Supplementary Material 1

Details on the automated methodology adapted from Kitchingman and Lai (2004) and Morato et al. (2008) used to identify topographic structures with high probability of being seamounts in the OSPAR area (NE Atlantic and Mediterranean)

The methodology followed three succeeding steps run on a cell-by-cell analysis over the bathymetric grids: (1) identifying all detectable peaks in the bathymetry dataset with the Environmental Systems Research Institute (ESRI) ArcGIS software flow direction and sink algorithms (http://www.esri.com), (2) isolating peaks with heights greater than 200 m above surrounding seafloor and displaying an approximately circular or elliptical shape and (3) isolating large seamount-like features (height >1000 m). The dataset produced after step 2 minus that produced after step 3 will be called the small seamounts dataset.

Step 2 and 3 were preformed with an algorithm that scanned depths around each peak, along 8 radii of 20 km each at 45º intervals. The lowest and highest depths over the radii and the cells where those values were obtained were then recorded. A peak was considered to be a potential seamount when the following conditions were met:

1 Each and all of the 8 radii included depths differing by at least 200 m. This helped eliminate all peaks of insignificant rises.

2 No more than one of the 8 radii has the highest depth shallower than the depth of the peak and if the distance between these two cells is greater than 10 km. This helped eliminate peaks that were part of a larger structure and peaks close to island slopes.

3 If 2 radii included depths between 200 and 1000 m with the shallowest point being closer to the peak than to the deepest point, and if the radii formed an angle of less than 135º. This condition was created to help separate ridges from seamounts.

4 At least 5 of the 8 radii around a peak included depths with a difference of at least 1000 m, with the shallowest point being closer to the peak than to the deepest point.

We didn’t use the rule that the average height of the peak above surrounding seafloor is greater than 1,000 m because we assume that rule 4 would suffice to define large seamount like structures. Peaks that met all four conditions were considered large seamounts while those that met only the first three conditions but failed to meet the fourth and fifth were categorized as small seamounts. Several characteristics were gauged for the small and large seamounts detected: 1) location recorded as the latitude and longitude of the centroid of the detected peak or seamount; 2) summit depth (m) recorded as the depth of the cell where the peak was located and must be interpreted as the average depth of the cell, not the absolute minimum depth of the seamount; 3) seamount height (h in m) estimated as the average height of the 8 radii of the seamount, where each radius height was estimated as the difference between the summit and the deepest record; 4) basal area (a_b in km^2) approximated by the area of the octagon formed by the location of the deepest cell in each radius; 5) height to radius ratio (ξ_r); 6) the average slope (ϕ in degrees) estimated as the average steepness of the 8 radii of the seamount calculated by the slope algorithm of ArcGIS software; and 7) distance to nearest seamount (km).

Seamount size distribution is well characterized by a negative exponential model that considers the cumulative numbers of seamounts having heights greater than a certain value (Jordan et al. 1983, Smith and Jordan 1988). This distribution is expressed as $v(H)=v_o \cdot \exp(-\beta \cdot H)$, where $v(H)$ is the number of peaks per unit area with height greater than H, v_o is the total number of peaks per unit area and β is the negative of the slope of a line fitting $\ln(v(H))$ and H.

After applying the methodology to the different bathymetry grids the outputs were compared. When parts of the bathymetry grids overlap the selection of seamounts was done on the layer with higher resolution. The final list of seamounts in the OPSAR area and Mediterranean was then compiled and resulted from multiple sources.

References

Kitchingman, A., and Lai, S.: Inferences on potential seamount locations from mid resolution bathymetric data, in: Seamounts: biodiversity and fisheries, Fisheries Centre Research Reports 12(5), University of British Columbia, Canada, 7-12, 2004.

Morato, T., Machete, M., Kitchingman, A., Tempera, F., Lai, S., Menezes, G., Pitcher, T.J., and Santos, R.S.: Abundance and distribution of seamounts in the Azores. Marine Ecology Progress Series, 357, 17-21, 2008.