The role of chemosynthetic primary production in coastal food-webs

Time frame: starting direct 2020 onwards (later start possible)
Type of data and techniques: Field sampling seagrass and benthic fauna, Stabile isotope analysis, statistical modelling
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Description:
It is generally excepted that energy from the sun is the main source of energy. Photosynthetic organisms, like plants and algae fix carbon in their cells by using CO₂ and energy from sunlight. It is long been thought that this primary productions is the fundament for live on earth. Although we know for a long time that there is also chemosynthetic primary production an energy source by using CO₂ and oxidation of electron donors from there environment. For example marine sediments in shallow coastal systems continuously produce reduced sulphur compounds and are therefore an ideal environment for sulphur oxidizing chemotaotropic bacteria. Lucinid bivalves and their gill-inhabiting, sulfide-oxidizing bacteria live in sulfide rich sediments in seagrass meadows. Recently it was discovered that this symbiotic consortium between seagrasses and Lucinid bivalves appears to be present in many seagrass meadows worldwide. In addition, lucinids have an impressive evolutionary fossil record and are tightly linked with seagrasses and mangroves since they evolved in the Cretaceous 100-million years ago. Even though this suggests that there is an important nutritious role in seagrass food webs for already a long time, the role of Lucinids and their general role through chemosynthetic primary production in coastal ecosystems remains unclear (Figure 1). In this research you will look at the role of chemosynthetic primary production as a nutritional input in shallow coastal systems.

Preliminary results from an ongoing survey (closed dots) and a meta-analysis (open dots; van der Heide et al 2012) show that lucinid clams with chemoautotrophic gill-bacteria occur in seagrass meadows worldwide, suggesting that chemoautotrophy (chemical energy), in addition to photosynthesis (light energy), is a significant secondary pathway for fuelling life in the shallow seas (see main text). Six research institutes from four continents will supply field samples and existing data to analyse the role of chemosynthesis in these coastal food webs (orange stars).

Relevant papers: