

Mapping the global biomass of mesopelagic fishes

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Mesopelagic fish, most belonging to the lanternfish family (Myctophidae) live, during daytime, at depths between 200m and 1000 m, performing a diel migration to between 200m and the water surface at night. They are largely quiescent during day, but feed actively at night, mostly on crustaceans (copepods, amphipods and euphausiids). Their oceanic distribution ranges from the Arctic to the Antarctic, but their annual production is highest in subtropical and tropical seas.

Mesopelagic fishes are generally not exploited by fisheries, owing to their extreme dispersion (about $1 \text{ g}\cdot\text{m}^{-3}$), but are an important prey item to a number of species targeted by fisheries, as well as to marine mammals and seabirds. As such, they must be included in ecosystem models, which is why the *Sea Around Us* project includes them as a 'layer' in its coverage of the world ocean (see www.seaaroundus.org).

Gjøsaeter and Kawaguchi (1980; henceforth: G&K), who also reviewed the biology of mesopelagic fishes, are the only authors to have attempted to describe their distribution globally. Combining the surface areas covered with estimates of density (in $\text{g}\cdot\text{m}^{-2}$), G&K estimated a global biomass of 945 million tonnes. This was done by summing up the biomass estimates (i.e., the products of density x surface area) from 15 Large FAO Areas, (Table 1), themselves composed of between 2 and 8 strata. We noted, however, some

obvious typographical errors, as well as small inconsistencies between different parts of G&K's report, which then prompted a verification of the entire work. We recomputed the surface area of each stratum, checked that they added up to the larger FAO area (using ArcGIS 9.0, a tool not available in 1980), and verified that the density estimates for each stratum were consistent with the text of G&K's report and with each other.

Table 1 summarizes the results by FAO Area. As can be seen, the sum of products calculated directly from the tables in G&K (which give densities and surface area for the different strata) for all 15

FAO Areas add to 797 million t (column A in Table 1), while the sum of the biomass for each FAO Area, mentioned in the text of G&K, is 945 million t (column B). Our revised estimate, finally, with all density estimates checked for internal consistency, and the surface area of all strata

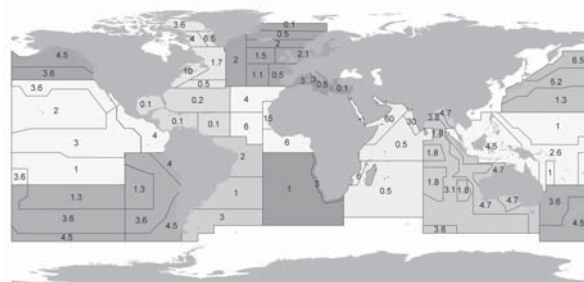


Figure 1. Density of mesopelagic fishes (in $\text{g}\cdot\text{m}^{-2}$) by strata of the world ocean. Shades of grey represent different FAO Areas.

recomputed, is 999 million tonnes (column C) - very nearly one billion tonnes. The resulting map (Figure 1) can be downloaded from www.seaaroundus.org, as a graph and as a shapefile, under the WORLD OCEAN menu item. This is new, incidentally, and features those of our web products that are global in nature.

Reference

Gjøsaeter, J. and Kawaguchi, K. 1980. *A review of the world resources of mesopelagic fish*. FAO Fisheries Technical Paper, 193, 151 pp.



Table 1. Biomass (in million t) estimated in various FAO Areas. Columns A, B, and C are defined in the text.

FAO Area	A	B	C
Northwest Atlantic (21)	14.9	14.8	22.0
Northeast Atlantic (27)	14.7	14.7	15.9
Western Central Atlantic (31)	1.9	19.4	2.3
Eastern Central Atlantic (34)	77.5	77.0	80.7
Mediterranean Sea (37)	2.5	2.5	3.0
Southwest Atlantic (41)	33.0	39.0	33.4
Southeast Atlantic (47)	17.8	18.0	20.4
Western Indian Ocean (51)	133.0	257.0	263.2
Eastern Indian Ocean (57)	92.9	94.0	02.3
Northwest Pacific (61)	48.6	49.0	52.5
Northeast Pacific (67)	26.8	27.0	27.8
Western Central Pacific (71)	51.3	52.0	85.4
Eastern Central Pacific (77)	129.0	129.0	35.0
Southwest Pacific (81)	101.0	01.0	99.9
Southeast Pacific (87)	52.1	51.0	54.9
Total	797.0	945.0	999.0