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TITLE: Surface Area and the Seabed Area, Volume, Depth, Slope, and Topographic Variation for the World?s Seas, Oceans, and Countries

AUTHOR: ['Mark J. Costello', 'Alan Cheung', 'N. De Hauwere']

ABSTRACT:

Depth and topography directly and indirectly influence most ocean environmental conditions, including light penetration and photosynthesis, sedimentation, current movements and stratification, and thus temperature and oxygen gradients. These parameters are thus likely to influence species distribution patterns and productivity in the oceans. They may be considered the foundation for any standardized classification of ocean ecosystems and important correlates of metrics of biodiversity (e.g., species richness and composition, fisheries). While statistics on ocean depth and topography are often quoted, how they were derived is rarely cited, and unless calculated using the same spatial resolution the resulting statistics will not be strictly comparable. We provide such statistics using the best available resolution (1-min) global bathymetry, and open source digital maps of the world's seas and oceans and countries' Exclusive Economic Zones, using a standardized methodology. We created a terrain map and calculated sea surface and seabed area, volume, and mean, standard deviation, maximum, and minimum, of both depth and slope. All the source data and our database are freely available online. We found that although the ocean is flat, and up to 71% of the area has a < 1 degree slope. It had over 1 million approximately circular features that may be seamounts or sea-hills as well as prominent mountain ranges or ridges. However, currently available global data significantly underestimate seabed slopes. The 1-min data set used here predicts there are 68,669 seamounts compared to the 30,314 previously predicted using the same method but lower spatial resolution data. The ocean volume exceeds 1.3 billion km(3) (or 1.3 sextillion liters), and sea surface and seabed areas over 354 million km(2). We propose the coefficient of variation of slope as an index of topographic heterogeneity. Future studies may improve on this database, for example by using a more detailed bathymetry, and in situ measured data. The database could be used to classify ocean features, such as abyssal plains, ridges, and slopes, and thus provide the basis for a standards based classification of ocean topography.

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