Science Foundation Chapter 3 Appendix 3.1 – Case Study Rocky Intertidal Organisms

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DESCRIPTION OF THE GROUP

Rocky intertidal habitat in the Bay is largely confined to Central Bay, particularly around the Golden Gate, Angel and Alcatraz Islands, and in parts of South Bay and Carquinez Strait. This habitat hosts a suite of organisms including attached algae and animals such as sponges, bryozoans, tunicates, hydrozoans, anemones, barnacles, mussels, and oysters. Numerous other invertebrate animals (e.g., crabs) and fishes (e.g., prickly sculpin) forage in rocky intertidal areas at high tide.

CRITERIA FOR SELECTION OF THE GROUP

Rocky intertidal areas are exposed at low tide and therefore to high air temperature, so warming is likely to affect these areas. Species introductions have also had a great influence on rocky intertidal assemblages.

OTHER INFORMATION ABOUT THE GROUP

Rocky intertidal habitat with its associated organisms is characteristic of the Pacific coast from Baja California to Alaska. Within central California there is a characteristic suite of species that can colonize rocky intertidal areas, and the actual species found at a given location depends on wave energy, sun exposure, elevation, steepness of the shore, and various biotic interactions. The species assemblage within San Francisco Bay is likely similar to those in similar environments on the outer coast, although these habitats have not been surveyed.

A total of 162 species of attached algae have been reported from surveys within the estuary, most attached to intertidal hard substrate including naturally occurring rock and artificial substrate. Most of these were species also found on the open coast, while 33 were classified as estuarine and five were accidentally introduced (Silva 1979, Josselyn and West 1985).

Native (*Mytilus trossulus*) and invasive (*M. galloprovincialis*) mussels occur on rocky intertidal substrates in the Bay, where they apparently compete for space (Schneider and Helmuth 2007). The introduced species seems better able to withstand high temperature, particularly during exposure at low tide, and is more abundant in exposed locations (Schneider and Helmuth 2007). This emphasizes that it is the interaction among species that will determine the outcomes of climate change, rather than only the physiological responses and stress tolerance of each species.

REVIEW OF LONG-TERM EFFECTS

High air temperature can cause desiccation, potentially lowering the upper elevation that can be occupied by less-tolerant species. This is likely to result in rearrangements of species assemblages due to competitive and predatory interactions. In particular, thermally sensitive species will be forced lower in the intertidal where they will be subject to heavier predation by subtidal and low-intertidal organisms such as starfish (Helmuth 2002). High temperature and low oxygen content in isolated pools may result in loss of biota there.

Rocky intertidal assemblages can be expected to maintain their vertical zonation in relation to the range of tides, and therefore to keep up with rising sea level if there is accommodation space available.

OTHER STRESSORS

Oil spills can cause severe damage to rocky intertidal areas.

FACTORS THAT MAY AFFECT SPECIES RESILIENCE

Probably high.

LIKELY CLIMATE CHANGE IMPACTS AND RISKS

High temperature – both air and water

MANAGEMENT ACTIONS TO BE CONSIDERED

None recommended

UNCERTAINTY AND KNOWLEDGE GAPS

Little is known about rocky intertidal habitats in the Bay apart from the two algal surveys. A survey of these habitats may be warranted.

LITERATURE CITED AND RESOURCES

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Silva, P. C. 1979. The benthic algal flora of central San Francisco Bay, p. 287-311. *In* T. J. Conomos [ed.], San Francisco Bay: the urbanized estuary. Pacific Division, American Association for the Advancement of Science.