ASSESSING ECOLOGICAL RECOVERY: SOMETIMES THE QUESTION IS “WHO ISN’T HERE AND WHY?”

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Sediments contaminated with polychlorinated biphenyls (PCB) and polycyclic aromatic hydrocarbons (PAH) pose ecological problems because these contaminants are persistent, bioaccumulative, and toxic. Remediation strategies designed to reduce the effects of these contaminants in sediments face the challenge of assessing the ecological response and success of the remediation action. As part of an in situ remediation of PCBs and PAHs at Hunters Point Naval Shipyard in San Francisco Estuary, we are testing a conceptual model of how in situ contaminant concentrations can be used to predict the ecological characteristics and trajectory of recovery. The ecological basis of our conceptual model is that (1) the benthic species that are present at a location reflect their ability to live, eat, reproduce, and recruit into that location (i.e., the sediment and associated contaminants do not limit the functional requirements of the species), and (2) species that live in contaminated environments do so due to a combination of their specific physiological response to the contaminant and their functional ecology. Tests begin by evaluating several hypotheses that the functional ecology of the benthos at the contaminated site differs from that in similar non-contaminated habitats. For example, we predicted that invertebrates that lay eggs in the sediment and deposit feed in the deep sediment might be challenged by an environment with contaminated sediment (preliminary analysis confirms this hypothesis). Biodynamic models are then used to examine the underlying mechanisms of why some species do better than others in contaminated environments. These models use measures of contaminant uptake, elimination and metabolism, to predict contaminant bio-uptake in individual species, based on in situ contaminant concentrations. Because of the wide range of conditions that are tested in the laboratory, biodynamic models are powerful predictive tools that allow for the prediction of the full range of a species’ contaminant concentrations and their tolerance for the contaminant in the field. The species composition of a recovered site is then predicted based on functional ecology. This prediction is based on an assessment of the available species in the recruitment pool from similar but less contaminated habitats. Assessing species availability and their functional ecology, in combination with the knowledge gained from biodynamic modeling, allows for the forecast of a new post-recovery benthic community.