



Assessment of the Subtidal Assemblages Within the Olympic Coast National Marine Sanctuary

Olympic Coast National Marine Sanctuary

Reef Environmental Education Foundation

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Project Overview

The Olympic Coast National Marine Sanctuary (OCNMS) covers over 3,300 square miles of ocean off Washington State's rocky Olympic Peninsula coastline and Sanctuary waters host abundant marine life. The Reef Environmental Education Foundation (REEF) initiated an annual monitoring project in 2003 to document the status and trends of sub-tidal fish assemblages and key invertebrates. Between 2003 and 2008:

- 371 surveys have been conducted at 13 sites within the Sanctuary
- 70 species of fish and 28 species of invertebrates have been documented and monitored



REEF Advanced Assessment Team members prepare for the OCNMS monitoring.

Methods

- Monitoring was conducted by Advanced Assessment Team REEF Experts

- Surveys were conducted as part of a 5-day project held each August.

- During each monitoring event, the team conducted an average of 62 Roving Diver Technique (RDT; Schmitt and Sullivan 1996) surveys.

-The RDT is a non-point survey method, divers move freely about a defined survey area. All positively identified fish species are recorded and an estimate of abundance is assigned: Single (1), Few (2-10), Many (11-100), and Abundant (> 100). 43 key invertebrates are also monitored.

- A weighted Abundance Score is calculated as Sighting Frequency (%) * Density Score, where Density Score is: $[(nS \times 1) + (nF \times 2) + (nM \times 3) + (nA \times 4)] / (nS + nF + nM + nA)$, where n is the number of times each abundance category was assigned.



REEF Advanced Assessment Team member Doug Biffard observes a Red Irish Lord in the OCNMS. Photo by Pete Naylor.

Study Area and Survey Effort

Table 1. REEF survey effort within the Olympic Coast NMS.

	2003	2004	2005	2006	2007	2008
Box Canyon	6	6	6	6	6	9
Chibahdehl Rocks	6	7	6	6	6	8
Janna's Joy	0	5	6	6	6	8
Koitiak Point	6	6	6	6	6	8
Mushroom Rock	0	6	0	0	0	0
Tatoosh Island East	0	3	5	6	6	0
Tatoosh Island So.	4	0	6	6	6	0
Warm House Beach	7	6	6	6	6	8
Third Beach	6	12	0	0	0	9
TOTAL	62	63	59	54	59	74

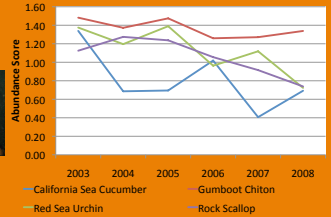


Figure 1. Map showing locations where REEF surveys have been conducted between 2003-2008 as part of an annual monitoring project.

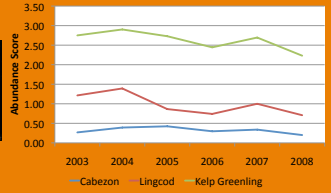
Table 2. Species that have been reported during 371 REEF surveys in the OCNMS, conducted between 2003 and 2008.

Common Name	Scientific Name	Sighting Frequency
Kelp Greening	<i>Hexagrammos decagrammus</i>	97%
Fish-eating Anemone	<i>Urticina piscivora</i>	93%
Orange Cup Coral	<i>Balanophyllia elegans</i>	92%
Plumose Anemone	<i>Metridium senile/forbesi</i>	91%
Leather Star	<i>Dermasterias imbricata</i>	91%
Sunflower Star	<i>Pycnopoda helianthoides</i>	91%
Black Rockfish	<i>Sebastes melanops</i>	89%
Gumboot Chiton	<i>Cryptochiton stelleri</i>	66%
Pink Hydrozoal	<i>Stylander verticillus venustus</i>	65%
White-spotted Anemone	<i>Urticina lactaria</i>	65%
Longfin Sculpin	<i>Jordania zoroara</i>	63%
Orange Social Ascidian	<i>Metanepharcys taylora/dura</i>	62%
Lingcod	<i>Ophiodon elongatus</i>	59%
Red Sea Urchin	<i>Strongylocentrotus franciscanus</i>	57%
Giant Barnacle	<i>Balanus nubilus</i>	57%
Leafy Nornmouth	<i>Ceramidostoma foliatum</i>	55%
Striped Seaperch	<i>Embleeca lateralis</i>	55%
Rock Scallop	<i>Crassidomina giganteum</i>	55%
China Rockfish	<i>Sebastes nebulosus</i>	53%
Juvenile (YOY) Rockfish Sp.	<i>Paralichthys californicus</i>	48%
California Sea Cucumber	<i>Cadina leucomarginata</i>	43%
Yellow Margin Doris	<i>Hemilepidotus hemilepidotus</i>	42%
Red Irish Lord	<i>Arctides hanngreni</i>	40%
Scalyhead Sculpin	<i>Cucumaria miniata</i>	39%
Orange Sea Cucumber	<i>Sebastes meliger</i>	37%
Quillback Rockfish	<i>Zirona arborescens</i>	35%
White-lined Dirona	<i>Dodecaceria howesi</i>	30%
Fringed Tube Worm	<i>Cyrtospiocephalus marmoratus</i>	25%
Oregon Triton	<i>Fusitriton oregonensis</i>	25%
Coarctate Shrimp	<i>Pandalus danae/P. gurneyi</i>	24%
Blue Rockfish	<i>Sebastes myrius</i>	22%
Opalescent Nudibranch	<i>Hermisidina crassicornis</i>	21%
Yellowtail Rockfish	<i>Sebastes flavidus</i>	20%
Messhead Warbonnet	<i>Chirolophis nugarator</i>	17%
Spiny Pink Star	<i>Plaster brevipapillus</i>	16%
Lacy Pycnosel	<i>Phidippota labiata</i>	16%
Green Sea Urchin	<i>Strongylocentrotus droebachiensis</i>	15%
Copper Rockfish	<i>Sebastes caucanus</i>	13%
Spiroside Sculpin	<i>Asemichthys taylora</i>	11%
Shiny Orange Sea Squirt	<i>Ceramidostoma fransmarkiensis</i>	10%
Manicard Sculpin	<i>Synchrobus gilli</i>	9%
Puget Sound Rockfish	<i>Sebastes emphaeus</i>	9%
Canary Rockfish	<i>Sebastes inniger</i>	9%
Giant Pacific Octopus	<i>Octopus dofleini</i>	8%
Longfin Gurnard	<i>Pholis diemali</i>	7%
Tiger Rockfish	<i>Sebastes nigroocinctus</i>	6%
Buffalo Sculpin	<i>Engrichthys bison</i>	6%
Northern Feather Duster Worm	<i>Paralichthys venocuvieri</i>	5%
Wolf-Eel	<i>Anarhichthys ocellatus</i>	5%
Northern Abalone	<i>Rhaphidococcus richardsoni</i>	5%
Grunn Sculpin	<i>Chirolophis decaratus</i>	4%
Decorated Warbonnet	<i>Pholiscaurus nicholsi</i>	4%
Orange Sea Pen	<i>Pagurilla producta</i>	3%
Blackeye Goby	<i>Bacchystichus frenatus</i>	3%
Northern Kelp Crab	<i>Hexagrammos stelleri</i>	2%
Kelp Surfperch	<i>Euparia lewisii</i>	2%
Vermilion Rockfish	<i>Ovalichthys pinnatus</i>	2%
White-spotted Greenling	<i>Azeleichthys rhodurus</i>	2%
Lewis's Moonshell	<i>Aulorhynchus flavidus</i>	2%
Painted Greenling	<i>Atleactis lineolata</i>	2%
Rosytip Sculpin	<i>Clinocottus acuticeps</i>	2%
Tube-Snout	<i>Cyanea capitata</i>	1%
Smoothhead Sculpin	<i>Hemimicropus spinosus</i>	1%
Sharpnose Sculpin	<i>Corynactis californica</i>	1%
Sea Blubber	<i>Cancer productus</i>	1%
Brown Irish Lord	<i>Pholis laeta</i>	1%
Strawberry Anemone	<i>Citharichthys sigmaeus</i>	1%
Red Rock Crab	<i>Pleuronichthys oregonus</i>	1%
Crescent Gurnet	<i>Sebastes ruberrimus</i>	1%
Speckled Sandbar	<i>Neuhausichthys scolofasciatus</i>	1%
C.O. Sole	<i>Sebastes entomelas</i>	1%
Yelloweye Rockfish	<i>Cymatogaster aggregata</i>	1%
Saffin Sculpin	<i>Leptocottus armatus</i>	1%
Widow Rockfish	<i>Arctides foveolatus</i>	1%
Shiner Surfperch	<i>Liparis greeni</i>	1%
Ladefoe Snailfish	<i>Arctides foveolatus</i>	1%
Paddled Sculpin	<i>Gibbosus metzi</i>	1%
Striped Killifish	<i>Aurelia aurita/labiata</i>	1%
Moon Jelly	<i>Sebastes ciliatus</i>	1%
Dusky Rockfish	<i>Ribicodius varca</i>	1%
Pile Perch	<i>Ammodites hexapterus</i>	1%
Pacific Sandlance		

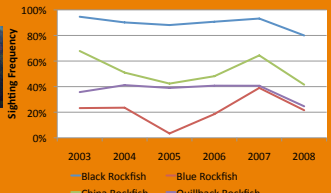
Results



Gumboot chiton are frequently sighted in the OCNMS. Photo by Steve Lonhart.



A Cabezon blending in. Photo by Chris Grossman.



Tiger and China rockfish hide in a crevice. Photo by Rhoda Green.

Figure 2. Trends of key fish and invertebrate species based on data collected during REEF's annual monitoring within the OCNMS. Survey effort and locations are shown in Table 1.

Acknowledgements

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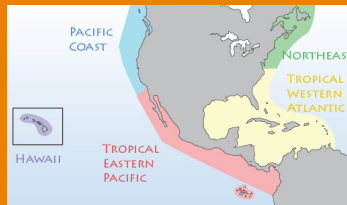
Why Use Volunteers?

Effective management of coastal marine ecosystems requires information on the distributions, abundances and trends of organisms. However, field scientists are often too few and too little funding is available for large-scale data collection programs. Volunteer data collection, or citizen science, provides a valuable alternative for scientists and resource agencies needing information but lacking sufficient resources to gather it. In addition, involvement leads to greater awareness by the public and creates a stewardship ethic among key user groups.

REEF Volunteer Survey Project

The Reef Environmental Education Foundation (REEF) Volunteer Survey Project is a program that enables volunteer divers and snorkelers to collect fish sighting information during recreational dives. The project started in 1993 in Florida and has expanded to include all coastal areas of North and Central America, the Caribbean and Hawaii. The Project provides a standardized survey method, data management system, and Internet summary reporting.

REEF Project Regions



Access to the REEF Database

Custom data summary reports can be generated through the REEF Website (www.reef.org).

Detailed Raw data files can be provided upon request.

The REEF Database topped 120,000 surveys in 2008.

The REEF Survey Method

Volunteer Survey Project volunteer divers use the Roving Diver Technique (RDT; Schmitt & Sullivan 1996).



REEF volunteers confer about sightings after a dive.

- Swim freely around dive site, dive times vary according to depth and conditions
- Record all species positively identified
- Estimate relative abundance for each species

Single (S) - 1
Few (F) - 2-10
Many (M) - 11-100
Abundant (A) - >100

- At the conclusion of each dive, the species data, survey time, depth, temperature and other environmental information are transferred to REEF via online data entry (paper scanforms also available).
- Quality control programs are run prior to entry into REEF's database.



A volunteer conducting a REEF Survey. Photo by Pete Naylor.