Tuna fisheries and pelagic biodiversity around seamounts in the Western Central Pacific Ocean (WCPO)

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The Oceanic Fisheries Programme of the Secretariat of the Pacific Community (SPC) has recently completed a study on tuna fisheries around seamounts in the Western Central Pacific Ocean (WCPO). This research is part of the Pacific Islands Oceanic Fisheries Management Project, which is supported by the Global Environment Facility (GEF). There is high biodiversity of benthic communities on seamounts and they are considered important in the conservation of marine ecosystems. Little, however, is known about their importance for pelagic species such as tuna. The 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 WCPO; (2) an investigation of whether tuna catch was 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 scales (from individual cruises to worldwide satellite data) were gathered to compile a detailed list of underwater features for the WCPO (Allain et al., 2008). The Kitchingman and Lai (2004) dataset (KL04) from satellite altimetry data provided the baseline for this study because it covers the entire region of interest and includes depth information. All KL04 potential seamounts were cross-checked with other datasets to remove any atolls and islands incorrectly classified as seamounts, to add seamounts previously undetected by KL04, to update the overall database (geolocation, depth) and to provide a 12-class typology of the different types of underwater features. Of the 4627 potential seamounts identified in KL04, 822 (18%) were actually emerged banks, atolls and islands and 272 were multiple identifications of the same underwater features (e.g. multiple peak seamounts), leaving 3533 actual underwater features. Conversely, 490 underwater features documented in other datasets but not registered by KL04 were added. The screening of all the potential WCPO seamounts produced a final list of 4023 underwater features with accurate position and information (Figure 1).

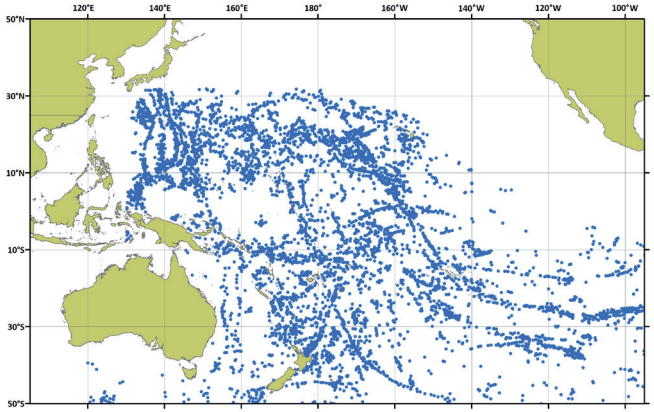

Figure 1- List of 4023 underwater features identified in Allain et al. (2008).

References

Allain, V., J.-A. Kerandel, S. Andréfouët, F. Magron, M. Clark, D.S. Kirby, and F.E. Muller-Karger. 2008. Enhanced seamount location database for the western and central Pacific Ocean: Screening and crosschecking of 20 existing datasets. Deep-Sea Research Part I 55(8):1035-1047.

Kitchingman, A., S. Lai. 2004. Inferences on potential seamount locations from mid resolution bathymetric data. Pp. 7-12 in Morato, T. and D. Pauly (eds) Seamounts: Biodiversity and Fisheries. Fisheries Centre Research Report 12(5).

Morato T., V. Allain, S. Hoyle, and S. Nicol. 2009a. Tuna longline fishing around west and central Pacific seamounts. Fifth regular session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. 10-21 Aug. 2009. Port Vila, Vanuatu. WCPFC-SC5 – EB IP-4: 1-19. Available at http://www.wcpfc.int

Morato T., V. Allain V., S. Hoyle, S. Nicol. 2009b. Report on pelagic by-catch and biodiversity patterns around West and Central Pacific seamounts, Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia, 65 pp.

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Tuna fisheries around WCPO seamounts

This study has conducted the first large ocean basin scale study on the association between pelagic fisheries and seamounts (Morato et al., 2009a) using a spatially explicit dataset of tuna longline catch collected over the last 47 years in the WCPO, together with the recently validated database on seamount locations held at SPC (Allain et al., 2008). The study found higher CPUE (catch per unit effort) values for at least one tuna species close to the summits of many seamounts, however not all seamount showed higher catches of tuna. Extrapolation of this analysis estimates that Pacific Ocean seamounts may be responsible for an annual longline combined catch of 17,000 tons for yellowfin, bigeye and albacore tuna (Figure 2). These numbers however, should be interpreted as indicative only as there was considerable statistical uncertainty associated with their estimation. Although yellowfin and bigeye 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. Whilst this is generally a positive 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 the Oceanic Fisheries Programme to include the effect of seamounts when preparing data for the regular assessment of tuna stock status in the WCPO.

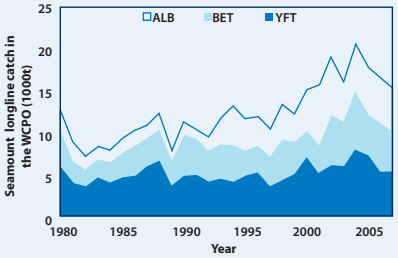

Figure 2 - Cumulative longline tuna catch in Western Central Pacific Ocean (WCPO) seamounts in thousands of metric tons. YFT is yellowfin tuna (blue line), BET is bigeye (green) and ALB is albacore (red).

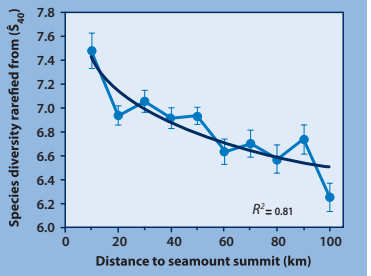

Figure 3 - Mean species diversity rarefied from 40 ($\hat{S}_{40}$) individuals as a function of distance to seamount summit. The fitted logarithmic regression is also shown (grey line).

Pelagic biodiversity around WCPO seamounts

Morato and colleagues also used detailed fisheries observer data to clarify the role of seamounts in aggregating large pelagic biodiversity and to identify pelagic species that are associated with seamounts (Morato et al., 2009b). These analyses suggest that seamounts, mainly within 30-40 km of the 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, oceanic whitetip shark, swordfish, moonfish and sunfish, but also albatross and dolphins. The results indicate that seamounts are potentially areas of special interest for conservation, particularly since many occur within the EEZs (exclusive economic zones) of SPC member countries. Management of oceanic ecosystems is considered easier within the boundaries of EEZs than in the high seas. Observer data is insufficient for identifying which seamounts aggregate more biodiversity than others, but with continual improvement and expansion in the observer programmes of SPC member countries, such analyses are possible in the near future.