From the catchment to the estuary - linking nutrient loading to estuarine food web structure

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Abstract Nutrient availability is a critical variable controlling primary production and the structure and dynamics of higher trophic levels in estuaries. We investigated the links between nutrient loading, primary producer communities and food web structure in eight estuaries scattered across the state of Victoria (Australia). Annual total dissolved (TN) and inorganic nitrogen (TIN) loads to the estuaries were estimated from time-series of nutrient concentrations and flow within the rivers, and then modified with an estimate of water residence time in the estuary to yield effective N-loads. Aerial photography and in situ groundtruthing were used to map the spatial coverage of three habitats (seagrass, macroalgae, bare sediment) in each estuary. Community and food web structure (including plants, invertebrates and fish) was assessed by means of a seine survey that targeted the three habitats identified above; specimens captured during the survey were retained for stable isotope analysis. Estimates of effective N-loads showed a gradient of loading conditions that ranged from high effective loads of TN and TIN in estuaries with highly modified catchments, to low effective N-loads in estuaries with relatively pristine catchments. Seagrass coverage peaked in those estuaries experiencing intermediate effective N-loads; whereas, the ratio of seagrass coverage to total vegetated area was inversely related to effective N-loading. Catch and stable isotope data from the seine survey revealed spatial and temporal differences in food web structure among the habitat types and across estuaries. Importantly, seasonal patterns suggest that the influence of nutrient loading on estuarine food web structure is dynamic and varies intra-annually. Overall, our data indicate that bottom-up forcing by catchment-derived nutrient loads is an important factor influencing the structure and dynamics of food webs in these estuaries.