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TITLE: Bio-physical coupling in the formation of zooplankton and fish aggregations over abrupt topographies

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ABSTRACT:

Aggregations of zooplankton, micronekton and fish are frequently observed above seamounts, canyons and shelf breaks. The aggregations are produced by five different mechanisms, all driven by ocean currents. Upwelling is frequently generated when ambient currents impinge on abrupt topographies. Nevertheless, upwelling enhances local production of zooplankton and fish only over large topographies such as shelf breaks, where the residence time of the upwelled water is sufficiently long to allow enrichment in primary production to propagate up the food web and augment the growth of resident animals. Daily accumulations occur over topographies at shallow and intermediate depths when the topography blocks the morning descent of migrating zooplankton. This mechanism is common over seamounts. Two other mechanisms are driven by behavioral response to vertical currents when zooplankton swims vertically in order to maintain depth: accumulations by depth retention against upwelling are common at depths to which migrating zooplankton descend during the day, while depth retention against downwelling seems to operate only in the upper water column (e.g., along topographically generated fronts). The fifth mechanism is driven by the amplification of currents over abrupt topographies. Strong currents enhance population growth of resident animals by augmenting fluxes of suspended food. A feed-rest hypothesis is proposed to explain how site-attached planktivorous fish can benefit from strong currents at sites with ample quiescence shelters in which the fish rest during non-feeding intervals. Four of the above mechanisms generate 'trophic focusing', a process by which prey from immense volumes of flowing water is accumulated (or trapped) in a relatively small confined area. The ensuing subsidy of prey propagates up the food web, supporting aggregations of higher predators, such as fish, marine mammals and fishermen. Abrupt topographies can have an important role in determining trophic interactions in the marine realm.

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