

## June 14<sup>th</sup> Workshop – VIABILITY ANALYSIS

**Group 1 Breakout:** Rocky Intertidal Community and Unconsolidated intertidal community

Members: Terrie Klinger, Rich Osborne, Rowann Tallmon, Laura Arnold, Tina Whitman, Phil Greene, Joe Gaydos (note taker)

### **Key Ecological attributes for Rocky Intertidal Communities**

(Discussion: chlorophyll is the standing primary producer, stressors are things like trampling, if you don't have structure you'll also lose organisms; other stressors include introduced species, nutrient pollution, etc)

#### THOUGHTS:

1. Macrophytes / Canopy structure (i.e. if you go to diatoms only, you lose your canopy)
2. Water quality – specifically nutrient levels, turbidity so maybe just say turbidity and nutrient levels and not water quality
3. Water temperature and air temperature are both important
4. Light
5. Water Flow (i.e. can be changed by jetty's, bulk heads, etc)
6. Trophic interactions – how do you measure this?
7. Percent cover of primary producers
8. *Fucus* plays a really predominant role and probably is very important – what about *Fucus* – could cover primary production and canopy cover – if we had to measure something it would be percent cover of *Fucus* spp. – *Fucus* is highly susceptible to trampling and thus this is a good measure of intertidal trampling
9. Limpets also are probably really good indicators of trampling
10. What about negatives such as number of invasive species like *Crassostrea gigas* (Pacific oyster).
11. Oyster catchers are present when an undisturbed population of limpets are present, which are only present with primary productivity is present – indicator of trophic interactions
12. Zonation is an attribute of the rocky intertidal system. This could be changed by sea level and measured by barnacle cover.

#### Important Attributes (and indicators)

1. vegetative canopy (indicators: percent of *Fucus* spp. cover)
2. key trophic interactions (indicators are numbers nesting oystercatchers in region (or average number of fledged young per year), number of limpets on a specific beach, numbers of *Katharina* on an intertidal area, percent cover of *Hedophyllum*).
3. zonation (indicator: species composition at different zones)
4. larval and algal sediment (indicators: larval settlement rate; water turbidity; substrate temperature; healthy marine microlayer?)

## June 14 Workshop Notes: Viability Analysis – Group 1 (Kirsten)

Notetaker: Joe Gaydos

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### **Key Ecological attributes for Intertidal Communities of Unconsolidated Substrates:**

Discussion of processes – vegetative canopy structure (will vary quite a bit based on substrate – should capture eelgrass will break down into cobble / gravel and fine sediments). Shoreline processes (feeder bluffs, drift cells, upland water sources, fluvial sediment sources; depositional habitats); trophic interactions; spawning

1. vegetative canopy (indicator: percent cover of eelgrass,
2. spawning (indicators: surf smelt spawning distribution and quantity; *Licuna* sp. spawning on eelgrass; littleneck or other native infaunal bivalve spawning – indices to be determined)
3. trophic interaction (indicator: *Hemigrapsus* spp. abundance on beaches – also could be a measure of fine sediment / detritus and omnivores as well as intertidal trampling); infaunal polychetes as a group also could be considered
4. sediment processes (indicator: changes in sediment deposition rate; changes in grain size composition– do each sediment type separately)

## June 14 Workshop Notes: Viability Analysis – Group 2/B (Zach)

Notetaker: Jody Kennedy

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### Breakout Group 2/B: Zach

Doug Myers, Eric Eisenhardt, Kevin Britton-Simmons, Don Rothaus, Steve Norton, Sandy Wyllie-Echeverria, Ginny Broadhurst (floating), Jody Kennedy (note-taker)

### TARGET 1: Rocky Sub-tidal

#### Attributes Discussion

Want to keep this at the species level, not get too into the diversity/ genetic variation of species. If there was a species that was a target, then diversity could be an attribute, but we are dealing with a target that this habitat type.

**Key elements:** size, condition, and landscape context

Size: shouldn't get too deep into size because it's not going to change much. Doug: climate change might change patch size as sea level changes.

Condition: vegetative cover, can get more specific into types of kelp beds, that vary. Don: knows that DNR has some data on this, but not much data on change in subtidal species coverage.

1. Key attribute: Nereosistis (bull kelp) easiest to measure, a relative health of the nereosistis as a relative indicator of the health of the community. Indicator: area cover, not a percent, but an area of surface water covered by nereosistis. These things can appear and disappear, how do you gauge for natural variation? Mumfords group at DNR has data on this for 15 years. Kevin, doesn't think those variations are not real based on how data was captured
2. Key attribute: sargassum. Indicator: linear (m)/ there is about 90% cover of sargassum, want less than 10% or 0%, Indicator: % of 100 meter segments without sargassum. *Changed to positive.* Attribute: 0% sargassum, Desired: 100%, Current: < 50% of rocky substrate is w/out sargassum right now more or less (KBS). Poor= <25%. Fair= <50%. Good=>75%. Very Good=100%

#### Rocky Subtidal -- Bellow the water

urchins might be a good indicator of what's happening on the bottom, but how do we use a harvestable species? What about anemones, they grow on the rock wall. Need underwater video to measure/ collect necessary data.

3. Key attribute: surfgrass. Indicator: linear (m)
4. Key attribute: green urchin. Indicator: density/unit. If we're going to choose one urchin as an indicator, green is better because they are healthy. Don't know much about them, so a good indicator might be density. Recruitment is episodic. Indicator: length Frequency distribution. For both green and red urchins, harvest is a limiting factor.

## June 14 Workshop Notes: Viability Analysis – Group 2/B (Zach)

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Currents really structure plant and animals communities in the substrate. Is that a good indicator? Model what Jim Carr did with integrity (Sandy). Do we care about algal diversity? Yes.

5. Key attribute: algal diversity. Indicator: number of species per unit area. Not enough data to go further with this one.

Rocky subtidal is pretty vague. Shallow -3 zone and Photic

Size is fixed/ unalterable by us, rule it out. By fixed is that not changeable and is that true? In the short time frame we're talking, it likely won't change much. Depends on what we're talking about. Biotic component of this target will change.

Landscape context

6. Key attribute: Herbivory – things coming in and eating the biotic components. Indicator: % crustos coralline algae/ resistance. Is this a measure of ecosystem health? Intermediate levels are good. Need persistent herbivory for a healthy community. This indicator doesn't capture episodic characteristic. Greens represent a pulse disturbance, but the reds ... it's hard to use either of these species that are harvested. But wouldn't otters be harvesting these species if we weren't? Otters don't occur in middens, a possible sign that they weren't always part of the system.
7. Key Attribute: vertical rockwall. Measure/ Indicator: invertebrate diversity/ percent cover. Percent cover or biodiversity on the rockwall

Throw out depth categories. Red urchins are deep species for instance.

Fish

Pinnacle predators: lingcod, marine mammals. Measures: population density, species diversity – want about eight species that are abundant enough to do a survey. You can have good habitat and no fish, so what are we talking about? Are they a condition of the habitat? No, they are a condition of WDFW policies. Could be a condition or it could be a size. Can't leave out fish. What are the indicators? What information do we have that are not linked with management policies? Rockfish recruitment? This is vary spatially and temporally variable. Young lings also use eelgrass beds. Maybe greenling density. Since management is so prevalent, can we use this as an attribute?

Condition

8. Key attribute: bottomfish abundance. Indicator: bag limit. Or catch per human effort, or sustainable catch. Void the term sustainability. There are problems with doing population density because of harvest. But can measure reserves. Complicated. Let's leave this for further discussion. This is a community and a condition of health.

Pterygropa – heavy wooded kelp. High energy, distinctive kelp. Shades everything out. Pseudo perennial. Docked.

attribute: Algal diversity

Unconsolidated Rocky reef substrate

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### Condition

9. Key Attribute: eelgrass. Indicator: 5 cover; density per unit area. Do we need to stratify? In and out of embankments. Out of embankments: in San Juan County are pretty good. Haven't measured it, but feel it's pretty good. Very good= X. Inside embankments are poor, trends are down.
10. Key Attribute: seapens/seawhips. Indicator: (caveat: seawhips are a better indicator for mud; pens better for sand) move to two.
11. Key attribute: shrimp/spot prawns. Capture deep strata
12. Key Attribute: crab/dungenus

Water quality – how do we deal with this issue? Tumors on an English soul.

13. Key attribute: English Soul. Indicator: % liver lesions,

Landscape scale? Really developed for terrestrial communities. Not sure it applies. Geomorphic processes.

14. Key Attribute: chlorophyll regime, milligrams of chlorophyll per liter. anthropogenic impacts: Derelict gear, pipelines, trawling, anchoring, docks, moorings.

## **Afternoon Breakout- Group C/3**

### Group C/3: Shoreline Processes/ Freshwater Systems



#### 1. Shoreline Processes

##### Key Attributes

- A. Marine riparian community
  - Potential Indicators:
    - i. % native v. non-native spp.
      - How to measure?
        - % of rhizomatic cover- native plants generally have more rhizomes, which stabilize bank (i.e. maintain feeder bluffs longer)? [RB]
        - Developed v. natural cover (quantify spatially)? [PB]
      - Problems w/ seed transport of invasives- i.e. birds transporting seeds might keep out of v. good range always! [RB]
      - **Need to separate by discrete geomorphic units first** [SH]
      - Range:
        - v. good: >90% over- and under-story cover
        - good: 75-90%
        - fair: 50-75%
        - poor: <50%
      - → **Break by geomorphic unit (i.e. feeder bluffs will have different composition than rocky shore)**
      - → Two different categories for over- and understories
      - More useful on an area specific unit?
        - Spatially explicit management units important? → all agree
        - Should they be mapped by watershed in San Juans?
        - Yes. Map by watershed... geomorphic unit on watershed by watershed basis
        - Drift cells? Important to focus on watersheds over drift cells [LA]
    - ii. Successional stage
      - Vary by geomorphic unit



## 2. Freshwater Systems

### Key Attributes

- A. Levels of toxics (heavy metals, PCBs, etc)
  - Indicators
    - i. Copper levels
      - Based on EPA stds?
        - Toxic Coalition ([www.watoxics.org](http://www.watoxics.org)) research on lethal levels for fish
      - Maybe PCB levels in top level consumers (i.e. large birds)?
      - Creosote levels?
      - All seemed to like this method...
- B. Unimpeded flow of ground- and surface-water
  - Indicators
    - i. % of watershed area impounded by ponds
      - Relative to size of watershed
      - Use GIS?
      - Range:
        - v. good: zero
        - good: maybe ~2%
      - All liked this method...
    - ii. Proportion of historic oyster area currently occupied by oysters
      - Indicator of freshwater presence in the nearshore
      - Salinity
      - Range:
        - v. good: >90%
        - good: 75-90%
        - fair: 50-75%
        - poor; <75%
      - All liked this method...
- C. Nutrient loads (organic and inorganic)
  - Indicators
    - Tough to measure? Use biologic oxygen demand (BOD)?
    - i. BOD's
      -



## June 14 Workshop Notes: Viability Analysis – Group 2/B (Rachelle)

Notetaker: Critter Thompson

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- ii. Isotopes?
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- iii. Phosphates imported?
- D. Native marsh vegetation
- E. Natural reservoir capacity/wetlands (alder wetlands/ peat bogs)
- F. Potability
- [note: none of these were elaborated on in any detail. Just listed.]
- Social issues to think about:
  - Social components of water quality
  - How do you market these issues to the public?
    - i.e. market the idea around the number of amphibians, marine mammals, etc.

[That's it in my notes! Group meeting adjourned and final gathering with larger group]

1. Targets originally selected were Marine Birds and Pelagic Zone. However, there was no marine bird expert in the group, so Pelagic Zone was the only target put through the Viability Analysis.
2. Brainstorm list of key ecological attributes – size, condition, landscape context
  - Stratification: water columns of mixed vs. stratified layers; the intensity and persistence of stratified layers are indicators (Claudia)
3. Comment that “landscape” doesn’t work for pelagic zone – change to “spatial.” (Jan N.)
4. Do attributes have to indicate health? No. Must be able to measure an attribute. Stratification can be measured; stratification could change as a result of global warming.
5. Back to listing attributes:
  - Spring productivity – timing and amount are indicators (Alan)
  - Temperature (Jan N.)
6. JW suggests group consider integrative attributes, such as species abundance. Which species? Group suggests orcas, harbor seals, harbor porpoises as attributes.
  - Indicators: spatial and temporal distribution of pelagic vertebrates
7. More attributes:
  - depth of pelagic zone (Claudia) NOTE: JW did not agree with depth as an attribute, but Claudia added it at the last minute to the flip chart – no real consensus by Group, but captured for further consideration
  - chemical composition (Jacques)
8. JW suggests including pelagic vertebrates AND invertebrates as attributes – group agrees.
  - Pelagic Vertebrates (resident): harbor porpoise, rhinoceros auklet, harbor seal  
Discussion: salmon and Dall’s porpoise were not considered to be resident; insufficient data on herring.
  - Pelagic Vertebrates (migratory): orca, marine birds, forage fish (some uncertainty about migratory aspects, but wanted forage fish captured)  
Discussion: salmon suggested but failed the Figure 1 test for Example Indicators of KEAs, so salmon were not included. Group agreed that resident orcas are indicators of salmon abundance.
  - Pelagic Invertebrates (resident): gelatinous zooplankton, krill, mesozooplankton  
Discussion: Only Claudia Mills has data on gelatinous zooplankton. Group uncertain as to whether sufficient data exists on krill.

9. Discussion: Should pelagic zone be divided into sub-areas? For example: Haro Strait, East Sound, Rosario Strait, etc.; or straits, channels, bays, and inlets? JW: sub-areas become “categories” of attributes.

10. Criteria for Indicator ratings

Stratification: Discussion – What’s “good” vs. “bad” stratification? If there’s weak stratification, there are fewer toxic blooms.....decided to ask Jan Newton to look into this.

Primary Productivity criteria: species composition/harmful algae; timing match/mismatch (timing of food production is critical to health of predators.)

Temperature criteria: temperature anomalies (“departure from cold”); “warm is bad”; linked to climate change and variability.

Pelagic Vertebrates (resident) criterion, using Harbor Porpoise as representative: distribution. Current rating is “good”. We have count estimates from 1991 and 1996 aerial surveys; boater surveys from 1999, 2001, 2003. Recommended that Brad Hansen provide names of key data sets.

Pelagic Verts (resident), Harbor Seal: distribution. Current rating is “very good.” Data from NMFS and WDFW.

Pelagic Verts (resident), Orca: Criterion is current trend count; rating is “fair.” Whale research center has data.

Marine Birds criteria: distribution and abundance. Current rating is “fair”. Data from PSAMP, WDFW, USFWS

11. Viability Analysis Worksheet (hopefully you have the original white sheet because there were some changes made in the last, rushed minutes that I don't think I caught.)

TARGET	CAT	KEY ATT	INDICATOR	POOR	FAIR	GOOD	VERY GOOD	CURRENT
Pelagic Zone		Temperature				?		?
		Primary Productivity	Timing, amount, species composition			?		?
		Stratification	Persistence, location, intensity			?		?
		Pelagic Verts.	Spatial distrib., temporal distrib., species composition, abundance	Orcas	Harbor Por. Marine Birds	Harbor Seals		Orcas=F HP=G MB=F HS=VG
Pelagic Zone	Pelagic Inverts.	Spatial distrib., temporal distrib., species composition, abundance	jellyfish	krill				jf=P/Fair k=P/Fair
	Chemical composition	Oxygen, salinity, pollutants, nutrients						
	Depth							

NOTE: Group 4 did not assign criteria for indicator ratings, unless it got done after the final presentation – if so, I was not still around to take notes. Looks like the group got confused and put the attributes in the columns according to their current condition, rather than providing criteria for the ratings. Also, the Viability Analysis Worksheet does not have a “category” column, but JW included it in his hand-written flipchart version of the worksheet, so it is included here. Two items could be included in the “Category” column to

indicate 2 sub-areas of the pelagic zone: straits/channels and bays/inlets. Finally, the question marks (?) in some columns indicate the group does not know current status of attribute.

