Spatial and temporal variation in trace elemental fingerprints of mytilid mussel shells: A precursor to invertebrate larval tracking

Becker, Bonnie J., F. Joel Fodrie, Pat A. McMillan, Lisa A. Levin

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ABSTRACT: Elements incorporated into developing hard parts of planktonic larvae record the environmental conditions experienced during growth. These chemical signatures, termed elemental fingerprints, potentially allow for reconstruction of locations of larvae. Here, we have demonstrated for the first time the feasibility of this approach for bivalve shells. We have determined the spatial scale over which we are able to discriminate chemical signatures in mussels in southern California and characterized the temporal stability of these signals. Early settlers of *Mytilus californianus* and *Mytilus galloprovincialis* were collected from eight sites in southern California. Shells were analyzed for nine isotopes using laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS). We discriminated among mussels collected in two bays and the open coast using Mn, Pb, and Ba shell concentrations. Shell concentrations of Pb and Sr were sufficiently different to discriminate between mussels from the northern and southern regions of the open coast, each representing approximately 20 km of coastline. These signals were relatively stable on monthly and weekly time scales. These results indicate that trace elemental fingerprinting of shell material is a promising technique to track bivalve larvae moving between bays and the open coast or over along-shore scales on the order of 20 km. Identification of spatial variation in elemental fingerprints that is stable over time represents a crucial step in enhancing our ability to understand larval transport and population connectivity in invertebrates.

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