Tuna fisheries and pelagic biodiversity around seamounts in the western and central Pacific Ocean

SPC's Oceanic Fisheries Programme has recently completed a study on tuna fisheries around seamounts in the western and central Pacific Ocean (WCPO). This research is part of the Pacific Islands Oceanic Fisheries Management Project, which is supported by the Global Environment Facility. There is high biodiversity of benthic communities on seamounts, which form important marine ecosystems. Little, however, is known about the importance of seamounts for pelagic fish species such as tunas. This study was undertaken in three parts: 1) use of remote sensing data and existing literature to identify and validate the location of all seamounts in the WCPO; 2) an investigation of whether tuna catches were higher on seamounts as opposed to coastal or other oceanic habitats; and 3) an analysis examining whether pelagic biodiversity was higher on seamounts than in coastal or other oceanic habitats.

Seamounts in the WCPO

Twenty datasets on seamounts and bathymetry from different sources and on different scales (from individual cruises to worldwide satellite data) were compiled to form a detailed list of underwater features for the WCPO. One dataset (KL04) from satellite altimetry data provided the baseline for this study because it covers the entire region of interest and includes information on depth. All potential seamounts in this dataset were cross-checked with other datasets to: 1) eliminate any atolls and islands that were incorrectly classified as seamounts; 2) include seamounts previously undetected by KL04; 3) update the overall database (geolocation, depth); and 4) provide a 12-class typology of the different types of underwater features. Of the 4,627 potential seamounts identified in KL04, 822 (18%) were actually emerged banks, atolls and islands, while 272 were multiple identifications of the same underwater feature (e.g. multiple peak seamounts), leaving 3,533 actual underwater features. Conversely, 490 underwater features documented in other datasets, but not registered by KL04, were added. The screening of all potential WCPO seamounts produced a final list of 4,023 underwater features with accurate positions and information (Fig. 1).

Tuna fisheries around WCPO seamounts

This study was the first large, ocean basin-scale study of the association between pelagic fisheries and seamounts, using a spatially explicit dataset of tuna longline catches collected over the last 47 years in the WCPO, together with the recently validated database on seamount locations held at SPC. The study found higher catch per unit of effort values for at least one tuna species near the summits of many seamounts, however not all seamounts showed higher tuna catches. Extrapolation of this analysis estimates that Pacific Ocean seamounts may be responsible for a combined annual longline catch of 17,000 mt for yellowfin, bigeye and albacore tunas (Fig. 2). These numbers, however, should be interpreted as being indicative only because there was considerable statistical uncertainty associated with their estimation. Although

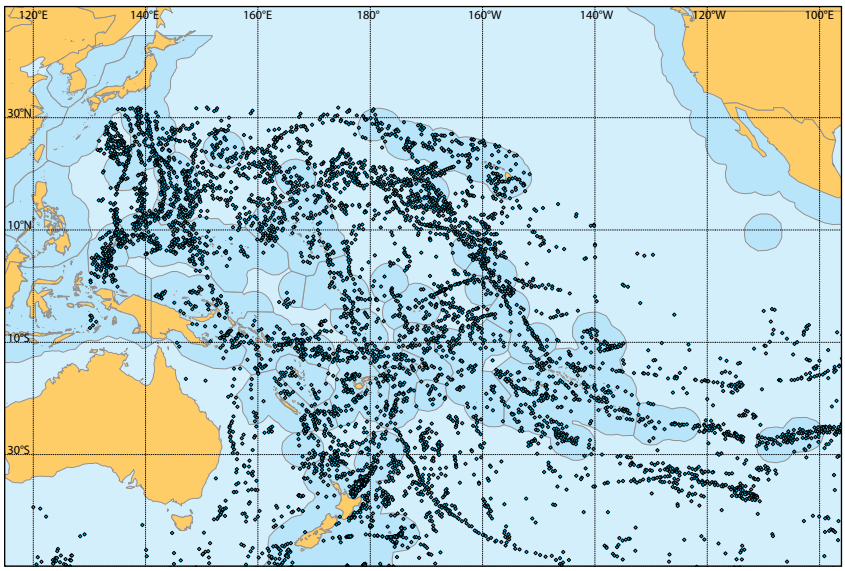

Figure 1. The 4,023 underwater features in the WCPO.

yellowfin (*Thunnus albacares*) and bigeye (*T. obesus*) stocks declined between 1980 and 2007, temporal changes were not apparent on seamounts. These results have important implications for tuna fisheries management, particularly for yellowfin and bigeye. When overall population abundance declines, as is the present situation for yellowfin and bigeye, fishing vessels may concentrate on areas where fish remain. Such aggregation areas may promote what fisheries scientists call hyperstability of catch rates. While this is generally a positive sign for the viability of the tuna industry, it is important that such hyperstability does not hide real trends in the data that might indicate a decline in the status and viability of tuna stocks. The results from this study will allow SPC's Oceanic Fisheries Programme to include the effect of seamounts when preparing data for the regular assessment of tuna stock status in the WCPO.

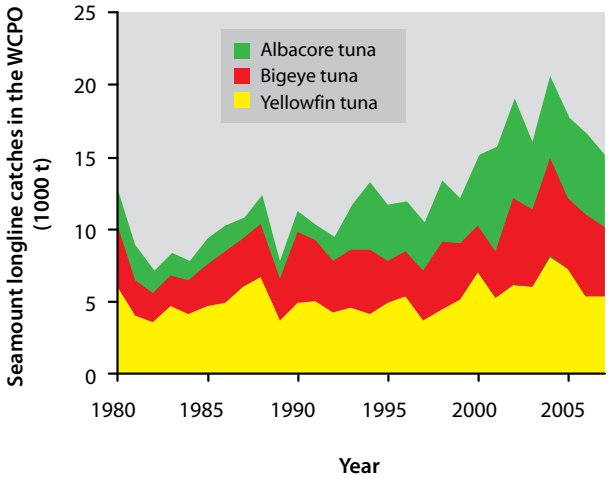

Figure 2. Cumulative longline tuna catch from WCPO seamounts in thousands of metric tonnes.

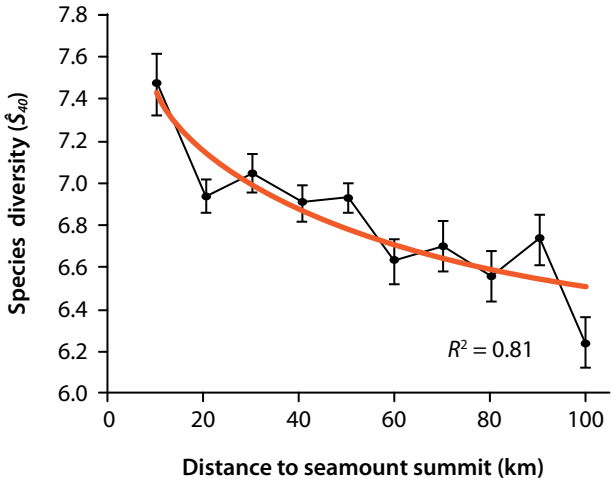

Figure 3. Mean species diversity rarefied from 40 ($\hat{S}_{40}$) individuals as a function of distance to seamount summit. The fitted logarithmic regression is also shown (orange line).

Pelagic biodiversity around WCPO seamounts

Some researchers have used detailed fisheries observer data to clarify the role of seamounts in aggregating large pelagic biodiversity, and to identify pelagic species associated with seamounts. These analyses suggest that seamounts, mainly within 30–40 km from the seamount summits, are hotspots of pelagic biodiversity, showing consistently higher species richness than coastal or oceanic areas. Many species were observed to aggregate near seamount features, such as blue shark (*Prionace glauca*), oceanic whitetip shark (*Carcharhinus longimanus*), swordfish (*Xiphias gladius*), moonfish (*Lampris guttatus*) and sunfish (*Mola mola*), but also albatross and dolphins. The results indicate that seamounts are potentially areas of special interest for conservation, particularly because many occur within the exclusive economic zones (EEZs) of SPC member countries and territories. Management of oceanic ecosystems is considered easier within the boundaries of EEZs than in high seas areas. Observer data are insufficient for identifying which seamounts aggregate more biodiversity than others, but with continual improvement and expansion of observer programmes in SPC member countries and territories, such analyses will be possible in the near future.

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