LIVING BLUE PLANET REPORT

LIVING PLANET INDEX Q&A

1. **What is the Living Planet Index?**

The Living Planet Index (LPI) tracks changes in the size of thousands of animal populations to give us an idea of the status of species around the world. The LPI is calculated by taking the average value of all the annual changes in populations for each year and transforming it into a single index. The data used in constructing the index are time series of either population size, density, abundance or a proxy of abundance. For example, the number of nests or breeding pairs recorded may be used instead of a direct count of population. The LPI now contains populations which span any number of years between 1970 and 2012.

This report focuses on a subset of the LPI for marine populations of mammal, bird, reptile and fish species. These have been coded as marine as they permanently or mostly occur in a marine habitat or they have been monitored in a marine habitat. New data for over 300 additional species and nearly 2,700 populations were added to the data set for this report.

The marine LPI reflects 42 years of trend data – from 1970 to 2012. After 2012, the amount of available data decreases due to the time taken for data to be collected, published and then entered into the LPI database, making the 2012 database the most comprehensive and reliable for use at this time.

2. **How many species and populations have been used in the LPI analysis?**

The marine LPI is based on trends in 5,829 populations of 1,234 mammal, bird, reptile and fish species from around the globe. The other LPIs in the report are subsets of the marine LPI divided according to species group, habitat or region. The number of species in each LPI can be found in Table 1.

3. **What "cuts" of the LPI are included in the report?**

The report contains cuts of the LPI to reflect trends in:

A) Species groups

a. Marine fish

All populations in the LPI are classified as to whether they are utilised by people or not. The definition of utilised that we have used here refers to fishing on any scale from local subsistence level to commercial fisheries. The LPI for utilised fish includes only those populations that have been identified as utilised. In order to look at a highly commercial group of fish species, we produced a separate LPI for the Scrombidae family which are mackerel, tuna and bonito species.

b. Echinoderms (Sea cucumber)

We don't currently collect data for invertebrate species in the LPI so we weren't able to calculate an index for sea cucumber. However, we used data on production[1] which gives an indication of the fishing pressure placed on these species. We also used some case studies which had monitored individual populations to see the effect of over-exploitation.

B) Habitats

a. Coral reef

To produce an LPI for coral reef habitat, we first identified fish species that are associated with coral reef according to Fishbase, a comprehensive database on fish. Reef associated is defined as: 'Living and feeding on or near coral reefs'[2] (Fishbase, 2015). We then cross-checked these species with a global distribution map of tropical coral[3] *(UNEP-WCMC, WorldFish Center, WRI, TNC 2010)* to find those populations that were monitored in a tropical coral area. Using ArcGIS we selected populations that occurred within a coral area with a 1 decimal degree buffer. This gave us a data set of 2,501 populations in coral locations of 352 reef associated fish species.

b. Seagrass

We used a similar approach when producing an LPI for seagrass habitat. We weren't able to identify species that are closely associated with seagrass so we just selected fish species and identified those populations that were monitored in a seagrass location according to a map of the global distribution of seagrasses[4] (UNEP-WCMC, Short FT, 2005). We again selected populations that occurred within a seagrass area with a 1 decimal degree buffer.

c. Mangrove

There was not enough LPI data from mangrove areas to do a similar analysis for this type of habitat. Instead, we used data from the Food and Agriculture Organisation (FAO)[5] that shows changes in the extent of cover of mangrove habitat.

C) Regions

a. North Atlantic – deep sea habitat

We used several resources to identify fish species which occur in deep sea habitat. A fish species was included in this analysis if it appeared in any of the following data sets:

- IUCN Red List[6] - a species occurring in Marine Deep Ocean Floor habitat
- Fishbase[7] – a species occurring on seamounts
- Ocean Biogeographic Information System (OBIS)[8] – a species occurring on

[1] Purcell, S. W., Mercier, A., Conand, C., Hamel, J. F., Toral-Granda, M. V., Lovatelli, A., & Uthicke, S. (2013). Sea cucumber fisheries: global analysis of stocks, management measures and drivers of overfishing. Fish and Fisheries, 14(1), 34-59

[2] Froese, R. and D. Pauly. Editors. 2015. FishBase. World Wide Web electronic publication. www.fishbase.org, version (04/2015).

[3] UNEP-WCMC, WorldFish Centre, WRI, TNC (2010). Global distribution of coral reefs, compiled from multiple sources including the Millennium Coral Reef Mapping Project. Includes contributions from IMaRS-USF and IRD (2005), IMaRS-USF (2005) and Spalding et al. (2001). Cambridge (UK): UNEP World Conservation Monitoring Centre. URL: http://data.unep-wcmc.org/datasets/1

[4] UNEP-WCMC, Short FT (2005). Global Distribution of seagrasses (version 2). Updated version of the data layer used in Green and Short (2003). Cambridge (UK): UNEP World Conservation Monitoring Centre. URLs: http://data.unepwcmc. org/datasets/8 (polygons) and http://data.unep-wcmc.org/datasets/7 (points)

[5] FAO (2007). The world's mangroves 1980-2005. FAO Forestry paper 153. Rome.

[6] IUCN 2015. IUCN Red List of Threatened Species. Version 2015.2. <www.iucnredlist.org>. Downloaded on 24th July 2015

[7] Froese, R. and D. Pauly. Editors. 2015. FishBase. World Wide Web electronic publication. www.fishbase.org, version (04/2015)

seamounts
- UNEP-WCMC report[9] on deep sea habitat – species identified in the report as deep sea

b. Southern Ocean

We didn't have sufficient data to produce an LPI for this region, so we took two examples of fish species, Mackerel icefish and Marbled rockcod, to illustrate how the issue of overfishing in the area can impact populations.

TRENDS IN THE LPI

4. What are the main trends shown by the marine LPI?

The global marine LPI declined by 49 per cent between 1970 and 2012. This figure shows more of a decline than the previous result from Living Planet Report 2014, which was a 39 per cent decline, for two reasons. Firstly, because the marine LPI shows two more years of data and the index is declining, it means that the overall trend will be worse than in 2010. Secondly, as part of the preparatory work for this report, data for over 300 additional species and nearly 2,700 populations were added to the data set. The addition of new data will often affect the overall trend value as the new trends will influence the average. However, the direction and trajectory of the trend has not changed since the previous result so we are still getting the same picture of a declining trend in marine vertebrate species.

Table 1: Trends in the Living Planet indices between 1970 and 2010 (2012 for the marine LPI), with 95 per cent confidence limits. Positive number means increase, negative means decline.

		Number of species	Per cent change	95% confidence limits	
				Lower	Upper
Marine	Global	1,234	-49%		
Species groups	Utilised fish populations	492	-50%	-61%	-36%
	Scrombidae species	17	-76%	-88%	-49%
Habitats	Coral reef-associated fish	352	-34%	-47%	-18%
	Fish in seagrass locations	232	-74%	-88%	-45%
Regions	North Atlantic fish – deep sea species	25	-72%	-83%	-52%

5. What role has climate change played in the overall decline of species, particularly in recent trends?

It is likely that climate change has caused a decline in populations of some species, particularly those in vulnerable ecosystems such as coral reefs, mountains and the Arctic. Looking at the main threats affecting marine species populations, this report found that for populations in tropical coral reefs, climate change was the third biggest threat after habitat change and exploitation over the last 40 years. Over the next 40 years, however, climate change is likely to become a more prevalent factor affecting population trends, as well as itself being a driver of habitat loss and alteration.

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[8] OBIS (2015) [Map of species occurrences in seamount habitat] (Available: Ocean Biogeographic Information System. Intergovernmental Oceanographic Commission of UNESCO. http://www.iobis.org. Accessed: 2015-07-24)

[9] Clark MR. Tittensor D. Rogers AD, Brewin P, Schlacher T, Rowden A, Stocks K, Consalvey M 120061. Seamounts, deep-sea corals and fisheries: vulnerability of deep-sea corals to fishing on seamounts beyond areas of national jurisdiction. UNEPWCMC, Cambridge. UK.

Shift in species distribution has already been observed in almost every part of the ocean, with marine organisms relocating to higher latitudes, consistent with warming trends. Fish and zooplankton are migrating at the highest rates, particularly toward high latitudes in the northern hemisphere. In some cases, organisms and ecosystems appear unable to relocate as surface waters increase in temperature.

Changes in ocean temperature are also altering the timing of key life history events such as plankton blooms, and the spawning and migratory behaviour of turtles, fish and invertebrates.

CALCULATING THE LPI

6. Where does the data used in the LPI come from?

All data used in constructing the index are time series of either population size, density, abundance or a proxy of abundance. The species population data used to calculate the index are gathered from a variety of sources. Time-series information for vertebrate species is collated from published scientific literature, online databases and grey literature, totaling 2,337 individual data sources. Data is only included if a measure of population size is available for at least two years, and information available on how the data was collected, what the units of measurement were, and the geographic location of the population. The data must be collected using the same method on the same population throughout the time series and the data source referenced and traceable.

The period covered by the index is from 1970 to 2012. The year 2012 is chosen as the cut-off point for the index because there is not yet enough data to calculate a robust index up to the present day. Datasets are continually being added to the database.

7. What are the technical details of the calculations?

There are two stages to the calculation of the LPI – calculating annual species trends and weighting the final index.

Calculating annual species trends

For each population, the rate of change from one year to the next is calculated. If the data available is from only a few, non-consecutive years, a constant annual rate of change in the population is assumed between each data year. Where data is available from many years (consecutive or not) a curve is plotted through the data points using a statistical method called generalized additive modelling. In the case where more than one population trend for a single species is available, the average rate of change across all of the populations is calculated for each year for that species.

Weighting the index

There are two options for weighting that we use for LPIs. We use the LPI-D to produce global LPIs (including the marine LPI) and the LPI-U to produce all smaller scale LPIs. The reason we have alternative weighting systems is because the LPI-D is only applicable to large data sets and ones that we have good taxonomic reference information for. It is not possible to use this method of weighting for smaller data sets.

The unweighted LPI (LPI-U) methodology was used for all LPIs in the report except for the global marine LPI. It makes calculations based on the average rate of change across all species from year to year. The index is set equal to 1 in 1970, and the average annual rate of population change is used to calculate the index value in each successive year (For more details: Collen, B., Loh, J., McRae, L., Whitmee, S., Amin, R. & J. Baillie. 2009. Monitoring change in vertebrate abundance: the Living Planet Index. Conservation Biology 23: 317-327.)

The LPI-D used for the global marine LPI is an adapted version of this method which attempts to make the indicator more representative of vertebrate biodiversity by accounting for the estimated diversity of species globally. Because the LPI dataset is not uniformly distributed across regions and species this new approach is being employed to calculate indices to reflect the number and distribution of vertebrate species in the world. The LPI-D method involves a system of weighting that reflects the actual proportions of species found in each taxonomic group and realm. These proportions allow the index to be weighted accordingly.

Table 2 shows the proportion by realm of the total number of species found in each taxonomic group. The greater the number for a given group, the more weight given to the population trends of those species. For example, fish species represent the largest proportion of vertebrate species in all marine realms, so they carry most weight. Of the realms, the Tropical and Sub-tropical Indo-Pacific realm has the most species so this realm carries the most weight within the marine LPI. This provides a means of reducing bias in groups such as temperate species, which have previously dominated some of the global and regional LPIs.

Table 2: The proportion of species by group and realm for marine species. The values also represent the weighting applied to the data for each species group when calculating the marine LPI. The individual classes of fish have been aggregated into one group encompassing all fish species.

	Arctic	Atlantic North Temperate	Atlantic Tropical and Sub-tropical	Pacific North Temperate	Tropical and Sub-tropical Indo-Pacific	South Temperate and Antarctic
Reptiles	0	0.0027	0.0022	0.0010	0.0063	0.0010
Birds	0.2047	0.1441	0.0939	0.0901	0.0557	0.0564
Mammals	0.0415	0.0205	0.0084	0.0283	0.0056	0.0236
Fishes	0.7539	0.8326	0.8955	0.8806	0.9324	0.9189
Realm weighting	0.0155	0.0881	0.1997	0.0767	0.5007	0.1189