

Characterization of the rocky intertidal ecological communities associated with Northern California Areas of Special Biological Significance

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INTRODUCTION

The regulatory environment

The California Ocean Plan defines water quality objectives for State waters and is the basis of regulation of discharges to marine environment. In 1972 there was recognition that certain areas had biological communities with ecological value or that were fragile. These areas were deemed to deserve enhanced protection to preserve and maintain natural (not affected by anthropogenic influences) water quality. These areas were designated Areas of Special Biological Significance (ASBS). As a result, regulations were enacted to prohibit discharges into ASBS as well as to any nearby waters that could affect the natural water quality in ASBS. In 1974 the State Water Board (SWB) designated 33 ASBS. An additional area was designated in 1975; there have been no subsequent designations.

ASBS have been designated to protect marine species or biological communities from an undesirable alteration in natural water quality. Furthermore ASBS provide intrinsic value or recognized value to man for scientific study, commercial use, recreational use, or esthetic reasons. Consistent with previous versions of the Ocean Plan, the 2009 Ocean Plan states: "Waste shall not be discharged to areas designated as being of special biological significance. Discharges shall be located a sufficient distance from such designated areas to assure maintenance of natural water quality conditions in these areas." This absolute waste discharge prohibition in the Ocean Plan stands, unless an "exception" is granted. The requirements for an exception are included in the Ocean Plan. When granting exceptions the State Water Board must determine that the public interest is served, and that protections of beneficial uses are not compromised. Despite the prohibition against waste discharges to ASBS, in 2003 there were approximately 1,658 outfalls to these marine water quality protected areas (SCCWRP 2003). As a result, the State Water Board has initiated regulatory actions, establishing special protections through the Ocean Plan's exception process.

The key attribute that underlies the ASBS water quality regulations is the standard of "natural water quality". The logic of the standard is that natural water quality is attainable using limited spatial regulations (prohibition of discharges in some areas) and essential for certain biological communities. Unfortunately for California ASBS, coastal waters may no longer pristine.

Since a definition of natural water quality did not exist, a committee of scientists, termed the ASBS Natural Water Quality Committee, was formed to provide such a definition for the State Water Board. In 2010 the ASBS Natural Water Quality Committee provided the State Water Board with its findings (Dickson 2010), including an operational definition of natural water quality with the following criteria. These criteria address the two tenets of ASBS protections.

- 1) It should be possible to define a reference area or areas for each ASBS that currently approximate natural water quality and that are expected to exhibit the likely natural variability that would be found in that ASBS.
- 2) Any detectable human influence on the water quality must not hinder the ability of marine life to respond to natural cycles and processes. Such criteria will ensure that the beneficial uses identified by the Ocean Plan are protected for future generations.

This operational definition of natural water quality allows for the assessment of biological impacts related to water quality in ASBS and it provides the basic design elements for the assessment. In particular the use of reference areas for each ASBS allows for control of natural and temporal variability in biological communities.

The ecological environment

Because most discharges are into intertidal areas (defined as that area between low and high tides), there has been concern that impacts would be primarily manifested in ecological communities in sandy beach and rocky intertidal systems. Ecological communities in sandy beach habitats are extraordinarily dynamic (McLachlan 1993, Defeo 2008) and attribution of change to anthropogenic causes is quite difficult, mainly due to low statistical power. Species associated with rocky intertidal areas are also dynamic, but much less so than those in or on sandy beaches. As a result, attribution of the cause of change is easier for species or communities associated with rocky intertidal habitats (Littler and Murray 1975, Minchinton and Raimondi 2005, Conway-Cranos and Raimondi 2007, Pinedo et al. 2007, Arevalo et al. 2007).

Within rocky intertidal communities, species have a variety of life histories that affect the assessment of potential causes of change. Shorter lived species like *Chthamalus*, *Ulva* and *Porphyra* often are associated with disturbance, while longer lived species like *Balanus*, fucoid algae and mussels tend to be associated with more stable environments. Hence, communities with higher cover of the more ephemeral species are often considered to be indicative of recent or ongoing perturbation. Clearly, perturbations can be due to both natural and anthropogenic causes and hence the design of the sampling program is critical for separating these two general mechanisms of change.

Here we report on a project designed to: (1) characterize the ecological community living on rocky intertidal habitats near discharges inside northern California ASBS, and at reference areas far from discharges and, (2) use the comparison between ASBS discharge and reference areas as a means to assess the likelihood that differences in ecological community structure could be due to water quality degradation within ASBS. The methods used are consistent with those used in phase I and II assessments for ASBS in southern California (Raimondi et al. 2012, Raimondi 2014)

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