ROCKY INTERTIDAL COMMUNITIES AT THE FARALLON ISLANDS

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ABSTRACT

The rocky intertidal communities of the Farallon Islands, within the Gulf of the Farallones National Marine Sanctuary, have been monitored since 1993. Methods used included point-frames, haphazard shore search, and photographic recording. A total of 221 taxa have been documented. Eight species are considered to be rare in this region or outside the limit of their normal range: *Branchioglossum undulatum*, *Myriogramme variegata*, *Cirrulicarpus* sp., *Hommersandia palmatifolia*, *Lithophyllum proboscideum*, *Mazzaella cornucopiae*, *Peyssonnelia pacifica*, and *Ulva conglobata*. Three algal species commonly found on the California mainland, *Fucus gardneri*, *Pelvetia fastigiata*, and *Pelvetiopsis limitata*, were not observed on any of the Farallon Islands. The mean annual percent cover for algae and sessile macroinvertebrates at the South Farallon Islands ranged from 122 to 255%. *Corallina*, *Mazzaella*, *Ulva*, *Mastocarpus*, *Mytilus*, and *Anthopleura* were the dominant taxa found on the islands. Algal species known to be negatively impacted by oil spills are common and abundant on the Farallon Islands. These sites can be used as either controls or to monitor the effects of recovery of the intertidal zones after an oil or diesel spill.

Keywords: Algae, Farallon Islands, invertebrates, monitoring, rocky intertidal.

PRESENTATION SUMMARY

Monitoring of the rocky intertidal communities at the Farallon Islands within the Gulf of the Farallones National Marine Sanctuary, has been conducted since 1993. The Farallon Islands include seven small islands and rocks and the terrestrial portions are within the Farallon National Wildlife Refuge. Southeast Farallon Island and West End Island are collectively called the South Farallon Islands (37° 42' N, 123° 0' W) and are the largest of the Farallon Islands (44 hectares). Middle Farallon, the Isle of Saint James, and North Farallon Islands lie in a chain, northwest of the South Farallon Islands.

Monitoring methods included point-frame counts of permanent and randomly selected quadrats and photographic recording at six sampling stations on the South Farallon Islands. The shoreline was also searched hapazardly for species not found within the quadrats. Inaccessible areas at each island were searched for conspicuous species from a boat, 15 to 100 m offshore. Percent cover was calculated for each sampling site on the South Farallon Islands. All algal and sessile macroinvertebrate species under the point of contact were recorded. Multiple layers of the same species (taxon) under a single point were tallied only once.

We detected a total of 221 taxa; 105 species have not previously been documented at the Farallon Islands (Blankinship and Keeler 1892; CSWRCB 1979). Eight species are considered to be rare in this region or outside the limit of their normal range: *Branchioglossum undulatum*, *Myriogramme variegata*, *Cirrulicarpus* sp., *Hommersandia palmatifolia*, *Lithophyllum proboscideum*, *Mazzaella cornucopiae*, *Peyssonnelia pacifica*, and *Ulva conglobata*. *Corallina*, *Mazzaella*, *Mytilus*, *Anthopleura*, *Ulva*, and *Mastocarpus* were the dominant taxa found on the Islands (Tables 1 and 2). Common mainland intertidal algal species, *Fucus gardneri*, *Pelvetia fastigiata*, and *Pelvetiopsis limitata* were not observed on any of the Farallon Islands. The mean annual percent cover for algae and macroinvertebrates combined, at the South Farallon Islands ranged from 122 to 255%. Species richness was high (42 to 65 species) within the sampling quadrats on the South Farallon Islands, in comparision with similar sampling sites on the mainland (Cosentino 1998). Species richness was five to seven species higher than at monitoring sites located on the mainland central California coast. From 1993 through 1997, no significant temporal (seasonal or annual) differences were found in mean percent cover.

Algae and invertebrates are susceptible to both natural and human induced disturbances. Natural disturbances such as changes in weather conditions (El Niño-Southern Oscillation), pinniped excrement, and trampling can affect the local distribution and abundance of these organisms. Signs of disturbance include bleaching, reduced thallus length, and absence of dominant grazers. Human induced disturbance such as oil spills can also affect the local distribution and abundance. Oil spills can injure plants by weighing down the fronds eventually breaking them off (Nelson-Smith 1972), by affecting reproduction (Steele and Hanisk

1979), and by smothering the plants causing reduced photosynthesis and respiration rates (North et al. 1965). Past oil spill related studies off the coast of California and Washington demonstrate that species such as *Balanus glandula*, *Corallina vancouveriensis*, crustose corallines, *Mastocarpus* spp., Mytilus californianus, *Phyllospadix scouleri*, *Pollicipes polymerus*, and *Ulva* spp. were all found to be susceptible to oil with significant moralities recorded (Straughan 1971). All of these species are common and abundant on the Farallon Islands. *Corallina vancouveriensis* was found at all six monitoring sites. At Raven's Cliff and Drunk Uncle's Islet, mean percent cover for *C. vancouveriensis* was greater than 50% in the high zones and 100% in the low and mid-tidal zones. With pre-spill (baseline) data on such dominant species, we will be able to use sites on the Farallon Islands as either controls or to monitor the effects of recovery of the intertidal zones after an oil or diesel spill (Thursby et al. 1993).

Table 1. Algae and sessile macroinvertebrates within the rocky intertidal areas at the South Farallon Islands.

PLANTS

DIVISION CHLOROPHYTA

ULOTRICHACEAE
Ulothrix laetevirens [a]

ULVACEAE
Enteromorpha intestinalis[a]
Ulva angusta [a]
Ulva conglobata [a, b]
Ulva taeniata [a]

ULVELLACEAE
Endophyton ramosum [a]
Entocladia viridis [a]

CLADOPHORACEAE
Cladophora graminea

CODIOLACEAE
Urospora sp. [a]

ACROSIPHONIACEAE
Acrosiphonia coalita

BRYOPSIDACEAE
Bryopsis corticulans [a]

DERBESIACEAE
"*Halicystis ovalis*" [a]

CODIACEAE
Codium fragile

DIVISION PHAEOPHYTA

ECTOCARPACEAE
Pilayella sp. [a]
Spongonema tomentosum [a]

RALFSIACEAE
Ralfsia sp. [a]

CORYNOPHLAEACEAE
Leathesia difformis

PUNCTARIACEAE
Melanosiphon intestinalis [a]

SCYTOSIPHONACEAE
Scytosiphon simplicissimus [a]
Petalonia fascia [a]

DESMARESTIACEAE
Desmarestia ligulata

LAMINARIACEAE
Laminaria ephemera [a]
Laminaria setchellii
Costaria costata

ALARIACEAE
Alaria marginata
Egregia menziesii

LESSONIACEAE
Dictyoneurum californicum
Postelsia palmaeformis [a]
Macrocystis integrifolia
Nereocystis luetkeana

DIVISION RHODOPHYTA

ERYTHROPELTIDACEAE
Erythrocladia subintegra [a]
Erythrotrichia carnea [a]
Erythrotrichia pulvinata [a]
Smithora naiadum

BANGIACEAE
Porphyra gardneri [a]
Porphyra lanceolata [a]
Porphyra nereocystis
Porphyra perforata

ACROCHAETIACEAE
Acrochaetium sp.
Rhodochorton purpureum

CHAETANGIACEAE
Scinaia confusa [a]

HELMINTHOCLADIACEAE
Cumagloia andersonii [a]

GELIDIACEAE
Gelidium coulteri [a]
Gelidium purpurascens
Gelidium pusillum [a]
Gelidium robustum
Pterocladia caloglossoides
Pterocladia capillacea [a]

DUMONTIACEAE
Farlowia compressa [a]
Farlowia conferta [a]
Farlowia mollis [a]
Pikea californica
Pikea robusta [a]
Dilsea californica [a]

WEEKSIACEAE
Weeksia reticulata [a]

PEYSSONNELIACEAE
Peyssonnelia pacifica [a, c]

HILDENBRANDIACEAE
Hildenbrandia occidentalis [a]
Hildenbrandia prototypus [a]

Table 1. Continued.

CORALLINACEAE
- *Lithothamnium* sp.[a]
- *Melobesia marginata*
- *Melobesia mediocris*
- *Lithophyllum grumosum*
- *Lithophyllum proboscideum* [a, b]
- *Pseudolithophyllum neofarlowii* [a]
- *Lithothrix aspergillum* [a]
- *Corallina pinnatifolia* [a]
- *Corallina vancouveriensis*
- *Bossiella californica*
- *Bossiella dichotoma* [a]
- *Bossiella orbigniana*
- *Bossiella schmittii*
- *Calliarthron tuberculosum*

ENDOCLADIACEAE
- *Endocladia muricata*

CRYPTONEMIACEAE
- *Grateloupia doryphora*
- *Grateloupia filicina* [a]
- *Prionitis cornea* [a]
- *Prionitis lanceolata*
- *Prionitis linearis*
- *Prionitis lyallii*

KALLYMENIACEAE
- *Pugetia fragilissima*
- *Erythrophyllum delesserioides*
- *Callophyllis crenulata* [a]
- *Cirrulicarpus* sp. [a, b]
- *Hommersandia palmatifolia* [a, b]

PETROCELIDACEAE
- "Petrocelis franciscana" [a]
- *Mastocarpus jardinii* [a]
- *Mastocarpus papillatus*

SOLIERIACEAE
- *Opuntiella californica*
- *Sarcodiotheca gaudichaudii* [a]

PLOCAMIACEAE
- *Plocamium cartilagineum*
- *Plocamium oregonum* [a]
- *Plocamium pacificum* [a]
- *Plocamium violaceum*

GRACILARIACEAE
- *Gracilariopsis sjoestedtii*
- *Gracilariophila oryzoides* [a]

PHYLLOPHORACEAE
- *Gymnogongrus chiton* [a]
- *Ahnfeltiopsis leptophylla* [a]
- *Ahnfeltiopsis linearis*

AHNFELTIACEAE
- *Ahnfeltia fastigiata* [a]

GIGARTINACEAE
- *Chondracanthus canaliculatus*
- *Chondracanthus exasperatus*
- *Chondracanthus harveyanus* [a]
- *Chondracanthus spinosus* [a]
- *Mazzaella cornucopiae* [a, b]
- *Mazzaella flaccida*
- *Mazzaella heterocarpa*
- *Mazzaella lineare* [a]
- *Mazzaella splendens*
- *Mazzaella volans* [a]
- *Mazzaella affinis* [a]
- *Mazzaella californica*
- *Mazzaella rosea* [a]

RHODYMENIACEAE
- *Fauchea fryeana* [a]
- *Fauchea laciniata*
- *Rhodymenia californica*
- *Rhodymenia pacifica*
- *Rhodymenia rhizoides* [a]

CHAMPIACEAE
- *Gastroclonium subarticulatum*

CERAMIACEAE
- *Ceramium eatonianum* [a]
- *Microcladia borealis*
- *Microcladia coulteri*
- *Callithamnion pikeanum* [a]
- *Bornetia californica*
- *Neoptilota hypnoides*

DELESSERIACEAE
- *Branchioglossum undulatum* [a, b]
- *Branchioglossum bipinnatifidum*
- *Membranoptera dimorpha* [a]
- *Delesseria decipiens*
- *Phycodrys setchellii* [a]
- *Polyneura latissima*
- *Myriogramme spectabilis* [a]
- *Myriogramme variegata* [a, b a]
- *Nitophyllum* sp. [a]
- *Hymenena flabelligera*
- *Hymenena multiloba*
- *Cryptopleura corallinara*
- *Cryptopleura lobulifera* [a]
- *Cryptopleura rosacea* [a]
- *Cryptopleura violacea*
- *Botryoglossum farlowianum*
- *Botryoglossum farlowianum* var. *anomalum* [a]

RHODOMELACEAE
- *Polysiphonia hendryi* [a]
- *Polysiphonia pacifica*
- *Pterosiphonia baileyi*
- *Herposiphonia plumula* [a]
- *Osmundea spectabilis* [a]
- *Janczewskia gardneri*
- *Odonthalia floccosa*
- *Neorhodomela larix* [a]

VASCULAR PLANTS

ZOSTERACEAE
- *Phyllospadix scouleri*[a]

MACROINVERTEBRATES

PHYLUM PORIFERA
- *Aplysilla glacialis*
- *Aplysilla polyraphis*
- *Ophlitaspongia pennata*
- *Haliclona permollis* [a]
- *Haliclona* sp. (beige)
- *Haliclona* sp. (lavender)

PHYLUM CNIDARIA
- *Tubularia crocea* [a]
- *Aurelia aurita* [a]
- *Aglaophenia latirostris* [a]
- *Balanophyllia elegans* [a]
- *Anthopleura elegantissima*
- *Anthopleura xanthogrammica*
- *Epiactis prolifera*
- *Urticina crassicornis*
- *Urticina lofotensis*
- *Corynactis californica*

PHYLUM NEMERTEA
- *Tubulanus sexlineatus* [a]

PHYLUM ANNELIDA
- *Phyllochaetopterus prolifica* [a]
- *Phragmatopoma californica* [a]
- *Serpula vermicularis*

PHYLUM ARTHROPODA
- *Pycnogonum rickettsi* [a]
- *Nymphopsis spinosissima*
- *Pollicipes polymerus*
- *Tetraclita rubescens* [a]
- *Semibalanus cariosus*
- *Balanus glandula* [a]
- *Balanus nubilus*
- *Pagurus sp.*
- *Pugettia producta*

Table 1. Continued.

Cancer antennarius [a]
Cancer productus [a]
Cancer magister [a]
Pachygrapsus crassipes
Cirolana harfordi
Idotea resecata [a]
Caprella californica

PHYLUM MOLLUSCA

Lepidochitona dentiens
Tonicella lineata
Nuttallina californica
Mopalia ciliata
Katharina tunicata
Cryptochiton stelleri
Haliotis cracherodii
Haliotis rufescens
Discurria scutum
Lottia digitalis
Lottia gigantea
Lottia pelta
Lottia strigatella
Macclintokia scabra
Tegula brunnea
Tegula funebralis
Lacuna unifasciata
Littorina keenae [a]
Littorina planaxis
Littorina scutulata
Littorina sitkana [a]
Nucella canaliculata
Nucella emarginata
Anisodoris noblis
Hopkinsia rosacea [a]
Triopha catalinae
Hermissenda crassicornis
Modiolus capax [a]
Musculus pygmaeus
Mytilus californianus

PHYLUM ECTOPROCTA

bryozoan[a]

PHYLUM ECHINODERMATA

Leptasterias hexactis [a]
Pisaster ochraceus
Strongylocentrotus droebachiensis [a]
Strongylocentrotus franciscanus
Strongylocentrotus purpuratus

PHYLUM CHORDATA

Pycnoclavella stanleyi [a]

[a] Newly documented species; species not documented by Blankinship and Keeler 1892 or CSWRCB 1979.
[b] Species not previously documented in this area of central California.
[c] Species that are not abundant or commonly found along the central California coast.

Table 2. Conspicuous genera documented by boat surveys, 50 to 100 m from shore at the Middle Farallon, Isle of Saint James, and North Farallon Islands.

Middle Farallon	Isle of Saint James	North Farallon
Plants	Plants	Plants
Alaria	*Corallina*	*Corallina*
Corallina	*Egregia*	*Ulva*
Hildenbranchia	*Ulva*	
Ulva		
Macroinvertebrates	Macroinvertebrates	Macroinvertebrates
Mytillus	*Mytillus*	*Mytillus*
Pollicipes	*Sembalanus*	*Pollicipes*
Sembalanus		*Sembalanus*

LITERATURE CITED

Blankinship, J. W. and C. A. Keeler. 1892. On the natural history of the Farallon Islands. Zoe 3: 144-186.

California State Water Resources Control Board (CSWRCB). 1979. California Marine Waters Areas of Special Biological Significance Reconnaissance Survey Report: Farallon Island. Water Quality Monitoring Report No. 79-13. Sacramento, CA.

Cosentino, N. 1998. Monitoring the rocky intertidal communities within the Gulf of the Farallones and Monterey Bay National Marine Sanctuaries. Contract Report, Contract No. 1443CX8140-95-039, National Oceanic and Atmospheric Administration, Gulf of the Farallones National Marine Sanctuary, San Francisco, CA.

Nelson-Smith, A. 1972. Oil Pollution and Marine Ecology. Elek Science Press, London, UK.

North, W. J., M. Neushul, and K. A. Clendenning. 1965. Successive biological change observed in a marine cove exposed to a large spillage of mineral oil. Symposium sur les pollutions Marines par les Microorganisms et les produits Petroliers. Secretariate General de la Commission, Monaco.

Steele, R. L., and M. D. Hanisak. 1979. Sensitivity of some brown algal reproductive stages to oil pollution. Proceedings of the Ninth International Seaweed Symposium. Science Press, Princeton, NJ.

Straughan, D. 1971. What has been the effect of the spill on the ecology in the Santa Barbara Channel. Biological and oceanographic survey of the Santa Barbara Channel oil spill. Allen Hancock Foundation.1:401-426.

Thursby, G. B., I. B. Anderson, G. E. Washe, and R. L. Steele. 1993. A review of the current status of marine algae testing in the United States. Pages 362-377 *in* Landis, W. G., Hughes, J. S., and Lewis, M. A., (eds.), First Symposium on Environmental Toxicology and Risk Assessment: Aquatic, Plant and Terrestrial. ASTM STP 1179. Philadelphia, PA.