Trophic cycling and carbon export relationships in the California Current Ecosystem

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ABSTRACT: We constructed a simple non – steady-state model of trophic cycling relationships in the California Current Ecosystem and tested its predictions of mesozooplankton fecal-pellet export against vertical carbon-flux measurements by the ^{234}Th method taken during Lagrangian experiments. To assess trophic relationships, we simultaneously measured ^{14}C-primary productio and chlorophyll-based rate estimates of phytoplankton growth, microzooplankton grazing, mesozooplankton grazing, and net phytoplankton growth. Study locations ranged from coastal upwelling to offshore oligotrophic conditions. *E*-ratios (carbon export : ^{14}C-primary production) predicted by the model ranged from 0.08 to 0.14, in good agreement with both the magnitude a the variability found in contemporaneous measurements of ^{234}Th export and C : ^{234}Th-ratios of sinking particles. *E*-ratios were strongly decoupled from new production estimates. The lowest measured and predicted *e*-ratios were associated with higher nutrient chlorophyll parcels with net accumulating phytoplankton in the inshore region. For our study sites, variability in export efficiency was determined by the local net balance of growth and grazing and the relative strengths of grazing pathways to microzooplankton and mesozooplankton. Despite very different plankton assemblages studied, the consistently good agreement between independently measur production-grazing processes and biogeochemical rates suggest that zooplankton are the major drivers of vertical carbon-flux in this system during springtime.