Who we are

Principal/Associate Investigators

**UCSB**
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Manjunath, Deborah Iglesias-Rodriguez, Doug McCauley, Milton Love

**Florida State University**
Andrew Rassweiler

**USGS**
Kevin Lafferty

**UCSD - SIO**
John Hildebrand

**NOAA – NMFS SWFSC**
Andrew Thompson
Partners

Plumes and Blooms (NASA)

BOEM Pacific Region

Santa Barbara Coastal LTER (NSF)

Channel Islands National Marine Sanctuary

Southern California Coastal Water Research Project

Southern California Coastal Ocean Observing System (SCCOOS)

Channel Islands National Park

Gray Whales Count

CalCOFI
MBON Prototype:

1. Provide data to inform managers and society about patterns of biodiversity across taxa, space, and time
   • *Integrate existing data*
   • *Develop new methods & products*

2. Build a replicable framework to allow MBON production under diverse circumstances
Data Integration and Delivery

Focus on time series
- **oldest**: 34 yrs
- **youngest**: 17 yrs

13 Data packages published
- **stable, immutable**
- **with DOI**

Spanning taxa from microbes to whales

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Reproduced from Kissling et al 2018, Figure 1.
Progress, by Taxonomic Group

Measurement Class:
- D: Occurrence (EBV “distribution”)
- A: abundance or density (EBV “abundance”)

Delivery Mechanisms:

**Tested mechanisms for:**
- DwC-A in repository
  - EDI/DataONE
- EML-to-ERDDAP
  - SCCOOS
- Manual contributions
  - OBIS
- Workflow input to research community formats
  - EDI

Pros & cons outlined
Net Environmental Benefit Analysis of offshore platform decommissioning alternatives

Users:

- US Bureau of Ocean Energy Management
- CA State Lands Commission
- Petroleum industry (e.g. Exxon, Chevron, Venoco)

https://meyer-gutbrod.shinyapps.io/Decommissioning_WebApp/

Meyer-Gutbrod et al., in prep
Webinization of Condition Reports

California Sheephead Abundance in CINMS

The California sheephead (Semicossyphus pulcher) is a large and beautiful fish that plays an important role in the food web of kelp forests and rocky reefs in southern California. Sheephead are also a popular sport fish for recreational and commercial fishing and a draw for SCUBA divers.

Abundance of California Sheephead

Average density of California sheephead at Channel Island National Park kelp forest monitoring sites at the five islands in CINMS. Sheephead density was averaged across all monitoring sites at each island to examine overall sanctuary trends. Note that juveniles (< 10 cm) were excluded from analysis.

Average density of California sheephead observed by SCUBA divers at 14 sites across four islands in CINMS monitored by the PISCO keip forest monitoring program. Observed density was averaged across all monitoring sites at each island to examine overall sanctuary trends.

KEY CLIMATE & OCEANOGRAPHIC DRIVERS

- Nitrogen-Phosphorus
- Sea surface temperature
- Seafloor temperature
- pH
- U50
- U80

KEY HUMAN ACTIVITIES

- 02: O13: Contaminants in fish
- 04, 05: Marine debris abundance
- 09: Commercial fishing activity level
- 10: Recreational fishing activity level
- 14, 15: Boating activity level

Q7: California Sheephead Abundance: mean structure
Q8, Q10: Kelp forest fish
- Species abundance & size structure, diversity indices
- Colony size & fledging rate
Q9: Non-indigenous species
- Abundance & size structure
Q16: Biogenic invertebrates
- Abundance & diversity indices
Q7: Sea urchin (red & purple)
- Abundance & size structure
Q7: Sea star (Pycnopodia & Oseaster)
- Abundance & size structure
Q8: Abalone
- Abundance & size structure
Q5: Kelp canopy
- Areal extent
Q6: Understory algae
- Abundance
Q8: YOY reef fish
- Abundance & diversity indices
Q7: Spiny lobster
- Abundance & diversity indices
Uncovering the complex and multiscale drivers of kelp forest communities

What are the most important scales of variation?

What environmental factor(s) underlie each spatial scale?

Lamy et al. 2018, Oecologia
Species Archetype Modelling (SAM) identifies nine archetypes, SST and wave height important predictors.

Model evaluation: Correctly predicts species presence/absence in 87% of observations.
New Products: Deep learning for image analysis

Typical machine learning

- Engineer required throughout
- Time consuming (months)
- Only works on specific type of data

Deep learning

**Benefits**
- Generalizes to your data
- Fully automated - no feature selection
- High accuracy

**Leverages**
- Scalable services
- Annotation system
- Cluster processing
- Fast classification on GPUs

BisQue
Diver images: reef communities

Percent cover at 95% confidence

Top performers

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BisQue
Habitat partitioning

AUV images: deep benthic communities

Top performers

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Miller et al. in prep
New Products: Acoustics

Acoustic Detection of Marine Mammals

Seasonal shift
daytime foraging
In the fall / winter on squid

Nighttime foraging
in the spring/summer on fish

Grampus (Risso’s dolphin)

Hildebrand et. al submitted
Optical imagery and acoustics: users

- Oil platforms and natural reefs
- Rocky intertidal
- Deep benthos
- Marine mammals

- Marine mammals
- Noisy fish
- Deep benthos
- Deep sea corals
New Products: Remote Sensing
Phytoplankton functional diversity

Phytoplankton Pigment “Communities”

Pigment communities defined with cluster, EOF analyses as proxy for PFTs

Mode 4: 6.7%

Catlett and Siegel, 2018.
Bio-Optical Models Extend Biomarker Pigment Time Series

Catlett et al., in prep.
New Products: Genomics
Microbial diversity & community structure

Mock community deviation from expected abundance with four different primer sets:

Ordination plots of the same marine time-series samples sequenced with four primer sets:

A - V4-5
B - V4
C - V3-4
D - V1-2

Wear et al. 2018
Linking Genomics and Bio-optics

• Mock communities developed for testing methods
• Lots of work left to answer these questions:
  1. Can we derive PFT indices from sequences?
  2. Do they align with pigment PFTs?
  3. Can we use PFTs to predict microbes?

Catlett et al., in prep
New Products: Remote Sensing

Kelp condition, age, and forest extent

Bell & Siegel in prep
Bell et al. L&O 2018
Kelp age and demographics can be modeled from RS data

Bell & Siegel in prep
What does kelp data tell us about broader biodiversity?

Giant kelp increases biodiversity through physical engineering

Kelp positively affects kelp forest species richness, especially sessile invertebrates and mobile predators

Miller et al 2018
eDNA and Acoustic Telemetry Detection of Great White Sharks

Lafferty et. al in review, Biology Letters
Remote Sensing & Genomics: users

- Spatial maps of biodiversity
- Oil-degrading microbes
- Natural seeps as source
- DOI Remote Sensing Working Group (DOIRSWG)

- Coliform bacteria
- Pathogens

- HABS
  - *Pseudo-Nitschia*

- PACE, HyspIRI/ESBG
- Phyto Functional Types