition (3nm and eez) | Additional year of data | None |  |
| CITES signatories | Additional year of data | Small change to gapfilling: territories are given same score as administrative regions |  |
| Social Progress Index | Additional years of data (and previous back years from 2014 and 2015 now available) | Improved gapfilling method (old method was too labor intensive with additional years of data) | Updates to source data  Changes to pressure scores < 2 points in most cases |
| World Governance Indicators | Additional year of data | None |  |
| Effectiveness of commercial fisheries management (Mora data) | None | None |  |
| Effectiveness of artisanal fisheries management (Mora data) | None | None |  |
| CBD data (5 resilience measures): Management of habitat diversity; protection of biodiversity from following pressures: Mariculture, invasive species, tourism, pollution | None | None |  |
| Mariculture Sustainability Index | None | None |  |
| Global Competitiveness Index | Additional 2 years of data (this layers was not updated last year) | Uninhabitated areas now gapfilled with NA | Changes to scores are very small |