

Update: Ocean Climate Indicators Project

SAC Meeting
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What Are Climate Change Indicators?

- Determine presence and impacts of climate change
- Basis of many climate change monitoring and response plans
- 2 Categories:
 1. Physical
 2. Biological



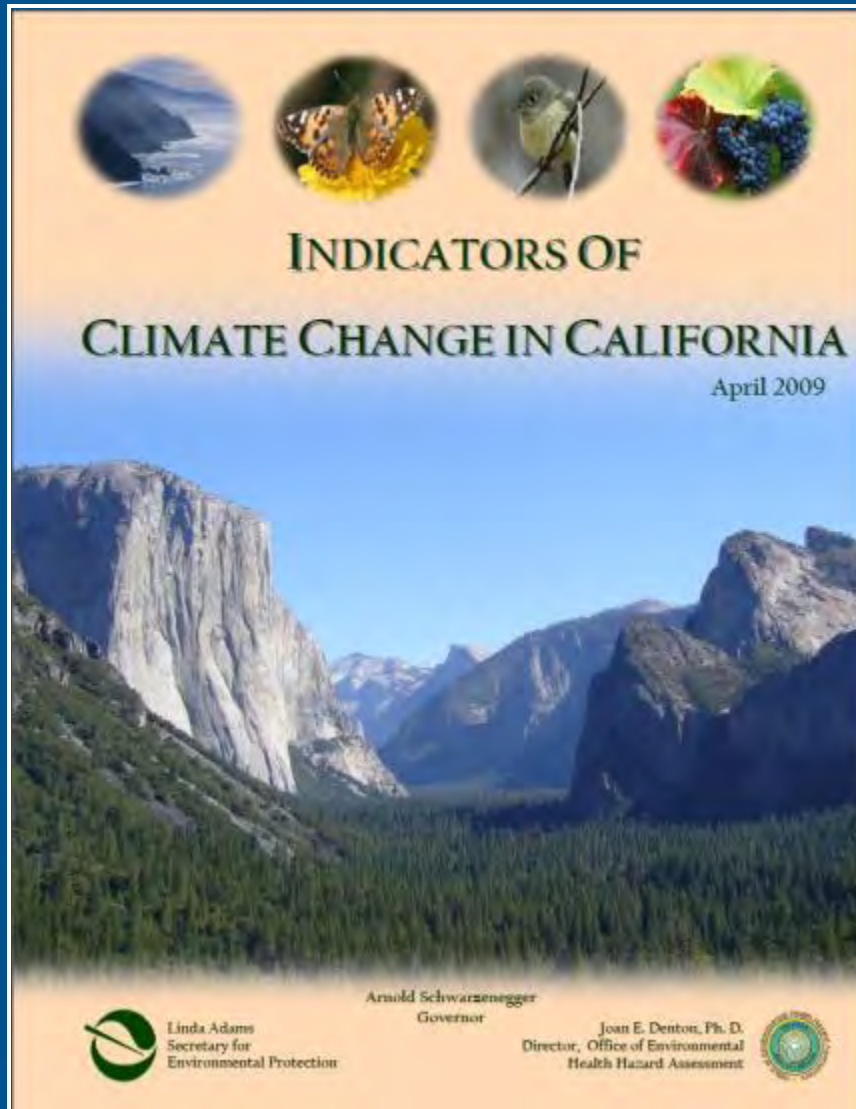
Jan Roletto, GFNMS

Likely Uses of Climate Change Indicators

- Used by:
 - Natural resource managers
 - Scientists
 - State and municipal planners
- Used to:
 - Monitor impacts of climate change
 - Develop climate change adaptation strategies
 - Mitigate impacts of climate change



Existing Climate Change Indicators



- State of CA report (Mazur & Milanes 2009)
- No regionally-scaled set of climate change indicators for GFNMS
- *Need:* environmental and biological climate change indicators scaled for North-central CA coast

Project Goals

1. Create a set of clearly-defined climate change indicators for GFNMS region
2. Maximize confidence in chosen indicators with:
 - a. Collaboration with partner scientists & local experts
 - b. Regional climate modeling or statistical downscaling
 - c. Data analysis
3. Define climate change monitoring goals for study region
4. Incorporate indicators into a collaborative monitoring inventory & plan

Phase I: Information Gathering (3-4 months)

Literature review and interviews

- Published and unpublished literature
- Existing indicator reports
- Existing monitoring plans

Review regional climate models

- Best model for region?
- Available GCM or RCM output?
- Determine computing resources needed

Determine selection process and criteria

- Coordinate with sanctuary & regional management
- Discuss project with regional scientific experts

Phase II: Physical and Biological Indicators (1 year)

Create list of candidate indicators

Discuss & refine candidate indicators with mentors

Determine data available for candidate indicators

Consult with experts about candidate indicators

- Written survey
- Workshop
- Phone interview

Refine list based on expert consultation

Run model(s)/Analyze existing candidate indicator data

Follow-up consultation with experts

Finalize indicators

Phase III: Indicator Report (3 months)

Develop detailed indicator report for journal publication

Develop outreach indicator report for management

Journal publication about process, time permitting

Phase IV: Working Group & Monitoring Plan (6 months)

Define monitoring goals

Develop monitoring strategies based on final indicators

For each monitoring strategy, determine:

- implementation timelines
- partners involved
- funding requirements

Finalize monitoring plan

Phase I: Information Gathering

(Complete)

Literature review and interviews

Published and unpublished literature
Existing indicator reports
Existing monitoring plans

Review regional climate models

Best model for region?
Available GCM or RCM output?
Determine computing resources needed

Determine selection process and criteria

Coordinate with sanctuary & regional management
Discuss project with regional scientific experts

Phase I: Indicator Selection Process

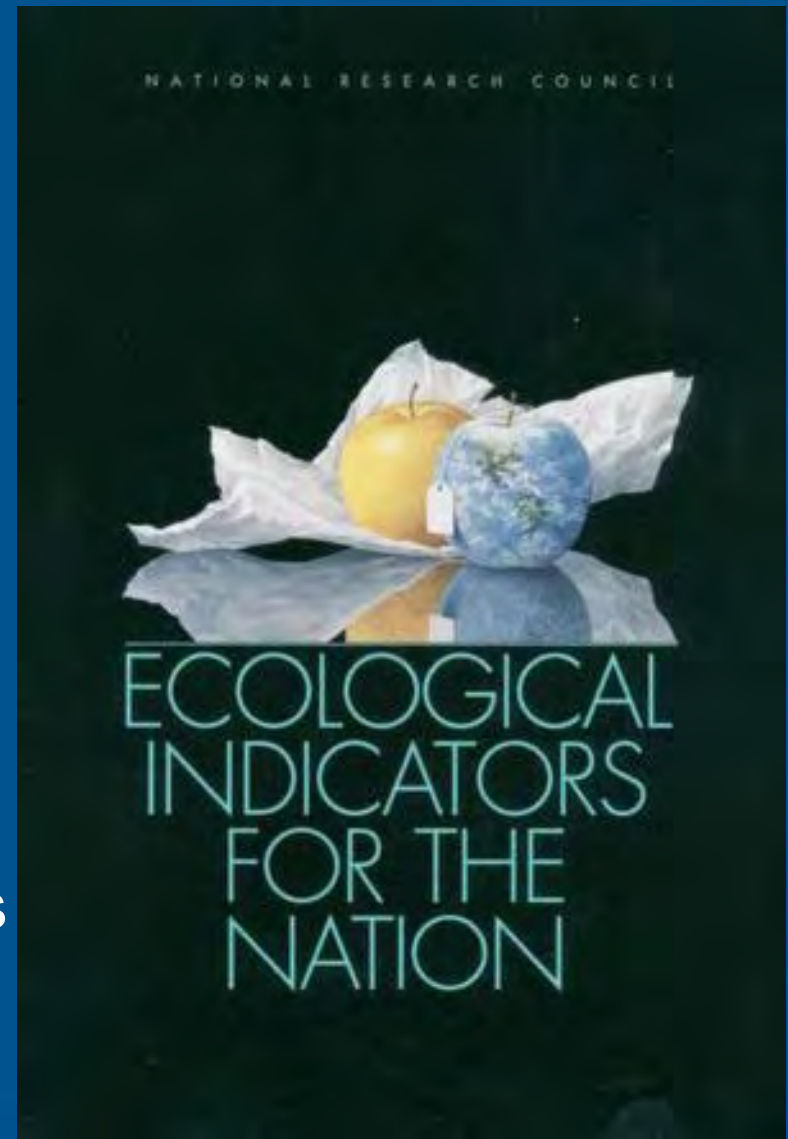
Based on NRC report: Ecological Indicators for the Nation

1. Created key documents (posted on project website):

- a. Ecosystem Description
- b. Conceptual Ecological Model
- c. Priority Management Questions
- d. Indicator Selection Criteria

2. Used documents & literature review to select candidate indicators

3. Refine & finalize indicators with procedure in Phase II



Phase II: Physical and Biological Indicators

(Underway – Expected Completion Jan 2013)

Create list of candidate indicators

Discuss & refine candidate indicators with mentors

Consult with experts about candidate indicators

Written survey
Workshop
Phone interview

Refine list based on expert consultation

Run model(s)/Analyze existing data

Follow-up consultation with experts

Finalize indicators

Indicator Survey

- Questions based on Indicator Selection Criteria
- Asked to rate agreement with series of statements
- Scores used to rank 10 physical and 13 biological candidate indicators
- Respondents invited to:
 - Suggest additional indicators
 - Assess physical, biological, or both types of indicator



OCEAN CLIMATE INDICATORS WORKSHOP

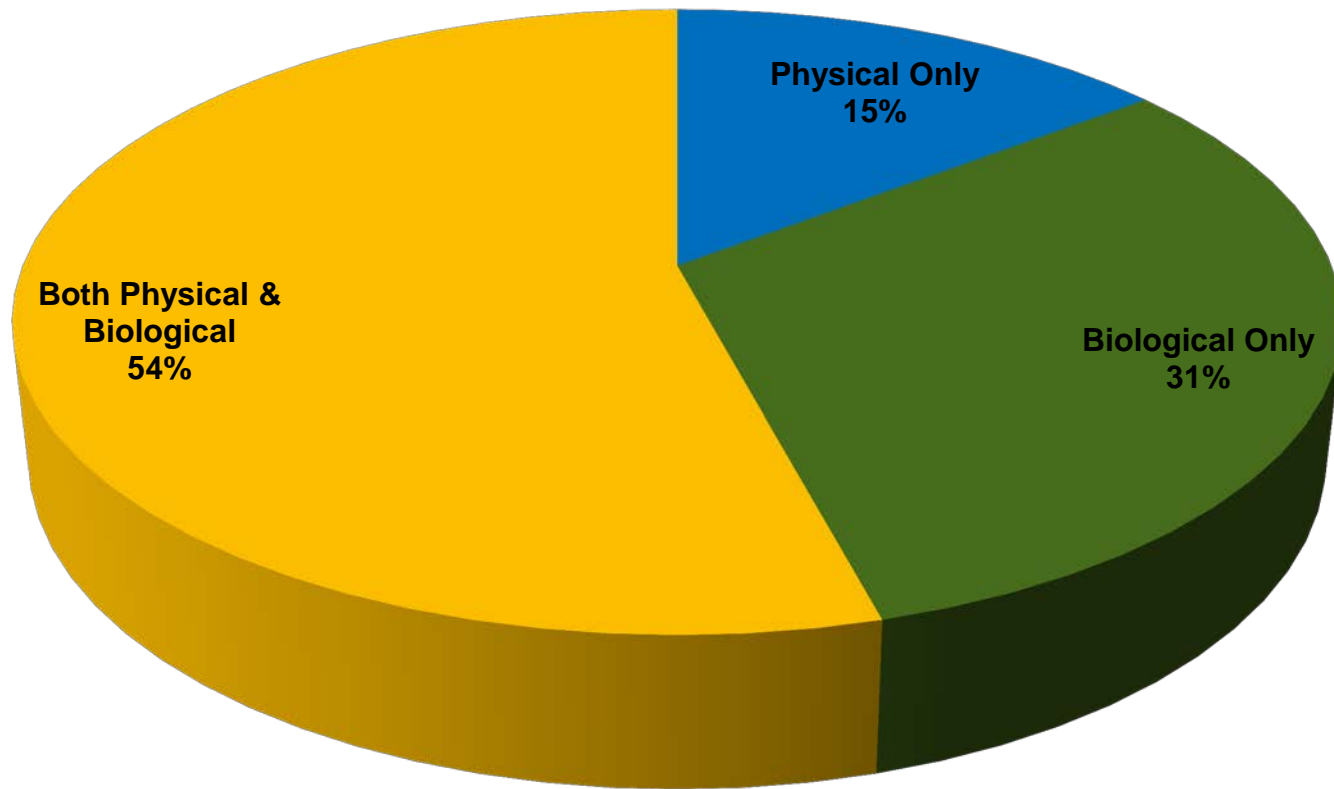


1. Present Indicators Survey Results:
 - a. Top ranked indicators
 - b. Additional potential indicators
2. In breakout groups:
 - a. Discuss survey results
 - b. Determine set of finalist indicators
 - c. Determine data sources available
3. Compare finalist indicators in full group discussion

Workshop Summary at:

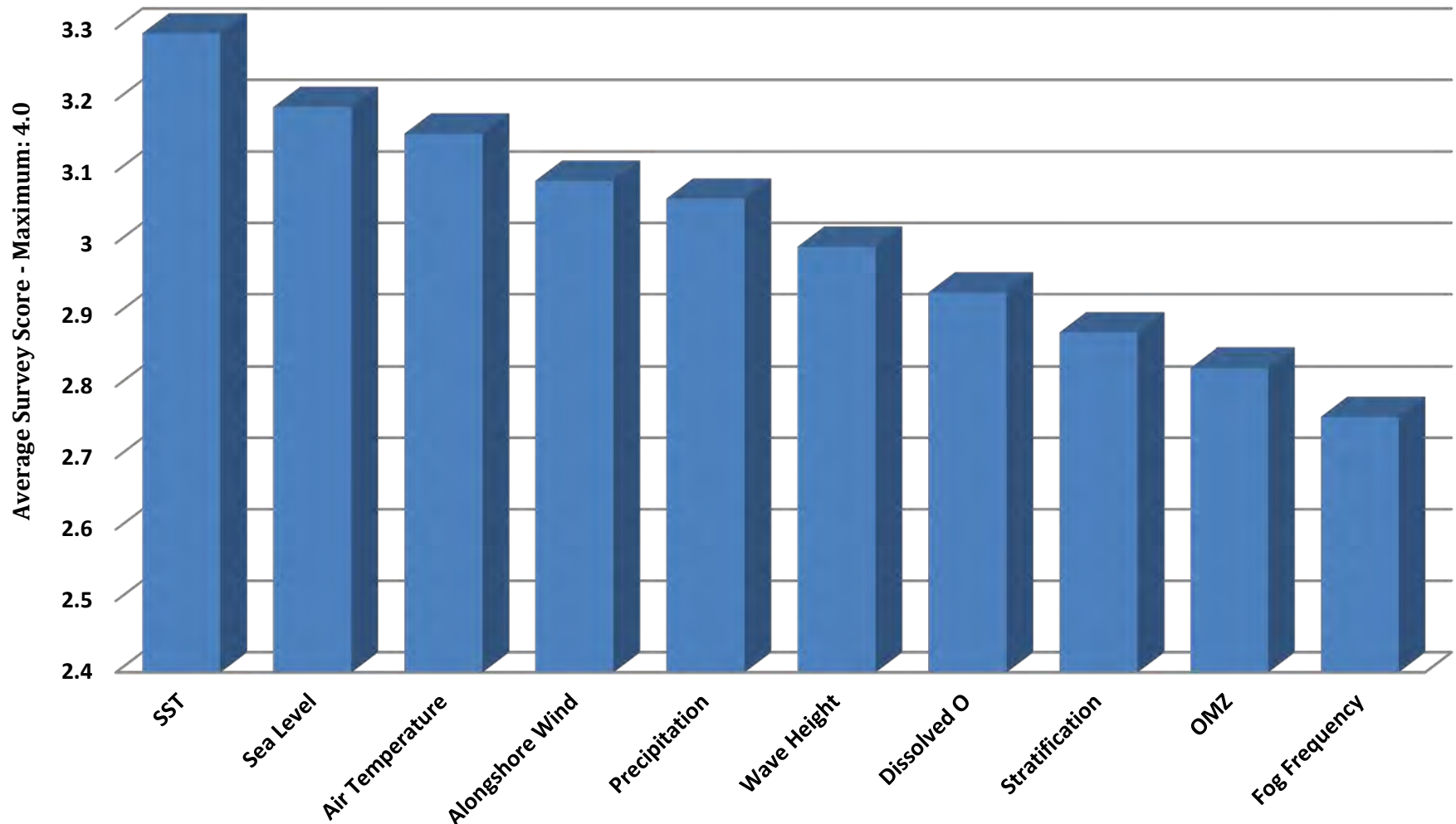
<http://farallones.noaa.gov/manage/climate/indicators.html>

Indicator Selection Survey: Respondent Expertise



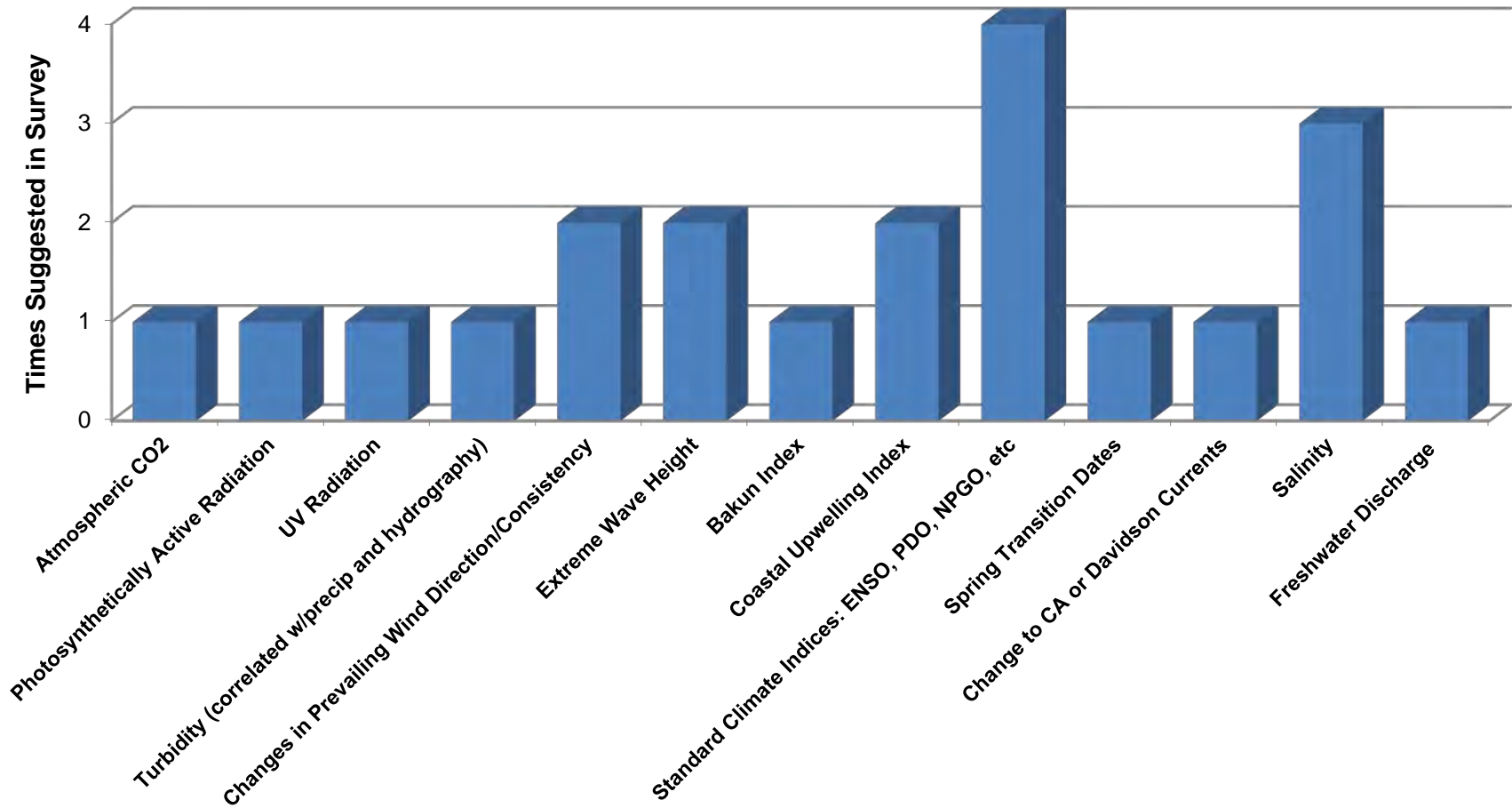
Survey Results #1: Top Physical Indicators

Physical Indicators - Average Survey Scores

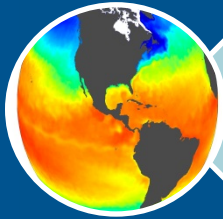


Survey Results #2: Additional Potential Physical Indicators

Potential Additional Physical Indicators
(Suggested in Indicators Survey)



Workshop Priority *Physical* Indicators



Ocean Water Properties

- SST
- Sea Surface Salinity
- Ocean Acidification (pH)
- Dissolved Oxygen



Sea Level



Wave Height

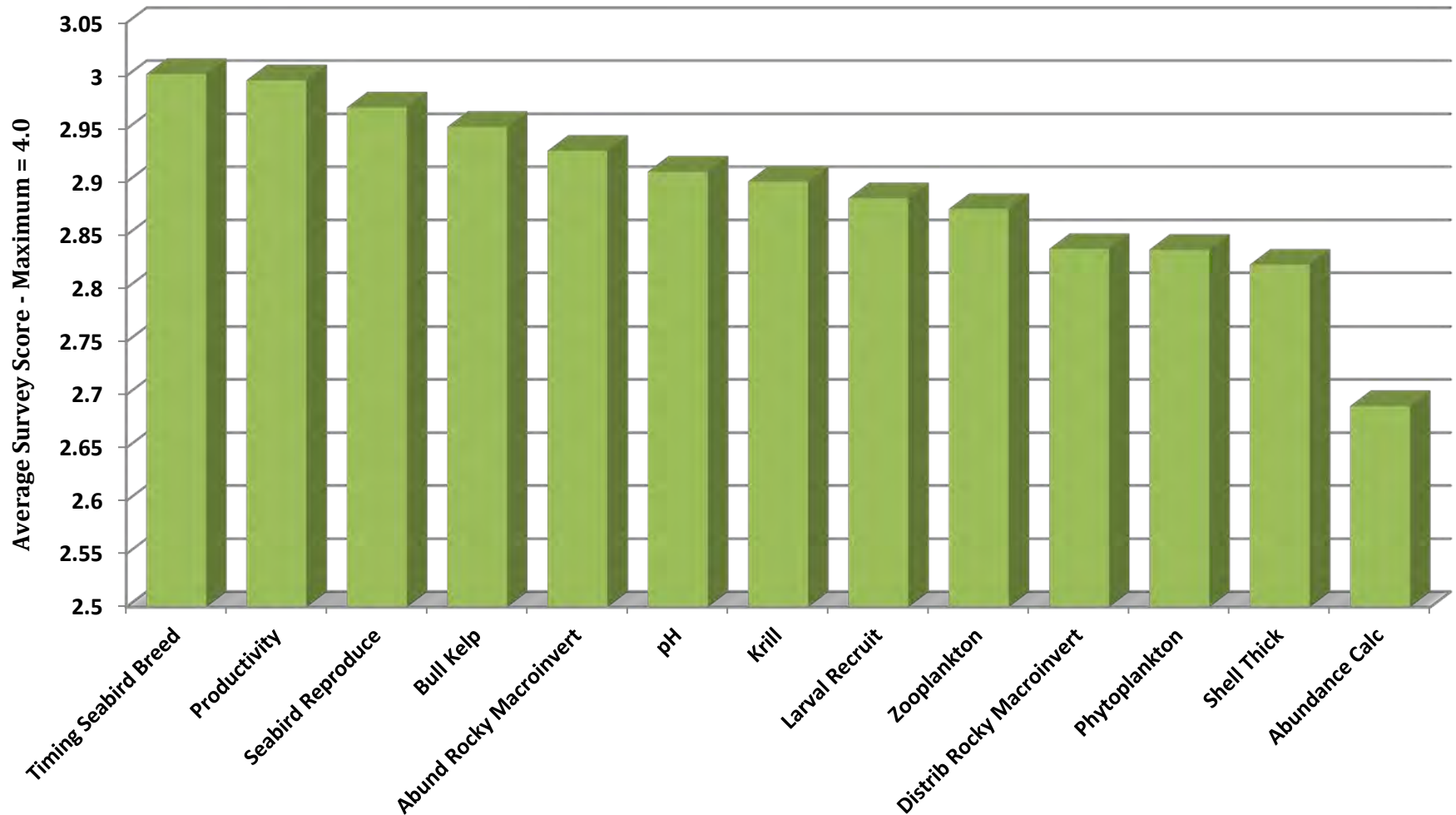


Atmospheric Measurements

- Air Temperature
- Wind Speed

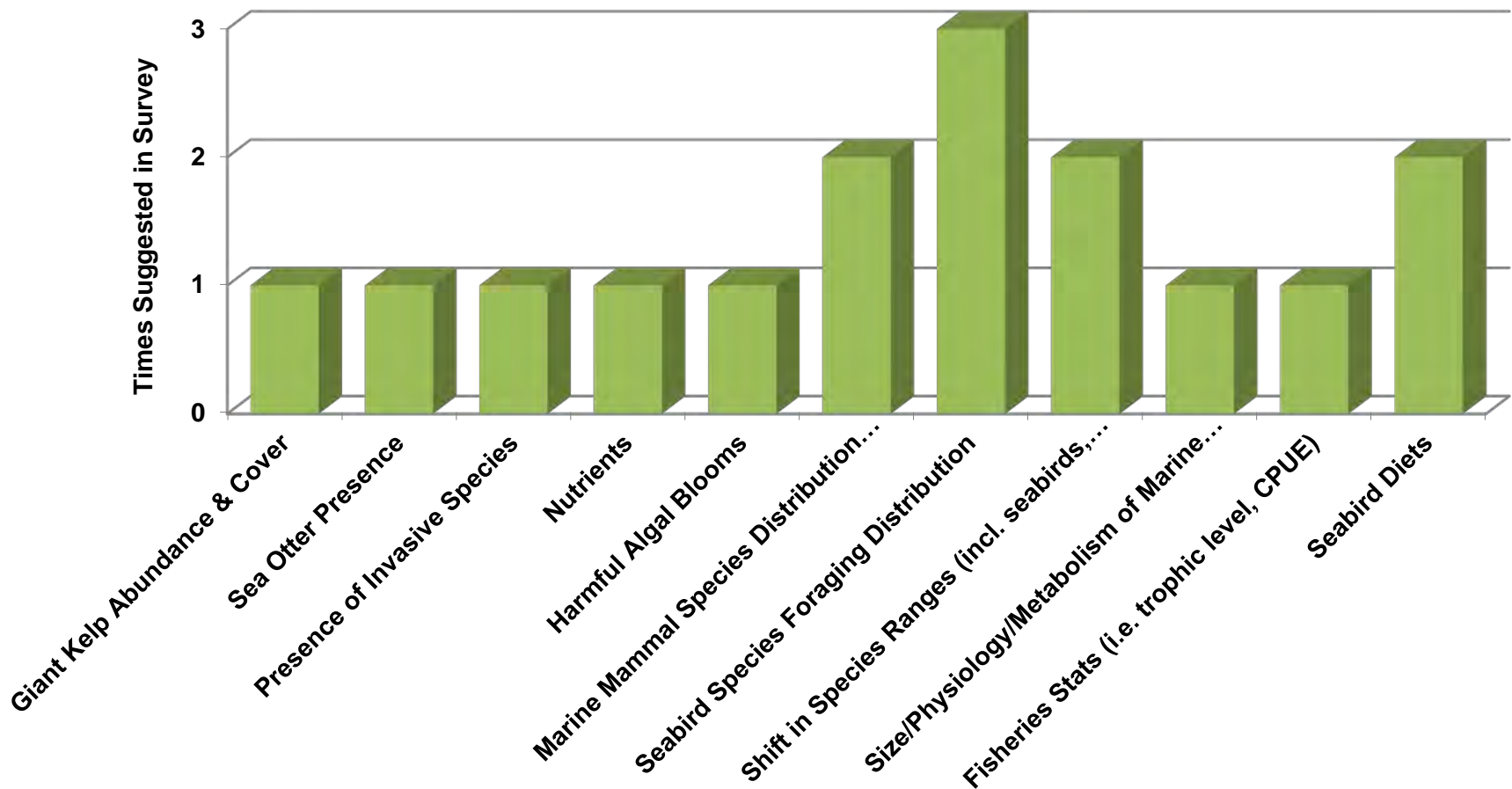
Survey Results #3: Top Biological Indicators

Biological Indicators - Average Survey Scores

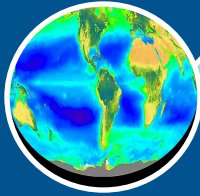


Survey Results #4: Potential Additional Biological Indicators

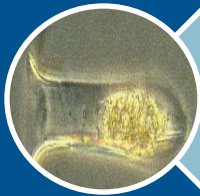
Potential Additional Biological Indicators
(Suggested in Indicators Survey)



Workshop Priority *Biological* Indicators



Primary Productivity



Mid-Trophic Level Species Abundance,
Biomass and/or Phenology:

- Macroinvertebrates
- Zooplankton



Aerial Extent of Habitat-Forming
Organisms

- Seagrass Beds
- Mussel Beds



Seabirds:

- Diet/Foraging Effort
- Breeding Success
- Timing of Breeding

Next Steps

1. Evaluate relative importance of finalist indicators:
 - Analyze available observations
 - Perform downscaling experiments from climate models
2. Finalize indicators (January 2013)
3. Develop indicator monitoring inventory and plan

SAC Working Group Request

- Active Nov 2012 – Sep 2013
- 3 meetings
- Goals:
 - Define indicator monitoring goals
 - Develop strategies to meet monitoring goals
 - Determine implementation timelines, partners, funding needs
- Deliverable:
 - Ocean Climate Indicators Monitoring Plan

National Marine Sanctuaries
National Oceanic and Atmospheric Administration

