Recent Large-Scale Kelp Loss in Northern California

Dr. Cynthia Catton
Monterey Bay National Marine Sanctuary Meeting
April 20, 2018
Interns and Volunteers

Shiho Koike

Jesse Bray

Alex Grinshpan

Gabby Genhart-Steihler

Lara Slatoff

And so many more!!!
Bull Kelp (*Nereocystis luetkeana*)

A critical foundation species for kelp forest ecosystems on the north coast.
Bull kelp provides food and habitat for fish and shellfish.

Grows to the surface of the water during Summer.

Aerial surveys can be used to track natural fluctuations of kelp growth over time.
Annual Life-History of Bull Kelp

1-year life span
Other shorter kelp species are also important and may have thick woody stalks.
Pink crustose algae are very hard and not good to eat, but **very important** habitat for young shellfish
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Red Abalone
Flat Abalone
Flat Abalone

Red Abalone

Pinto Abalone

A. Maguire
Red Urchins

Purple Urchins
Sunflower Star – Important urchin predator
Giant-Spined Star
Ochre Seastars
Leather Star
Six-Armed Star
Sea Otter in Bodega Bay (May 10, 2017)
Climate Change Expectations

• Increased:
  • Global surface temperature
  • Sea level
  • Ocean acidification and hypoxia
  • Increased frequency and intensity of:
    • Extreme Events
    • Heat waves
    • Precipitation
    • Uptick in Harmful Algal Blooms
    • Diseases
  • Reduced:
    • Extreme cold temperature events
    • Sea ice
    • Permafrost
    • Ocean fisheries

Variable Effects by Latitude & Altitude

Large-Scale Impacts

Likely Multiple Compounding Stressors

IPCC AR5 Synthesis Report 2014
“Perfect Storm” Decimates Northern California Kelp Forests

Northern California Beyond Tipping Point

Dramatic Changes in Kelp Forest Ecosystems

Total bull kelp habitat area ~15 km²
Key range ~250 km coast

https://cdfwmarine.wordpress.com/2016/03/30/perfect-storm-decimates-kelp/
Recent Severe Kelp Loss in Northern California

L. Rogers-Bennett (CDFW)
A. Weltz (CDFW)
Aerial Kelp Surveys (CDFW)

- 93% kelp loss in 2014
- Additional 33% loss in 2015
- Limited kelp growth in 2016 and 2017
“The Perfect Storm”

- Harmful Algal Bloom 2011
- El Niño 2015 - Present
- Seastar Wasting Disease 2013
- Purple Urchin Boom 2014 - Present
- "Warm Blob" 2014 - Present

Decimation of Kelp Forest

https://cdfwmarine.wordpress.com
Multiple, Large-Scale Impacts

- Harmful Algal Bloom (2011)
- Sea Star Wasting Disease (2013)
- Purple Urchin Explosion (2014 - )
- Persistent Warm Water (2014 - )
Increased Subtidal (10m) Temperature and Purple Urchin Populations

Seastar Mortalities

Fall 1997

Fall 2014 & 2015

Temperature (°C)

Density (# m⁻²)

Year

Purple Urchins

Fort Ross
Timber Cove
Ocean Cove
Salt Point
Point Arena
Van Damme

Purple Urchins
Urchins overgrazing Bull Kelp at the holdfast
Leather stars and bat stars are dominating now.

Very few observations of seastar wasting disease.

A. Maguire (CDFW)

K. Joe (CDFW)
Impacts to Fisheries

- Red abalone fishery closure 2018
- Red urchin fishery
  - 80% decline in catch
  - Requested federal disaster relief
What Can We Do to Support Recovery?

A. Maguire
Protect the Spore Bank through purple urchin control

• Maintain connectivity between sites through spore dispersal
• Benefit fisheries by enhancing localized food and habitat availability
• Protect culturally significant areas for local tribal nations
• Broad partnership of stakeholders, scientists, and government agencies

• Focus on bull kelp forest ecosystem
  • Fill critical knowledge gaps
  • Assess recovery potential
  • Support rapid widespread kelp recovery by maintaining spore production along the coast
KELPRR Partnership
North Coast Urchin Industry
David Goldenberg
GFNMS-CDFW Joint Kelp Recovery Working Group

- Interdisciplinary team of stakeholders and scientists
- Evaluate potential effective recovery efforts
- Identify knowledge gaps
- Develop pathways to engage communities
- Produce report with management objectives and recommendations
Non-Profits Supporting Urchin Removals

Watermen’s Alliance – Josh Russo
Get Inspired – Nancy Caruso
Science & Monitoring

Reef Check – Jan Freiwald
(Anna Newman)
Activities To Date
Test methods for purple urchin control

- Collaboration with urchin industry
- Pilot studies completed
- Compared purple urchin culling methods
  - Efficiency
  - By-catch
  - Inundation rates
- Ready to scale up efforts
Removals vs “Smashing”

- Test efficacy of hand-picking vs smashing urchins in place
- How quickly do the urchins return?
- Cleared two sets of plots in August 2017
- Re-surveyed areas within 1 week and 1 month
One Month After Urchin Clearing (September 2017)
Involving Recreational Divers

• Developing application for scientific collection permit
• Protocol will include education on species ID and responsible harvest methods
• Focused work in the shallows to complement commercial diver efforts
Science and Monitoring

- Diver Effort Tracking
- Dockside Sampling
- Seasonal Subtidal Surveys
- Aerial Kelp Surveys
- Kelp Spore Experiments
Diver Effort Tracking

<table>
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<tr>
<th>Date</th>
<th>Diver’s names</th>
<th># hours underwater</th>
<th>Depth range (ft)</th>
<th>Lbs urchins collected</th>
<th># of urchins collected</th>
<th>size range of urchins</th>
<th>avg size</th>
<th>ft2 cleared</th>
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<tr>
<td>12/31/2017</td>
<td>Jon, Harry</td>
<td>3</td>
<td>12'-35'</td>
<td>150</td>
<td>~5,000</td>
<td>1/2&quot;-2.5&quot;</td>
<td>1.5&quot;</td>
<td>~700</td>
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<td>1/1/2018</td>
<td>Jon, Harry</td>
<td>4</td>
<td>20'-30'</td>
<td>350</td>
<td>~12,000</td>
<td>1&quot;-2&quot;</td>
<td>1.5&quot;</td>
<td>~1,200</td>
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<tr>
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<td>Jon, Harry</td>
<td>3.25</td>
<td>15-20'</td>
<td>284</td>
<td>~10,000</td>
<td>1/2-2.5&quot;</td>
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<tr>
<td>2/3/2018</td>
<td>Jon, Harry</td>
<td>4.5</td>
<td>15-30'</td>
<td>538</td>
<td>~16,000</td>
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<tr>
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<td>10-30'</td>
<td>354</td>
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<td>1/2-2.5&quot;</td>
<td>1.5&quot;</td>
<td>~1,500</td>
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Technology can help to track diver profiles and GPS
Dockside Sampling

- Noyo Science Center Volunteers
- Estimating # of Urchins
- Assessing gonad
Seasonal Subtidal Monitoring
Developing New Purple Urchin Markets (Long-Term Solution)

- Expanding non-traditional sushi markets
- Aquaculture-based conditioning
- Exploring preparation of tests for crafts
- Compost / Fertilizer
Bull Kelp Recovery Requires:

- Innovative thinking
- Improved scientific understanding
- Attention to scales (landscape and local)
- Strong collaborative partnerships
Thank you!

Cynthia.Catton@wildlife.ca.gov

K. Joe