Fish and Game Commission
Meeting Binder

July 21, 2016

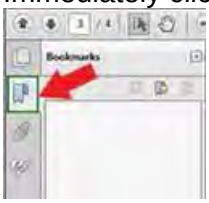
Marine Resources Committee Meeting

Petaluma

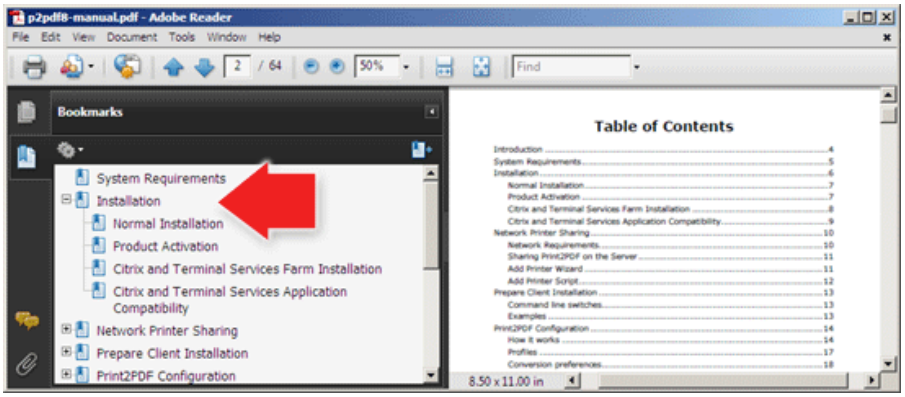
EASY GUIDE TO THE BINDER

1. Download and open the binder document using your Adobe Acrobat program/application.

2. Immediately click/tap on the “bookmark symbol” located near the top left-hand corner.



3. A bookmark panel should appear on either the top or the left-hand side of the screen. To make adjustments, simply use the Page Display option in the View tab. If done correctly, you should see something like:



4. We suggest leaving open the bookmark panel to help you move efficiently among the staff summaries and supporting documents included in the binder. It’s helpful to think of these bookmarks as a table of contents which allows you to go to specific points in the binder without having to scroll through hundreds of pages.

5. Resize the bars by placing the icon in the dark, vertical line located between the text boxes and using a long click/tap to move ↔ in either direction. You may also adjust the sizing of the documents by adjusting the sizing preferences located on the Page Display icons found in the top toolbar or in the View tab.

6. Upon locating a staff summary for an agenda item that interests you, notice that you can get more information by double-clicking/tapping on any item underlined in blue.

7. Return to the staff summary by simply re-clicking/tapping on the item in the bookmark panel.

OVERVIEW OF FISH AND GAME COMMISSION COMMITTEE MEETING

- Our goal today is informed discussion to guide future decision making, and, we need your cooperation to ensure a lively and comprehensive dialogue.

- We are operating under Bagley-Keene Open Meeting Act, but the Committee is not a decision making body and only makes recommendations to the full Commission for possible action.

- These proceedings may be recorded and posted to our website for reference and archival purposes.

- Items may be heard in any order pursuant to the determination of the Committee Co-Chairs.

- In the unlikely event of an emergency, please locate the nearest emergency exits.

- Restrooms are located _____.

- As a general rule, requests for regulatory change need to be redirected to the full Commission and submitted on the required petition form, FGC 1, titled "Petition to the California Fish and Game Commission for Regulation Change" (Section 662, Title 14, CCR). However, at the Committee's discretion, the Committee may request that staff follow up on items of potential interest to the Committee and possible recommendation to the Commission.

- Committee meetings operate informally and provide opportunity for everyone to provide comment on agenda items. If you wish to speak on an agenda item, please follow these guidelines:
    1. Raise your hand and wait to be recognized by the Committee.
    2. Provide your name, affiliation (if any), and the number of people you represent.
    3. Time is limited; please keep your comments precise to give others time to speak.
    4. If several speakers have the same concerns, please appoint a group spokesperson.
    5. If you would like to present handouts or written materials to the Committee, please provide five copies to the designated staff member just prior to speaking.
    6. If speaking during public comment, the subject matter you present should <u>not be related</u> to any item on the current agenda (public comment on agenda items will be taken at the time the Committee members discuss that item).

- **Warning!** Laser pointers may only be used by a speaker doing a presentation.

INTRODUCTIONS FOR FISH AND GAME COMMISSION MARINE RESOURCES COMMITTEE

FISH AND GAME COMMISSIONERS

Eric Sklar	Co-Chair (Saint Helena)
Peter Silva	Co-Chair (Chula Vista)

COMMISSION STAFF

Susan Ashcraft	Acting Deputy Executive Director, Marine Advisor
Elizabeth Pope	Acting Marine Advisor
Caren Woodson	Analyst

DEPARTMENT OF FISH AND WILDLIFE

David Bess	Deputy Director and Chief, Law Enforcement Division
Steve Riske	Assistant Chief, Law Enforcement Division
Craig Shuman	Manager, Marine Region
Tom Barnes	State Fisheries Program Manager, Marine Region
Sonke Mastrup	Invertebrate Fisheries Program Manager, Marine Region

I would also like to acknowledge special guests who are present:
(i.e., key DFW staff, elected officials, tribal chairpersons, other special guests)

_____

_____

_____

_____

_____

Commissioners
Eric Sklar, President
Saint Helena
Jacque Hostler-Carmesin, Vice President
McKinleyville
Anthony C. Williams, Member
Huntington Beach
Russell E. Burns, Member
Napa
Peter S. Silva, Member
Chula Vista

STATE OF CALIFORNIA
Edmund G. Brown Jr., Governor

Fish and Game Commission

Wildlife Heritage and Conservation
Since 1870

Valerie Termini, Executive Director
1416 Ninth Street, Room 1320
Sacramento, CA 95814
(916) 653-4899
www.fgc.ca.gov

MARINE RESOURCES COMMITTEE

Committee Chairs: Commissioner Sklar and Commissioner Silva

Meeting Agenda
July 21, 2016 10:30 a.m.

Petaluma Regional Library
100 Fairgrounds Dr., Petaluma

This meeting may be audio-recorded

NOTE: See important meeting procedures and information at the end of the agenda.
All agenda items are informational and/or discussion only. The Committee develops recommendations to the Commission but does not have authority to make policy or regulatory decisions on behalf of the Commission.

Call to order; roll call

1. Approve agenda

2. Public forum for items not on the agenda
   The Committee may not discuss or take action on any matter raised during this item, except to consider whether to recommend that the matter be added to the agenda of a future meeting. [Sections 11125, 11125.7(a), Government Code]

3. Agency Updates

4. Red Abalone Fishery Management Plan – progress update

5. Pacific Herring Fishery Management Plan – progress update

6. Marine Life Management Act Master Plan for Fisheries amendment process update

7. Update on progress and completion of new ecological impact assessment tool for scientific collecting permit applications in marine protected areas

8. California's Fishing Communities: Summary of July 20 public meeting and discuss next steps

9. Update on Fisheries Bycatch Workgroup

10. Informational Presentation and Discussion: Ocean Acidification and Hypoxia

11. Finding Dory: Opportunities to encourage environmental stewardship

12. Update on topics previously before the Committee

    (A) Marine debris and plastic pollution

    (B) Pier and jetty fishing review

13. Future agenda topics

    (A) Review work plan agenda topics and timeline

    (B) Potential new agenda topics for FGC consideration

Adjournment

2016 FISH AND GAME COMMISSION
MEETING SCHEDULE
www.fgc.ca.gov

MEETING DATE	COMMISSION MEETING	COMMITTEE MEETING
August 24-25	Lake Natoma Inn Hotel & Conference Center 702 Gold Lake Drive Folsom, CA 95630	
September 21		**Wildlife Resources** Woodland Public Library Leake Center Community Room 250 First Street Woodland, CA 95695
October 18		**Tribal** Red Lion Hotel 1929 4th Street Eureka CA 95501
October 19-20	Red Lion Hotel 1929 4th Street Eureka CA 95501	
November 17		**Marine Resources** Sacramento, CA
December 7-8	Portofino Inn & Suites 3805 Murphy Canyon Road San Diego, CA 92123	

OTHER MEETINGS OF INTEREST

Wildlife Conservation Board

- August 30, Sacramento
- November 16, Sacramento

Pacific Fishery Management Council

- August 30, Sacramento
- November 16, Sacramento

Pacific Flyway Council

- September 2016, Date and location TBD

Western Association of Fish and Wildlife Agencies

- July 21-27, 2016, Cody, WY

IMPORTANT COMMITTEE MEETING PROCEDURES INFORMATION

Welcome to a meeting of the California Fish and Game Commission's Marine Resources Committee. The Committee is chaired by up to two Commissioners; these assignments are made by the Commission.

The goal of the Committee is to allow greater time to investigate issues before the Commission than would otherwise be possible. Committee meetings are less formal in nature and provide for additional access to the Commission. The Committee follows the noticing requirements of the Bagley-Keene Open Meeting Act. It is important to note that the Committee chairs cannot take action independent of the full Commission; instead, the chairs make recommendations to the full Commission at regularly scheduled meetings.

The Commission's goal is the preservation of our heritage and conservation of our natural resources through informed decision making; Committee meetings are vital in developing recommendations to help the Commission achieve that goal. In that spirit, we provide the following information to be as effective and efficient toward that end. Welcome, and please let us know if you have any questions.

PERSONS WITH DISABILITIES

Persons with disabilities needing reasonable accommodation to participate in public meetings or other Commission activities are invited to contact the Reasonable Accommodation Coordinator at (916) 651-1214. Requests for facility and/or meeting accessibility should be received at least 10 working days prior to the meeting to ensure the request can be accommodated.

SUBMITTING WRITTEN MATERIALS

The public is encouraged to attend Committee meetings and engage in the discussion about items on the agenda; the public is also welcome to comment on agenda items in writing. You may submit your written comments by one of the following methods (only one is necessary): **Email** to fgc@fgc.ca.gov**; deliver** to California Fish and Game Commission, 1416 Ninth Street, Room 1320, Sacramento, CA 95814; or **hand-deliver to a Committee meeting.**

Comment Deadlines: Written comments received at the Commission office by **5:00 p.m. on July 7** will be made available to the Committee prior to the meeting. Written comments received between **5:00 p.m. on July 7 and 12 noon on July 15** will be made available to the Committee at the meeting. **After July 15 at noon**, five copies of written comments must be delivered at the meeting, otherwise they will not be made available to the Committee until after the meeting.

The Committee **will not** consider comments regarding proposed changes to regulations that have been noticed. If you wish to provide comment on a noticed item, please provide your comments during Commission business meetings, via email, or deliver to the commission office.

NOTE: Materials provided to the Committee may be made available to the general public.

REGULATION CHANGE PETITIONS

As a general rule, requests for regulatory change need to be redirected to the full Commission and submitted on the required petition form, FGC 1, titled “Petition to the California Fish and Game Commission for Regulation Change” (Section 662, Title 14, CCR). However, at the Committee’s discretion, the Committee may request that staff follow up on items of potential interest to the Committee and possible recommendation to the Commission.

SPEAKING AT THE MEETING

Committee meetings operate informally and provide opportunity for everyone to comment on agenda items. If you wish to speak on an agenda item, please follow these guidelines:

1. Raise your hand and wait to be recognized by the Committee co-chair(s).
2. Once recognized, please begin by giving your name and affiliation (if any) and the number of people you represent.
3. Time is limited; please keep your comments concise so that everyone has an opportunity to speak.
4. If there are several speakers with the same concerns, please try to appoint a spokesperson and avoid repetitive comments.
5. If you would like to present handouts or written materials to the Committee, please provide five copies to the designated staff member just prior to speaking.
6. If speaking during public forum, the subject matter you present should not be related to any item on the current agenda (public comment on agenda items will be taken at the time the Committee members discuss that item). As a general rule, public forum is an opportunity to bring matters to the attention of the Committee, but you may also do so via email or standard mail. At the discretion of the Committee, staff may be requested to follow up on the subject you raise.

VISUAL PRESENTATIONS/MATERIALS

All electronic presentations must be submitted by the written materials deadline **(July 15 at 12 noon)** and approved by the Commission executive director before the meeting.

1. Electronic presentations must be provided by email or delivered to the Commission on a USB flash drive by the deadline.
2. All electronic formats must be Windows PC compatible.
3. It is recommended that a print copy of any electronic presentation be submitted in case of technical difficulties.
4. A data projector, laptop and presentation mouse will be available.

LASER POINTERS may only be used by a speaker during a presentation.

2. PUBLIC FORUM

Today's Item **Information** ☒ **Direction** ☐

Receive public comments for items not on the agenda.

Summary of Previous/Future Actions (N/A)

Background

The Committee generally receives two types of correspondence or comment under public forum: Requests for the Committee to consider new topics, and informational items. As a general rule, requests for regulatory change need to be redirected to the full Commission and submitted on the required petition form, FGC 1, titled "Petition to the California Fish and Game Commission for Regulation Change" (Section 662, Title 14, CCR). However, at the discretion of the Committee, staff may be requested to follow up on items of potential interest to the Committee and possible recommendation to the Commission.

Significant Public Comments (N/A)

Recommendation

If the committee wants to recommend any new future agenda items based on issues raised and within the FGC's authority, staff recommends holding for discussion under today's Agenda Item 13.(B), *Potential new agenda topics for FGC consideration*.

Exhibits (N/A)

Committee Direction/Recommendation (N/A)

COMMITTEE STAFF SUMMARY FOR JULY 21, 2016

3. AGENCY UPDATES

Today's Item **Information** ☒ **Direction** ☐

Receive updates from other government agencies on marine items.

Summary of Previous/Future Actions (N/A)

Background

This is a standing item for DFW, Ocean Protection Council (OPC), and other government agencies to provide an update on marine-related items of interest.

A. OPC: An OPC staff member (TBD) is scheduled to provide an update.

B. DFW Marine Region: Dr. Craig Shuman, Regional Manager, will provide an update on recent activities.

C. DFW Law Enforcement Division: Assistant Chief Steve Riske will provide an enforcement update.

Significant Public Comments (N/A)

Recommendation (N/A)

Exhibits (N/A)

Committee Direction/Recommendation (N/A)

4. RED ABALONE FMP

Today's Item **Information** ☒ **Direction** ☐

Progress update on red abalone fishery management plan (FMP) timeline and public involvement.

Summary of Previous/Future Actions

• FGC accepts MRC recommendation to develop red abalone FMP	Oct 8, 2014; Mt Shasta
• Most recent update on FMP process	Mar 21, 2016; MRC, Los Alamitos
• **Today receive update on FMP process and timeline**	**Jul 21, 2016; MRC, Petaluma**

Background

This is a standing item to update the MRC on DFW progress developing a fishery management plan (FMP) for the red abalone fishery. The FMP has been under development since 2014 to develop an FMP for the existing northern California recreational red abalone fishery, separate from recovery under the FGC-adopted Abalone Recovery and Management Plan (ARMP),.

In Mar 2016, DFW staff reported that an extended timeline would be needed to provide for efforts to increase public outreach based on stakeholder interest; specifically that a public workshop in conjunction with The Nature Conservancy was scheduled for early May to discuss development of a harvest control rule, including options for integrating abalone size measurements (Exhibit 1). Today CDFW will provide an update for the FMP timeline, and an overview of the results from the public workshop.

Recent changes in environmental conditions affecting red abalone are also been tracked. In Feb 2016, FGC received a presentation from DFW staff working on the red abalone FMP on an unexpected set of environmental conditions it referred to as the "perfect storm." The "perfect storm" of conditions resulted from several large-scale stressors that led to significant biological impacts and ecological imbalance, notably the collapse of kelp forest species (Exhibit 2). This required redirection of abalone FMP staff focus to evaluate the impacts, resulting in further delay to the FMP process. In conjunction with the FMP update at this MRC meeting, DFW will also provide an update on the status of those conditions.

Significant Public Comments (N/A)

Recommendation (N/A)

Exhibits

1. CDFW News – Abalone Public Workshop Scheduled
2. DFW presentation to FGC, Feb 10, 2016

Committee Direction/Recommendation (N/A)

5. PACIFIC HERRING FMP

Today's Item **Information** ☒ **Direction** ☐

Receive DFW update on planning process to develop a Pacific herring fishery management plan.

Summary of Previous/Future Actions

- Receive DFW update on FMP contract Mar 21, 2016; MRC, Los Alamitos
- **Today receive update on FMP process** **Jul 21, 2016; MRC, Petaluma**

Background

A critically important forage species in California and the west coast, FGC annually adopts commercial herring regulations to establish fishing quotas, pursuant to Section 163, Title 14, California Code of Regulations. Quotas are proposed based on herring spawning population size estimates from DFW surveys. At the Mar 2016MRC meeting, DFW provided an overview of the 2015-16 herring fishery, and implications for possible regulation changes this fall.

FGC and DFW have identified Pacific herring as a priority fishery for developing an FMP as mandated in the Marine Life Management Act. For over two years, a collaborative working group of herring fleet leaders, staff from conservation non-governmental organizations, and DFW staff, has been developing a vision and concepts for an FMP. A contract manager was recently hired to assist with FMP development. Today, DFW will introduce contracted project manager Sarah Valencia and provide updates on the status of FMP development, stock assessment peer review, and tribal consultation processes.

Significant Public Comments (N/A)

Recommendation (N/A)

Exhibits (N/A)

Committee Direction/Recommendation (N/A)

COMMITTEE STAFF SUMMARY FOR MARCH 21, 2016

6. MLMA MASTER PLAN

Today's Item **Information** ☒ **Direction** ☐

Receive DFW update on progress in efforts to review and amend the current FGC-adopted master plan for fisheries pursuant to the Marine Life Management Act (MLMA).

Summary of Previous/Future Actions

- Received overview of plan and timeline — Nov 4, 2015; MRC, Ventura
- Update on progress — Mar 21, 2016; MRC Los Alamitos
- **Today's update on progress** — **Jul 21, 2016; MRC Petaluma**

Background

The MLMA, enacted in 1998, directs DFW and FGC to manage state fisheries sustainably through an ecosystem-based approach (§ 7050 et seq., Fish and Game Code). To help achieve its goals, the MLMA calls for developing a master plan that specifies the process and resources needed to prepare, adopt and implement fishery management plans (FMPs) for fisheries managed by the state (§ 7073, Fish and Game Code). The master plan is intended to help focus management effort on the highest priority species and to describe the specific tools and approaches to be applied in achieving the goals of the MLMA.

The current master plan for fisheries was developed by DFW with input from stakeholders and adopted by FGC in 2001 (see www.wildlife.ca.gov/Conservation/Marine/Master-Plan). An effort to amend the master plan is currently underway to broaden the policy scope of the document and facilitate moving more fisheries under active management and FMPs, as envisioned in the MLMA. Given the significance and value of this undertaking, DFW's Marine Region has established it as a priority in its current strategic work plan.

In Nov 2015, DFW provided an overview of the background, scope, and proposed approach to amend the MLMA master plan for fisheries. In Mar 2016, DFW updated the MRC on the four-phase process to update the Master Plan for Fisheries. Today DFW will provide an update on the MLMA Amendment Process including a revised timeline, draft framework, and updated FAQ sheet (exhibits 1-4).

Significant Public Comments (N/A)

Recommendation (N/A)

Exhibits

1. DFW Memo- Update on Marine Life Management Act Master Plan Amendment, received Jul 8, 2016
2. Overview of Draft Amended Framework for MLMA-Based Management, dated Jul 2016
3. MLMA Master Plan Amendment Process Timeline, dated Jul 2016 *(Note: Corrected copy provided Jul 19, 2016)*
4. MLMA Master Plan for Fisheries Amendment Process Frequently Asked Questions, dated Jul 2016

Committee Direction/Recommendation (N/A)

7. ECOLOGICAL IMPACT ASSESSMENT TOOL IN MPAS

Today's Item **Information** ☒ **Direction** ☐

Update on progress and completion of new ecological impact assessment tool for scientific collecting permit applications in marine protected areas (MPAs).

Summary of Previous/Future Actions

- Most recent update on tool development Nov 5, 2014; MRC, Los Alamitos
- **Today's update on progress and pilot application Jul 21, 2016; MRC, Petaluma**

Background

Two goals within the MLPA: 1) Improvement of scientific research opportunities within MPAs, and 2) protecting populations, biodiversity, and habitat, may conflict unless science-based removal of organisms within MPAs is managed. DFW gives special consideration to scientific collecting permit applications that propose to remove organisms from MPAs to conduct their research. To assist DFW in improving the rigor of their evaluation, and consideration of multiple projects, DFW requested assistance from the OPC's Science Advisory Team. A workgroup of this team has met since June 2012 to develop a tool for this purpose. DFW has previously provided the MRC with an overview and updates on tool development (most recently in Nov 2014), and its potential applications in management of research within MPAs.

Today, Brian Owens from DFW, and Dr. Karina Nielsen, from the SAT working group, will provide an update on the tool and will detail its progress, status of completion, and pilot application (exhibits 1 and 2). DFW has also submitted an executive summary of the framework that outlines the four step approach to the decision-making process, its ecological impacts, impact thresholds, and benefits of use (Exhibit 3).

Significant Public Comments (N/A)

Recommendation (N/A)

Exhibits

1. DFW Transmittal Memo, dated Jul 1, 2016
2. DFW presentation for Jul 21, 2016 MRC meeting
3. Executive Summary: Scientific Research in Marine Protected Areas - Development of a Novel Ecological Impact Assessment Framework, dated Jun 20, 2016

Committee Direction/Recommendation (N/A)

COMMITTEE STAFF SUMMARY FOR JULY 21, 2016

8. FISHING COMMUNITIES

Today's Item **Information** ☒ **Direction** ☐

Receive update on California's fishing communities and summary of Jul 20 public meeting, consider next steps

Summary of Previous/Future Actions

- Initial discussion on fishing communities — Mar 4, 2015; MRC, Marina
- Continue discussion on fishing communities — Nov 4, 2015; MRC, Ventura
- Public meeting and discussion — Jul 20, 2016; Public Meeting, Petaluma

Background

Discussions in Mar and Nov 2015 between the MRC and members of various fishing communities demonstrated the potential value in expanding the conversation surrounding challenges facing California's coastal communities and providing additional time through a public meeting dedicated to the topic. At the direction of the MRC, a public meeting was held Jul 20, 2016 in Petaluma. Today, staff will provide highlights from the discussion and explore how to move forward. The agenda from the public meeting is included as Exhibit 1.

Significant Public Comments (N/A)

Recommendation (N/A)

Exhibits

1. Agenda, Fishing Communities Public Meeting, Jul 20, 2016, Petaluma

Committee Direction/Recommendation (N/A)

9. BYCATCH WORKGROUP

Today's Item **Information** ☒ **Direction** ☐

Receive an update on the progress of the Fisheries Bycatch and Incidental Take Workgroup (BWG).

Summary of Previous/Future Actions

- BWG first meeting — May 18, 2016; BWG, Santa Barbara
- **Today's progress update** — **Jul 21, 2016; MRC, Petaluma**

Background

On May 18, 2016, the BWG held its first meeting in Santa Barbara with 14 members of the public attending (see staff summary in Exhibit 1). In preparation for future meetings, BWG subgroups were formed to work on specific topics for future BWG consideration, and FGC staff agreed to provide a draft workgroup work plan for BWG members to review for submittal to the MRC. At this meeting, staff will provide an update on work plan drafting progress and next steps.

Significant Public Comments (N/A)

Recommendation

Discuss and provide direction to workgroup on work plan focus, if warranted.

Exhibits

1. Bycatch workgroup meeting summary, May 18, 2016

Committee Direction/Recommendation (N/A)

10. OCEAN ACIDIFICATION AND HYPOXIA

Today's Item **Information** ☒ **Direction** ☐

Informational presentation panel and discussion regarding Ocean Acidification and Hypoxia.

Summary of Previous/Future Actions (N/A)

Background

An item previously referred to the MRC, today three informational presentations will be provided by representatives of the Ocean Protection Council (OPC) and California Natural Resources Agency (CNRA), the fishing community, and California Ocean Science Trust (OST), including an overview of major findings of the West Coast Ocean Acidification & Hypoxia Science Panel (OAH Science Panel) convened by the OST on behalf of OPC.

A. OST: Emily Knight of Ocean Science Trust will provide an overview of major findings, recommendations, and actions from the OAH Science Panel, which was released in April 2016 (Exhibit 1). A specific focus on fisheries will be offered.

B. Commercial Fishing Industry Perspective: Bruce Steele, a Southern California fishing representative that has actively engaged in ongoing public and policy dialogue about OAH, will provide a brief overview based on his study and observations of how eelgrass and kelp might provide benefits to offset ocean acidification impacts.

C. OPC/CNRA: Jennifer Phillips will discuss how CNRA and OPC are viewing the OAH Science Panel report, goals for action and provide potential roles for FGC engagement.

Significant Public Comments (N/A)

Recommendation

Explore opportunities for FGC to consider OAH in its decision-making, with the panel's recommendations in mind.

Exhibits

1. OAH Panel Key Findings, Recommendations, and Actions, dated Apr 2016

Committee Direction/Recommendation (N/A)

11. FINDING DORY - ENVIRONMENTAL STEWARDSHIP

Today's Item **Information** ☒ **Direction** ☐

Finding Dory: Opportunities to encourage environmental stewardship

Summary of Previous/Future Actions (N/A)

Background

Media has the potential to indirectly impact biological resources. Effects from the release of movies, such as Pixar's current film "Finding Dory", can lead to an increased demand for the species featured in the movie. For example, after the film "Finding Nemo" was released, a spike in sales of already-declining clownfish occurred, leading to over-collection in some locations. This highlighted the need to balance wild conservation with economic opportunities such as a healthy aquarium trade, through sustainable sourcing and captive breeding (e.g., University of Queensland clownfish breeding program and non-profit collaborations like savingnemo.org). However the media impact on demand for wild populations of "charismatic species" is not documented well enough to predict potential results. In the case of the movie "Finding Dory", Dory is a Blue Tang, In contrast to clownfish, blue tang, and sister-species in the surgeonfish family, is not listed as threatened by the Convention on the International Trade in Endangered Species (CITES), although it has experienced limited success under aquarium trade captive breeding to date.

Significant Public Comments (N/A)

Recommendation

Suggests a discussion about how FGC can encourage Californians to know the source in order to support sustainable operations with all aquarium purchases, as with all fisheries. Staff has reached out to Pixar and is exploring possible avenues to support this messaging.

Exhibits (N/A)

Committee Direction/Recommendation (N/A)

12A. UPDATES: MARINE DEBRIS

Today's Item **Information** ☒ **Direction** ☒

Update on topics previously before the Committee: Marine Debris

Summary of Previous/Future Actions

- Informational presentations on marine debris — Mar 21, 2016; MRC, Los Alamitos
- FGC approved MRC recommendation — Apr 13-14, 2016; Santa Rosa
- **Today's update** — **Jul 21, 2016; MRC, Petaluma**

Background

FGC referred this topic to the MRC in Feb 2016 to discuss concerns over marine debris and plastic pollution in California's coastal waters and ocean ecosystem. The FGC previously discussed several issues that fall under this broad topic, ranging from *land-based* activities to *ocean-based* activities leading to *floating* or *submerged* marine debris. This includes plastics originating from land, and several ocean-based activities such as lost gear associated with fishing and shellfish aquaculture. These all have the potential to harm to marine wildlife through ingestion, entanglement, or habitat disruption.

In Mar 2016, the MRC received informational briefings from three invited speakers on marine debris and plastic pollution and discussed actions and opportunities at local, state and federal levels. Based on discussion, the MRC recommended and FGC approved staff to coordinate with the California Ocean Protection Council (OPC) regarding possible efforts to jointly address marine debris (e.g., interagency workgroup or a possible multi-stakeholder workshop to share ideas). Today provides an opportunity to hear an update on this effort and a range of other current marine debris issues.

1. OPC update: Today, Holly Wyer from OPC will provide an overview of initial planning for a process to update the 2008 multi-agency OPC Implementation Strategy for the 2007 OPC Resolution to Reduce and Prevent Ocean Litter (exhibits 1 and 2). The update is envisioned to highlight progress and expand NGO and public stakeholder involvement opportunities. In relation to FGC's interest, Ms. Wyer will highlight efforts to engage and coordinate with FGC as well as NOAA's Marine Debris Program.

2. Plastics bag ban status and new referendum: The first statewide ban on single-use plastic bags in grocery stores, passed under SB 270 by the Legislature in 2014 (Exhibit 3), reflects alignment with OPC goals reflected in its resolution and strategy noted above. However, the new state law was stayed due to qualifying of a voters' referendum by opponents of the ban. Staff will briefly highlight the "California Plastic Bag Ban Referendum", Proposition 67, which will be on the Nov 8, 2016 ballot in California as a veto referendum that would overturn or uphold the legislation banning plastic bags under SB 270.

3. Lost fishing gear: Efforts to reduce frequency of whale entanglement in fishing gear are continuing through industry best management practices, as well as introduction of SB 1287 by Senator McGuire, which would facilitate retrieval of lost or abandoned Dungeness crab traps through a DFW-established retrieval permit program.

4. Managing debris from state water bottom leases for aquaculture: As reported at Jun 2016 FGC meeting, DFW staff will be working with growers and the public to identify categories for best management practices in future regulations. DFW is targeting Nov for MRC update. Mr. Richard James, Tomales Bay Resident, is approved to give a brief presentation on the topic.

Significant Public Comments (N/A)

Recommendation

1. Receive input on ways that FGC might engage in addressing marine debris concerns, including possible coordination with other agencies, or with collaborative efforts underway such as efforts to reduce risk of whale entanglements from fishing gear.
2. Consider a staff update on Proposition 67 at the Oct FCG meeting (prior to Nov ballot vote)
3. Participate to the extent feasible with OPC update to the 2008 implementation plan

Exhibits

1. California OPC Resolution on Reducing and Preventing Marine Debris, dated Feb 8, 2007
2. Link: http://www.opc.ca.gov/webmaster/ftp/pdf/opc_ocean_litter_final_strategy.pdf
3. "Ballotpedia" overview of California Plastic Bag Ban Referendum, Proposition 67 (2016)
4. SB 270 (2014) Solid waste single-use carryout bags - Bill Text

Committee Direction/Recommendation (N/A)

12B. UPDATES: PIER AND JETTY FISHING

Today's Item **Information** ☒ **Direction** ☐

Receive update on pier and jetty fishing review, a topic previously before the Committee

Summary of Previous/Future Actions

- Discuss pier fishing incident and restrictions Nov 5, 2014; MRC, Los Alamitos
- Update on pier fishing follow-up/outreach Nov 4, 2015; MRC, Ventura

Background

This topic originated from an incident in summer 2014 that led to actions taken or proposed by cities of Manhattan Beach and Hermosa Beach, respectively, to close or restrict fishing on their public piers. FGC and other State agencies responded directly to the city managers and councils that these taken or proposed actions were found by to be solely within the authority of the State (see Exhibit 1 for background).

Following discussion at the Nov 2014 MRC meeting, FGC supported a staff review of pier and jetty fishing concerns as well as municipal codes and rules governing fishing from individual piers in Southern California, beginning with hotspot piers in Los Angeles County.

Following that time, a combination of public outreach efforts related to fishing on piers in LA county, such as public forum roundtables with city managers and councils, sport fishing organizations and NGOs (including a joint workshop between Heal the Bay and FGC staff), reflected the potential effectiveness of outreach and education efforts in lieu of State regulatory action.

Today's update was prompted by public comment at the Apr 2016 FGC meeting identifying potential concerns regarding pier fishing restrictions on several "hotspot" piers in Southern California. Staff will provide an update on recent review of fishing restrictions at the identified hotspot piers.

Significant Public Comments (N/A)

Recommendation (N/A)

Exhibits

1. Staff summary with additional subject background from Nov 2014 MRC meeting

Committee Direction/Recommendation (N/A)

13. FUTURE TOPICS

Today's Item **Information** ☒ **Direction** ☒

Review upcoming agenda items scheduled for upcoming MRC meetings, hear requests from DFW and interested stakeholders for future agenda, and identify new items for consideration.

Summary of Previous/Future Actions

- **Consider Nov MRC topics** **Jul 21, 2016; MRC Petaluma**
- FGC approves draft Nov MRC topics Oct 19-20, 2016; Eureka

Background

Committee topics are referred by FGC and scheduled as appropriate. FGC-referred topics and draft schedule are shown in Exhibit 1. MRC agendas currently include several complex and time-intensive topics. The committee placed emphasis on issues of imminent regulatory importance, and thus consideration of new topics will require planning relative to existing committee workload.

Agenda topics identified for the Nov 2016 MRC meeting include:

- Abalone Fishery Management Plan (FMP) update
- Fisheries Bycatch Workgroup update
- MLMA Master Plan for Fisheries revision update
- Kelp and algae harvest management review

Other work plan topics to potentially schedule for Nov 2016 include:

- Herring FMP development update
- California's fishing communities update
- Marine debris update

Two new topics were identified at Jun 2016 FGC meeting for potential referral to MRC in Nov:

- Nearshore Fishery Permit structure petition: Update on DFW review
- Developing best management practices (BMPs) for state water bottom leases for aquaculture

Significant Public Comments (N/A)

Recommendation

Review current rulemaking calendar (Exhibit 2) and draft MRC schedule, schedule or re-schedule recommended projects for 2016 or 2017, where possible, and consider any potential new topics to recommend. Staff supports adding the two new topics (nearshore fishery and aquaculture BMPs) on a timeline that DFW can be prepared to discuss them.

Exhibits

1. MRC 2016 Work Plan, updated Jul, 2016
2. Perpetual Timetable for FGC Anticipated Regulatory Actions, updated Jun 24, 2016

Committee Direction/Recommendation (N/A)

CDFW News

PUBLIC PARTICIPATION

Red Abalone Public Workshop to be Presented in Santa Cruz

APRIL 29, 2016 | KMACINTY

The California Department of Fish and Wildlife (CDFW (http://www.wildlife.ca.gov/)) is currently working on a Fishery Management Plan (FMP) for the North Coast Recreational Red Abalone Fishery. As part of CDFW's efforts to encourage public participation in the plan development process, The Nature Conservancy (TNC) and CDFW will jointly conduct a workshop on the topic. TNC is providing financial support for the event.

The workshop, which is open and free to the public, will be held on Monday, May 2, from 9 a.m. to 5 p.m. at the UC Santa Cruz Horticulture II Building, Arboretum Conference Room. Directions to the workshop location can be found at http://maps.ucsc.edu/content/directions-uc-santa-cruz-campus (http://maps.ucsc.edu/content/directions-uc-santa-cruz-campus).

Fishery scientists, citizen scientists, anglers and managers attending the workshop will discuss options

for developing a control rule to manage the recreational red abalone fishery. Invited speakers will describe the use of control rules and available options for integrating abalone size measurements into a comprehensive framework for decision-making.

# # #

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ABALONE **PUBLIC WORKSHOP**

North Coast Abalone and Urchin Fisheries at Risk?

Dr. Cynthia Catton
Marine Region
Invertebrate Management Project
Cynthia.Catton@wildlife.ca.gov

Economically Important Fisheries

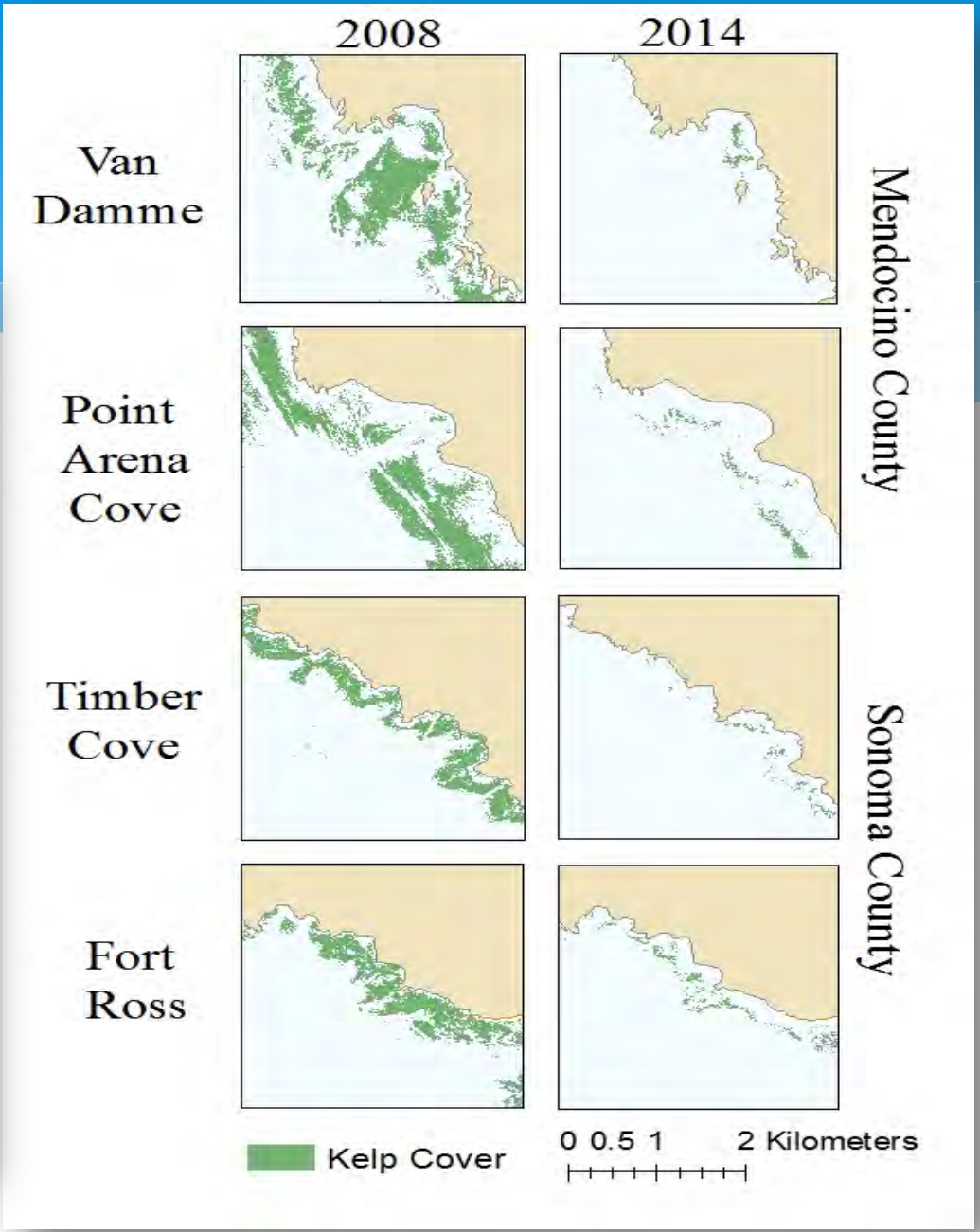
- **Recreational Red Abalone**
  ~$44 million dollars (non-market value)
- **Commercial Red Sea Urchin**
  ~$3 million dollars (ex-vessel value)

"The Perfect Storm": Multiple Large-Scale Stressors

* Kelp Forest Decline
  * Harmful Algal Bloom (2011)
  * Sea Star Wasting Disease (2013)
  * Purple Urchin Explosion (2014 -)
  * Persistent Warm Water (2014 -)

Kelp Fly-Over Data CDFW

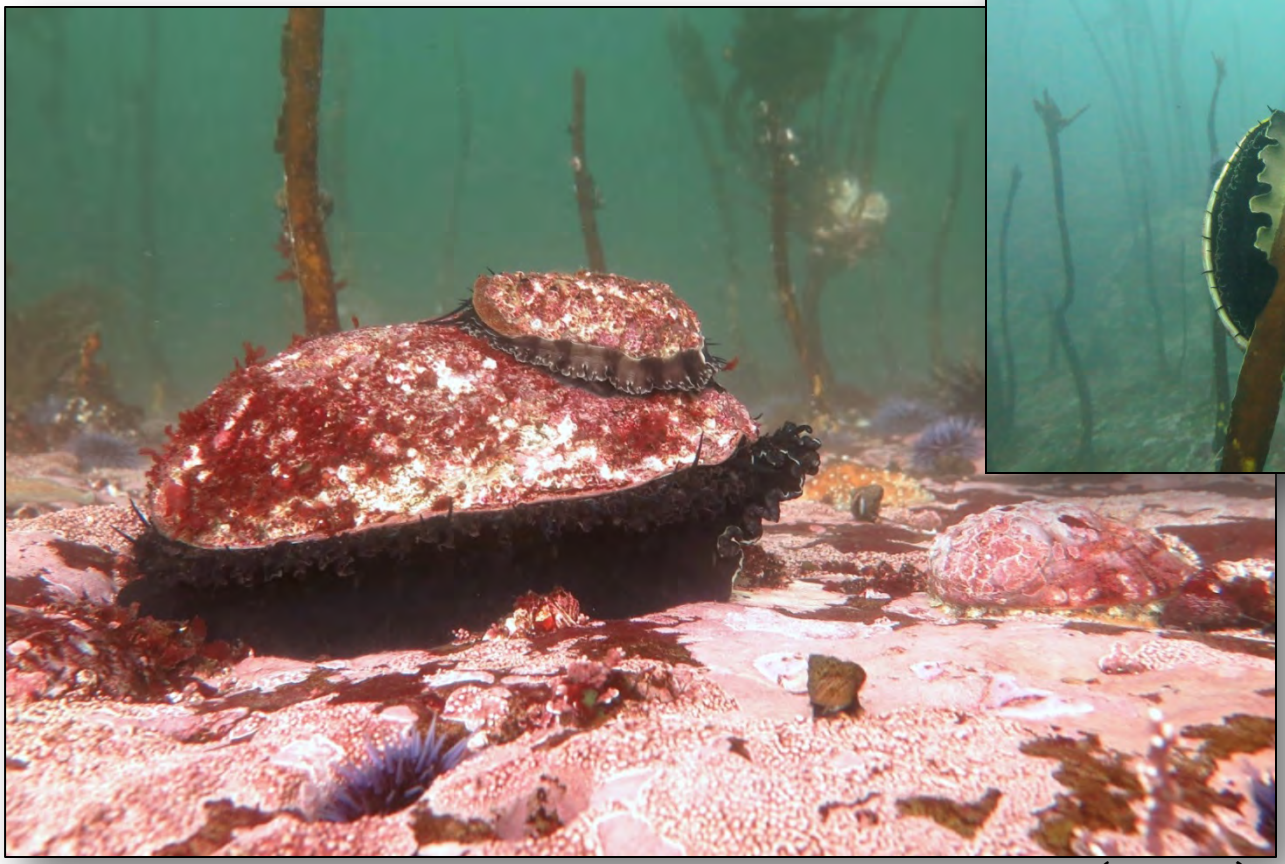
A. Weltz (CDFW)
Fort Ross 2015



Data M. Fredle

Starving Conditions in Northern California (2014-2015)

K. Joe (CDFW)


A. Maguire (CDFW)

Poor Fishery Product and Resource Health

66% drop

in north coast urchin catch and fishery value in 2015

Abalone and Shells Washed Up on Shore – Big Winter Storms

How did we get here?

A. Maguire (CDFW)

Harmful Algal Bloom (Red Tide)

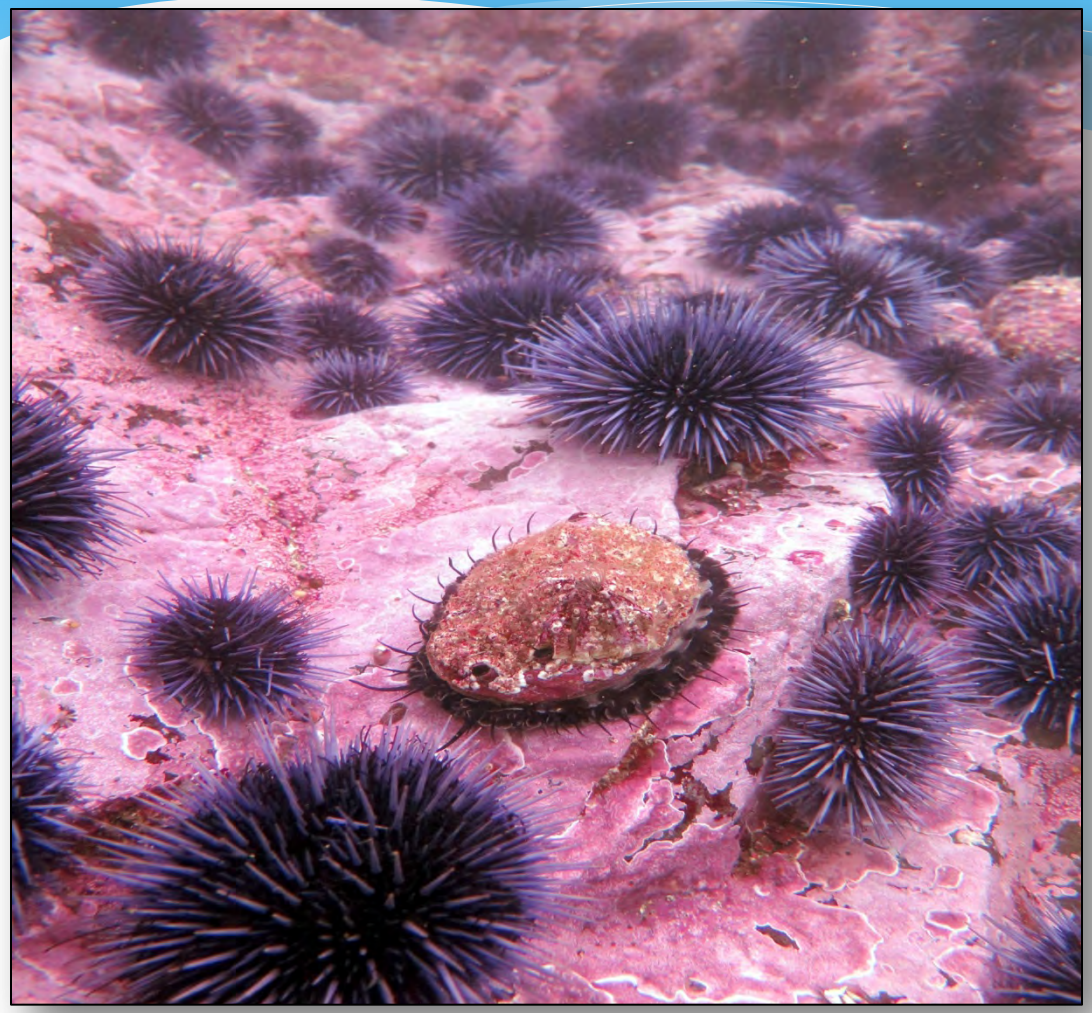
Sonoma County 2011

Photo:
Nate Buck
Fort Ross 2011

Sea Star Wasting Disease 2013

A. Maguire (CDFW)

Unprecedented Large-Scale Purple Sea Urchin Explosion in 2015

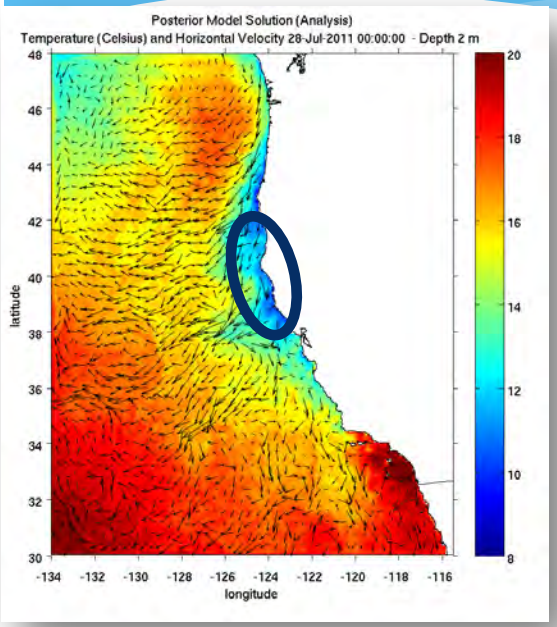


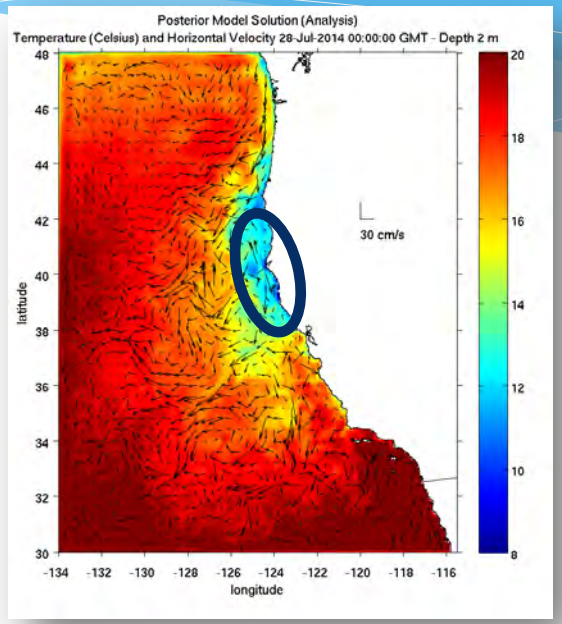
A. Maguire (CDFW)

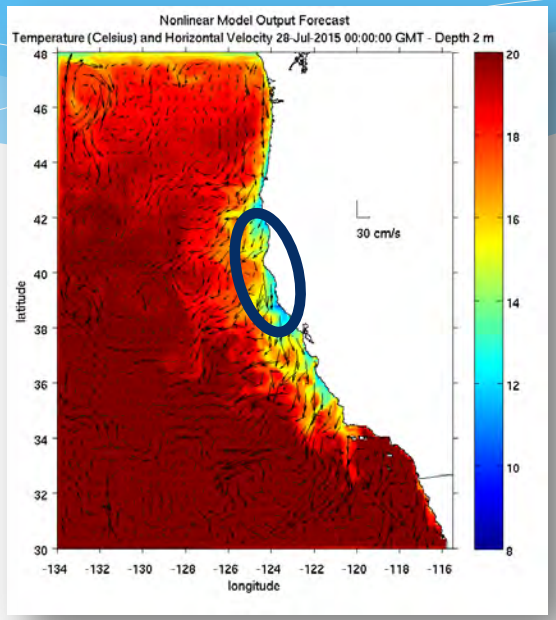
> 60x historic densities in N. California

Reports of high urchin numbers from Central California to Washington State

Persistent Warm Water Conditions







* July 28, 2011

Normal

* July 28, 2014

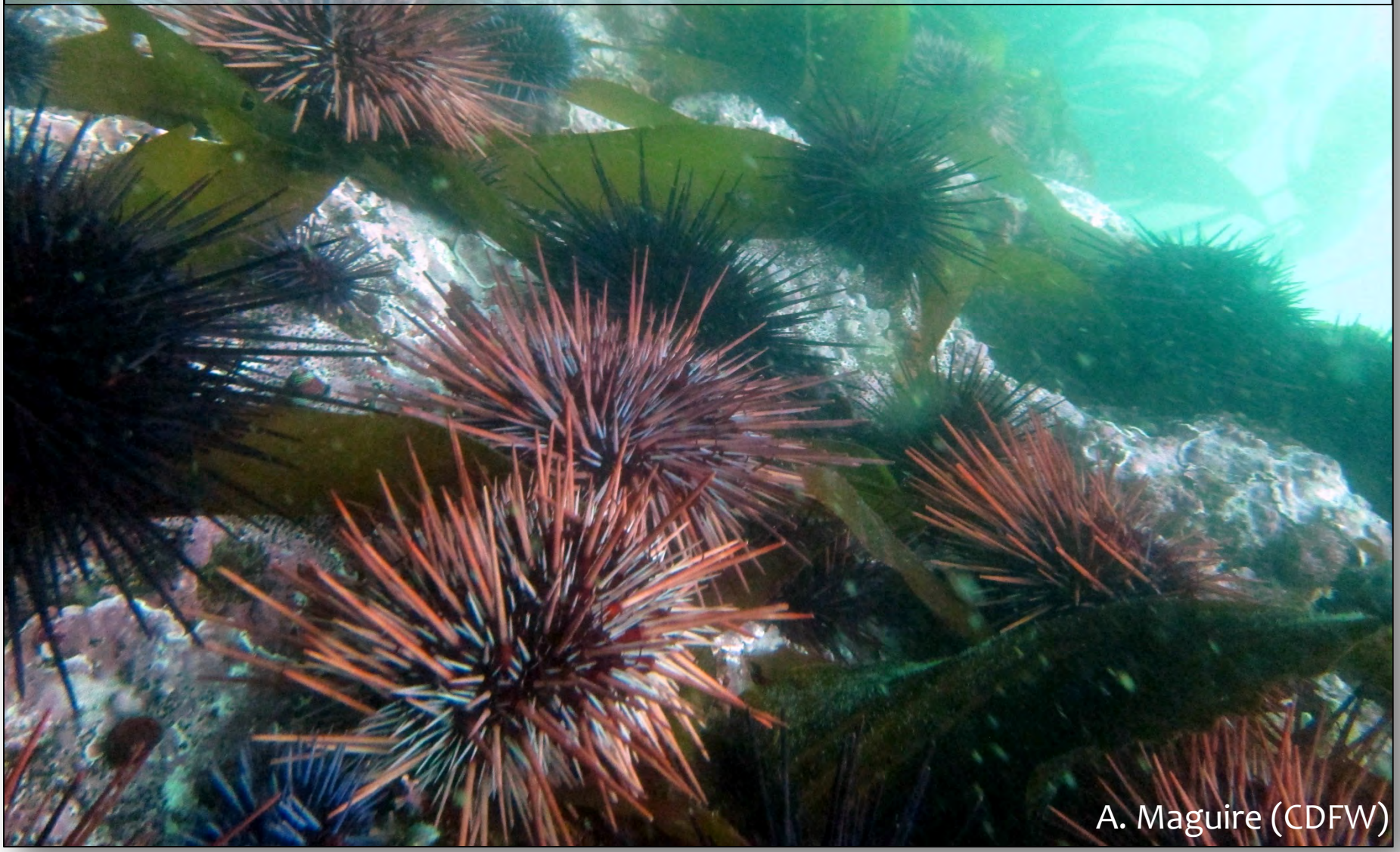
"Warm Blob"

* July 28, 2015

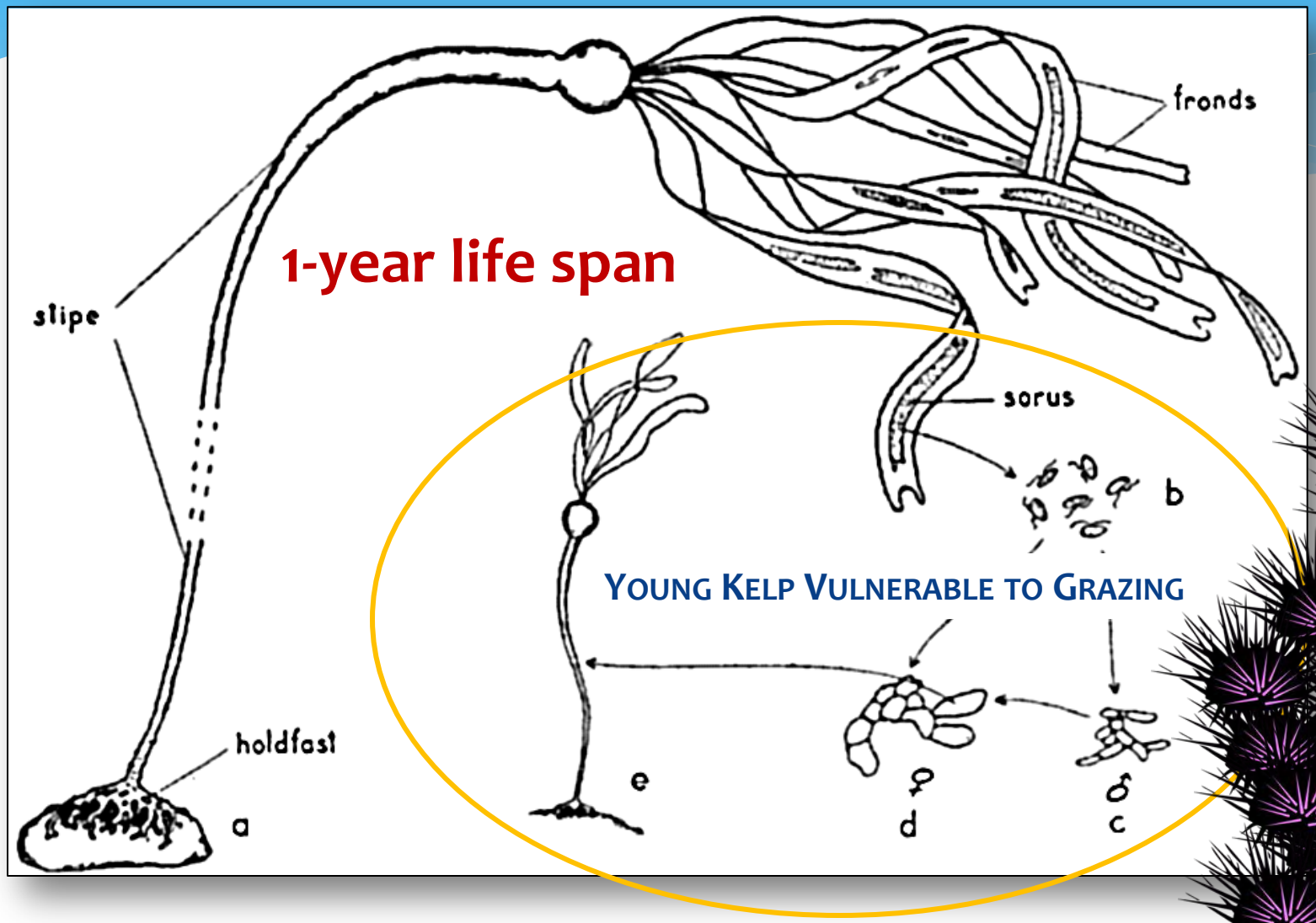
"Warm Blob" + Strong El Niño

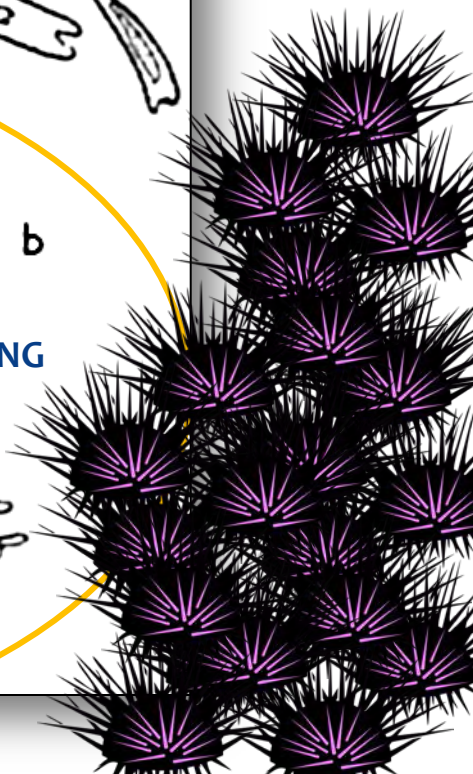
http://oceanmodeling.ucsc.edu/ccsnrt/webplots/latest/latest_SST.png

What do we expect in the future?



Concern for Bull Kelp Recovery





Kelp Forest Fisheries Are At Risk in Northern California

Expectations:

* Purple urchin barrens
* Poor red urchin and abalone fisheries
* Potentially negative impacts to rockfish populations
* Socioeconomic impacts to coastal communities

A. Maguire (CDFW)

What Are We Doing?

* Alert FGC, industry, science community, and the public
* Leverage CDFW knowledge of past conditions to understand future dynamics
  - Monitor abalone health and reproduction
  - Monitor future environmental conditions
  - Research bull kelp recovery potential

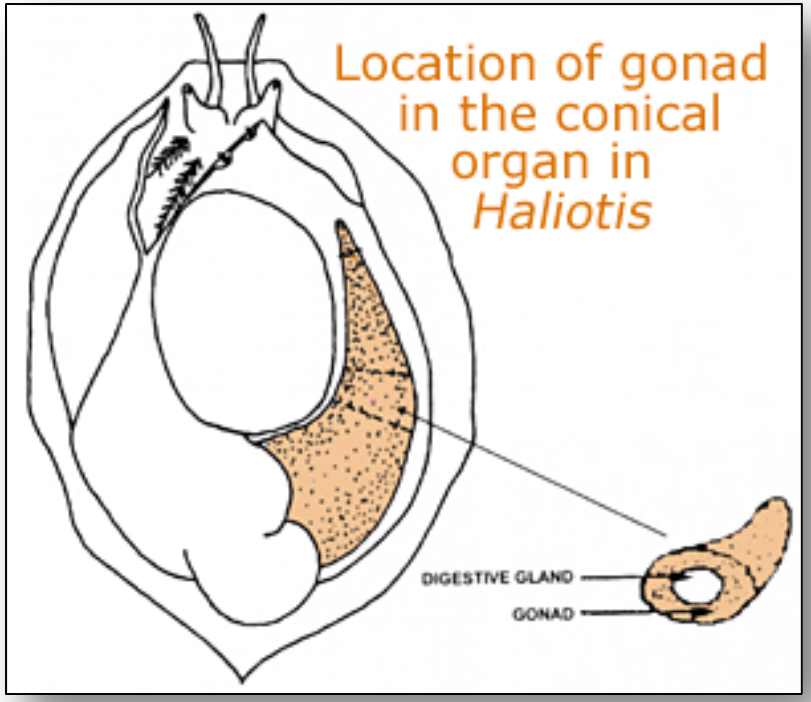
Thank you

A. Amrhein (CDFW)

K. Joe (CDFW)

Dr. Cynthia Catton
Marine Region
Invertebrate Management Project
Cynthia.Catton@wildlife.ca.gov

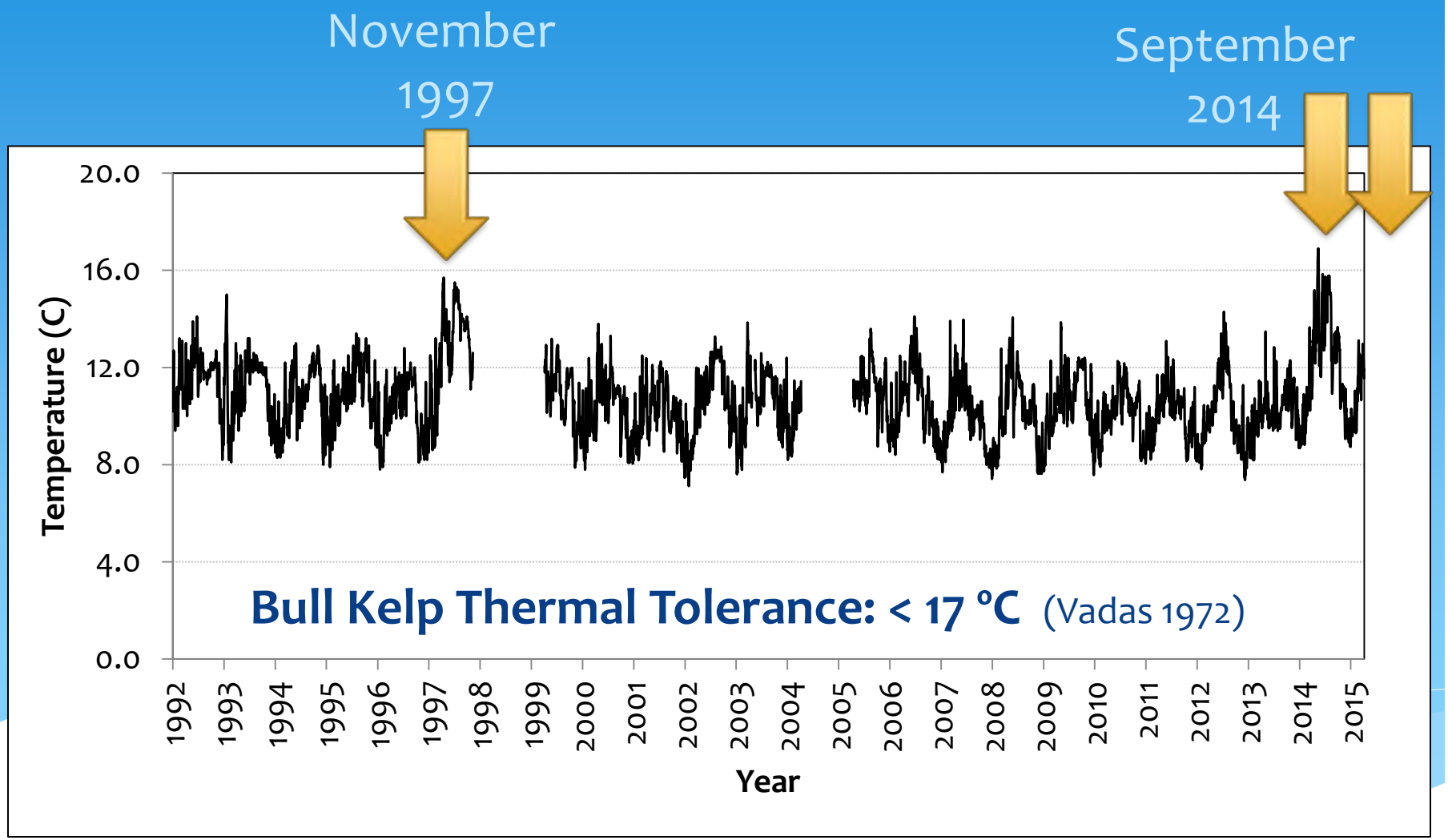
Gonad and Body Condition



Monitor Abalone Health and Reproduction

- Inspect abalone caught by fishermen (creel surveys)
- Compare indices of health and reproduction to past data

Daily Subtidal Seawater Temperature (10m) Mendocino County



Kelp Restoration Research
A CDFW / Urchin Industry Partnership

- **Remove urchins from multiple sites along the north coast**
- **Determine geographic scale of kelp recruitment potential**
- **Identify need and strategies for future kelp reforestation**

State of California
Department of Fish and Wildlife

M e m o r a n d u m

Date: July 8, 2016

To: Valerie Termini
Executive Director
California Fish and Game Commission

From: Craig Shuman
Regional Manager, Marine Region

Subject: Agenda Item for the July 21, 2016, Marine Resources Committee Meeting: Update on Marine Life Management Act Master Plan Amendment

At the July 21st Marine Resources Committee (MRC) meeting, the Department of Fish and Wildlife (CDFW) will be provide an update to the MRC describing the process and status of the Marine Life Management Act Master Plan (Master Plan for Fisheries) amendment.

The Master Plan for Fisheries is a planning document that describes how California fisheries are managed. It prioritizes fisheries according to the need for comprehensive management through fishery management plans. The Master Plan for Fisheries is intended to help focus management effort on the highest priority species and to describe the specific tools and approaches to be applied in achieving the goals of the Marine Life Management Act. The current Master Plan for Fisheries was developed by CDFW with input from stakeholders and adopted by the Fish and Game Commission in 2001.

Amending the Master Plan will provide a clear and explicit roadmap for fisheries management that reflects the updated interests and priorities of managers and stakeholders invested in a sustainable future for California's fisheries. It will also recognize opportunities to incorporate newly available fisheries management tools and approaches.

The Department has developed a suite of informational materials to orient the MRC and stakeholders on the proposed draft framework, timeline, and approach to amending the Master Plan for Fisheries. All components of the framework are still being developed and tested for relevance and feasibility and will be the focus of workshops and other discussions with stakeholders.

If you have any questions regarding this item, please contact Dr. Craig Shuman, Regional Manager, Marine Region at (805) 568-1246. Stakeholders and interested members of the public are invited to visit https://www.wildlife.ca.gov/Conservation/Marine/MLMA or contact MLMA@wildlife.ca.gov for more information.

Attachments
Attachment 1: Overview of Draft Amended Framework for MLMA-based Management
Attachment 2: MLMA Amendment Process Timeline
Attachment 3: MLMA Master Plan for Fisheries Amendment Process: Frequently Asked Questions (revised July 2016)

Overview of a Draft Amended Framework for MLMA-based Management

July 2016

The Marine Life Management Act (MLMA) is the guiding statute for ocean fisheries management in California. Enacted in 1999, this progressive law moved the state towards ecosystem-based management of its marine resources. This overview details some of the challenges with the current management approach, and the opportunity that revising the MLMA's work plan, the Master Plan for Fisheries, offers. It lays out a draft framework for prioritizing and scaling the intensity of management to the risks and potential benefits for each fishery, enabling more strategic allocation of limited funds and staff capacity to the fisheries that are in greatest need of management intervention. It also describes how this approach can be used to bring all fisheries in California up to a standardized level of management consistent with the MLMA. It is intended to serve as a road map, linking various information gathering projects that are underway together into a cohesive strategy and vision for the Master Plan amendment.

Before the MLMA, ocean fisheries were managed through adjustments in legislation or in regulation adopted by the Fish and Game Commission (Commission) as problems became evident. However, the MLMA called for comprehensive, proactive management of the state's ocean fisheries to achieve a set of common objectives and to meet certain standards. Since passage of the MLMA, implementation has focused largely on targeted rulemakings and on the preparation of fishery management plans (FMPs) for a few fisheries, often in response to legislative action. Controversy and complexity in these fisheries increased the intensity of FMP efforts and the demands on the California Department of Fish and Wildlife's (the Department) capacity. As a result, most of the state's fisheries have not fully benefited from the provisions of the MLMA.

The draft "Amended Framework for MLMA-based Management" proposed here addresses three needs: I) a process for prioritizing future management actions both among and within fisheries; II) a process for scaling those management actions to reflect the needs, risks, and values of each fishery together with the Department's capacity; and III) a means of conveying up-to-date fisheries information in a way that's easy for stakeholders, researchers, and the public to navigate and digest. This framework is depicted on Page 5. Projects on climate change, partnerships, stakeholder engagement, and peer review are underway and are anticipate to apply across the framework as appropriate. It is important to note that all components of the framework are still being developed and tested for relevance and feasibility and will be the focus of workshops and other discussions with stakeholders.

I. Prioritization Component

The prioritization component is intended to assess the need for management action in individual fisheries in a transparent and consistent fashion by conducting three types of analyses. Besides grouping fisheries as high, medium, or low need for management action, these analyses can also identify high priority actions that can be taken to improve management. These three analyses can be distilled into the following questions: 1) where are there risks?; 2) how well is current management addressing those risks?; and 3) where would confronting those unaddressed risks have the most biological, economic, social, or administrative benefit?

Analysis 1. Risk Assessment

Under the draft prioritization section of the framework, all fisheries go through a risk assessment to identify and evaluate any ecological and/or biological risks posed by fishing. This assessment is composed of two assessments: a Productivity Susceptibility Analysis (PSA), which assesses the risks to a particular stock, and an Ecological Risk Assessment (ERA), which assesses the risk a fishery poses to the ecosystem. California Ocean Science Trust (OST) is currently conducting a PSA on 45 of the state's most significant fisheries in terms of commercial value

and recreational participation. OST will also be adapting an ERA framework for California and applying it to five fisheries as an initial pilot.

The draft prioritization section of the framework would use the results of the Risk Assessment to classify fisheries as being of low, medium, or high concern. Those fisheries classified as medium or high-risk move on to the next steps of the prioritization framework, while those classified as posing a low risk are not an initial priority for additional management.

Analysis 2. Assessing Management Effectiveness - MLMA-based Assessment

The next analysis evaluates a fishery's level of consistency with the MLMA. The first step in this analysis is an assessment of the degree to which management is consistent with the full range of the MLMA's objectives. The second step is a specific assessment of the degree to which risks identified in the Risk Assessment are being addressed by current management. The Center for Ocean Solutions is currently developing the draft MLMA-based assessment framework. If the Department determines the tool is effective, those fisheries that are classified as having low or medium consistency with the MLMA, particularly in relation to the risk areas identified in the Risk Assessment step, would be candidates for additional analysis described below. Those fisheries where management is determined to have high consistency with the MLMA require no additional management actions, although triggers for reconsidering this assessment might be identified.

Analysis 3. Economic Value/Opportunity

All of the fisheries that have achieved this stage of analysis have been deemed to pose medium to high ecological and/or biological risks, and may have related deficiencies in terms of consistency with the MLMA. As a result, these fisheries will likely require additional management actions to address these risks and improve consistency with the MLMA. The last step in the prioritization framework assesses the relative tradeoffs to socio-economic impacts from more active management. Approaches to conducting such an analysis are being discussed, however relevant data are relatively limited.

Prioritization results

Under the draft prioritization section of the framework, fisheries would be categorized into three classes of concern, high, medium, and low. Generally, fisheries classified as high priorities for management would be the first to be considered for management action. In the absence of extenuating circumstances, additional management action, beyond preparation of the Enhanced Status Report described below, would be deferred on fisheries classified as medium or low priority.

II. Management Scaling Component

The fisheries that fall under the scope of the MLMA range widely in complexity, biological characteristics, number of participants, geographic extent, availability of data, management need, and other factors. The process described below is intended to incorporate this variability in the range of approaches to applying MLMA-based management, from expanded and better structured Status Reports to traditional, resource intensive FMPs. The draft management scaling component of the framework seeks to match the scope and intensity of management effort with the needs and complexity of a given fishery.

Defining the Management Continuum

Fisheries vary significantly regarding the appropriate level of management effort. For example, a small single sector fishery with low ecological and/or biological risk, that is largely consistent with the MLMA, and for which expected benefits from additional management are likely to be low may justify a lower level of response. Alternately, a large-scale, multi-sector fishery with conservation concerns and a high degree of controversy will likely demand a more intensive

effort. This may lead to implementation of the MLMA taking place along a continuum ranging from a basic level represented by an Enhanced Status Report, to an intensive, complex FMP process.

Low – Enhanced Status Report Alone

All fisheries would be the subject of an Enhanced Status Report. Building off current Status Reports, Enhanced Status Reports would be structured around the requirements of the MLMA itself, helping to ensure that included information is relevant to management under the MLMA. These reports would have sections on the history and socio-economics of the fishery, the biology and status of target stocks, ecosystem aspects of the fishery, past and current conservation measures, essential fisheries information (EFI), and monitoring. This revised format would ensure a basic standard of MLMA-based management is applied across all fisheries in a consistent and transparent fashion. It would summarize all of the available EFI for each fishery, and make it readily apparent what is not available. This structure is envisioned to assist the Department in planning both short and long-term research activities and inform external parties about research opportunities that may benefit management. Enhanced Status Reports can serve as a repository of information documenting the consistency of a fishery's management with the MLMA and the results of the analyses described above. They can also serve as sources of information for future analyses and FMP development.

Medium low - Status Reports Plus Focused Rulemakings

A second group of fisheries may need relatively simple adjustments in management to address specific risks or concerns identified in the prioritization analyses. These might include a modification to an existing regulation, or the creation of a new one, where the available science is sufficient to warrant the change and there is broad stakeholder support behind the change. Any rulemakings made in this context should be relatively non-controversial, easily enforceable, and applied to the entire fishery with relative ease. An Enhanced Status Report plus a tailored rulemaking to address relatively simple issues may be an effective combination for many lower risk fisheries. Similar to the revised approach to Enhanced Status Report, the content of these limited rulemakings could more explicitly track with the areas of concern identified in the MLMA.

Medium high to high - Scaled Fishery Management Plans

In cases where the degree of management change, fishery complexity, controversy, and information needs are high, an FMP may be required. The MLMA specifies what information must be included in an FMP, but does not specifically describe the process required to achieve that outcome. Rather than considering FMPs as having a process recipe in which there is a list of requirements to be checked off, it may be helpful to view the FMP as a graduated process, with increasing levels of intensity as required.

The resource demands on the Department and Commission may be reduced through several means, including process design, partnerships, and efficient stakeholder engagement, among other things. For example, creating Enhanced Status Reports early can help the Department to flag missing EFI in fisheries that have been prioritized for additional management action in the medium term.

Identifying where along the continuum of management a fishery belongs depends on, 1) the degree of management change required to address risk and improve MLMA consistency, 2) the complexity of the fishery and, 3) the type and amount of information needed. The level of management change has two essential components, the impact on the fleet from the anticipated changes, and the administrative difficulty for managers to implement them. A change in decision-making framework or from input to output based controls may constitute a major change. Examples of minor changes in the degree of management might include a modification to the gear used to prosecute the fishery. In addition to the anticipated degree of management change, the level of complexity of the fishery will influence the intensity of the public process as

well as the scope and scale of the resulting management document. Complexity criteria include the number of gear types, sector use and allocation, geographic distribution, and number of participants. Another key factor in determining the need for an FMP is whether existing statutes might conflict with the necessary changes to the fishery. By adopting an FMP, any conflicting statutes can be rendered inoperative for that particular fishery, allowing a great deal of management flexibility.

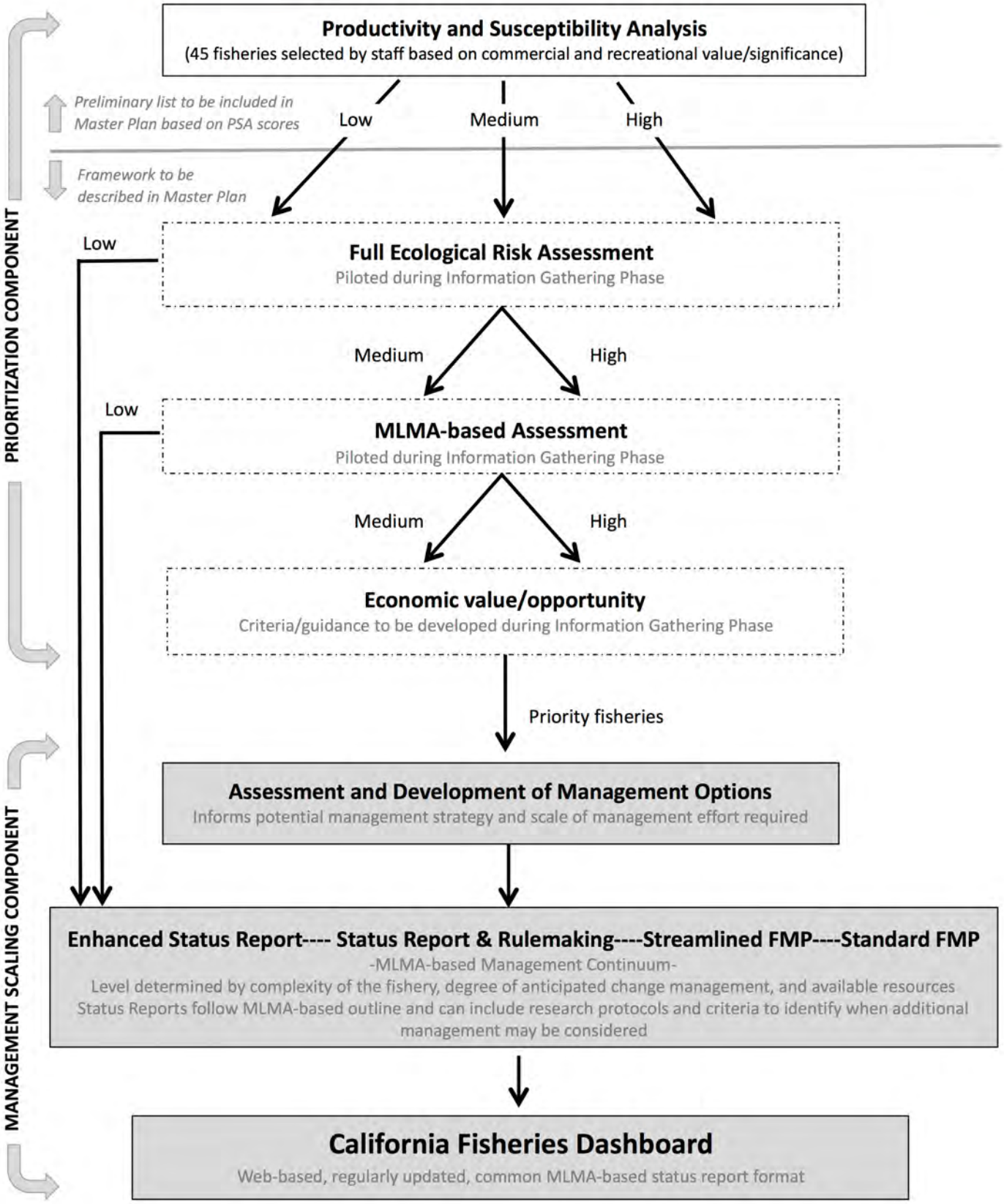
While the first component of the framework is designed to help focus limited Department capacity on fisheries of greatest concern, this management scaling component is intended to match the level of management effort and resources to the characteristics and needs of a given fishery. In many ways this provides an explicit framework around what is an intuitive approach and seeks to identify important criteria for managers and stakeholders to consider when scaling management efforts.

III. ***The Web-based Fishery Dashboard***

The information gathered throughout the prioritization and management processes could be housed and regularly updated on a web-based dashboard. The dashboard would be a user interface that organizes and presents information from status reports in a way that is easy to understand at a glance. At its core would be a front page where users could choose among the state's fisheries and learn basic information, with more details nested within specific categories. The tabbed page format would be common to all fisheries, and would break the information from each Enhanced Status Report into its major component parts, including tabs for "at-a-glance", "natural history", "the fishery", "ecosystem considerations", "management issues", and "research and monitoring". While substantial time and cost will be required upfront to develop the dashboard and its underlying database, once established it should be designed to be relatively simple to maintain and update. The web-based dashboard is envisioned to help promote transparency in fisheries management, foster public engagement, and focus academic research on areas of management relevance.

DRAFT- Amended Framework for MLMA-based Management

Development and implementation of this framework is contingent upon sufficient resources and capacity
Projects on climate change, partnerships, stakeholder engagement, and peer review apply across the framework
(Dashed boxes indicate tools or analyses that may be utilized if successfully developed in the information gathering phase)



Marine Life Management Act (MLMA) Master Plan Amendment Process

Overview

The California Department of Fish and Wildlife (CDFW) and its partners are amending the Marine Life Management Act (MLMA) Master Plan. The current Master Plan was adopted by the California Fish and Game Commission in 2001. Since then, priorities have evolved and new tools and approaches have become available that can improve fisheries management in California. The MLMA Master Plan amendment process will occur through 2018.

Goals

The MLMA Master Plan amendment is expected to:

- Enhance the sustainability of the state's ocean fisheries.
- Help ensure fisheries management is more efficient, effective, and streamlined.
- Establish a clear pathway detailing the management approach for each fishery.
- Foster transparency and flexibility in fisheries management with stakeholders and interested members of the public.

2015 | 2016 | 2017 | 2018

Engagement with California Tribal Governments

Stakeholder Engagement

Phase I: Build Knowledge

Gather Information

Resources are reviewed to help develop priorities, products, and tools for potential integration into the amended Master Plan:

- Fisheries Management Plans
- Lessons Learned from the MLMA
- "Information Gathering Projects" are launched to collect and consider socioeconomics, risk assessments, status of fisheries, monitoring programs, etc.

Tribal Engagement

Outreach to tribes and native communities is formally initiated.

Stakeholder Engagement

Initial outreach to community leadership is conducted to share information and build communication networks.

Draft Amendment Framework for MLMA-Based Management

A "Draft Amendment Framework for MLMA-Based Management" is made available for stakeholder review and input.

Phase II: Amend Master Plan

Stakeholder Input

There are multiple opportunities and platforms for stakeholders to provide feedback and guidance on key components of the amended Master Plan, including:

- Community workshops
- Web-based surveys
- Small group discussions

Prepare Draft Master Plan Amendment

CDFW will prepare a Draft Amended Master Plan that will be available for stakeholder review. The draft will be shared with tribes, and undergo a scientific peer review. Opportunities for stakeholder input and discussion will continue.

Late 2017: Submit Draft Master Plan to Fish and Game Commission

CDFW will present the Draft Amended Master Plan to the California Fish and Game Commission.

Phase III: Review and Possible Adoption

The goal is for an amended Master Plan to be adopted that reflects the interests and priorities of stakeholders invested in a sustainable future for California's fisheries.

The Amendment Team consists of CDFW, Ocean Protection Council, Resources Legacy Fund, and contractors to support project coordination and outreach. *For more information about the MLMA Master Plan Amendment process, visit* https://www.wildlife.ca.gov/Conservation/Marine/MLMA.

July 2016
Timeline subject to change

Marine Life Management Act Master Plan for Fisheries Amendment Process
Frequently Asked Questions
Updated July 2016

1. **What is the Marine Life Management Act Master Plan for Fisheries?**
   The Marine Life Management Act (MLMA) Master Plan for Fisheries (Master Plan) is a planning document that describes how California fisheries are managed. It prioritizes fisheries according to the need for comprehensive management through fishery management plans. The Master Plan is intended to help focus management effort on the highest priority species and to describe the specific tools and approaches to be applied in achieving the goals of the MLMA. The current Master Plan was developed by the Department of Fish and Wildlife (Department) with input from stakeholders and adopted by the Fish and Game Commission (Commission) in 2001.

2. **Why is the Master Plan for Fisheries being amended now?**
   The current Master Plan was adopted in 2001. Amending the Master Plan will provide a clear and explicit roadmap for fisheries management that reflects the updated interests and priorities of managers and stakeholders invested in a sustainable future for California's fisheries. It will also recognize opportunities to incorporate newly available fisheries management tools and approaches.

3. **Who is leading the effort to amend the Master Plan?**
   The Department's Marine Region is directing the effort. The Department is overseeing contractors assigned to specific tasks such as project coordination, outreach, meeting facilitation, editing, conducting analyses, etc.

4. **What are the goals of amending the Master Plan?**
   The goals of the Master Plan amendment are to:
   - Enhance the sustainability of the state's ocean fisheries;
   - Help promote more efficient, effective, and streamlined fisheries management;
   - Establish a clear pathway detailing the management approach for each fishery; and
   - Foster transparency and flexibility in fisheries management with stakeholders and interested members of the public.

5. **What are the benefits of amending the Master Plan?**
   Amending the Master Plan will help the Department and stakeholders develop shared expectations of what successful fisheries management and implementation of the MLMA looks like. It will reflect updated fisheries priorities and new management tools and approaches that can help fisheries achieve or maintain sustainability. For example, it may incorporate tools and approaches that have been developed over the last decade to better assess the status of stocks and ensure management measures are better tuned to the needs of fish populations and the fishing communities that depend on them. Successful implementation of these tools through an amended Master Plan can reduce risk and potentially result in greater fishing opportunity, improved access to the growing number of sustainability conscious markets, increased revenue, and greater adaptability to changing climate and oceanic conditions.

6. **Are there opportunities for stakeholder input to update the Master Plan for Fisheries?**
   Yes. The MLMA places significant emphasis on the role stakeholders and outside experts should play in the development of the Master Plan. There will be multiple opportunities and platforms for stakeholders to provide feedback and guidance on key components of the amended Master Plan, including, but not limited to, community workshops, small group discussions, and meetings of the Fish and Game Commission

and its Marine Resources Committee. Tribal engagement is an important component of the amendment process and was formally initiated by letters sent to California tribes in June 2016. A framework and subsequent draft of the Master Plan amendment will be available for public review and comment. Please see the timeline referenced in question 8 for further details.

7. **What is the timeframe for updating the Master Plan?**
   The Master Plan amendment process is a phased approach. An anticipated timeline is available that outlines each phase, available here. In brief:
   - Information Gathering Phase, 2015- 2016
     - Information gathering projects underway to develop work products and tools to be assessed by CDFW, with input from stakeholders, and potentially integrated into a draft amended Master Plan framework to inform the Amendment Phase.
     - Resources, including, but not limited to, existing Fisheries Management Plans (FMPs) and the MLMA Lessons Learned, are reviewed to help inform priorities, products, and tools for potential integration into the amended Master Plan;
     - Tribal consultation begins.
   - Amendment Phase, 2016 –2017
     - Tribes and stakeholder will be invited to review options developed in the Information Gathering phase and provide feedback and guidance on key components of the amendment;
     - Public workshops and other community outreach opportunities will take place during this phase.
     - The draft amendment will be prepared, available for stakeholder comments, and undergo a scientific peer review process;
     - The draft amendment will be presented to the Fish and Game Commission.
   - Implementation, 2018
     - The draft amendment will be considered and potentially adopted by the Fish and Game Commission.

8. **How will stakeholders be affected by the Master Plan amendment?**
   The Master Plan amendment will not change fishing regulations directly. Rather, it will establish priorities, policies, and approaches that will guide management in the future, making management more consistent and predictable. These policies are anticipated to include identifying fisheries that will most benefit from fishery management plans, identifying tools for assessing fish stocks and managing harvest, understanding when and how to consider socioeconomic impacts, how to integrate the marine protected area (MPA) network into fisheries management, and how best to engage stakeholders and build partnerships with fisheries managers.

9. **How are outside groups and funding involved in amending the Master Plan?**
   Partnerships are an important means of leveraging outside resources to expand the Department's capacity and improve management outcomes. Partners for this process include tribes and outside groups such as fishing associations and environmental groups to build knowledge and help develop priorities, products, and tools for potential integration into the amended Master Plan. In addition, funds from the Ocean Protection Council and the philanthropic community are helping to pay for facilitation and supporting analyses. The Department and the Commission are committed to maintaining the integrity and transparency of the process and all partnerships will be structured to achieve that goal.

10. **Does the Master Plan amendment process have any relationship to the Marine Life Protection Act Initiative?**
No. This is a separate effort under a different law. The Marine Life Protection Act (MLPA) Initiative was focused on redesigning California's system of marine protected areas (MPAs) to function as a network. The effort prohibited or restricted fishing in some areas with the goal of improving ecosystem function. By contrast, the MLMA and its implementation plan, the Master Plan for Fisheries, are focused on the compatible goals of improving fisheries management and on how to achieve sustainable and economically viable fisheries in California. Nevertheless, the MLMA Master Plan amendment process is an opportunity to help identify how the new MPA network should be considered when managing fisheries.

11. **How does the Master Plan amendment affect other Department priorities?**
Several major strategic initiatives are moving forward at the same time as the Master Plan amendment process. These include: the development of fisheries management plans for the recreational red abalone and commercial herring fisheries; the transition to electronic reporting; addressing whale entanglements; and ongoing management of state and federally managed fisheries, among others. The Master Plan amendment is a major undertaking that will shape how the Department manages state fisheries over the next five to ten years. As a result, some other activities will likely be deferred until it is completed. An amended Master Plan will make state management of fisheries more efficient, transparent, and consistent. The goal is for an amended Master Plan to be adopted that reflects goals of the amendment process (see FAQ #4) and the interests and priorities of stakeholders invested in a sustainable future for California's fisheries.

12. **How can I stay informed about the Master Plan for Fisheries amendment?**
For more information about the MLMA Master Plan Amendment process, visit https://www.wildlife.ca.gov/Conservation/Marine/MLMA or email MLMA@wildlife.ca.gov.

State of California
Department of Fish and Wildlife

M e m o r a n d u m

Date: July 1, 2016

To: Valerie Termini
Executive Director
California Fish and Game Commission

From: Craig Shuman
Regional Manager, Marine Region

Subject: **Agenda Item for the July 21, 2016, Marine Resources Committee Meeting Regarding Information on an Ecological Impact Assessment Developed to Better Manage Research in Marine Protected Areas.**

At the July 21st Marine Resources Committee (MRC) meeting, the Department will provide an update on the status of a framework constructed to improve permitting decisions on research in Marine Protected Areas (MPAs). This will be the third time the Department has updated the MRC on this issue. This update is informational only, but provides the Department with an opportunity to get feedback from both the MRC and the public in attendance.

If you have any questions regarding this item, please contact Dr. Craig Shuman, Regional Manager, Marine Region at (805) 568-1246.

Attachments
Attachment 1: Presentation of Ecological Impact Assessment on Research in MPAs

Attachment 2: Executive Summary: Scientific Research in Marine Protected Areas-Development of a Novel Ecological Impact Assessment Framework

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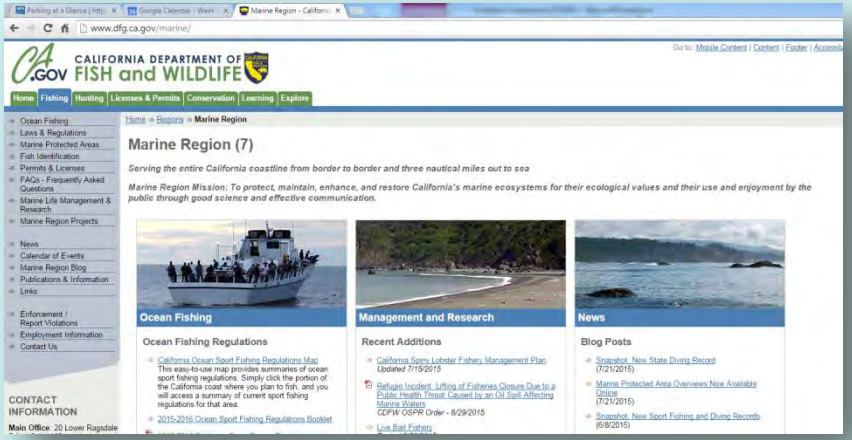
Scientific Research in Marine Protected Areas: Development of a Novel Ecological Impact Assessment Framework

Marine Resource Committee
Fish and Game Commission

Research in Marine Protected Areas Working Group
Department of Fish and Wildlife
and
California Ocean Protection Council Science Advisory Team
July 21, 2016

CA Department of Fish and Wildlife & CA Ocean Protection Council Science Advisory Team -Working Group



- **Brian Owens, CDFW**
  - Environmental Scientist
- Becky Ota, CDFW
  - Habitat Conservation Program Manager
- Emily Saarman, PISCO
  - Project support

- **Karina Nielsen, RTC/SF State**
- Rich Ambrose, UCLA
- Mark Carr, UCSC
- John Field, NMFS
- Steven Murray, CSU Fullerton
- Steve Weisberg, SCCWRP

Presentation Outline

- Background on Scientific Collecting Permit (SCP) Program
- Assessment Need & Purpose
- Challenge & Approach
- Overview of Assessment
- Benefits
- Feedback & Questions

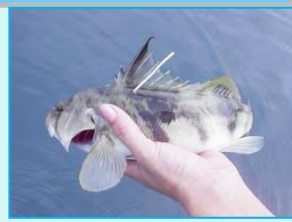
DFG Archives

SCP Program Background

- SCPs authorized by Fish and Game Code § 1002 &1002.5 and regulated by Title 14, 650
- Department currently undergoing a rulemaking to restructure the program
- Research is authorized via an SCP
- Process used to approve SCPs in MPAs
- SCPs issued by Marine Region since 2012:
  - Yearly average of 287 total permits, 107 in MPAs

DFG Archives

Management Issue



- Marine protected areas (MPA) are important conservation and management tools

- Scientific research and monitoring are part of the MPA mission

- Scientific research in MPAs may impact the ecosystem and reduce MPA effectiveness

The Challenge

- MPA Managers Need to:
  - Evaluate research impacts while estimating ecological costs from cumulative impacts in MPAs to make informed permitting decisions.

- **Goal:** Develop a framework that enables MPA managers to quantify the ecological impacts of scientific research activities in an unbiased, transparent, and objective manner

Approach: Overview

A decision making tool was based on:

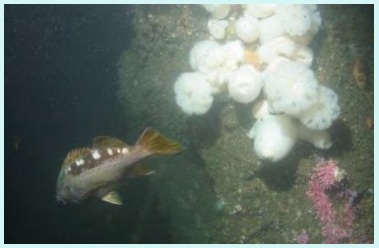
- Established ecological principles
- Quantitative, evidence-based process

The approach:

- Estimates potential ecological impacts of single and multiple scientific projects in an MPA
- Compares impacts against policy-set thresholds for each MPA
- Informs decision-making, doesn’t prescribe

Approach: Elements

Four step assessment procedure to inform permitting decisions:



1. Filter out projects
2. Quantify ecological impacts
3. Calculate the cumulative impact of all projects
4. Compare the cumulative impacts with policy-based, acceptable impact thresholds for species, assemblages, and habitats

Estimating Ecological Impacts

- Quantitative models that capture ecological impacts to three ecosystem components
  - Populations of targeted species
  - Ecological assemblages
  - Physical habitat
- Calculations are based on proportionate loss or injury
  - Impacts are adjusted using multipliers
- Considers direct and indirect effects of each proposed study procedure
- Data tables that quantify ecological costs for a wide array of sampling activities are provided to facilitate model use

Impact Thresholds

Three impact threshold levels lead to four possible permitting decisions:

- Max of 10% of any population, assemblage, or habitat may be impacted by projects before MPA is compromised

Category	Threshold	Priority	Permit Status
De Minimis	Less than 2%	All research that passes the management review.	Approve
Negligible Impacts	Between 2% and 5%	Direct MPA related research or priority projects.	Approve
Impacts of Concern	Between 5% and 10%	Research that is critical for management.	Approve
Not Recommended	More than 10%	N/A	Deny or ask to modify or relocate.

Benefits of the Approach

- Quantitative, unbiased, and transparent
  - Enables identification of projects with highest impact
  - Allows Department to allocate resources to manage high-impact projects
- Allows for consistency in approving permits across staff changes and over time
- Enables applicants to know in advance impacts of their proposed research and to work with department to reduce them
- Should expedite the permitting process

Project Timeline

Past:

- Since June 2012, workgroup has met over 50 times

Current :

- Completed - Ecological Impact Assessment framework
- Early stages of developing data management system
- Present to Ocean Protection Council Science Advisory Meeting

Goals:

- Peer-reviewed manuscript (currently in preparation)
- Summer/Fall 2016- Implement assessment

Thank You ◈ Questions

Karina Nielsen

Romberg Tiburon Center for Environmental Studies, SF State

Brian Owens

California Department of Fish and Wildlife

Scientific Research in Marine Protected Areas:
Development of a Novel Ecological Impact Assessment Framework

Executive Summary

Prepared by the Research in Marine Protected Areas Work Group[1]
for
The California Fish and Game Commission's Marine Resources Committee

June 20, 2016

Marine protected areas (MPAs) and MPA networks are important management tools that often have multiple goals and must balance potentially conflicting activities, one of which is scientific research. MPAs provide unique and important research opportunities because the associated ecosystems are subject to minimal human disturbance. Moreover, research is essential for evaluating MPA performance, and thus is an integral component of MPA management. However, scientific research may also impact the biota and habitats being studied. Hence, MPA managers must understand and weigh the ecological costs and benefits of proposed research activities to determine whether they can be permitted within MPA boundaries without compromising the effectiveness of the MPA or the integrity of an MPA network.

At the request of the California Department of Fish and Wildlife (Department), the Research in MPAs work group proposed a quantitative, ecologically-based decision framework to estimate the impacts of scientific research with the goal of facilitating scientific permitting decisions in California's newly established network of MPAs. The framework identifies the ecological consequences of a diversity of scientific research activities and provides an unbiased, transparent, and objective means to inform permitting decisions. This approach consists of four steps:

1) **Exclude projects that do not need to be conducted in MPAs** – This "MPA relevance" component considers whether or not an MPA is essential for meeting the objectives of the research project (e.g., does the project require a protected population or community or are non-MPA locations inappropriate for the study). The Department has been employing a similar criterion for reviewing permits since 2008.

2) **Quantify ecological impacts of the project** – This model-based element uses scientific principles to assess the proportionate impacts within an MPA to: a) the population of any targeted species, b) four major marine ecological assemblages (macrophytes, sessile invertebrates, mobile invertebrates, and fishes), and c) the physical habitat that supports MPA biota. The model quantitatively estimates the ecological impacts of scientific activities, including consideration of the vulnerability of targeted species, assemblages, and habitats, based on their recovery time and the ecological significance of affected biota.

3) **Quantify the cumulative impacts to species, assemblages, and habitats affected by the proposed project and all other on-going projects in the MPA** – This analysis allows each research project to be evaluated independently while also determining its contribution to the cumulative impacts of all research activities in the MPA.

4) **Compare the estimated cumulative impacts of all projects with policy-based acceptable impact thresholds for species, assemblages, and habitats** - This outcome will lead to decisions to accept, deny, or request modification and resubmittal of proposed projects.

---

[1] The Research in MPAs work group is comprised of staff from the Department of Fish and Wildlife, select members of the Ocean Protection Council's Science Advisory Team, with staff support from the Partnership for Interdisciplinary Studies of Coastal Oceans

Ecological Impacts

The core of the framework is a suite of quantitative models that estimate the ecological impacts for the many methods commonly used in scientific research projects. Ecological impact is expressed as a proportion of the population, assemblage, and habitat within an MPA that will be affected by the proposed research. The models take into account direct impacts (e.g., activities resulting in immediate mortality or habitat damage), as well as indirect impacts (e.g., activities that generate incidental or unintentional effects on other species, assemblages, or habitats). Impacts are calculated separately for individual species, ecological assemblages, and habitats. These proportionate impacts are then adjusted to account for vulnerability of the species, assemblage or habitat, based on their estimated time for recovery and the ecological significance of the affected biota.

Impact Thresholds

Determining an acceptable level of ecological impact is a policy decision that may vary among species, ecosystems and MPAs. As a starting point, we propose an overall (i.e. cumulative) impact threshold of 10% to any population, assemblage, or habitat, as a level beyond which the conservation value of an MPA may be compromised. The ecological impacts calculated in the framework are then compared with the impact threshold to determine if any individual project, or the cumulative impact of multiple projects, exceeds the acceptable threshold. The ecological impacts are compared to the acceptable impact thresholds, both individually and cumulatively for each targeted species, each of the four assemblages (macrophytes, sessile invertebrates, mobile invertebrates, and fishes), and the habitat. If any of these exceed the threshold, the approach outlined in the framework indicates that the proposed research should be revised to reduce its impact or permission to proceed should be denied.

While we propose an overall threshold of 10% impact, we also recommend that the amount of allowable impact should be linked to the anticipated benefits of the research. The Department should allow projects with small direct management value to consume only a small fraction of the available impact threshold, leaving room for future research envisioned to be of greater scientific value, or critical to informing MPA management. Moreover, we propose that no individual project should consume more than 1/5th of the available threshold for any population, assemblage, or habitat without the likelihood of generating equivalent benefits as determined by permitting staff.

Benefits of This Approach

The proposed approach identifies the ecological impacts of proposed scientific procedures and estimates their effects on species, communities, and habitats within each MPA and compares the individual and cumulative impacts of scientific projects against Department-determined threshold limits. This objective, transparent, and unbiased method for making decisions to permit scientific research in MPAs can be consistently applied across staff and over time and facilitate interactions between managers and researchers so that modifications to study designs can be made before or after permit submission. Applicants will benefit because this approach should expedite permitting decisions for most projects. It will also provide managers and researchers with information on the state of species, assemblages and habitats within an MPA targeted for study. An additional advantage of using this framework is that high-impact projects can be readily identified and staff resources can be focused on projects of greatest concern to achieving MPA conservation goals.

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Jacque Hostler-Carmesin, Vice President
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Huntington Beach
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Fish and Game Commission

Wildlife Heritage and Conservation
Since 1870

Valerie Termini, Executive Director
1416 Ninth Street, Room 1320
Sacramento, CA 95814
(916) 653-4899
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Fishing Communities Discussion
Meeting Agenda
July 20, 2016, 1:00 pm

Petaluma City Schools Board Room
200 Douglas Drive, Petaluma

Meeting Goals

- Opportunities for coastal communities to share perspectives on observed changes in ocean ecosystems, marine resources and related harvest opportunities
- Discuss ideas for building stronger coastal communities in the face of change
- Identify process for next steps, if any

I. Welcome, Background, and Goals

1) Welcome and introductions

2) Background of Commission fishing communities discussion

3) Identify goals for In-Depth Discussion from Commission and participants viewpoints

II. In-Depth Discussion and Dialogue

PART A: Understanding California's fishing communities - a community-based dialogue

Discussion Questions:

1) What defines a fishing community (port, region, fishery, state)?

2) What makes a high quality working waterfront for California? Does that vary substantially across regions and ports or are there uniform needs that you can identify statewide?

3) What are the changes in your fishing community that have affected productivity (e.g., aging infrastructure, biological changes from ocean conditions, access)?

4) What traditionally available resources relied on by your fishing community have changed, and how?

5) What characteristics of fishing communities are most important to protect or are the most vulnerable to change?

6) What are the current and foreseeable barriers to success for fishing communities in the current management structure (e.g., costs, permits, biological changes)?

PART B: Continuing the Discussion - Looking forward

Discussion Questions:

1) What does success look like for the future of California fishing communities given the changes that have occurred?

2) What localized efforts have happened to promote fishing communities? Can they be shared across fishing communities and working waterfronts?

3) Suggestions on moving forward? How can your fishing community directly move forward to promote opportunities for development (e.g., sustainably caught seafood co-operatives, working waterfront models, shared permits, diversify fisheries, etc.)?

III. Next Steps and Wrap-up

1) Meeting recap

2) Explore possible next steps

3) Meeting Close and Adjournment

Thank you for participating!

MEETING SUMMARY AND KEY OUTCOMES

Marine Resources Committee
Bycatch Workgroup
Kickoff Meeting
May 18, 2016 11:00 a.m. – 3:00 p.m.
Santa Barbara Harbor Community Room
107 Harbor Way
Santa Barbara, CA

Meeting Overview:
The kick-off meeting was intended to provide a common background and understanding, lay an operational foundation for the Bycatch Workgroup (BWG), identify common themes, set work group goals, discuss possible work products, and identify next steps. BWG members agreed on ground rules for communication and participation without modification. Fish and Game Commission (Commission) staff provided a "refresher" overview of Marine Resources Committee (MRC) bycatch discussions including previously identified areas of concern, possible mechanisms for addressing concerns, and identified potential direction or product outcomes for the BWG relative to Commission authority using existing regulatory language and frameworks.

Group discussion yielded outcomes that can be categorized by core themes and areas of agreement across BWG membership, work groups, work products, and next steps (*outlined in Part I below*). Key outcomes by agenda topic are provided in Part II.

PART I

Core Themes:
- Communication standard: establish open e-mail list and file sharing site
- Recommendations should be made on sound scientific principles
- Recognize the BWG as an opportunity to increase public understanding of bycatch and bycatch issues (i.e., not all bycatch are dead discards)
- Ensure the development of work products is transparent and inclusive
- Clearly identify when consensus or dissent exist
- How to build capacity to collect bycatch data and increase data streams
- Explore what tools currently exist for addressing bycatch issues and reducing discard mortality
- Incorporate input from Tribes early and effectively
- There are many different understandings of what bycatch is or is not
- Identify areas of uncertainty (e.g., is a species considered bycatch if the target species changes or is in multi-target fishery)
- Many ideas for areas of BWG focus and work products offered (e.g., update Master Plan bycatch section, reevaluate how multi-species fisheries are defined or characterized relative to "incidental" marketable take, review available data, develop a bycatch reduction work plan)

Areas of Agreement:

- Need to identify clear and specific goals for the BWG
- Goals will help to inform product development
- Supports having Commission staff provide a DRAFT work plan for the BWG
    - Use BWG-suggested goals as starting point
    - Intent to have a draft ready for the July MRC meeting
- Utilize DFW staff and data sets to help inform products
- Establish a common set of working definitions of bycatch, target, incidental, and unacceptable
- Identify and build upon areas of overlap with Federal and Pacific state efforts
- Any products developed through a subgroup of the BWG will be brought to the entire BWG for discussion and input

Action Items

- DRAFT work plan (Commission Staff)
- Develop initial definitions for bycatch, target, incidental, and unacceptable (Christopher Voss, Diane Pleschner-Steele, Mick Kronman).
- Identify areas of overlap for federal and pacific state efforts on bycatch issues (Mike Conroy)
- Seek funding to off-set participation costs (volunteers??)
- Scientific literature background research (Geoff Shester)

Next Steps:

- Schedule check in phone meeting for status report on product development
- Set next meeting date (possibly early July in order to report to MRC on July 21)
- Solicit and coordinate input time-frame for identified work products

PART II

Meeting Agenda Outcomes

1. Welcome, introductions, and agenda review

   Commission staff welcomed attendees, round-table introductions and sign-in sheet distributed.

2. Establish basic operating rules, procedures, and guiding principles

   Presentation by Commission staff to solicit feedback on suggested ground rules for participation and communication; ground rules were accepted by the group without modification.

3. Understanding the role of the BWG: Review background and workgroup scope

   Commission staff provided an overview of previous MRC guidance that the BWG adhere to relevant State legislation (Marine Life Management Act) and

regulations (Title 14 and Fish and Game Code), and focus on State-managed fisheries under direct Commission authority as top priority, followed by State fisheries under State legislative authority, for considering bycatch issues.

LUNCH

4. Brainstorming: What are the desired outcomes for you and for the BWG

   Round table where each participant identified desired specific goals for individual constituency and the BWG specifically.

5. Discussion: Setting objectives and priorities for the BWG

   Priorities identified for work products and next steps based on the brainstorming discussion. Common goal to increase the understanding of bycatch to improve public understanding on bycatch related issues.

6. Discuss next meeting dates

   No formal meeting date set. A variety of options for the venue for the next meeting were discussed. Some emphasized exploring "low carbon footprint" options (webinar, teleconference, email), while others highlighted the value of in-person meetings. Appropriate venue may vary at different project stages.

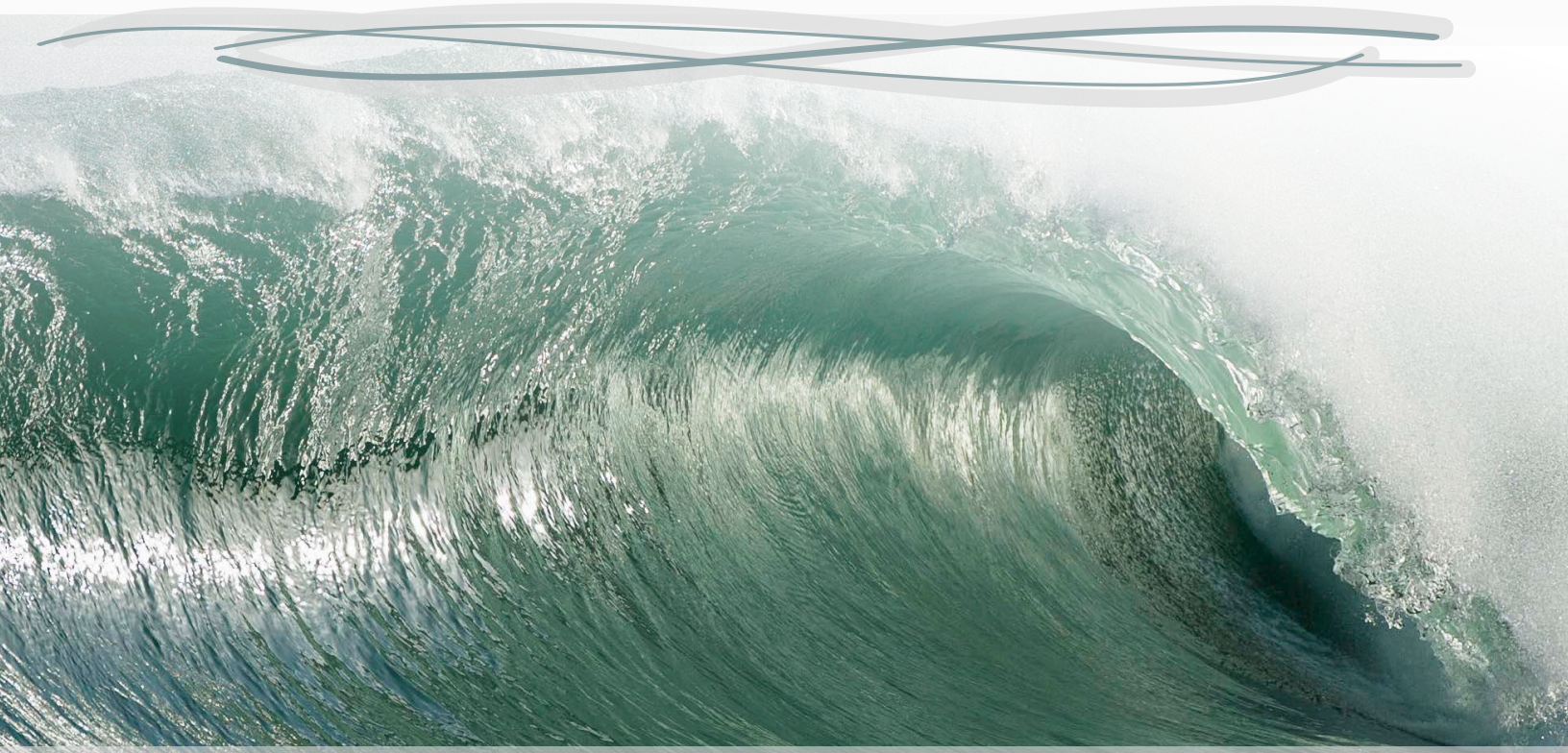
7. Meeting wrap-up and next steps

   Establish sub-groups to: begin working on common definitions for terms associated with bycatch but not defined in state law, compile status of parallel bycatch efforts by the Federal and pacific states, and explore scientific literature and background. Sub groups to bring products back to group via e-mail and in hard copy at next meeting. Commission staff to distribute a DRAFT work plan to the BWG for comment with the intent that it be provided to the MRC at the July 21 meeting in Petaluma.

Adjourn

The West Coast Ocean Acidification and Hypoxia Science Panel

MAJOR FINDINGS, RECOMMENDATIONS, AND ACTIONS



APRIL 2016

Table of Contents

I. Introduction **4**

II. Major Findings **5**

III. Panel Recommendations **6**

IV. Appendices **13**

Appendix A: Why West Coast managers should care about ocean acidification 14

Appendix B: Why the West Coast is vulnerable to ocean acidification – and what we can learn from it 16

Appendix c: Managing for resilience to address ocean acidification and hypoxia 18

Appendix D: The cost of inaction 20

Appendix E: Using modeling to enhance understanding 22

Appendix F: Approaches to reduce CO_2 in seawater 24

Appendix G: Existing water quality criteria are inadequate to protect marine ecosystems 26

Appendix H: Establishing ocean acidification and hypoxia research priorities 28

Appendix I: Tracking changing ocean chemistry through an ocean acidification and hypoxia monitoring network 30

V. The Panelists **32**

VI. Additional Panel products supporting the "Major Findings, Recommendations, and Actions" **36**

This report was produced by the West Coast Ocean Acidification and Hypoxia Science Panel (the Panel), working in partnership with the California Ocean Science Trust. The Panel was convened by the Ocean Science Trust at the request of the California Ocean Protection Council in 2013, working in collaboration with ocean management counterparts in Oregon, Washington, and British Columbia. Ocean Science Trust and the Oregon Institute for Natural Resources served as the link between the Panel and government decision-makers. The information provided reflects the best scientific thinking of the Panel. More information on the Panel can be found at www.westcoastOAH.org.

Recommended citation: Chan, F., Boehm, A.B., Barth, J.A., Chornesky, E.A., Dickson, A.G., Feely, R.A., Hales, B., Hill, T.M., Hofmann, G., Ianson, D., Klinger, T., Largier, J., Newton, J., Pedersen, T.F., Somero, G.N., Sutula, M., Wakefield, W.W., Waldbusser, G.G., Weisberg, S.B., and Whiteman, E.A. *The West Coast Ocean Acidification and Hypoxia Science Panel: Major Findings, Recommendations, and Actions.* California Ocean Science Trust, Oakland, California, USA. April 2016.

See back cover for support and image credits.

Panelists

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Francis Chan (co-chair), Oregon State University*
Jack Barth, Oregon State University
Elizabeth Chornesky, Independent Consultant
Andrew Dickson, University of California, San Diego, Scripps Institution of Oceanography
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Skyli McAfee
California Ocean Science Trust (formerly)
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Staff

Hayley Carter, Emily Knight, Moose O'Donnell, Eve Robinson, Sarah Wheeler
California Ocean Science Trust

*Denotes Panel Executive Committee Member

I. Introduction

Global carbon dioxide (CO_2) emissions over the past two centuries have altered the chemistry of the world's oceans, threatening the health of coastal ecosystems and industries that depend on the marine environment. This fundamental chemical alteration is known as ocean acidification (OA), a phenomenon driven by the oceans absorbing approximately one-third of atmospheric CO_2 generated through human activities. Scientists initially observed the impacts of OA on calcifying marine organisms that were having difficulty forming their shells, but additional evidence now indicates that growth, survival and behavioral effects linked to OA extend throughout food webs, threatening coastal ecosystems, and marine-dependent industries and human communities (see Appendix A).

Although OA is a global phenomenon, emerging research indicates that, among coastal zones around the world, the West Coast of North America will face some of the earliest, most severe changes in ocean carbon chemistry. The threats posed by OA's progression will be further compounded by other dimensions of global climate change, such as the intensification and expansion of low dissolved oxygen – or hypoxic – zones. In the coming decades, the impacts of ocean acidification and hypoxia (OAH), which are already being felt across West Coast systems, are projected to grow rapidly in intensity and extent. Even if atmospheric CO_2 emissions are stabilized today, many of the ongoing chemical changes to the ocean are already "locked in" and will continue to occur for the next several decades. Given these challenges, decision-makers must act decisively and in concert now.

In an effort to develop the scientific foundation necessary for West Coast managers to take informed action, the California Ocean Protection Council in 2013 asked the California Ocean Science Trust to establish and coordinate a scientific advisory panel in collaboration with California's ocean management counterparts in Oregon, Washington and British Columbia. The resulting West Coast Ocean Acidification and Hypoxia Science Panel, comprised of 20 leading scientific experts (see V. The Panelists, page 32), was charged with summarizing the current state of knowledge and developing scientific consensus about available management options to address OAH on the West Coast.

This document, "**Major Findings, Recommendations, and Actions**" of the Panel, summarizes the Panel's work and presents **Actions** that can be taken now to address OAH. The appendices to this document contain a series of two-page synopses that provide more detail on many of the key concepts that are mentioned in the main body. In addition to this document, the Panel has produced a number of longer supporting documents intended for agency program managers and technical audiences (see VI. Additional Panel Products Supporting the "Major Findings, Recommendations, and Actions," page 36).

Why ocean acidification AND hypoxia?

OA and hypoxia refer to distinct phenomena that trigger a wide range of marine ecosystem impacts. The Panel considered them together because they frequently co-occur and present a collective West Coast challenge. In particular, OA and hypoxia share a common set of drivers – increased atmospheric CO_2 levels and local nutrient and organic carbon inputs. Consequently, OA and hypoxia can be managed synergistically via an overlapping set of management strategies.

The Panel's products are more focused on OA because our understanding of the effects of OA and its interaction with hypoxia is only beginning to grow. In contrast, scientists have built a sizeable body of research on hypoxia, so its impacts on marine environments are better understood. Note that when the Panel uses the term OAH, it is a deliberate reference to both phenomena collectively; the terms OA, hypoxia and OAH cannot, however, always be used interchangeably.

II. Major Findings

The Panel's scientific experts reached consensus on six **Major Findings**:

1. OAH will have severe environmental, ecological and economic consequences for the West Coast, and requires a concerted regional management focus.

OAH is a problem that is expected to grow in intensity with far greater impacts to come, particularly along the West Coast, where regional ocean circulation patterns dramatically heighten the potentially devastating effects of OAH. Local governments alone do not have the capability to halt fundamental, widespread changes to the chemistry of coastal waters. Decision-makers need a common core of scientific information that will enable them to use limited resources in a strategic, coordinated, regional fashion to best serve the ecological and socioeconomic needs of the entire West Coast region. Appendix B provides more detail about the trajectory of OAH-triggered change, and why the West Coast is more vulnerable than other coastal regions.

2. Global carbon emissions are the dominant cause of OA.

Although this document is focused on how the West Coast is impacted by OA and the associated intensification of hypoxia, OA is a global problem that will require global solutions. Given that the dominant cause of OA is global carbon dioxide emissions, the Panel stands firmly behind multinational efforts to reduce atmospheric carbon dioxide emissions worldwide; humankind's ability to reduce the levels of CO_2 being absorbed by the world's oceans will be the single most important, effective strategy for mitigating OA. To that end, the Panel encourages West Coast leadership to develop a regional carbon management strategy, expanding on initiatives such as California's AB 32 and Washington's Climate Action Team.

3. There are actions we can take to lessen exposure to OA.

Although local actions cannot wholly undo the global impacts of OA, West Coast managers can take action to improve local conditions by managing local factors that contribute to declining water quality. In particular, opportunities exist to implement better controls on nutrients and organic matter pollution that flow from land into coastal waters, as these chemicals provide nourishment for algae and bacteria that, in turn, can trigger hypoxia and exacerbate acidification. In selecting specific areas in which to implement these controls, managers should work closely with scientists, as these actions are typically costly and will not be equally effective everywhere; monitoring and modeling results can be used to inform best options.

4. We can enhance the ability of ecosystems and organisms to cope with OA.

West Coast managers are not limited to mitigating OA; they also can take actions to reduce the negative biological and ecological impacts from OA. Fostering ecosystem resilience – that is, taking management actions intended to support an ecosystem's ability to withstand the impacts of OA – offers a near-term strategy for maintaining functional ecosystems along the West Coast as the environment changes. Managing for resilience can be achieved by expanding and adjusting approaches already in place along the West Coast, including the use of protected areas, ecosystem approaches to fisheries management, and integrated coastal management techniques. The concept of enhancing resilience is more thoroughly explored in Appendix C.

5. Accelerating OA science will expand the management options available.

The state of knowledge about OA and its interaction with hypoxia is rapidly evolving, but is still limited and thus able to inform only a limited suite of management options to date. West Coast managers should be looking for opportunities to foster rigorous, managerially relevant research, develop coordinated cost-effective monitoring programs that continue to provide information about the projected trajectories of OAH, and integrate knowledge from multiple domains into decision-making. As scientific understanding of OAH grows, so will the options available for devising effective, fiscally prudent management strategies.

6. Inaction now will reduce options and impose higher costs later.

It is becoming increasingly clear that OA will cause significant ecosystem changes, with widespread negative consequences that diminish valuable ecosystem benefits and services. Over time, OA conditions will intensify, diminishing opportunities for managers and West Coast communities to adapt to the changing marine environment. Delaying action now could render future management interventions far less effective (detailed further in Appendix D). Actions taken now based on best available science offer the possibility of forestalling at least some of the negative consequences for ecosystems and society.

III. Panel Recommendations

Consistent with these **Major Findings**, the Panel has formulated eight **Recommendations** to guide management responses. These **Recommendations** are divided among three themes:

1. Address local factors that can reduce OAH exposure;
2. Enhance the ability of biota to cope with OAH stress; and,
3. Expand and integrate knowledge about OAH.

For each **Recommendation**, the Panel provides specific **Actions** that can be implemented immediately and largely accomplished within a one-year timespan. The Panel's **Recommendations** and **Actions** highlight avenues where new science can quickly catalyze management options for addressing OAH.

By The Numbers

THREE THEMES

Eight Recommendations

Fourteen Actions

THEME 1
ADDRESS LOCAL FACTORS THAT CAN REDUCE OAH EXPOSURE

RECOMMENDATION 1

Reduce local pollutant inputs that exacerbate OAH

Action 1.1: Generate an inventory of areas where local pollutant inputs are likely to exacerbate OA.

Action 1.2: Develop robust predictive models of OAH.

Action 1.3: Develop an incentive-based strategy for reducing pollutant inputs.

RECOMMENDATION 2

Advance approaches that remove CO_2 from seawater

Action 2.1: Use demonstration projects to evaluate which locations are optimal for implementing CO_2 removal strategies.

Action 2.2: Generate an inventory of locations where conservation or restoration of aquatic vegetated habitats can be successfully applied to mitigate OA.

Action 2.3: Consider CO_2 removal during the habitat restoration planning process.

RECOMMENDATION 3

Revise water quality criteria

Action 3.1: Agree on parameters that will be part of OAH criteria.

THEME 2
ENHANCE THE ABILITY OF BIOTA TO COPE WITH OAH STRESS

RECOMMENDATION 4

Reduce co-occurring stressors on ecosystems

Action 4.1: Integrate OA effects into the management of ocean and coastal ecosystems and biological resources.

RECOMMENDATION 5

Advance the adaptive capacity of marine species and ecosystems

Action 5.1: Inventory the co-location of protected areas and areas vulnerable to OAH.

Action 5.2: Evaluate the benefits and risks to active enhancement of adaptive capacity.

THEME 3
EXPAND AND INTEGRATE KNOWLEDGE ABOUT OAH

RECOMMENDATION 6

Establish a coordinated research strategy

Action 6.1: Create agreement among the multiple organizations that fund OAH research to establish joint research priorities.

RECOMMENDATION 7

Build out and sustain a West Coast monitoring program that meets management needs

Action 7.1: Define gaps between monitoring efforts and management needs.

Action 7.2: Enhance comparability of and access to OAH data.

RECOMMENDATION 8

Expand scientific engagement to meet evolving management needs

Action 8.1: Create a science task force.

THEME 1: ADDRESS LOCAL FACTORS THAT CAN REDUCE OAH EXPOSURE

Recommendation 1: Reduce local pollutant inputs that exacerbate OAH.

While elevated atmospheric CO_2 levels are a major driver of OA, local discharge of organic carbon and nutrients can exacerbate OA. Upon discharge, organic carbon is broken down by bacteria, which consume dissolved oxygen during the decomposition process, triggering hypoxic conditions, increasing CO_2 levels and lowering pH. When nutrients such as nitrogen and phosphorus are introduced to coastal waters, they can trigger proliferation of algae that, following their death, are decomposed by bacteria that further decrease dissolved-oxygen levels and increase acidity. The Panel's recommendation to reduce local inputs is tempered by the recognition that scientists do not yet have adequate information to precisely identify locations where reductions in local inputs can meaningfully mitigate OAH effects. In general, the effectiveness of local actions will be greatest in semi-enclosed water bodies, such as estuaries, where local processes dominate over oceanic forcing. Site-specific evaluations are needed to determine which local input(s) (wastewater discharges vs. non-point source pollution in river discharge or atmospheric deposition) should be the targets of nutrient reduction efforts. Because of uncertainties concerning which local-control strategies will be most effective in reducing OA, West Coast managers may find it advantageous to pursue more than a purely regulatory enforcement strategy. For example, upgrades to wastewater treatment plants or investment in water reuse could be incentivized to design facilities that reduce nutrient discharges. Regardless of whether incentive-based or regulation-based approaches are used to achieve desired outcomes, managers can support the expedited development of predictive OA models that will guide decisions about how to best implement local source controls.

- **Action 1.1: Generate an inventory of areas where local pollutant inputs are likely to exacerbate OA.**

  While local nutrient- or other discharge-related control programs will not be effective everywhere, there are a number of locations where local nutrient inputs are thought to exacerbate OA. West Coast managers should compile an inventory of those locations to focus their initial management efforts, as these locations can serve as testing grounds for understanding the relative successes that can be achieved by reducing local inputs.

- **Action 1.2: Develop robust predictive models of OAH.**

  One method to determine where reduction of local inputs will result in the greatest gains in water quality is through use of coupled physical-biogeochemical models. These models quantify to what degree various nutrient, carbon, and CO_2 inputs influence OAH, and project how these inputs will exacerbate OAH. Several research groups on the West Coast are in various stages of developing such models, but before they can be used to support OAH-related management decisions, further investment is required to enhance and coordinate modeling efforts, and to link them to managerially relevant endpoints. A more thorough discussion of how West Coast managers can enhance the usefulness of these modeling efforts appears in Appendix E. Once models are operational, model outputs should be made accessible for comparisons among models and with monitoring data.

- **Action 1.3: Develop an incentive-based strategy for reducing pollutant inputs.**

  West Coast managers can develop grants, loans and other programs to create financial incentives for both the public and private sector to work proactively toward reducing local inputs that can exacerbate OAH, as well as promote reductions in atmospheric CO_2 emissions.

In general, the effectiveness of local actions will be greatest in semi-enclosed water bodies, such as estuaries, where local processes dominate over oceanic forcings.

Recommendation 2: Advance approaches that remove CO_2 from seawater.

Seagrass and kelp beds remove CO_2 from seawater as they grow. This removal of CO_2 has the potential to offset the reductions in pH from OA. Emerging research suggests that conservation or restoration of aquatic vegetation habitats may indeed act to measurably lessen the severity of OA exposure. However, important uncertainties remain about when, where and how broadly local habitat conservation and restoration will mitigate OA exposure (see Appendix F). West Coast managers should actively explore the utility of this mitigation approach.

- **Action 2.1: Use demonstration projects to evaluate which locations are optimal for implementing CO_2 removal strategies.**

  Scientists have conducted research that demonstrates substantive positive benefits from coastal aquatic vegetation on CO_2 removal from seawater. The next step is to transition from these small-scale and short-term research efforts to larger-scale proof of concept demonstration studies across a range of habitats, providing managers with the opportunity to explicitly evaluate under which conditions protection and restoration of vegetated habitats will sufficiently remove CO_2 to meaningfully mitigate OA. These demonstration projects should be accompanied by rigorous monitoring, and physical and biogeochemical modeling to evaluate efficacy of such measures in reducing exposure to OA stress.

- **Action 2.2: Generate an inventory of locations where conservation or restoration of aquatic vegetation habitats can be successfully applied to mitigate OA.**

  The knowledge gained from demonstration projects in Action 2.1 can be used to identify and inventory locations across the West Coast where CO_2 removal strategies can be applied. This inventory can inform comprehensive planning for how local CO_2 removal approaches can be applied relative to other Actions to reduce local inputs of CO_2, non-OA stressors, and enhance ability of biota to cope with stressors.

- **Action 2.3: Consider CO_2 removal during the habitat restoration planning process.**

  A number of investments have already been made to promote aquatic habitat restoration. Carbon offset protocols are also under development in some instances to value the co-benefits from long-term carbon storage of such restoration. However, they do not incorporate the potential benefits of local reductions in OA stress. Accounting for this local ecosystem benefit will assist in better accounting for the full societal value of habitat restoration and management.

Emerging research suggests that conservation or restoration of aquatic vegetated habitats may indeed act to measurably lessen the severity of OA exposure.

Recommendation 3: Revise water quality criteria.

Water quality criteria serve as the foundation for many management activities, providing managers with thresholds to objectively determine the condition of a water body and to set targets for clean-up efforts. As such, they are an initiation point for both planning and implementation activities. However, existing water quality criteria, which were created four decades ago, are not scientifically appropriate for assessing OA conditions. Even when existing water quality criteria for seawater pH are met, a wide range of severe biological impacts of OA are observed. New criteria are needed. The Panel further recommends that OA water quality criteria be expanded to include other acidification parameters, as pH is only one of several possible parameters for describing the carbonate system. One such alternative, aragonite saturation state, has been found to be biologically relevant to a number of calcifying organisms. Appendix G provides additional insight about the need for revised water quality criteria.

- **Action 3.1: Agree on parameters that will be part of OAH criteria.**

  Water quality agencies should lead efforts among water quality and acidification experts to develop scientific consensus about which parameters are most appropriate for inclusion in new water quality criteria. In the immediate future, a scientific workshop is needed to identify appropriate biologically relevant indicators and thresholds to assess OA, and prioritize short-term research needs to support criteria development.

THEME 2: ENHANCE THE ABILITY OF BIOTA TO COPE WITH OAH STRESS

Recommendation 4: Reduce co-occurring stressors on ecosystems.

The ability of marine organisms to grow, survive, and reproduce in the face of OAH is partly dependent on the number, intensity, and interactions of other, non-OAH stresses they encounter, such as physical disturbances to nearshore habitats, warming temperatures, toxic contaminants, biological invasion, and harvest. Thus, it is important for West Coast managers to consider management plans and actions in the context of these multi-stressor effects. For example, the growing adoption of ecosystem approaches to fisheries management offers opportunities to consider the potential regional effects of OAH within the context of other ecological stressors as fisheries management plans are updated.

- **Action 4.1: Integrate OA effects into the management of ocean and coastal ecosystems and biological resources.**

  OA is likely to influence ecosystems along the West Coast via impacts on fish behavior, impaired calcification of shelled organisms, and fundamental changes in food web dynamics. Managers should work to understand and incorporate the probable impacts of OA into management plans for marine managed areas and fisheries. In some instances, this will require bilateral collaboration, for example, between the U.S. and Canada. For fisheries, the most promising avenue for advancing ecosystem-based fishery management along the West Coast is the Fishery Ecosystem Plan (FEP), adopted by the Pacific Fishery Management Council in 2013. The FEP is intended to improve and coordinate fishery management within the California Current Ecosystem by informing decisions made under each individual Fishery Management Plan with broader considerations about the ecosystem. Future updates of the FEP will provide an important opportunity to integrate improved OA knowledge into fishery management decisions, including ways that individual fisheries can be better managed to enhance ecosystem resilience and adaptive capacity under OA.

Recommendation 5: Advance the adaptive capacity of marine species and ecosystems.

Marine species and ecosystems have, to varying degrees, the ability to adjust and persist in the face of changing environmental conditions, a concept known as adaptive capacity. West Coast managers can support their adaptive capacity through relatively passive measures, such as use of protected areas. Managers can also undertake more proactive approaches, such as selective breeding, translocation of organisms that have shown adaptive capacity, and direct modification of genetic material. Genetic intervention efforts are already being explored as a means to improve the adaptive capacity of marine species to OA. The Panel recognizes that these more proactive approaches raise important concerns regarding their potential unintended consequences. Thus, such strategies should only be considered when other means of maintaining and promoting genetic adaptation are infeasible, and only when safety concerns have been addressed.

- **Action 5.1: Inventory the co-location of protected areas and areas vulnerable to OAH.**

  The West Coast includes five National Marine Sanctuaries, five National Estuarine Research Reserves, 15 National Wildlife Refuges, two Canadian marine protected areas, two Canadian Areas of Interest, multiple Essential Fish Habitat conservation areas created by the Pacific Fishery Management Council, 34 Areas of Special Biological Significance established by State of California, and numerous state-managed protected areas. Most protected areas, however, were designed and are being managed without regard to their vulnerability to OAH impacts, because little was known about OAH processes or impacts when most of the areas were established. Nevertheless, some of these protected areas could serve to promote adaptive capacity to OAH. Enhanced diversity and productivity of fish and invertebrate populations and preservation of ecological function within protected areas can strengthen the ability of populations and communities to cope with future OAH impacts. This may be particularly beneficial in instances where protected areas overlap with locations that are likely to face moderated exposure to OAH stress. In contrast, protected areas that are co-located with OAH hotspots offer an environment where biota that develop genetic tolerances to OAH are preserved. Both environments are important to maintaining adaptive capacity. West Coast managers should inventory the co-location of protected areas and areas vulnerable to OAH to assess the number of locations they presently have in the two categories.

...protected areas that are co-located with OAH hotspots offer an environment where biota that develop genetic tolerances to OAH are preserved.

- **Action 5.2: Evaluate the benefits and risks to active enhancement of adaptive capacity.**

  West Coast managers should facilitate the establishment of a working group of scientists and managers from relevant sectors to engage in joint fact-finding about the potential risks, benefits, and costs of active genetic intervention, such as through the selection, manipulation, and/or translocation of genetic varieties as a strategy for enhancing the persistence of species in mariculture settings and in natural ecosystems under intensifying OAH. Such intervention-based options are already being explored for OA but are occurring in the absence of deliberative guidance from the scientific and management communities. Historically, introductions of new genetic varieties and species on land and in the oceans have caused unintended harmful ecological or economic consequences that outweighed their benefits. The establishment of an active genetic intervention working group will set the stage for assessing the policy context for evaluating and regulating planned genetic interventions.

THEME 3: EXPAND AND INTEGRATE KNOWLEDGE ABOUT OAH

Recommendation 6: Establish a coordinated research strategy.

OA research is still in its infancy, with 75% of all acidification science studies published in the last five years, and only a handful of studies to date that have addressed the combined effects of OA and hypoxia, or OA and temperature, or OA and any other stressor. These constraints limit the ability to formulate options for effective management actions grounded in sound science. Generating more options will require further investment in directed research on OAH and its impacts on marine ecosystems. The research should be driven by management needs and should focus on evaluating the breadth of responses available to management, including scale and cost. The Panel has developed a comprehensive set of recommendations about which research topics are most likely to yield the greatest expansion of management options (see Appendix H), and Appendix H is supported by a separate and more extensive technical document outlining recommendations for research priorities ("*Ocean Acidification and Hypoxia Research Priorities to Inform Decisions and Develop Solutions*").

- **Action 6.1: Create agreement among the multiple organizations that fund OAH research to establish joint research priorities.**

  OAH research is taking place at multiple levels – across a range of federal, state, provincial, local and nonprofit funding sources. West Coast leadership should develop a coordinated long-term vision and funding plan to achieve a sustained, leveraged OAH research strategy for the region. West Coast managers should meet with funding entities to help unify their research around focused management goals and ensure that research efforts are effectively coordinated.

Recommendation 7: Build out and sustain a West Coast monitoring program that meets management needs.

Monitoring is a cornerstone of effective environmental management, highlighting spatial differences in OAH condition, and revealing the trajectory of conditions and providing a means for assessing effectiveness of management actions. OAH monitoring programs have often focused on measuring chemical parameters – such as pH and dissolved oxygen – but managers need a comprehensive program that assesses an array of interrelated physical oceanographic, chemical and biological variables and indices. Moreover, most West Coast monitoring is focused on addressing local issues, but these can readily be coordinated to achieve a regional-level program that addresses management needs coast-wide. A more thorough description about the need and opportunities for enhanced monitoring appears in Appendix I and in a supporting Panel technical document that describes a desired monitoring framework ("*Ocean Acidification and Hypoxia Monitoring Network: Tracking the Impacts of Changing Ocean Chemistry to Inform Decisions*").

...research should be driven by management needs and should focus on evaluating the breadth of responses available to management, including scale and cost.

- **Action 7.1: Define gaps between monitoring efforts and management needs.**

  West Coast managers should cultivate partnerships between monitoring practitioners and decision-makers to better define OAH information needs across ecosystem types and for diverse uses. First, they should build on existing efforts to complete a comprehensive inventory of existing oceanographic and ecological monitoring programs on the West Coast; the goal being to identify what monitoring is being conducted, what management questions these efforts address, what synergies and enhancements could be achieved, what measurements are missing, and what geographic areas have inadequate coverage to meet management needs.

- **Action 7.2: Enhance comparability of and access to OAH data.**

  Data comparability among disparate programs is necessary to achieve an understanding of OAH. West Coast managers should facilitate training and quality assurance procedures that will enhance comparability among programs. Furthermore, managers should work toward a consistent level of data discoverability, ensuring that the OAH community can make effective use of OAH data. Development of centralized portals for OAH monitoring data will allow this key information to be linked and shared, ensuring that monitoring can be used effectively to inform further research and ultimately management actions. This portal can also be used to access OAH model outputs.

Recommendation 8: Expand scientific engagement to meet evolving management needs.

Over the past two years, the Panel has not only created a set of written products outlining its "**Major Findings, Recommendations, and Actions**," but has also taken advantage of an unprecedented opportunity to network, convey relevant scientific perspectives, and build a community within a relatively nascent research area. Going forward, the region will benefit from this continued thoughtful interaction among scientists that is simultaneously focused and region-wide, and enhanced dialogue between scientists and managers. This is a rapidly evolving field, so cross-boundary communication is crucial to ensuring that new science products developed from research initiatives are appropriately vetted and communicated for use by the management community.

- **Action 8.1: Create a science task force.**

  West Coast managers will need a highly qualified body of scientists to advise them as new science develops in this rapidly evolving field. Given our West Coast-wide scientific commitment, investment, and momentum, this should remain a West Coast regional body with representation from California, Oregon, Washington, British Columbia, Alaska and Mexico as this issue will transcend state and federal geographic boundaries. The task force can evolve from the existing OAH Panel, but it should be refined to focus expertise on topic areas that align with management needs. A West Coast science task force will ensure that managers and legislators continue to be equipped with the most up-to-date information to make important decisions to protect the West Coast.

A West Coast science task force will ensure that managers and legislators continue to be equipped with the most up-to-date information to make important decisions to protect the West Coast.

IV. Appendices

APPENDIX A:
Why West Coast managers should care about ocean acidification

APPENDIX B:
Why the West Coast is vulnerable to ocean acidification - and what we can learn from it

APPENDIX C:
Managing for resilience to address ocean acidification and hypoxia

APPENDIX D:
The cost of inaction

APPENDIX E:
Using modeling to enhance understanding

APPENDIX F:
Approaches to reduce CO_2 in seawater

APPENDIX G:
Existing water quality criteria are inadequate to protect marine ecosystems

APPENDIX H:
Establishing ocean acidification and hypoxia research priorities

APPENDIX I:
Tracking changing ocean chemistry through an ocean acidification and hypoxia monitoring network

APPENDIX A

Why West Coast managers should care about ocean acidification

Ocean acidification is already posing a substantial threat, even if it's just beginning to enter the public consciousness.

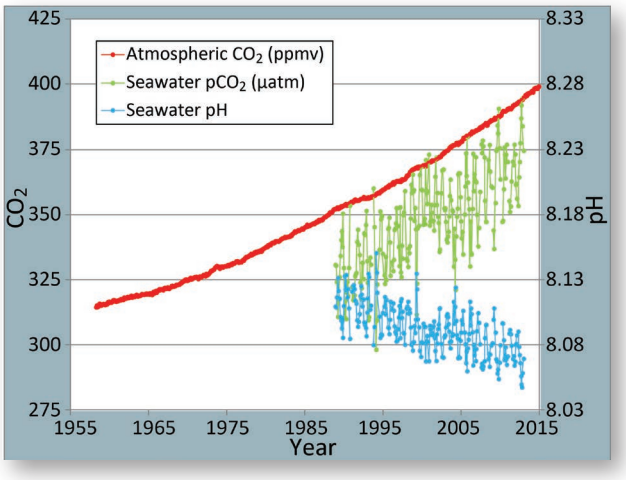
In the same way that legacy pollutants in the marine environment inspired a generation of environmental activism in the 1970s and 80s, ocean acidification (OA) will define West Coast environmental management in the coming decades. OA endangers not only the biological health of marine organisms but also the numerous economic and societal benefits that stem from the West Coast's dependence on its coastal waters. The Panel unanimously and vigorously affirms that acidification of coastal waters is an undeniable, pervasive issue whose impacts have only begun to be felt.

1. Ocean chemistry is changing at an alarming rate, with no projected end or slowdown in sight.

- **Rapid change:** The fundamental alteration of the ocean's chemistry from continued absorption of atmospheric CO_2 is indisputable. At the current rate of global CO_2 emissions, the average acidity of the surface ocean is expected to double over pre-industrial levels by the end of this century.
- **Consequential change:** Seemingly small changes in ocean pH – which serves as a measure of acidification – are anything but small, as pH is expressed on a logarithmic scale. The 0.1 pH units of change that the ocean has recently experienced is equivalent to a 30% increase in acidity. For some organisms, this can be the difference between being able to grow a shell and having their shell dissolved.

> ...the average acidity of the surface ocean is expected to double over pre-industrial levels by the end of this century.

Credit: Modified after R.A. Feely, Bulletin of the Meteorological Society, July 2008.

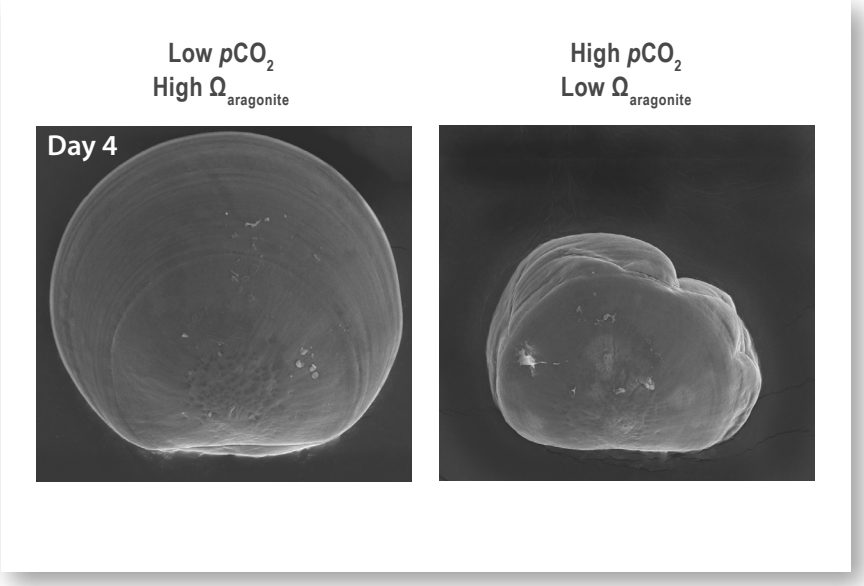


2. West Coast ecosystems are already facing the pervasive impacts of OA.

- **Shell-forming abilities crippled:** Even small increases in acidity of the local water can dramatically reduce the ability of marine organisms to properly grow shell or skeletal structures. Shellfisheries are particularly vulnerable. Oyster hatcheries are seeing high mortality rates during early life stages when shell formation is critical. In 2007, hatchery managers began to experience a severe loss of oyster seed stock as a consequence of OA, which led to acute shortages available to oyster growers up and down the West Coast.
- **Reverberation through food webs:** Microscopic algae and zooplankton that form carbonate structures during their life cycle are at risk, resulting in consequences for marine food webs. For example, swimming sea snails known as pteropods, serve as an important food source for many West Coast fisheries species, including herring, mackerel and salmon. In some locations, more than 50% of these sea snails are already showing signs of shell dissolution. The evidence is compelling, with studies demonstrating that the percentage of pteropods affected by shell dissolution corresponds with local acidity levels.
- **Effects extend beyond shelled organisms:** Rising CO_2 in seawater has been found to disrupt basic neural function and sensitive skeleton structure in marine fishes. These disruptions adversely affect critical behaviors such as orientation, distinguishing predators from prey, finding food, and identifying appropriate habitats. Scientists' understanding of how OA impacts organisms and ecosystems continuously expands, so effects will likely extend beyond those described here.

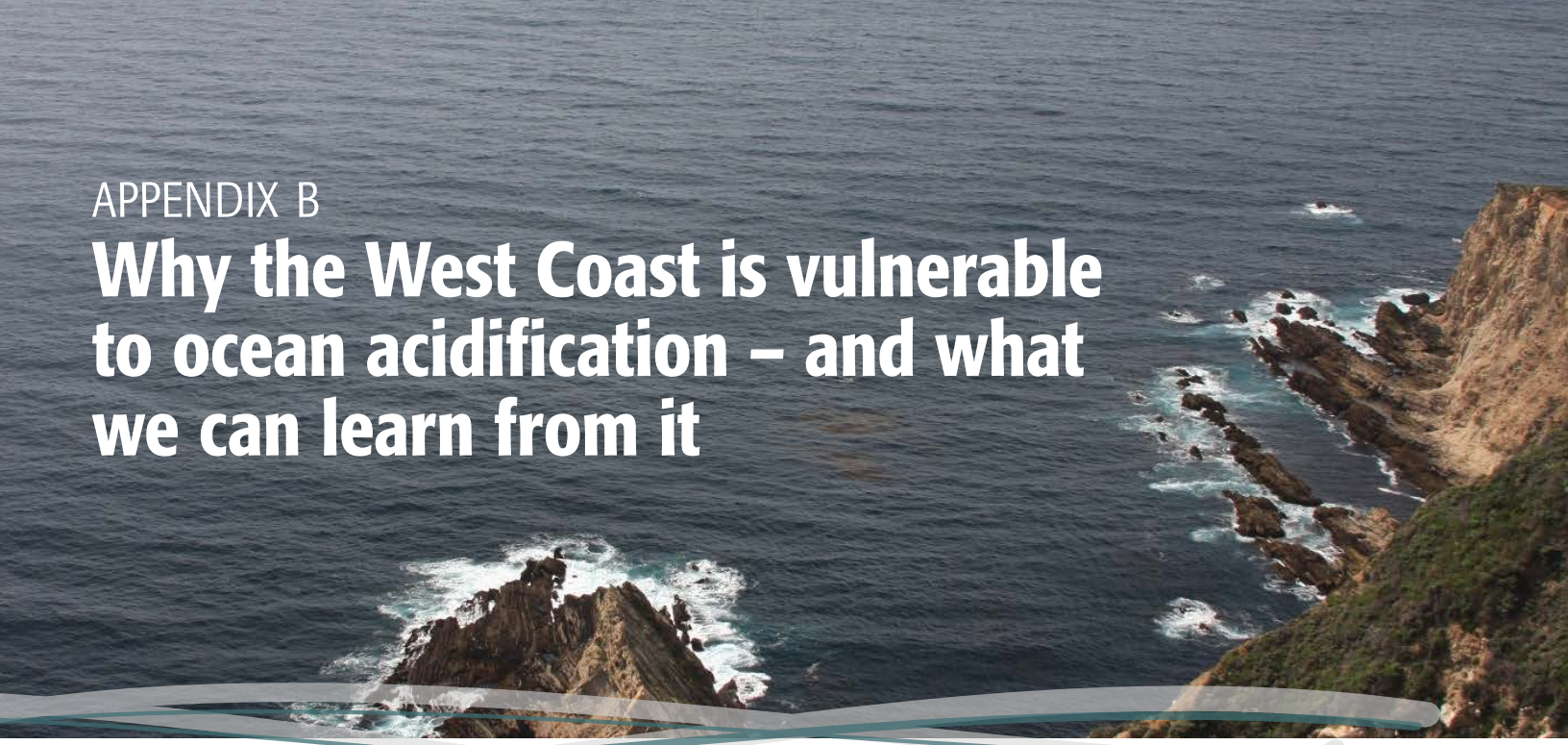
3. The consequences of OA are affecting ocean industries, with effects projected to worsen over time.

- **Operational disruption:** A West Coast shellfish farmer has relocated his hatchery to Hawaii, where exposure to low-pH marine waters is less than along the West Coast. Other hatcheries have invested in building expensive monitoring and water conditioning systems as necessary to maintain their West Coast operations.
- **Economic loss:** Oyster production in the Pacific Northwest declined 22% between 2005 and 2009 (13% decline in gross sales). In Washington and Oregon alone, two of the three major West Coast oyster seed hatcheries experienced production declines of up to 80% from 2006 to 2009. A Canadian company reported that it lost $10 million during its scallop harvest in 2014 in part due to OA. As the OA trajectory continues, a range of shellfish industries, including those for oysters, mussels and crabs, will be subject to economically devastating losses.
- **Domino effects of job losses:** Washington State's commercial and recreational fishing industries generate $8 billion in sales and 65,000 in jobs annually. In Oregon, the commercial and recreational fishing industries generate $1.5 billion in sales, and 19,000 jobs annually. Lastly, sales generated by the commercial and recreational fishing industries in California are $25.7 billion, and 158,000 jobs generated annually. As these industries endure future increases in acidification, the impacts could set off a domino effect of job losses throughout coastal communities, particularly in places where the fishing industry and coastal tourism provide the economic base.



Even small increases in acidity of the local water can dramatically reduce the ability of marine organisms to properly grow shell or skeletal structures.

Figure. Pacific oyster larvae from the same spawn, raised by the Taylor Shellfish Hatchery in natural waters of Dabob Bay, WA having favorable (left, pCO_2 = 403 ppm, $\Omega_{aragonite}$ = 1.64, and pH (total) = 8.00) and unfavorable (right column, pCO_2 = 1418 ppm, $\Omega_{aragonite}$ = 0.47, and pH (total) = 7.49) carbonate chemistry during the spawning period.
Photo credit: Brunner/Waldbusser.



APPENDIX B

Why the West Coast is vulnerable to ocean acidification – and what we can learn from it

Ocean acidification (OA) is a global problem triggered by the world's oceans absorbing society's CO_2 emissions from the atmosphere, but the effects of OA will manifest unevenly in different regions of the world. The West Coast of North America – among the first and most prominent regions being impacted by OA – is especially vulnerable because of a confluence of factors affecting this ecologically and economically significant region. However, as OA's global impacts intensify, other regions of North America – from the fisheries-dependent Gulf Coast to the slow-flowing embayments of New England – also will be altered by OA. Thus, the West Coast can and should serve both as a harbinger of OA's impacts worldwide and as a case study on how to develop a highly effective, region-specific science strategy for reducing the threat of OA on the West Coast and other regions of North America.

A confluence of factors makes the West Coast especially vulnerable to OA

OA along the West Coast is being driven by a confluence of conditions that will create increasingly severe impacts over the foreseeable future. There are two primary natural phenomena that work in concert to heighten the region's vulnerability to global CO_2 emissions:

1. **Ocean currents:** Acidification of West Coast waters originates with oceanic currents that transport waters across the northern Pacific Ocean from Asia to the West Coast. The journey for these waters – which takes about 30 years but can be as long as 50 years – begins off the coast of Japan, where surface waters absorb atmospheric CO_2 produced through global human activity and then sink hundreds of feet beneath the ocean's surface. As these subsurface waters move toward the West Coast, CO_2 levels rise even more as natural respiration processes break down sinking organic matter (and deplete dissolved oxygen). Because these deep waters are naturally enriched in CO_2, the added CO_2 from atmospheric emissions has a disproportionately large impact on ocean chemistry.
2. **Coastal upwelling:** Along the West Coast, winds that blow southward push surface waters away from the coastline. As surface waters are displaced, the deep waters rich in CO_2 and poor in dissolved oxygen (DO) are pulled to the surface in a process known as upwelling. Upwelling spreads CO_2–enriched waters across the entire continental shelf, pushing chemical conditions past biological thresholds for harm in many coastal zones.

A confluence of factors makes the West Coast particularly vulnerable to ocean acidification; a regional, coordinated science approach is the best strategy to mitigate impacts.

Because these physical and biogeochemical processes play out over a multi-decade timeframe, the effects of West Coast OA are projected to become increasingly severe over time. Three decades ago, atmospheric CO_2 levels were about 16% lower than they are today. Thus, the waters already in transit to the West Coast will carry an increasingly heavy anthropogenic CO_2 burden as they arrive on West Coast shores. In fact, even if atmospheric CO_2 emissions could immediately be stabilized, the West Coast would still be grappling with increasingly CO_2-rich waters for at least the next three decades.

Compounding these challenges is global climate change, which is also triggered by rising CO_2 emissions. As the world's oceans warm, seawater will become less able to hold DO, and the difference in temperatures between surface waters and deeper waters will grow bigger, reducing the oxygen resupply to deeper waters. Both trends will result in larger and more severe low oxygen, or hypoxic zones. Meanwhile, West Coast upwelling is projected to intensify as the winds that drive upwelling strengthen in response to global warming. Because upwelled waters are also depleted in DO, the progression of OA in many parts of the West Coast will take place against a backdrop of increasing risk of hypoxia events. This co-occurrence of hypoxia poses further challenges for organisms already subject to OA stress, increasing the vulnerability of the West Coast region to the effects of rising CO_2 emissions.

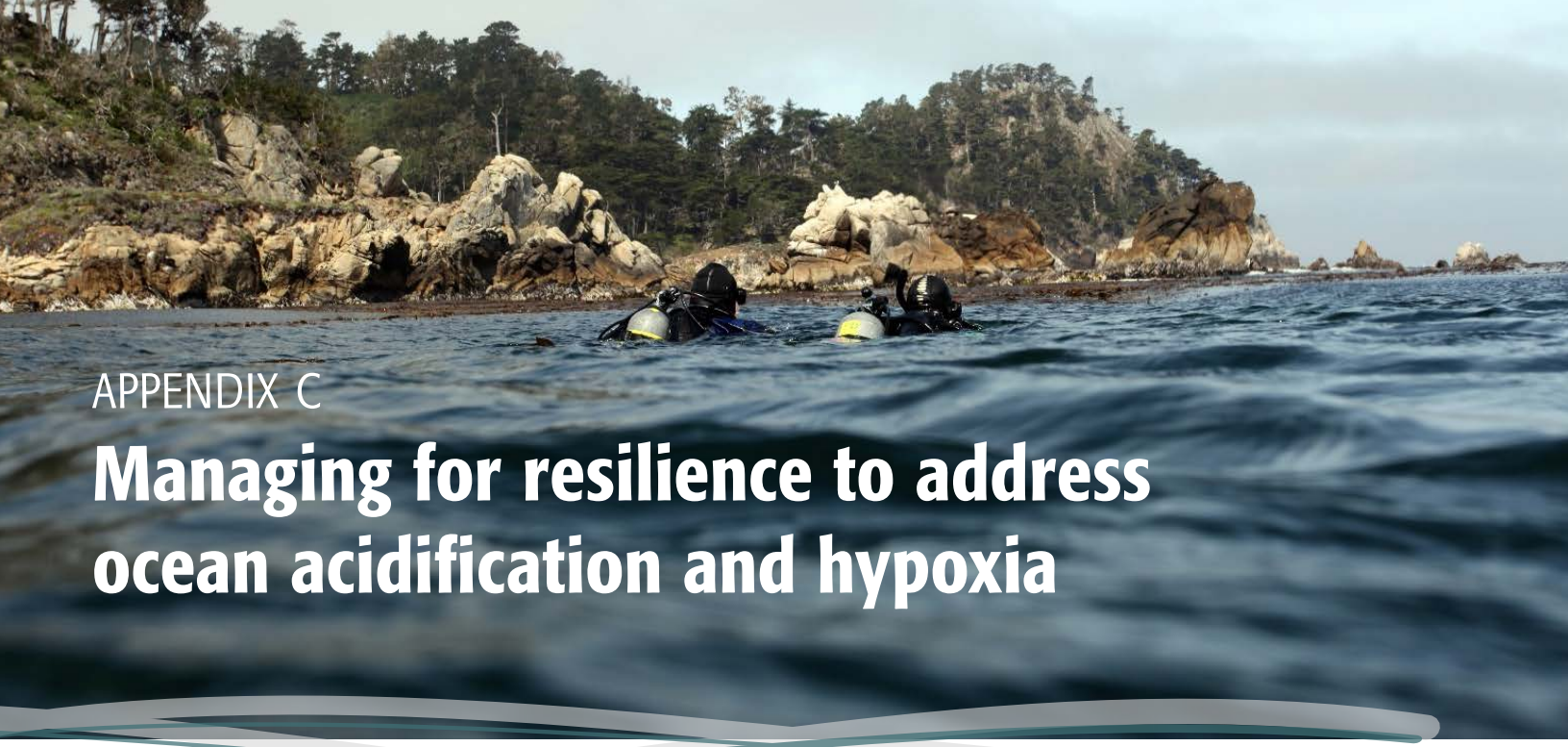
The most effective way to reduce West Coast vulnerability is through coordinated science

Because OA is a regional problem for the West Coast, the best way to mitigate OA's impacts is a regionally coordinated scientific research and monitoring strategy. Scientists and managers from across the West Coast can work together toward reducing OA's impacts on coastal ecosystems. A coordinated approach can take advantage of scientific commonalities that link the geographically and ecologically disparate areas that make up the West Coast region. For example, while Southern California's highly urbanized coastline may bear little resemblance to the minimally developed outer coast of Washington, they share many species of marine life in common. In fact, many important fishery species such as hake, tuna, and sardines move readily across state and national borders. Even for bottom-dwelling invertebrates such as Dungeness crabs, clams, and mussels, local populations can be genetically connected over large distances by the dispersal of planktonic young on ocean currents. Insights into biological vulnerability gained from one region can thus quickly inform information needs in another. Likewise, projections of ocean chemistry changes in any local ecosystem will require input from coast-wide models that set the stage for broader-scale patterns and trends in exposure. The development of such crucial coast-wide models is already underway and offers another avenue to accelerate access to knowledge needed across the region.

While local modeling and monitoring efforts are critical, they can have tremendous added value when they are linked together in a region-wide context that matches the regional scope of West Coast OA. By forming collaborative partnerships that leverage regional expertise and resources, and reduce redundancies, the West Coast can take advantage of economies of scale to mount a strong defense against this intensifying region-wide problem. OA knows no political boundaries and cannot be managed within defined jurisdictional borders, underscoring the value of highly coordinated, leveraged science.

The West Coast can serve as a proving grounds for strategic OA management

The West Coast will be a harbinger for the types of OA impacts that will be widely felt across coastal North America in the coming decades. By working in a coordinated fashion, scientists can provide managers with useable knowledge and information that informs and supports their OA management decisions. Just as importantly, the West Coast can serve as a proving ground for strategic OA management in other regions of North America and the world. Even within the West Coast region, "one size fits all" approaches are unlikely to be successful, as local factors that amplify or dampen OA vulnerability will differ with geography. Consequently, the vast and varied West Coast region offers the opportunity to test and compare diverse strategies, models and guides that can be transferred to other regions of North America.



APPENDIX C

Managing for resilience to address ocean acidification and hypoxia

The term "resilience," as applied here, refers to the adaptive capacity of ecological systems to cope with and recover from the impacts of ocean acidification and hypoxia (OAH) and other stressors. Here we provide the Panel's suggestions for how the management community can support ecological resilience under conditions of intensifying OAH by undertaking targeted actions that preserve or enhance the capacity for ecological systems to cope with and recover from OAH. Managing for resilience includes adaptation measures that seek to proactively lessen the impacts of OAH, and mitigation approaches that reduce exposure to co-occurring stressors. Such actions can be applied now to address impending changes in ocean chemistry. While intensifying OAH conditions may eventually cause some ecosystems to change substantially or irreversibly, over the near-term, managing for resilience represents an important strategy for "buying time" to slow the onset and reduce the scope of harmful ecosystem changes.

Ecological concepts that underlie managing for resilience

Resilience spans many scales of biological organization, ranging from short-term physiological adjustments that take place within individual organisms, expression of adaptive capacity through evolutionary changes in populations, to the maintenance of ecological function by species turnover at the scale of ecosystems. Despite the number and complexity of biological and ecological processes that contribute to ecological resilience, scientists have been able to identify a specific set of desired attributes of resilient systems that are well-suited for protection or enhancement via management intervention. These general attributes include diversity, redundancy, modularity, connectivity, and adaptive capacity. For example, diversity in the form of a species-rich and functionally-redundant community of aquatic vegetation can be fostered by habitat protection measures. The resilience of fish populations can be promoted through harvest regulations that maintain broad distributions in age class structure and the contribution of sub-populations to a fishery. Population connectivity and, to a lesser extent, modularity, are already central elements in the design of coastal protected area networks.

...over the near-term, managing for resilience represents an important strategy for "buying time" to slow the onset and reduce the scope of harmful ecosystem changes.

Managers can also develop solutions that foster resilience by focusing on stressors that co-occur with OAH, such as physical disturbances to nearshore habitats, warming temperatures, toxic contaminants, biological invasion, and harvest. Co-occurring stressors can diminish the ability of ecological systems to cope with OAH, but may be amenable to control through management action.

Maximizing benefits from managing for resilience

Although managing for resilience is a useful near-term management strategy for coping with OAH, the adaptive capacity of West Coast ecosystems is not limitless. Managing for resilience is likely to become less and less effective as OAH intensifies and degrades precisely the biological and ecological attributes that confer resilience to populations, communities, and ecosystems. Where and when managing for resilience is likely to be most successful is also likely to vary greatly among systems and from place to place, but understanding of this variation is poorly developed for OAH. Identifying priority candidate fisheries or systems where the development and implementation of resilience-focused management plans are most likely to be beneficial would be an important first step in managing for resilience across the region.

Resilience management can involve actions to prevent the loss of resilience from status quo conditions, or interventions that enhance the resilience of a system in the face of intensifying OAH stress. The effectiveness of either approach will depend on establishing metrics of resilience, defining targets and goals, and developing the ability to track changes in resilience and intervene adaptively if goals are not met. Because preserving and enhancing resilience to OAH are not currently explicit goals of natural resource management, metrics to quantify resilience, targets for those metrics and approaches to monitor changes in resilience have yet to be fully developed.

Increasing the capacity to hone such tools is an important opportunity to advance managing for resilience from conceptual strategy to concrete implementation. For now, managers will need to work with scientists to develop, test, and refine such approaches in real world applications.

Resilience management can involve actions to prevent the loss of resilience from status quo conditions, or interventions that enhance the resilience of a system in the face of intensifying OAH stress.

APPENDIX D

The cost of inaction

Failure to take action will reduce management options and trigger more severe ecological harm

Marine ecosystems, and the industries that depend on them, face growing risks of widespread harm that will become increasingly difficult to reverse as rising CO_2 emissions intensify ocean acidification and hypoxia (OAH). Thus, the cost of inaction on OAH, in the form of reduced management options and wider ecological changes, will rise over time. Scientists are working to understand where and when OAH's aggregate impacts will cross thresholds, or "tipping points," where ecosystems switch to significantly degraded or altered states from which recovery becomes increasingly unlikely. Scientists also are continuing to evaluate what actions West Coast managers can take now to slow the progression of OAH and mitigate its most ecologically and economically threatening impacts.

The full scope of ecological changes ahead is not yet well understood or described, and, as with any area of scientific projection, understanding will come qualified by caveats about scientific and statistical uncertainty. While skeptics might argue that West Coast managers should wait to take action until these uncertainties are resolved, the Panel strongly disagrees with that assessment. OAH science allows researchers to link various observational and modeling data to develop reasoned, informed projections that can help bound expectations about what the world might look like in 1 year, in 10 years, in 50 years. These projections will change as scientific understanding of OAH improves, but the general trends are clear.

...the cost of inaction on ocean acidification and hypoxia, in the form of reduced management options and wider ecological changes, will rise over time.

Science supports the decision to act now to start addressing OAH

The Panel's rationale for why West Coast managers should take action now includes:

1. Larger and more rapid changes in ocean chemistry lie ahead.

Continued atmospheric CO_2 emissions will alter the chemistry of coastal waters in ways that will fundamentally make it more difficult to support ecosystems and the benefits that they provide to humans today. These changes in ocean chemistry are not projected to occur in a simple incremental fashion, as non-linearities in the carbonate system amplify the impacts of future rise in seawater CO_2 content. Larger and more rapid changes can also arise from processes associated with climate change and nutrient inputs that enhance inorganic carbon loading and the intensity of ocean hypoxia.

2. The risk of crossing biological and ecological thresholds will increase as OAH stress intensifies.

In addition to non-linear changes in ocean chemistry, scientists also expect impacts on marine life populations and ecological communities will rise non-linearly as the intensification of OAH stress exceeds the physiological tolerance of an increasingly large suite of species that interact within coastal food webs.

3. Predictive power will decrease as the effects of OAH move deeper into uncharted territory.

As the West Coast moves away from presently observable states of ocean chemistry and ecology, it will become harder for scientists to predict with confidence how ecological systems will be affected by OAH. Thus, West Coast managers will benefit from slowing OAH's impacts, as it will help to preserve access to the best-constrained assessments of risks and options.

4. Degraded systems may become less resilient to OAH stress.

Emerging science suggests that as ecosystems become degraded by OAH and other stressors, they become less resilient and less able to withstand increased OAH stress going forward. This suggests that taking actions now to prevent the loss of resilience can lessen the impacts of OAH in the future.

5. Reversing OAH degradation later will involve greater effort and/or longer lag times.

Preventing declines in populations or ecosystems is often more tractable and less costly than reversing declines once they have occurred. For example, challenges in rebuilding fish populations once genetic diversity is lost, or restoring habitats once they have shifted into a less desired state, illustrate the difficulty of reversing ecological degradation. By allowing more changes to manifest before taking management action, OAH effects may become more difficult and perhaps impossible to reverse.

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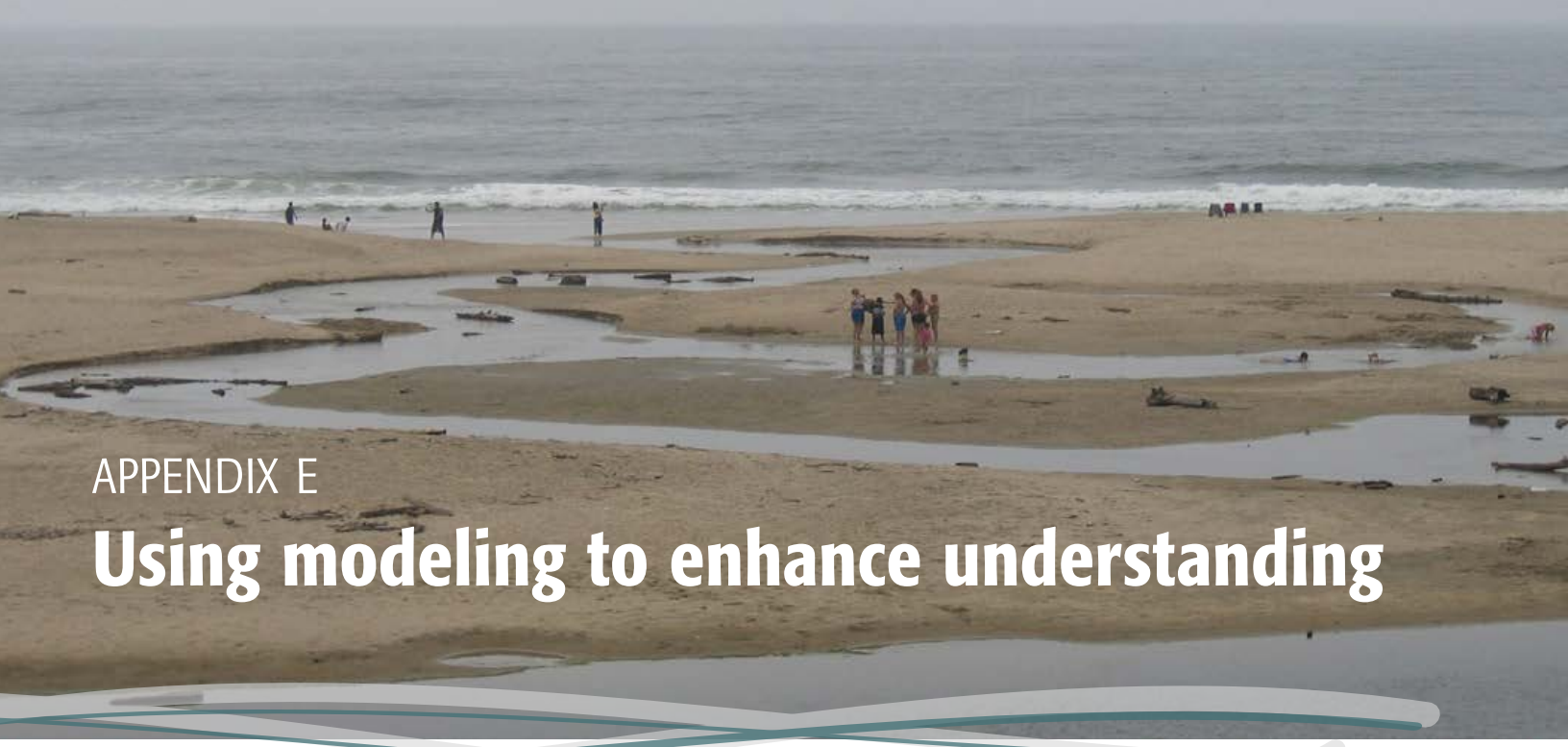


APPENDIX E

Using modeling to enhance understanding

Predictive mathematical models that provide insight into the potential ramifications of ocean acidification and hypoxia (OAH) play an instrumental role in scientists' ability to offer a suite of management options that address OAH in an informed, scientifically defensible fashion. Modeling tools allow scientists to forecast what future conditions will look like, to interpolate limited data sets to build a comprehensive picture of conditions, to evaluate likely success of potential management actions, to prioritize data gaps, and to evaluate monitoring plans.

OAH models will allow coastal managers to make better-informed decisions about implementing controls on local pollution sources that are exacerbating OAH, and to engage in ecosystem-scale resource management planning. Multiple research groups are already in various stages of developing such models, but efforts to date are limited in several respects. First, OAH model development has primarily focused on large oceanic scales, leaving important knowledge gaps in scientists' ability to predict OAH dynamics in near-coastal waters, estuaries and bays that are the primary focus of potential management action. Second, physical models that describe the movement of ocean water across space and time have not yet been systematically coupled with biogeochemical models, which describe how various environmental elements together exert collective effects on OAH chemistry, or with ecosystem models that integrate physical, biogeochemical and ecological properties to predict effects on marine life populations and whole ecosystems.

Thus, additional investments in OAH modeling work are needed to enhance, coordinate and link existing modeling efforts to OAH-related management decisions. The Panel recommends that West Coast managers and the scientific community move forward by building and improving upon both coupled physical-biogeochemical models and fishery and ecosystem models. These models should be validated with management endpoints in mind and against various settings. The modeling community would also benefit from a modeling forum to promote collaboration and interaction with managers. These recommendations are outlined in greater detail here.

OAH models will allow coastal managers to make better-informed decisions about implementing controls on local pollution sources...

OAH Modeling Recommendations

1. Invest in a suite of coupled ocean-margin physical and biogeochemical models.

Although a nested set of physical and, to a lesser extent, biogeochemical models has already been developed for the West Coast, these models have coarse resolution that inhibits their application in areas that are the focus of management concern. West Coast managers should build capacity for downscaling these physical models, extending them closer to shore, and integrating them with biogeochemical models to create high-resolution, coupled models.

2. Improve fishery and ecosystem models.

Although a broad suite of models are currently employed to inform fishery management and predictions of ecosystem changes along the West Coast, the objectives of these efforts have generally fallen outside the scope of OAH management needs. Fishery and ecosystem models will be crucial for understanding and predicting the full extent of OAH impacts. The utility of these models, however, will depend on how biological and ecological responses of OAH are parameterized, and how outputs from coupled physical-biogeochemical models are utilized. To better support marine resource decisions, scientists should prioritize research that yields parameterize-able understanding of the biological and ecological impacts of OAH, and improvement in the capability of fishery and ecosystem models to be informed by advances in coupled physical-biogeochemical models.

3. Validate the models.

The management decisions that will be based on model outputs are likely to be costly. As such, models should be validated and improved with endpoint management decisions in mind, and with a focus on identifying knowledge gaps and quantifying uncertainty. Validation efforts should extend explicitly into near-coastal areas where temporal and spatial variability are the highest, and where a large number of management decisions are concentrated. Scientists should first seek to validate existing models using observational data for a broad range of climate and ecosystem states, with a focus on quantifying uncertainties and identifying key gaps in data and modeling infrastructure. Second, scientists should compare the outputs of multiple models to constrain uncertainty in their projections, which could ultimately pave the way for development of the next generation of models.

4. Collect data to support model development and refinement.

The ability of models to make accurate predictions of future ecosystem changes – be it aragonite saturation state, dissolved oxygen, biodiversity, or fish populations – is limited by the availability of data that can be used to parameterize those key attributes. In turn, confidence in model outputs will depend on a clear understanding of the ability of models to accurately reproduce features of the ecosystem that are of greatest management interests. This understanding will require diverse datasets that test model performance across different regions or habitats, and across different seasons and years as ocean and ecosystem conditions change. Investments in the sustained collection of integrated oceanographic and ecological data sets will be crucial for refining the performance of predictive models and their utility in informing decisions. There also should be effort to create a central repository for observational data and model output so that they are used effectively to inform further research, and ultimately management action.

5. Establish a forum to advance coastal ocean modeling.

The West Coast would benefit from creation of a forum that brings scientists and managers together to synthesize local and regional management needs, and to ensure that scientists are working in a coordinated, synergistic fashion to address those management needs. An organized community of modelers, observational researchers, and managers will serve to: (1) provide a vehicle for dialogue on management goals and scenarios, (2) encourage discussion on the use of model outputs to illustrate outcomes of management options to reach those goals, (3) facilitate discussion about the level of validation needed to use models to support management decisions, and (4) coordinate modeling products among different technical specialists. A first critical action is to convene a series of workshops to summarize key regional and local management needs, and identify the status of existing models to support those needs.

APPENDIX F

Approaches to reduce CO_2 in seawater

The impacts of rising atmospheric CO_2 concentrations on seawater carbonate chemistry can be reduced using two possible approaches. The first is biologically-based, making use of the natural ability of the ocean's photosynthetic organisms (algae and plants) to capture CO_2. For example, seagrasses, kelps and other macrophytes remove CO_2 from seawater and convert it into living tissue. This CO_2 uptake can occur at sufficiently rapid rates to significantly improve water quality for organisms sensitive to carbon chemistry changes. Although a substantial fraction of this organic carbon is released as CO_2 when plant tissue decomposes, active photosynthesis may offer a means to locally reduce CO_2 in shallow coastal environments.

There has been considerable interest along the West Coast in protecting and restoring aquatic vegetation as a means to reduce CO_2 in coastal aquatic ecosystems. Seagrass beds and kelp forests are among the world's most productive habitats, with rates of net primary production that can exceed those of tropical forests. The ability of aquatic vegetation to influence coastal chemistry is evident from estuarine monitoring data that show day to night swings in pH whose magnitude can exceed near-term declines projected from OA.

The second approach uses abiotic methods to mitigate OA exposure. Abiotic methods can be used to increase chemical buffering capacity (alkalinity) of seawater or physically remove CO_2. Synthetic base chemicals or natural base minerals can be added to seawater to increase its alkalinity. This in turn neutralizes seawater acidity and buffers against the effects of increasing CO_2 on seawater chemistry. CO_2 can be directly removed from seawater using engineered approaches such as electrochemistry, electrodialysis, vacuum extraction, and aeration with a CO_2-depleted gas.

...coastal vegetated habitats hold some of the highest concentration of organic carbon of any ecosystem on the planet, and serve as a globally important sink for carbon (i.e., blue carbon).

There are potential co-benefits of habitat protection and restoration

While one potential benefit of protecting and enhancing aquatic vegetation is reducing CO_2 in seawater, additional co-benefits may also be realized. A portion of the CO_2 converted into vegetation can be buried in sediments. This process represents the potential long-term storage or sequestration of CO_2. On an areal basis, coastal vegetated habitats hold some of the highest concentration of organic carbon of any ecosystem on the planet, and serve as a globally important sink for carbon (i.e., blue carbon). Consequently, their conservation and restoration could one day become eligible for carbon offsets in carbon trading markets, such as the one established in California, or for other funding that promotes carbon sequestration. We also note the distinction between short-term removal of CO_2 and the long-term sequestration of CO_2 by vegetated habitats. For example, kelp forests, while highly productive and active in CO_2 removal on a daily and seasonal basis, grow on hard bottom habitats where local sediment burial and the potential for long-term carbon sequestration may be minimal. In contrast, emergent marsh vegetation uses CO_2 from the atmosphere for photosynthesis and releases CO_2 to surrounding waters through root respiration. Yet, these systems can be highly effective in trapping and sequestering carbon-rich sediments, or removing nutrients that may otherwise contribute to acidification or hypoxia in downstream habitats.

Another benefit of protecting and enhancing aquatic vegetation is the creation of habitat for fish and other biota. One of the Panel's **Actions** is considering the ability of aquatic vegetation to remove CO_2 from seawater in addition to its habitat value during habitat restoration planning. Accounting for both of these ecosystem benefits will assist in better achieving the full societal value of habitat restoration and management.

Advancing research to increase management options

Across the West Coast, researchers are actively investigating approaches for restoring aquatic vegetation, their role in locally modifying coastal seawater chemistry, and the daily to seasonal patterns of carbon uptake of these environments. In the K'ómoks Estuary on Eastern-central Vancouver Island, the transplanting of eelgrass from donor beds to previously disturbed estuaries has been successful in establishing new beds. Dive surveys have confirmed a transplant success rate of 95%. In Washington, pilot studies have reported elevated daytime pH in waters over seagrass beds relative to bare sediment habitats. In Oregon, oyster hatchery managers at Netarts Bay have begun to selectively draw seawater into the hatchery during hours when photosynthesis in the seagrass-rich system has reduced CO_2 to levels acceptable for their operations.

These examples highlight the potential applications of aquatic vegetation protection and restoration as actions to reduce CO_2 and ameliorate, if not offset, OA in local ecosystems. If successful, such actions can increase the range of options available to managers to address OA. Important questions nonetheless remain as to the effectiveness of aquatic vegetation CO_2 reduction as an OA mitigation strategy and must be answered before implementation. For example: Will the benefits of photosynthesis be offset by increases in the daily and seasonal swings in carbon chemistry? How far does the spatial "footprint" of such effects extend? What are the range of settings and locations where vegetation protection and restoration will be most successful and beneficial? Can such measures be employed in concert with other management actions to maximize conservation benefits? These questions can be addressed directly in larger-scale, proof-of-concept demonstration studies. When conducted across a range of habitats, these efforts can provide managers with new, useable knowledge of if and where protection and restoration of vegetated habitats will sufficiently remove CO_2 to meaningfully mitigate OA.

Options from engineering approaches

Human intervention to mitigate OA through engineering addition of basic materials and removal of aqueous CO_2 is still in early development. The effective scale, ecological consequences, and carbon footprint of such efforts remain uncertain but can offer important options for impacted industries. For example, shellfish growers on the West Coast have begun to use alkalinity management to offset the increase in carbonate mineral corrosivity from OA in hatchery settings. Although currently available approaches remain likely tractable only at localized scales and in controlled environments, future technological advances may broaden the applications of engineering approaches. Further research will be needed to determine the safety, cost effectiveness and potential scale of such efforts in countering the ongoing global progression of OA and its regional expression on vulnerable West Coast ecosystems.

APPENDIX G

Existing water quality criteria are inadequate to protect marine ecosystems

Water quality criteria are the management foundation of the Clean Water Act. They provide a basis for assessing water body condition, determining the level of discharge that will maintain a water body in an ecologically acceptable condition, and objectively determining when a water body is impaired. Most importantly, water quality criteria serve as targets for water body planning and mitigation projects, even outside of the regulatory framework.

Unfortunately, the existing water quality criteria for pH are not scientifically valid for application to ocean acidification (OA). They were developed 40 years ago, and the Panel has determined that they are neither based on current science nor are they ecologically relevant. Damage to ocean biological communities has been documented at thresholds that are well within the criteria's legally permissible range.

Shortcomings of existing criteria

Existing OA criteria are based on two types of pH thresholds: a requirement that pH should not fall below 6.5, and a requirement that pH should deviate no more than 0.2 pH units from natural conditions. Both types of thresholds are flawed for the purposes of application to acidification.

The minimum pH of 6.5 is inadequate because numerous studies have shown diverse biological impacts routinely manifest at pH levels well above 7.5, at which acidity (hydrogen ion concentration) is an order of magnitude higher than pH 6.5 (pH is on a logarithmic scale). The Panel's publication, "*What changes in the carbonate system, oxygen, and temperature portend for the northeastern Pacific Ocean: a physiological perspective*," provides more detail about the range of biological responses that occurs even as existing pH criteria are met.

The second part of the criteria, which calls for a deviation of no more than 0.2 pH units from natural, is flawed because it is impractical to apply. "Natural" conditions cannot be established spatially because the entire West Coast region is undergoing change due to global atmospheric inputs, and it is difficult to establish temporally because there are few long-term data sets with enough precision and accuracy to capture this level of change. This is compounded because measurement imprecision of the technology used in discharge monitoring programs is greater than 0.2 pH units, creating a margin of error that can mask ecologically relevant pH changes. Criteria inadequacies regarding establishing "natural" conditions are further described in the Panel supporting document "*Water quality criteria for acidifying oceans: Challenges and opportunities.*"

...the existing water quality criteria for pH are not scientifically valid for application to ocean acidification.

Water quality criteria should be expanded to encompass other acidification parameters

Although developing an alternative pH criteria represents an important first step, revisions to water quality criteria should be expanded to include other biologically relevant acidification parameters. pH is only one of several possible parameters for describing effects of acidification, and it is unclear if pH is even the most biologically relevant variable for many species. Aragonite saturation state, another viable candidate indicator, has been found to be more biologically relevant than pH for shell-building in calcifying organisms. Considerable scientific evidence, particularly from studies of oysters and pteropods – a shelled zooplankton at the base of the food web – is already available for establishing both chronic and acute thresholds for aragonite saturation state. In addition, parameters such as pCO_2 have been found to be biologically relevant for fish, affecting their behavior and ability to navigate.

In developing ecologically relevant thresholds for OA parameters, managers should account for potential interactions of OA with co-occurring stressors such as hypoxia. There is a growing recognition that the most acidified regions of the ocean are also low in oxygen, with recent studies showing that dual effects of low pH and hypoxia are more severe than the predicted effects of either stressor alone. In the immediate future, a scientific workshop is needed to identify appropriate biologically relevant indicators and thresholds to assess OA, and to prioritize short-term research needs for informing criteria and threshold development.

> ...revisions to water quality criteria should be expanded to include other biologically relevant acidification parameters.

Development of biological criteria will improve assessment of acidification effects

The Clean Water Act provides an opportunity for assessing ocean health by examining condition of the biological communities that live within it, which has advantages over using pH or other chemical criteria alone. Traditional chemistry thresholds and associated monitoring are limited because they provide information about a relatively narrow portion of the environment at a discrete point in time. In contrast, bioassessment accounts for exposure to multiple stressors over extended time periods, and provides a more integrated reflection of aquatic ecosystem condition.

Incorporating biological criteria into a management context requires linking population and community effects with specific stressors. Effective biological criteria should provide early-warning management cues, before significant ecosystem alteration has already taken place. However, biological criteria also need to relate to effects on growth, survival, reproductive success or other metabolic functions that have repercussions at the population level, as opposed to simply quantifying exposure to a stressor. For example, pteropods might prove useful as a biologically relevant criterion for linking acidification stress to biological response, as they are an important food source for economically important fish and are among the first organisms to be affected by acidification in a marine ecosystem. Pteropods have thin aragonitic shells and narrow optimum windows for calcification, leading them to display rapid responses to corrosive waters. Acidification effects on their calcification have been studied under both field and laboratory circumstances and such indicators could offer a more integrated understanding of acidification effects.

Using ecologically relevant criteria to support OA management

Water quality criteria are typically used as regulatory tools, such as making decisions under the Clean Water Act Section 303(d) regarding whether a water body is impaired. The Panel recognizes that this is one application of water quality criteria, but the Panel also recognizes that credible water quality criteria can be effective in other decision-making contexts. For example, water quality criteria provide essential context for interpreting monitoring data or the output of model predictions about the likely effects of potential management actions. They also become part of a shared toolkit with managers from other sectors, providing a common framework for discussions about appropriate actions for fisheries and marine reserves. Additionally, scientifically-founded OA criteria can also be used to educate the public about OA and its effects on local waters.

APPENDIX H

Establishing ocean acidification and hypoxia research priorities

A strategy for aggressively expanding options for management action

To manage effectively for ocean acidification and hypoxia (OAH), West Coast managers need an arsenal of tools and options that are grounded in sound science. However, OAH research is still largely in its infancy, generally limiting the management options available. While the amount of OAH research being conducted has exploded over the past decade, many critical knowledge gaps remain. This document outlines the Panel's recommendations for aggressively expanding the breadth and depth of OAH research in order to meet the demands for management-relevant information on the West Coast and beyond. Organized around five major research areas, this research portfolio has been designed with the assessment that absent a coordinated and strategic prioritization of research foci, current research trajectories are unlikely to meet growing needs for management-relevant knowledge. To that end, scientists must go beyond answering academically stimulating questions; they also must maintain a relentless focus on providing managers with concrete, actionable options for immediately combatting the threats posed by OAH. Scientists are invested in seeing their OAH work translated into viable management options, but need help from West Coast managers in coalescing around a shared research vision and coordinating efforts for maximum impact and efficiency. The recommendations outlined in this Appendix are expanded in the Panel's more detailed document "*Research Priorities to Inform Decisions and Develop Solutions.*"

While the amount of OAH research being conducted has exploded over the past decade, many critical knowledge gaps remain.

Understand drivers of OAH

Scientists understand at a conceptual level that local nutrient and carbon inputs can exacerbate the impacts of OAH. However, management recommendations about reducing these local inputs are qualified by the lack of clear understanding about precisely where on the West Coast local inputs are sufficiently large to be meaningful relative to the global scale inputs that drive OAH. Furthermore, more clarity is needed about the relative importance among local inputs (non-point source vs. wastewater discharge vs. local atmospheric inputs) to prioritize for reduction. Thus, the Panel recommends investing in research that enhances our understanding of the relative importance of local vs. global contributions to OAH. West Coast managers should focus on developing key datasets, and coupled physical-biogeochemical models, validated with observations, that quantify the relative impacts of various nutrient, carbon and carbon dioxide sources on exacerbating OAH. Investments should also continue in developing new, accurate, cost-effective and

easily deployed ocean sensors for OAH parameters. These models should be evaluated in the context of decision-making processes, and observational data should be collected to enhance model validation. As scientists learn more, they can adjust and adapt strategy options for source reduction that will maximize effectiveness and minimize cost.

Assess vulnerability to changing conditions

A key management information need is understanding how fast seawater chemistry is changing, at what locations seawater chemistry will change the most, and what levels of chemical change will trigger substantial changes in biological communities. Scientists along the West Coast are in various stages of developing coordinated monitoring programs, conducting laboratory and field experiments, and refining numerical models to address such questions. However, additional research is needed to transition these studies from individual research projects to more concerted, connected sets of research activities that address the underlying management questions. In addition, current efforts need to be expanded to downscale global models to project change along the West Coast, elucidate the biological effects of multiple stressors within the context of real-world exposure conditions and enhance the translation of physiology-scale findings to population- and ecosystem-scale projections.

Understand evolutionary response to OAH

Although organisms have the potential for evolutionary adaptation to cope with OAH stress, scientists have insufficient information to predict whether, where, and how fast that genetic adaptation will occur. Thus, research is needed to understand rates of natural genetic change in response to OAH, and how evolutionary potential is distributed among taxa and localities. Moreover, West Coast managers need to understand how this potential for adaptation can best be incorporated into management strategies, such as use of refugia to protect the genetic diversity that now exists in local biota, especially those that are routinely exposed to high levels of OAH stress. Research will also allow assessment of the potential value and consequences of purposeful interventions, such as selective breeding and translocation. With sufficient knowledge, managers can determine whether and where opportunities exist to use evolutionary potential to address OAH's impacts on biological communities.

Explore sequestration and other carbon removal solutions

The acidification of seawater can be mitigated in two main ways: a) a biologically-based approach, in which seagrasses, kelp and other vegetation remove carbon dioxide from seawater and convert it into living tissues, and b) a chemically-based approach, in which the addition of base minerals such as carbonates is used to neutralize acidity. These approaches are appealing because they operate at the local level, but their applications to date have been limited and focused mostly on laboratory or small-scale settings. The Panel recommends supporting research on the type, capacity, cost-effectiveness, and safety of these removal processes as a means to determine which, if any, of these could become part of an effective marine conservation strategy.

Advance living marine resources management

Because the Panel has recommended that managers undertake actions that enhance the ability of organisms to cope with increasing OAH stress – critically important in the context of managing living marine resources such as commercial fisheries – the growing adoption of ecosystem approaches to fisheries management offers opportunities for fisheries managers to consider the potential regional effects of OAH as they update fisheries management plans. Critical to understanding OAH in an ecosystems context is that different areas are more vulnerable or resistant than others. Ecosystem models that support ecosystem-based fisheries management need to be developed and validated on local scales, and ecological risk assessments that increase understanding of fisheries vulnerabilities need to be conducted.

APPENDIX I

Tracking changing ocean chemistry through an ocean acidification and hypoxia monitoring network

A foundation for informed management decisions

Ocean acidification and hypoxia (OAH) monitoring programs dot the West Coast, as monitoring plays an invaluable role in scoping the severity of OAH-related problems, determining the trajectory of the problem (i.e., is it getting worse, and at what rate?), and assessing the effectiveness of past and planned management actions. Many monitoring programs were developed to address specific research or management needs. As a consequence, they do not adequately operate on the spatial and temporal scales over which OAH is occurring. Furthermore, traditional OAH monitoring focuses on measuring basic chemical parameters, such as pH and dissolved oxygen, rather than the full array of interrelated variables that collectively define OAH's impacts.

The Panel recommends establishment of a sustained, strategic and adaptive monitoring network that is founded on integration, coordination, and harmonization of existing efforts and their expansion in ways that will inform policy and management decisions. A regional OAH monitoring network will link decision-makers with a common pool of scientific data that will enable them to evaluate how, when, and where to act to serve the best interests of the region and society as a whole.

The monitoring network envisioned by the Panel explicitly includes physical, chemical, biological, and ecological monitoring to track change, understand impacts, and evaluate management actions. It leverages and enhances existing assets (e.g., observing systems, ecological time-series), technologies, protocols, partnerships, data systems and management frameworks (e.g., protected areas) to achieve a strategic, efficient network. The Panel's foundational requirements for a rigorous regional monitoring program are provided in a separate technical document entitled "*Ocean Acidification and Hypoxia Monitoring Network: Tracking the Impacts of Changing Ocean Chemistry to Inform Decisions*."

A regional OAH monitoring network will link decision-makers with a common pool of scientific data that will enable them to evaluate how, when, and where to act...

Here we describe the key actions needed to achieve that desired monitoring network.

1. Define management needs from OAH monitoring.

Cultivate and enhance existing partnerships between monitoring practitioners, modelers, and decision-making users to better define OAH information needs across ecosystem types, and for diverse uses.

2. Assess how well existing monitoring efforts meet those management information needs.

Complete a comprehensive inventory of the geographic distribution, data quality, and operational status of existing monitoring programs that provide information relevant to OAH management. Use this inventory to address how well these monitoring assets are positioned to address management questions and support OAH forecast models. Use OAH model outputs to evaluate the information value of existing and proposed monitoring locations.

3. Evaluate and prioritize needs for new investment.

Enhance existing monitoring efforts to fully address management questions. Assess the feasibility of adding new measurements and analytical capacity to existing monitoring efforts. Establish regular communication and connections among managers, scientists, system operators, and end-users to iteratively assess the strength of alignment between monitoring activities and decision-making needs.

4. Enhance consistency among programs through training and quality assurance.

Many monitoring programs on the West Coast were established independently and thus have unique procedures for data procurement and management. Measurement techniques and data archiving should be harmonized among monitoring efforts. Staff involved in monitoring requires training in these procedures, and quality assurance activities should be performed to ensure reliability and comparability of data.

5. Develop a centralized portal for accessing OAH monitoring data.

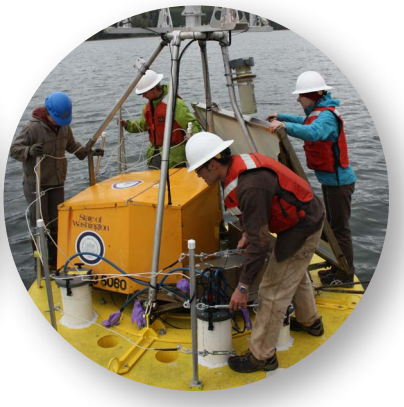
Develop a simple means for accessing diverse monitoring data sets as well as OAH model output that inform OAH management. This will allow data to be catalogued, combined, compared, and shared, ensuring that monitoring data and model output are used effectively to inform further research, and ultimately management action. Establish community protocols for submitting new data into common data portals.

6. Develop and sustain intellectual capacity.

It is not enough to just make measurements and run models - it is also critical to maintain the intellectual capacity to interpret and communicate the findings. Investments in data analysis and data distribution are critical pieces of a monitoring network, as they will ensure the data are used to inform the management decisions the program was designed to support.

7. Communicate information widely.

Develop tools and technologies to promote greater two-way communication regarding observations and analyses, and data synthesis products. Incentivize regular information exchange activities that engage the broader user community.



Enhance existing monitoring efforts to fully address management questions.

V. The Panelists

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Dr. Alexandria Boehm is a Professor in the Department of Civil and Environmental Engineering, and a Senior Fellow of the Woods Institute for the Environment at Stanford University. Her area of expertise is coastal water quality, with a focus on knowledge that is crucial to directing new policies, and management and engineering practices that protect human and ecosystem health along the coastal margin. Dr. Boehm received her M.S., and later her Ph.D., in Environmental Engineering from University of California, Irvine.

John A. Barth
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Dr. John "Jack" Barth is a Professor of Oceanography and Associate Dean for Research in the College of Earth, Ocean, and Atmospheric Sciences at Oregon State University. An expert in the physics of oceans and atmospheres, Dr. Barth specializes in understanding spatially and temporally variable circulation, water mass structure and ecosystem response in coastal waters. He received his Ph.D. from the Massachusetts Institute of Technology and Woods Hole Oceanographic Institution Joint Program in Oceanography.

Francis Chan, Panel Co-chair
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Dr. Francis Chan is an Associate Professor, Senior Research in the Department of Integrative Biology at Oregon State University. He is also a scientist with PISCO – the Partnership for the Interdisciplinary Studies of Coastal Oceans. Dr. Chan is an expert in interactions between biogeochemistry and ecological patterns and processes in coastal oceans, including the drivers and consequences of changing ocean chemistry from hypoxia and ocean acidification. Dr. Chan received his Ph.D. from Cornell University in the Department of Ecology and Evolutionary Biology.

Elizabeth Chornesky
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Dr. Elizabeth Chornesky is an Independent Consultant who assists non-profit organizations, philanthropies, and public agencies in designing science, policy, investment, and organizational strategies. Dr. Chornesky's areas of expertise include ecosystem management, sustainability, and global change, focusing on the integration of science with applied policies and practices to achieve societal goals. She earned her Ph.D. in Marine Ecology from the University of Texas at Austin.

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Dr. Andrew Dickson is a Professor of Marine Chemistry in the Marine Physical Laboratory Division at the Scripps Institution of Oceanography, University of California, San Diego. Playing a key role in providing quality control for oceanic carbon dioxide measurements, he is an expert in the chemistry of carbon dioxide in seawater, with an emphasis on ocean acidification and its effects on marine organisms. Dr. Dickson received his Ph.D. from the University of Liverpool.

Richard A. Feely
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Dr. Richard A. Feely is a Senior Scientist at the National Oceanic and Atmospheric Administration (NOAA) Pacific Marine Environmental Laboratory in Seattle, WA. He also holds an Affiliate Full Professor faculty position at the University of Washington School of Oceanography. Dr. Feely's area of expertise are carbon cycling and ocean acidification processes in the oceans. He received his M.S., and later his Ph.D., in the field of Chemical Oceanography from Texas A&M University.

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Dr. Burke Hales is a Professor in Ocean Ecology and Biogeochemistry in the College of Earth, Ocean, and Atmospheric Sciences at Oregon State University. He is a chemical oceanographer specializing in carbon cycling at the sea-floor, air-sea, and land-sea interfaces, and in the topics of carbon sequestration, ocean acidification, and de-oxygenation, as well as the analytical and physical chemistry of carbon dioxide in natural waters. He received his Ph.D. in Chemical Oceanography from the University of Washington.

Tessa Hill
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Dr. Tessa Hill is Associate Professor and Chancellor's Fellow at University of California, Davis, in the Department of Earth & Planetary Sciences. She is also affiliated with UC Davis Bodega Marine Laboratory, a research station on the Northern California Coast. Dr. Hill's expertise is in marine geochemistry, and the response of marine organisms to climate change, including the impacts of ocean acidification on California coastal environments. She earned her Ph.D. in Marine Science from University of California, Santa Barbara.

Gretchen Hofmann
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Dr. Gretchen Hofmann is a Professor in the Department of Ecology, Evolution, and Marine Biology at University of California, Santa Barbara. Dr. Hofmann is an eco-physiologist whose research focuses on the effects of climate and climate change on the performance of marine species, with a focus on how such environmental changes influence the regulation of mechanisms within the body that impact development, geographic distribution and survival. She received an M.S. and Ph.D. from the University of Colorado at Boulder in Environmental, Population and Organismal Biology.

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Dr. Terrie Klinger is the Director of the School of Marine and Environmental Affairs, Co-Director of the Washington Ocean Acidification Center (alongside Dr. Jan Newton), and holds the Stan and Alta Barer Endowed Professorship in Sustainability Science in Honor of Edward J. Miles. She is a marine ecologist focused on applying ecological theory to practical management solutions. Dr. Klinger received her Ph.D. in Biological Oceanography from Scripps Institution of Oceanography, University of California, San Diego.

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Dr. Debby Ianson is an Oceanographer and a Fisheries and Oceans Canada Research Scientist at the Institute of Ocean Sciences in Sidney, B.C., as well as an Adjunct Professor at the School of Earth and Ocean Sciences, University of Victoria, Victoria, B.C. An interdisciplinary expert in chemical and physical oceanography, she focuses on the impact of climate change on biogeochemical cycles along continental margins and their influence on the global ocean. Dr. Ianson received her Ph.D. in Physical Oceanography from University of British Columbia.

John Largier
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Dr. John Largier is Professor of Coastal Oceanography and Associate Director for Research of the Coastal and Marine Sciences Institute at the University of California Davis. Within the Department of Environmental Science and Policy, and resident at Bodega Marine Laboratory, he is an expert in the role of transport in ocean, bay, nearshore, and estuarine waters, including transport of plankton, contaminants, pathogens, nutrients, oxygen, and sediment. He places this work in the context of environmental issues as diverse as marine reserves, fisheries, mariculture, beach pollution, sea-level rise, wastewater discharge, and wildlife health, just to name a few. He earned his Ph.D. in Oceanography, from the University of Cape Town.

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Dr. Jan Newton is a Principal Oceanographer with the Applied Physics Laboratory of the University of Washington (UW) and affiliate faculty with the UW School of Oceanography and the School of Marine and Environmental Affairs, both in the UW College of the Environment. She is the Executive Director of the Northwest Association of Networked Ocean Observing Systems (NANOOS), the U.S. IOOS Regional Association for the Pacific Northwest, and Co-Director (alongside Dr. Terrie Klinger) of the Washington Ocean Acidification Center. A biological oceanographer, Dr. Newton is an expert in the physical, chemical, and biological dynamics of Puget Sound and coastal Washington, including understanding effects from climate and humans on water properties. She holds a Ph.D. in Biological Oceanography from the University of Washington.

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Dr. Thomas Pedersen is Professor of Oceanography at the University of Victoria. He is an internationally recognized authority on ocean chemistry, has published extensively in the field of paleoceanography, and has longstanding interests in climate change issues and the application of government policy to climate-change mitigation and adaptation. Dr. Pedersen holds a Ph.D. in Marine Geochemistry from the University of Edinburgh.

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Dr. George Somero is the David & Lucile Packard Professor Emeritus in Marine Sciences at Stanford University. He studies the effects of environmental factors, such as temperature, salinity, hydrostatic pressure, and oxygen availability on the physiology of marine animals. Dr. Somero received his Ph.D. in Biology from Stanford University.

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Dr. Sutula is a Principal Scientist at the Southern California Coastal Water Research Project (SCCWRP), where she is head of the Biogeochemistry Department. An expert in aquatic biogeochemistry and habitat assessment, Dr. Sutula oversees a variety of projects related to eutrophication and harmful algal blooms in streams, estuaries and nearshore waters, including studies of biogeochemical cycling and their linkage to anthropogenic activities and climate change. Beyond her research activities, she focuses on linking science to management, examples of which include her work as lead scientist to water quality agencies developing nutrient management strategies. Dr. Sutula received her Ph.D. in Coastal Oceanography from Louisiana State University.

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Dr. Waldo Wakefield is Research Fisheries Biologist at the National Oceanic and Atmospheric Administration (NOAA) Fisheries Northwest Fisheries Science Center. He also holds a Courtesy Associate Professor faculty position at Oregon State University in the College of Earth, Ocean, and Atmospheric Sciences. Dr. Wakefield's expertise is in fish ecology, biological oceanography, seafloor habitat characterization, conservation engineering and fisheries science. He received his Ph.D. in Oceanography from the Scripps Institution of Oceanography, University of California, San Diego.

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Dr. George Waldbusser is an Assistant Professor of Ocean Ecology and Biogeochemistry in the College of Earth, Ocean, and Atmospheric Sciences at Oregon State University. Dr. Waldbusser's interests broadly span marine ecology and biogeochemistry. He was a key player in documenting ocean acidification impacts in oyster hatcheries in the Pacific Northwest, and continues to work closely with industry on adaptation and mitigation strategies shellfish growers can implement. He received his Ph.D. in Marine and Estuarine Environmental Science from the University of Maryland.

Stephen B. Weisberg
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Dr. Steve Weisberg is Executive Director of the Southern California Coastal Water Research Project (SCCWRP), a research agency created to provide the scientific foundation for water quality management in California. A biologist who specializes in the design of environmental monitoring programs, Dr. Weisberg's present efforts focus on the development of coordinated, integrated, cost-effective regional monitoring in the Southern California Bight. He received his Ph.D. in Biology from the University of Delaware.

Elizabeth Whiteman
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Dr. Liz Whiteman is the Program Director for the California Ocean Science Trust, a non-profit organization dedicated to advancing science-informed ocean resource management and stewardship decisions. An expert in coral reef ecology, conservation, fisheries management, and the links between science and decision-making, Dr. Whiteman has worked throughout the Caribbean and U.S. West Coast studying the effectiveness of marine protected areas and providing recommendations to policymakers from several countries. Dr. Whiteman earned her Ph.D. in Marine Evolutionary Ecology from the University of East Anglia, U.K.

Skyli McAfee, Panel Convener
Executive Director, California Ocean Science Trust (formerly)
Science Advisor, California Ocean Protection Council (formerly)
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In May 2015, Skyli joined The Nature Conservancy as the Director of the North America Oceans and Coasts Program. She previously served as the Executive Director of the California Ocean Science Trust supporting California coastal and ocean resource managers by providing them with sound science to help inform decisions. She also served as the Science Advisor to the California Ocean Protection Council. In both roles, she built partnerships for science, decision-making and resource management in California.

Support: The West Coast Ocean Acidification and Hypoxia Science Panel, convened by California Ocean Science Trust, is funded by the Ocean Science Trust, the California Ocean Protection Council, and Coastal Impact Assistance Program. The Institute for Natural Resources in Oregon, working in collaboration with California, is supported by the Oregon Governor's Office, the Oregon Department of Fish and Wildlife, the Oregon Department of Agriculture, the Oregon Department of Environmental Quality, the Oregon Department of Land Conservation and Development, and the OSU Research Office. The participation of the Washington Ocean Acidification Center was supported by Washington State and the University of Washington.

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The West Coast Ocean Acidification and Hypoxia Science Panel, April 2016

www.westcoastoah.org

Resolution of the California Ocean Protection Council
On Reducing and Preventing Marine Debris

February 8, 2007

WHEREAS, since the 1970's, marine debris has been widely recognized as a threat to the marine environment; and

WHEREAS, despite global treaties to prevent dumping at sea and minimize land-based sources, and increasing efforts worldwide to protect water quality, the quantity of marine debris in the world's oceans is increasing; and

WHEREAS, the problem of plastic marine debris is increasing in California and the North Pacific Gyre, where densities of micro-plastics have tripled during the last decade; and

WHEREAS, on September 18, 2006, the West Coast Governor's Agreement (Washington, Oregon and California) on Ocean Health was created to address challenges to the declining health of the shared coastal ocean; and

WHEREAS, 60 to 80 percent of all marine debris and 90 percent of floating debris is plastic; and

WHEREAS, the U.S. Department of Commerce estimates that 80 percent of marine debris comes from land-based sources; and

WHEREAS, plastic lasts hundreds of years or longer in the environment without biodegrading; and

WHEREAS, by ingestion, entrapment and entanglement, plastic harms hundreds of wildlife species, some of which are threatened or endangered species under California or federal law; and

WHEREAS, plastic attracts other organisms that can float to distant habitats and become harmful invasive species; and

WHEREAS, plastic and other debris litters our beaches, and represents a threat to California's $46 billion ocean-dependent, tourism-oriented economy and in certain circumstances may pose a public health threat; and

WHEREAS, California state and local agencies spend millions of dollars per year in litter collection; and

WHEREAS, plastics can contain potentially harmful constituents such as phthalates, bisphenol A, styrene, vinyl chloride and flame retardants. Research is being conducted to determine whether water leaches these constituents out of plastic products, presenting a threat to the health of humans and wildlife; and

WHEREAS, small plastic items, such as bottle caps, food wrappers and polystyrene pieces, are some of the most abundant items polluting our beaches. In 2005, 61,117 bottle caps were collected during California's Coastal Cleanup Day; and

WHEREAS, thermoplastic resin pellets (commonly called “nurdles”), plastic powders, and production scrap, all of which are mistaken as food by marine life, are a significant source of beach pollution. One survey conducted in the summer of 1998 estimated that over 100 million nurdles were polluting Orange County beaches alone – this represented over 98 percent of all of the pollution collected in terms of abundance and 17 percent in terms of weight; and

WHEREAS, the U.S. Department of Commerce estimates that ocean-based sources constitute 20 percent of plastic marine debris, including lost and abandoned fishing gear that can be dangerous to wildlife, boaters and divers. Since May 2006, the California Derelict Fishing Gear Removal Project has removed nearly 10 tons of gear from waters around the California Channel Islands.

NOW, THEREFORE, the California Ocean Protection Council (OPC) hereby:

RESOLVES to call attention to this problem by widely distributing this resolution; and

FURTHER RESOLVES to identify the following top priority solutions from the June 2006 Plan of Action prepared by the Plastic Debris Project:

1. *Reduce the sources of plastic marine debris* – The California Redemption Value Program (CRV) has proven to be enormously successful at diverting over 60 percent of aluminum, glass and certain plastic containers to recycling centers. Placing a value on these items has assured that the majority get collected. The state should look closely at extending the CRV or similar Extended Producer Responsibility programs to include other plastics commonly found in marine debris. The state should also make changes to the recycling “processing fee” to encourage greater recycling of all forms of plastic containers. The Marine Debris Steering Committee (“Committee”) established by this Resolution shall, by December 1, 2007, propose a plan for implementing this CRV expansion and increase of processing fees, the goals to be achieved by not later than 2015.

2. *Increase enforcement of anti-litter laws generally, and enforcement of laws to eliminate pollution by plastic resin pellets (nurdles)* – Litter enters the marine environment when waste materials are deliberately or negligently discarded. Increased enforcement will not only reduce littering directly, it will send a strong message to the public that littering is not an acceptable social behavior. With respect to plastic resin pellets, best management practices should be encouraged to eliminate the discharge of pellets into the marine environment. By not later than December 1, 2007, the Committee shall prepare a plan to set targets for the reduction of nurdles, including handling and transport regulation and related enforcement provisions, with such targets to be achieved by not later than 2009.

3. *Seek innovative methods to reduce plastic waste* – In cooperation with the Department of Conservation (DOC), the Department of Toxic Substances Control (DTSC) and the California Integrated Waste Management Board (CIWMB), OPC will investigate and support plastic packaging alternatives that biodegrade in the marine environment, that contain no potentially toxic materials and that reduce the amount of plastic debris commonly found in the marine environment. Staff is directed to report back to OPC on progress at the June 2007 meeting.

4. *Continue and expand watershed-based cleanups* – Regular cleanups in trash-prone coastal areas reduce marine debris impacts and promote environmental stewardship. In 2006, volunteers at California's Coastal Cleanup Day collected nearly a million pounds of trash and recyclables. OPC supports the continuation and expansion of the watershed and beach cleanups currently run by the state, local governments and non-profit organizations.

5. *Increase the availability of trash, recycling and cigarette butt receptacles at public places, schools, and commercial establishments statewide* – Litter associated with convenience food and beverage items and discarded cigarette butts is a widely recognized problem in California. Adequate trash and recycling receptacles at both public places and commercial establishments would help mitigate this problem. Entities charged with trash maintenance should assess the adequacy of their trash and recycling collection services. Where necessary, these entities should increase the availability of these services, including recycling services at schools. Cigarette butt receptacles should also be available in public locations, including beaches, parks and marinas, and outside bars and clubs. All waste receptacles should be covered to prevent overflow spillage, windblown debris and removal by birds and other wildlife.

6. *Promote environmental education and outreach on the impacts of plastic debris and litter prevention* – The California Department of Transportation (Caltrans) operates an innovative statewide trash reduction campaign called "Don't Trash California." OPC will work to coordinate with Caltrans, DOC and other state and local entities to promote a consistent "Don't Trash California" message. OPC will also work with the California Environmental Protection Agency (CalEPA) Education and the Environment Initiative to promote marine debris reeducation education in schools. Staff is directed to report back to OPC on progress at the June 2007 meeting. OPC staff shall also support actions by other state agencies to enforce existing anti-litter laws (e.g., highway anti-litter laws, Clean Water Act total maximum daily loads for trash), and to promote fundamental state policy changes to prioritize the issue of marine debris reduction (e.g., the State Water Board's inclusion of prioritization of plastic debris as an amendment to the Ocean Plan.)

7. *Coordinate a Marine Debris Steering Committee* – OPC staff shall chair a Marine Debris Steering Committee to implement the recommendations of this Resolution. The Steering Committee shall include the California Integrated Waste Management Board, Department of Conservation, Department of Toxic Substances Control, Coastal Commission, and State Water Resources Control Board. The Steering Committee shall report at every OPC meeting.

8. *Coordinate a Regional Effort* – The OPC shall expeditiously work with parties to the West Coast Governors' Agreement on Ocean Health, and invite the participation of British Columbia, Hawaii and Baja California, to create, by January 1, 2008, coast-wide goals for marine debris reduction, with such goals to be achieved by not later than 2018. The OPC shall propose to this coalition to:

    a. Set joint litter target reductions of plastic single-use fast-food and convenience market packaging and containers;
    b. Set joint derelict fishing gear litter target reductions and site cleanup targets;

c. Consider relevant European Union chemical legislation restricting the marketing and use of harmful plastic materials and additives, including phthalates, bisphenol-A, styrene, perfluorooctanoic acid, vinyl chloride, nonylphenols, and alkylphenols; and
d. Jointly address handling requirements and related enforcement regulations for pre-production plastic resin pellets.

The OPC shall report to the public on progress of the formation of this coalition at its next OPC meeting.

9. *Reduce Single-Use Plastic Packaging* – The Marine Debris Steering Committee, working with other appropriate agencies shall, by June 1, 2008, propose a statewide plan to reduce to a targeted amount the use of plastic single-use fast-food and convenience market packaging and containers, with such plan to be achieved by not later than 2015.

10. *Remove Derelict Fishing Gear* – The Marine Debris Steering Committee (Committee) shall by December 1, 2007 propose a plan for achieving target reductions of derelict fishing gear, with such targets to be achieved by not later than 2015.

11. *Ban Toxic Plastic Packaging* – The Committee shall by December 1, 2007, prepare a plan for the phased ban of the most toxic types of plastic packaging. The plan shall address materials including styrene, bisphenol-A, perfluorooctanoic acid, vinyl chloride, nonylphenols, and alkylphenols, with such plan to be achieved by not later than 2015. OPC staff shall also identify and publicly report on OPC or Resources Agency funds, if any, that will be directed to DTSC for marine debris toxicity data and research.

12. *Advance Environmental Education* – OPC staff shall include on the next OPC meeting agenda a state presentation about the Environmental Education Initiative.

13. *Prepare an Education Plan* – By December 1, 2007 OPC staff shall prepare a report that incorporates:

    a. Recommendations for how the OPC could work with CalEPA, the Office of Education and the Environment, the Ocean Communicators Alliance ("Thank You Ocean" campaign), and other state partners to assist with an inventory of "environmental education" requirements in any ocean-related state permit requirements, enforcement actions or administrative decisions; and
    b. Recommendations for how the OPC could work with CalEPA and the Office of Education and the Environment, and other state partners, to assist in the development of an inventory of K-12 ocean-related environmental education programs, including funding sources.

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California Plastic Bag Ban Referendum, Proposition 67 (2016)

The **California Plastic Bag Ban Referendum** will be on the November 8, 2016, ballot in California as a veto referendum.

A **"yes"** vote is a vote in favor of upholding or ratifying the contested legislation banning plastic bags that was enacted by the California State Legislature under the name Senate Bill 270.

A **"no"** vote is a vote in favor of overturning Senate Bill 270.

If the measure is approved by the state's voters, it would:[1][2]

- Ratify Senate Bill 270 (2014).
- Prohibit large grocery stores and pharmacies from providing plastic single-use carryout bags and ban small grocery stores, convenience stores and liquor stores from doing so the following year.
- Allow single-use plastic bags for meat, bread, produce, bulk food and perishable items.
- Mandate stores to charge 10 cents for recycled, compostable and reusable grocery bags.
- Exempt consumers using a payment card or voucher issued by the California Special Supplemental Food Program from being charged for bags.
- Provide $2 million to state plastic bag manufacturers for the purpose of helping them retain jobs and transition to making thicker, multi-use, recycled plastic bags.

The American Progressive Bag Alliance, an opponent of the measure, is leading the campaign to repeal SB 270.[3]

California Plastic Bag Ban Referendum

Election date
November 8, 2016

Topic
Business regulation and Environment

Status
On the ballot

Type	Origin
Referendum	Citizens

Text of measure

Official summary:[4]

> If signed by the required number of registered voters and timely filed with the Secretary of State, this petition will place on the statewide ballot a challenge to a state law previously approved by the Legislature and the Governor. The challenged law must then be approved by a majority of voters at the next statewide election to go into effect. The law prohibits grocery and certain other retail stores from providing single-use bags but permits sale of recycled paper bags and reusable bags.[5]

Voting on Business Regulation

Ballot Measures
By state
By year
Not on ballot
Local [show

Background

Local ordinances

In 2007, San Francisco became the first jurisdiction in California to ban single-use plastic bags. Since then, 108 ordinances banning single-use plastic bags have been approved in the state, covering 137 county or local jurisdictions. Los Angeles, the largest city in California and second largest in the United States, banned single-use plastic bags and placed a 10 cent charge on paper bags. The city's ordinance went into effect on January 1, 2014, for large businesses and on July 1, 2014, for small businesses.[6]

There were initiative attempts to overturn local single-use plastic bag bans in Walnut Creek, Huntington Creek and Campbe

California LEGISLATIVE INFORMATION

SB-270 Solid waste: single-use carryout bags. (2013-2014)

Senate Bill No. 270

CHAPTER 850

An act to add Chapter 5.3 (commencing with Section 42280) to Part 3 of Division 30 of the Public Resources Code, relating to solid waste, and making an appropriation therefor.

[Approved by Governor September 30, 2014. Filed with Secretary of State September 30, 2014.]

LEGISLATIVE COUNSEL'S DIGEST

SB 270, Padilla. Solid waste: single-use carryout bags.

(1) Existing law, until 2020, requires an operator of a store, as defined, to establish an at-store recycling program that provides to customers the opportunity to return clean plastic carryout bags to that store.

This bill, as of July 1, 2015, would prohibit stores that have a specified amount of sales in dollars or retail floor space from providing a single-use carryout bag to a customer, with specified exceptions. The bill would also prohibit those stores from selling or distributing a recycled paper bag at the point of sale unless the store makes that bag available for purchase for not less than $0.10. The bill would also allow those stores, on or after July 1, 2015, to distribute compostable bags at the point of sale only in jurisdictions that meet specified requirements and at a cost of not less than $0.10. The bill would require these stores to meet other specified requirements on and after July 1, 2015, regarding providing reusable grocery bags to customers, including distributing those bags only at a cost of not less than $0.10. The bill would require all moneys collected pursuant to these provisions to be retained by the store and be used only for specified purposes.

The bill, on and after July 1, 2016, would additionally impose these prohibitions and requirements on convenience food stores, foodmarts, and entities engaged in the sale of a limited line of goods, or goods intended to be consumed off premises, and that hold a specified license with regard to alcoholic beverages.

The bill would allow a retail establishment to voluntarily comply with these requirements, if the retail establishment provides the department with irrevocable written notice. The bill would require the department to post on its Internet Web site, organized by county, the name and physical location of each retail establishment that has elected to comply with these requirements.

The bill would require the operator of a store that has a specified amount of sales in dollars or retail floor space and a retail establishment that voluntarily complies with the requirements of this bill to comply with the existing at-store recycling program requirements.

The bill would require, on and after July 1, 2015, a reusable grocery bag sold by certain stores to a customer at the point of sale to be made by a certified reusable grocery bag producer and to meet specified requirements with regard to the bag's durability, material, labeling, heavy metal content, and, with regard to reusable grocery bags made from plastic film on and after January 1, 2016, recycled material content. The bill would impose these requirements as of July 1, 2016, on the stores that are otherwise subject to the bill's requirements.

The bill would prohibit a producer of reusable grocery bags made from plastic film from selling or distributing those bags on and after July 1, 2015, unless the producer is certified by a 3rd-party certification entity, as

specified. The bill would require a reusable grocery bag producer to provide proof of certification to the department. The bill would require the department to provide a system to receive proofs of certification online.

The department would be required to publish on its Internet Web site a list of reusable grocery bag producers that have submitted the required certification and their reusable grocery bags. The bill would require the department to establish an administrative certification fee schedule, which would require a reusable grocery bag producer providing proof to the department of certification or recertification to pay a fee. The bill would require that all moneys submitted to the department pursuant to these fee provisions be deposited into the Reusable Grocery Bag Fund, which would be established by the bill, and continuously appropriated for purposes of implementing these proof of certification and Internet Web site provisions, thereby making an appropriation. The bill would also require a reusable grocery bag producer to submit applicable certified test results to the department. The bill would authorize a person to object to a certification of a reusable grocery bag producer by filing an action for review of that certification in the superior court of a county that has jurisdiction over the reusable grocery bag producer. The bill would require the court to determine if the reusable grocery bag producer is in compliance with the provisions of the bill and, based on the court's determination, would require the court to direct the department to either remove or retain the reusable grocery bag producer on its published Internet Web site list.

The bill would allow a city, county, or city and county, or the state to impose civil penalties on a person or entity that knows or reasonably should have known it is in violation of the bill's requirements. The bill would require these civil penalties to be paid to the office of the city attorney, city prosecutor, district attorney, or Attorney General, whichever office brought the action, and would allow the penalties collected by the Attorney General to be expended by the Attorney General, upon appropriation by the Legislature, to enforce the bill's provisions.

The bill would declare that it occupies the whole field of the regulation of reusable grocery bags, single-use carryout bags, and recycled paper bags provided by a store and would prohibit a local public agency from enforcing or implementing an ordinance, resolution, regulation, or rule, or any amendment thereto, adopted on or after September 1, 2014, relating to those bags, against a store, except as provided.

(2) The California Integrated Waste Management Act of 1989 creates the Recycling Market Development Revolving Loan Subaccount in the Integrated Waste Management Account and continuously appropriates the funds deposited in the subaccount to the department for making loans for the purposes of the Recycling Market Development Revolving Loan Program. Existing law makes the provisions regarding the loan program, the creation of the subaccount, and expenditures from the subaccount inoperative on July 1, 2021, and repeals them as of January 1, 2022.

This bill would appropriate $2,000,000 from the Recycling Market Development Revolving Loan Subaccount in the Integrated Waste Management Account to the department for the purposes of providing loans for the creation and retention of jobs and economic activity in California for the manufacture and recycling of plastic reusable grocery bags that use recycled content. The bill would require a recipient of a loan to agree, as a condition of receiving the loan, to take specified actions.

(3) The bill would require the department, no later than March 1, 2018, to provide a status report to the Legislature on the implementation of the bill's provisions.

Vote: majority Appropriation: yes Fiscal Committee: yes Local Program: no

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. Chapter 5.3 (commencing with Section 42280) is added to Part 3 of Division 30 of the Public Resources Code, to read:

CHAPTER 5.3. Single-Use Carryout Bags
Article 1. Definitions

42280. (a) "Department" means the Department of Resources Recycling and Recovery.

(b) "Postconsumer recycled material" means a material that would otherwise be destined for solid waste disposal, having completed its intended end use and product life cycle. Postconsumer recycled material does not include materials and byproducts generated from, and commonly reused within, an original manufacturing and fabrication process.

(c) "Recycled paper bag" means a paper carryout bag provided by a store to a customer at the point of sale that

meets all of the following requirements:

(1) (A) Except as provided in subparagraph (B), contains a minimum of 40 percent postconsumer recycled materials.

(B) An eight pound or smaller recycled paper bag shall contain a minimum of 20 percent postconsumer recycled material.

(2) Is accepted for recycling in curbside programs in a majority of households that have access to curbside recycling programs in the state.

(3) Has printed on the bag the name of the manufacturer, the country where the bag was manufactured, and the minimum percentage of postconsumer content.

(d) “Reusable grocery bag” means a bag that is provided by a store to a customer at the point of sale that meets the requirements of Section 42281.

(e) (1) “Reusable grocery bag producer” means a person or entity that does any of the following:

(A) Manufactures reusable grocery bags for sale or distribution to a store.

(B) Imports reusable grocery bags into this state, for sale or distribution to a store.

(C) Sells or distributes reusable bags to a store.

(2) “Reusable grocery bag producer” does not include a store, with regard to a reusable grocery bag for which there is a manufacturer or importer, as specified in subparagraph (A) or (B) of paragraph (1).

(f) (1) “Single-use carryout bag” means a bag made of plastic, paper, or other material that is provided by a store to a customer at the point of sale and that is not a recycled paper bag or a reusable grocery bag that meets the requirements of Section 42281.

(2) A single-use carryout bag does not include either of the following:

(A) A bag provided by a pharmacy pursuant to Chapter 9 (commencing with Section 4000) of Division 2 of the Business and Professions Code to a customer purchasing a prescription medication.

(B) A nonhandled bag used to protect a purchased item from damaging or contaminating other purchased items when placed in a recycled paper bag, a reusable grocery bag, or a compostable plastic bag.

(C) A bag provided to contain an unwrapped food item.

(D) A nonhandled bag that is designed to be placed over articles of clothing on a hanger.

(g) “Store” means a retail establishment that meets any of the following requirements:

(1) A full-line, self-service retail store with gross annual sales of two million dollars ($2,000,000) or more that sells a line of dry groceries, canned goods, or nonfood items, and some perishable items.

(2) Has at least 10,000 square feet of retail space that generates sales or use tax pursuant to the Bradley-Burns Uniform Local Sales and Use Tax Law (Part 1.5 (commencing with Section 7200) of Division 2 of the Revenue and Taxation Code) and has a pharmacy licensed pursuant to Chapter 9 (commencing with Section 4000) of Division 2 of the Business and Professions Code.

(3) Is a convenience food store, foodmart, or other entity that is engaged in the retail sale of a limited line of goods, generally including milk, bread, soda, and snack foods, and that holds a Type 20 or Type 21 license issued by the Department of Alcoholic Beverage Control.

(4) Is a convenience food store, foodmart, or other entity that is engaged in the retail sale of goods intended to be consumed off the premises, and that holds a Type 20 or Type 21 license issued by the Department of Alcoholic Beverage Control.

(5) Is not otherwise subject to paragraph (1), (2), (3), or (4), if the retail establishment voluntarily agrees to comply with the requirements imposed upon a store pursuant to this chapter, irrevocably notifies the department of its intent to comply with the requirements imposed upon a store pursuant to this chapter, and complies with the requirements established pursuant to Section 42284.

Article 2. Reusable Grocery Bags

42281. (a) On and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, may sell or distribute a reusable grocery bag to a customer at the point of sale only if the reusable bag is made by a producer certified pursuant to this article to meet all of the following requirements:

(1) Has a handle and is designed for at least 125 uses, as provided in this article.

(2) Has a volume capacity of at least 15 liters.

(3) Is machine washable or made from a material that can be cleaned and disinfected.

(4) Has printed on the bag, or on a tag attached to the bag that is not intended to be removed, and in a manner visible to the consumer, all of the following information:

(A) The name of the manufacturer.

(B) The country where the bag was manufactured.

(C) A statement that the bag is a reusable bag and designed for at least 125 uses.

(D) If the bag is eligible for recycling in the state, instructions to return the bag to the store for recycling or to another appropriate recycling location. If recyclable in the state, the bag shall include the chasing arrows recycling symbol or the term “recyclable,” consistent with the Federal Trade Commission guidelines use of that term, as updated.

(5) Does not contain lead, cadmium, or any other toxic material that may pose a threat to public health. A reusable bag manufacturer may demonstrate compliance with this requirement by obtaining a no objection letter from the federal Food and Drug Administration. This requirement shall not affect any authority of the Department of Toxic Substances Control pursuant to Article 14 (commencing with Section 25251) of Chapter 6.5 of Division 20 of the Health and Safety Code and, notwithstanding subdivision (c) of Section 25257.1 of the Health and Safety Code, the reusable grocery bag shall not be considered as a product category already regulated or subject to regulation.

(6) Complies with Section 260.12 of Part 260 of Title 16 of the Code of Federal Regulations related to recyclable claims if the reusable grocery bag producer makes a claim that the reusable grocery bag is recyclable.

(b) (1) In addition to the requirements in subdivision (a), a reusable grocery bag made from plastic film shall meet all of the following requirements:

(A) On and after January 1, 2016, it shall be made from a minimum of 20 percent postconsumer recycled material.

(B) On and after January 1, 2020, it shall be made from a minimum of 40 percent postconsumer recycled material.

(C) It shall be recyclable in this state, and accepted for return at stores subject to the at-store recycling program (Chapter 5.1 (commencing with Section 42250)) for recycling.

(D) It shall have, in addition to the information required to be printed on the bag or on a tag, pursuant to paragraph (4) of subdivision (a), a statement that the bag is made partly or wholly from postconsumer recycled material and stating the postconsumer recycled material content percentage, as applicable.

(E) It shall be capable of carrying 22 pounds over a distance of 175 feet for a minimum of 125 uses and be at least 2.25 mils thick, measured according to the American Society of Testing and Materials (ASTM) Standard D6988-13.

(2) A reusable grocery bag made from plastic film that meets the specifications of the American Society of Testing and Materials (ASTM) International Standard Specification for Compostable Plastics D6400, as updated, is not required to meet the requirements of subparagraph (A) or (B) of paragraph (1), but shall be labeled in accordance with the applicable state law regarding compostable plastics.

(c) In addition to the requirements of subdivision (a), a reusable grocery bag that is not made of plastic film and that is made from any other natural or synthetic fabric, including, but not limited to, woven or nonwoven nylon, polypropylene, polyethylene-terephthalate, or Tyvek, shall satisfy all of the following:

(1) It shall be sewn.

(2) It shall be capable of carrying 22 pounds over a distance of 175 feet for a minimum of 125 uses.

(3) It shall have a minimum fabric weight of at least 80 grams per square meter.

(d) On and after July 1, 2016, a store as defined in paragraph (3), (4), or (5) of subdivision (g) of Section 42280, shall comply with the requirements of this section.

42281.5. On and after July 1, 2015, a producer of reusable grocery bags made from plastic film shall not sell or distribute a reusable grocery bag in this state unless the producer is certified by a third-party certification entity pursuant to Section 42282. A producer shall provide proof of certification to the department demonstrating that the reusable grocery bags produced by the producer comply with the provisions of this article. The proof of certification shall include all of the following:

(a) Names, locations, and contact information of all sources of postconsumer recycled material and suppliers of postconsumer recycled material.

(b) Quantity and dates of postconsumer recycled material purchases by the reusable grocery bag producer.

(c) How the postconsumer recycled material is obtained.

(d) Information demonstrating that the postconsumer recycled material is cleaned using appropriate washing equipment.

42282. (a) Commencing on or before July 1, 2015, the department shall accept from a reusable grocery bag producer proof of certification conducted by a third-party certification entity, submitted under penalty of perjury, for each type of reusable grocery bag that is manufactured, imported, sold, or distributed in the state and provided to a store for sale or distribution, at the point of sale, that meets all the applicable requirements of this article. The proof of certification shall be accompanied by a certification fee, established pursuant to Section 42282.1.

(b) A reusable grocery bag producer shall resubmit to the department proof of certification as described in subdivision (a) on a biennial basis. A reusable grocery bag producer shall provide the department with an updated proof of certification conducted by a third-party certification entity if any modification that is not solely aesthetic is made to a previously certified reusable bag. Failure to comply with this subdivision shall result in removal of the relevant information posted on the department's Internet Web site pursuant to paragraphs (1) and (2) of subdivision (e) for each reusable bag that lacks an updated proof of certification conducted by a third-party certification entity.

(c) A third-party certification entity shall be an independent, accredited (ISO/IEC 17025) laboratory. A third-party certification entity shall certify that the producer's reusable grocery bags meet the requirements of Section 44281.

(d) The department shall provide a system to receive proofs of certification online.

(e) On and after July 1, 2015, the department shall publish a list on its Internet Web site that includes all of the following:

(1) The name, location, and appropriate contact information of certified reusable grocery bag producers.

(2) The reusable grocery bags of producers that have provided the required certification.

(f) A reusable grocery bag producer shall submit applicable certified test results to the department confirming that the reusable grocery bag meets the requirements of this article for each type of reusable grocery bag that is manufactured, imported, sold, or distributed in the state and provided to a store for sale or distribution.

(1) A person may object to the certification of a reusable grocery bag producer pursuant to this section by filing an action for review of that certification in the superior court of a county that has jurisdiction over the reusable grocery bag producer. The court shall determine if the reusable grocery bag producer is in compliance with the requirements of this article.

(2) A reusable grocery bag producer whose certification is being objected to pursuant to paragraph (1) shall be deemed in compliance with this article pending a determination by the court.

(3) Based on its determination, the court shall direct the department to remove the reusable grocery bag producer from, or retain the reusable grocery bag producer on, its list published pursuant to subdivision (e).

(4) If the court directs the department to remove a reusable grocery bag producer from its published list, the reusable grocery bag producer shall remain off of the published list for a period of one year from the date of the court's determination.

42282.1. (a) A reusable grocery bag producer shall submit the fee established pursuant to subdivision (b) to the department when providing proof of certification or recertification pursuant to Sections 42281.5 and 42282.

(b) The department shall establish an administrative certification fee schedule that will generate fee revenues sufficient to cover, but not exceed, the department's reasonable costs to implement this article. The department shall deposit all moneys submitted pursuant to this section into the Reusable Grocery Bag Fund, which is hereby established in the State Treasury. Notwithstanding Section 11340 of the Government Code, moneys in the fund are continuously appropriated, without regard to fiscal year, to the department for the purpose of implementing this article.

Article 3. Single-Use Carryout Bags

42283. (a) Except as provided in subdivision (e), on and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, shall not provide a single-use carryout bag to a customer at the point of sale.

(b) (1) On and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, shall not sell or distribute a reusable grocery bag at the point of sale except as provided in this subdivision.

(2) On and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, may make available for purchase at the point of sale a reusable grocery bag that meets the requirements of Section 42281.

(3) On and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, that makes reusable grocery bags available for purchase pursuant to paragraph (2) shall not sell the reusable grocery bag for less than ten cents ($0.10) in order to ensure that the cost of providing a reusable grocery bag is not subsidized by a customer who does not require that bag.

(c) (1) On and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, shall not sell or distribute a recycled paper bag except as provided in this subdivision.

(2) A store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, may make available for purchase a recycled paper bag. On and after July 1, 2015, the store shall not sell a recycled paper bag for less than ten cents ($0.10) in order to ensure that the cost of providing a recycled paper bag is not subsidized by a consumer who does not require that bag.

(d) Notwithstanding any other law, on and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, that makes reusable grocery bags or recycled paper bags available for purchase at the point of sale shall provide a reusable grocery bag or a recycled paper bag at no cost at the point of sale to a customer using a payment card or voucher issued by the California Special Supplemental Food Program for Women, Infants, and Children pursuant to Article 2 (commencing with Section 123275) of Chapter 1 of Part 2 of Division 106 of the Health and Safety Code or an electronic benefit transfer card issued pursuant to Section 10072 of the Welfare and Institutions Code.

(e) On and after July 1, 2015, a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, may distribute a compostable bag at the point of sale, if the compostable bag is provided to the consumer at the cost specified pursuant to paragraph (2), the compostable bag, at a minimum, meets the American Society for Testing and Materials (ASTM) International Standard Specification for Compostable Plastics D6400, as updated, and in the jurisdiction where the compostable bag is sold and in the jurisdiction where the store is located, both of the following requirements are met:

(1) A majority of the residential households in the jurisdiction have access to curbside collection of foodwaste for composting.

(2) The governing authority for the jurisdiction has voted to allow stores in the jurisdiction to sell to consumers

at the point of sale a compostable bag at a cost not less than the actual cost of the bag, which the Legislature hereby finds to be not less than ten cents ($0.10) per bag.

(f) A store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280, shall not require a customer to use, purchase, or accept a single-use carryout bag, recycled paper bag, compostable bag, or reusable grocery bag as a condition of sale of any product.

42283.5. On and after July 1, 2016, a store, as defined in paragraph (3), (4), or (5) of subdivision (g) of Section 42280, shall comply with the same requirements of Section 42283 that are imposed upon a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280.

42283.6. (a) The operator of a store, as defined in paragraph (1) or (2) of subdivision (g) of Section 42280 that makes recycled paper or reusable grocery bags available at the point of sale, shall be subject to the provisions of the at-store recycling program (Chapter 5.1 (commencing with Section 42250)).

(b) A store that voluntarily agrees to comply with the provisions of this article pursuant to subdivision (g) of Section 42280, shall also comply with the provisions of the at-store recycling program (Chapter 5.1 (commencing with Section 42250)).

42283.7. All moneys collected pursuant to this article shall be retained by the store and may be used only for the following purposes:

(a) Costs associated with complying with the requirements of this article.

(b) Actual costs of providing recycled paper bags or reusable grocery bags.

(c) Costs associated with a store's educational materials or educational campaign encouraging the use of reusable grocery bags.

42284. (a) A retail establishment not specifically required to comply with the requirements of this chapter is encouraged to reduce its distribution of single-use plastic carryout bags.

(b) Pursuant to the provisions of subdivision (g) of Section 42280, any retail establishment that is not a "store," that provides the department with the irrevocable written notice as specified in subdivision (c), shall be regulated as a "store" for the purposes of this chapter.

(c) The irrevocable written notice shall be dated and signed by an authorized representative of the retail establishment, and shall include the name and physical address of all retail locations covered by the notice. The department shall acknowledge receipt of the notice in writing and shall specify the date the retail establishment will be regulated as a "store," which shall not be less than 30 days after the date of the department's acknowledgment. The department shall post on its Internet Web site, organized by county, the name and physical location or locations of each retail establishment that has elected to be regulated as a "store."

Article 4. Enforcement

42285. (a) A city, a county, a city and county, or the state may impose civil liability on a person or entity that knowingly violated this chapter, or reasonably should have known that it violated this chapter, in the amount of one thousand dollars ($1,000) per day for the first violation of this chapter, two thousand dollars ($2,000) per day for the second violation, and five thousand dollars ($5,000) per day for the third and subsequent violations.

(b) Any civil penalties collected pursuant to subdivision (a) shall be paid to the office of the city attorney, city prosecutor, district attorney, or Attorney General, whichever office brought the action. The penalties collected pursuant to this section by the Attorney General may be expended by the Attorney General, upon appropriation by the Legislature, to enforce this chapter.

Article 5. Preemption

42287. (a) Except as provided in subdivision (c), this chapter is a matter of statewide interest and concern and is applicable uniformly throughout the state. Accordingly, this chapter occupies the whole field of regulation of reusable grocery bags, single-use carryout bags, and recycled paper bags, as defined in this chapter, provided by a store, as defined in this chapter.

(b) On and after January 1, 2015, a city, county, or other local public agency shall not enforce, or otherwise

implement, an ordinance, resolution, regulation, or rule, or any amendment thereto, adopted on or after September 1, 2014, relating to reusable grocery bags, single-use carryout bags, or recycled paper bags, against a store, as defined in this chapter, unless expressly authorized by this chapter.

(c) (1) A city, county, or other local public agency that has adopted, before September 1, 2014, an ordinance, resolution, regulation, or rule relating to reusable grocery bags, single-use carryout bags, or recycled paper bags may continue to enforce and implement that ordinance, resolution, regulation, or rule that was in effect before that date. Any amendments to that ordinance, resolution, regulation, or rule on or after January 1, 2015, shall be subject to subdivision (b), except the city, county, or other local public agency may adopt or amend an ordinance, resolution, regulation, or rule to increase the amount that a store shall charge with regard to a recycled paper bag, compostable bag, or reusable grocery bag to no less than the amount specified in Section 42283.

(2) A city, county, or other local public agency not covered by paragraph (1) that, before September 1, 2014, has passed a first reading of an ordinance or resolution expressing the intent to restrict single-use carryout bags and, before January 1, 2015, adopts an ordinance to restrict single-use carryout bags, may continue to enforce and implement the ordinance that was in effect before January 1, 2015.

Article 6. Financial Provisions

42288. (a) Notwithstanding Section 42023.2, the sum of two million dollars ($2,000,000) is hereby appropriated from the Recycling Market Development Revolving Loan Subaccount in the Integrated Waste Management Account to the department for the purposes of providing loans for the creation and retention of jobs and economic activity in this state for the manufacture and recycling of plastic reusable grocery bags that use recycled content, including postconsumer recycled material.

(b) The department may expend, if there are applicants eligible for funding from the Recycling Market Development Revolving Loan Subaccount, the funds appropriated pursuant to this section to provide loans for both of the following:

(1) Development and conversion of machinery and facilities for the manufacture of single-use plastic bags into machinery and facilities for the manufacturer of durable reusable grocery bags that, at a minimum, meet the requirements of Section 42281.

(2) Development of equipment for the manufacture of reusable grocery bags, that, at a minimum, meet the requirements of Section 42281.

(c) A recipient of a loan authorized by this section shall agree, as a condition of receiving the loan, to retain and retrain existing employees for the manufacturing of reusable grocery bags that, at a minimum, meet the requirements of Section 42281.

(d) Any moneys appropriated pursuant to this section not expended by the end of the 2015–16 fiscal year shall revert to the Recycling Market Development Revolving Loan Subaccount for expenditure pursuant to Article 3 (commencing with Section 42010) of Chapter 1.

(e) Applicants for funding under this section may also apply for funding or benefits from other economic development programs for which they may be eligible, including, but not limited to, both of the following:

(1) An income tax credit, as described in Sections 17059.2 and 23689 of the Revenue and Taxation Code.

(2) A tax exemption pursuant to Section 6377.1 of the Revenue and Taxation Code.

SEC. 2. No later than March 1, 2018, the department, as a part of its reporting requirement pursuant to Section 40507 of the Public Resources Code, shall provide a status report on the implementation of Chapter 5.3 (commencing with Section 42280) of Part 3 of Division 30 of the Public Resources Code.

COMMITTEE AGENDA ANALYSIS NOVEMBER 5, 2014

5. **PIER FISHING CONCERNS** **Est. Time: 60 min**

Today's Item: Information ■ Direction ☐

Review background, precipitating events, and issues associated with pier fishing and actions taken at the city level. Discuss a process to evaluate concerns associated with pier fishing regulations. We may see representatives from the Cities of Manhattan Beach or Hermosa Beach, who should be acknowledged.

Summary of Previous/Future Actions: N/A

Background:

The issue of regulations governing fishing from piers has been elevated in light of an incident occurring off the Manhattan Beach Pier between a fisherman, white shark, and swimmer. While this was an unusual precipitating event, the actions taken or contemplated by the City of Manhattan Beach, and subsequently the City of Hermosa Beach, highlight that pier fishing regulations and user conflicts warrant a review.

Actions taken by the City Council included a 90-day emergency closure to pier fishing, and development of a draft city ordinance to modify fishing regulations it described as necessary for public safety. Based on joint efforts of OPC, FGC, CDFW, and California Coastal Commission, the City Council postponed action to adopt the final city ordinance (Exhibits 5.1, 5.2). Instead, the group offered the opportunity for the city to present their concerns and proposed solutions, for consideration by the California Fish and Game Commission, following discussion at the MRC. The City of Manhattan Beach responded to request additional time to manage their concerns through non-regulatory means (Exhibit 5.3). However, the City of Hermosa Beach submitted a formal petition for regulatory change and request to discuss their concerns and draft options at the November MRC meeting (Exhibit 5.4).

This meeting provides an opportunity for the MRC to review the actions to date, hear concerns from the perspective of the cities, and discuss an appropriate process to investigate this issue further.

Significant Public Recommendations/Comments:

Email from Eileen Neill, in support of pier fishing closure

Letter from Marko Mlikotin, California Sportfishing League, opposing pier closure

Staff Recommendation:

Staff recommends that any review of issues or concerns be considered in the full context of user groups in the area surrounding public piers. A review of Fish and Game regulations governing pier fishing, followed by a review of city ordinances relevant to pier fishing and other users of piers or adjacent waters may help set the context. Provide direction to staff on next steps.

Exhibit(s):

1. Letter from FGC to Manhattan Beach City Council, 8/11/14

Author: Susan Ashcraft

2. Letter from CNRA Legal Counsel to City of Manhattan Beach, 8/18/14
3. Letter from City of Manhattan Beach to CNRA, 9/25/14
4. Letter from City of Hermosa Beach to FGC, 9/11/14
5. Email from Eileen Neill, in support of pier fishing closure
6. Letter from Marko Mlikotin, California Sportfishing League, opposing pier closure

Committee Direction: Provide guidance to staff regarding process to evaluate pier fishing regulations, user conflicts, and associated concerns.

Author: Susan Ashcraft

Marine Resources Committee (MRC) 2016-17 Work Plan: Scheduled topics and timeline for items referred to MRC
(Updated for July 2016 MRC meeting)

Topic	Type of Topic	2016			2017		
		MAR Los Alamitos	**JUL Petaluma**	NOV Ventura	MAR	JUL	NOV
Abalone FMP / ARMP update	DFW project	X	**X**	X	X/R		
Fisheries Bycatch Workgroup	MRC workgroup	X	**X**	X			
Pier and Jetty Fishing Review	Special FGC project		**X**				
Herring FMP Development Updates	DFW project	X	**X**	X			
California's Fishing Communities	Special FGC project		**X**	X			
Update to MLMA Master Plan- Fisheries	DFW project	X	**X**	X	X	X	
Annual Sportfish Regulations	Annual cycle	X			X		
Kelp and Algae Harvest Management and Regulations Review	DFW project			X			
Marine Debris and Plastic Pollution	Informational Presentation	X	**X**				
Ocean Acidification and Hypoxia	Informational Presentation		**X**				
Finding Dory – Environmental Stewardship	Informational Discussion		**X**				
Nearshore Fishery Permit Structure Petition	Referred for DFW Review			X			

KEY **X** Discussion scheduled
R Recommendation developed and moved to FGC

PERPETUAL TIMETABLE FOR CALIFORNIA FISH AND GAME COMMISSION ANTICIPATED REGULATORY ACTIONS

Updated: 06/24/16

For FGC Staff use.						2016					2017										
						AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	MAR	APR	APR	MAY	JUN	JUL	AUG	SEP
						24 25	21	19 20	17	7 8	?	? ?	?	?	? ?	?	?	? ?	?	? ?	?
QTRLY EFFECTIVE	DFW RU ANALYST	FGC ANALYST	LEAD	REGULATORY CHANGE CATEGORY	ACTION DATE, TYPE AND LOCATION	FGC FOLSOM	WRC WOODLAND	FGC EUREKA	MRC SACRAMENTO	FGC SAN DIEGO	WRC TBD	FGC TBD	TELECONFERENCE	MRC TBD	FGC TBD	TELECONFERENCE	WRC TBD	FGC TBD	MRC TBD	FGC TBD	WRC TBD
					File Notice w/OAL by	6/28/16		8/11/15		10/13/15		TBD	TBD		TBD	TBD		TBD		TBD	
					Notice Published	7/8/16		8/21/15		10/23/15		TBD	TBD		TBD	TBD		TBD		TBD	
					Title 14 Section(s)																
	SB	JS	FB	SPORT FISH	1.05 et al.	N		D		A	V		E 3/1				R			N	
	SB	SF	MR	PACIFIC HALIBUT SPORT FISHING	28.20					N		D			A		E 5/1				
	SB	SF	MR	OCEAN SALMON SPORT FISHING (PHASE I)	27.80(c)					N		D	A		E 4/1						
	SB	SF	MR	OCEAN SALMON SPORT FISHING (PHASE II)	27.80(d)							D				A	E 5/1				
	SB	SF	FB	KLAMATH RIVER SPORT FISHING	7.50(b)(91.1)	E 8/1	R			N		D				A	V	V V		E 8/1	R
*		ST	OGC	TRICOLORED BLACKBIRD - 2084 EMERGENCY	749		EE 9/6														
	SB	ST	FB	UPPER SACRAMENTO RIVER EMERGENCY	7.50(b)(156.5)	EE 8/29															
	MR	JS	FB	CENTRAL VALLEY SALMON SPORT FISHING	7.50(b)	E 8/1				N		D				A				E 8/1	
	MR	JS	WLB	MAMMAL HUNTING 2016-2017	265 et al.		R			N		D			A		V		E 7/1		R
	MR	JS	WLB	WATERFOWL	502		R			N		D			A		V		E 7/1		R
*	MR	CW	MR	ELECTRONIC REPORT OF MARINE LOGBOOKS	190																
*	MR	ST	MR	COMMERCIAL SEA URCHIN (PHASE I)	120.7																
*		SF	FGC	COMMISSION MEETING PROCEDURES	665			E 10/1													
*	SB	ST	MR	SPINY LOBSTER, SPORT AND COMMERCIAL	29.80 et al.			E 10/1													
*	SB	CW	WLB	NONLEAD AMMUNITION COUPON PROGRAM	250.2			E 10/1													
	SB	JS	LED	TIDAL WATERS SF/SAN PABLO BAY	1.53 27.00 28.65(a)	A					E 1/1										
*	SB	CW	WLB	DFW LANDS PASS	550 et al.	A					E 1/1										
	MR	CW	WLB	UPLAND (RESIDENT) GAME BIRD	300, 311, 745.5	A	E 9/1				R				N			D		A	E 9/1
*		CW	OGC	CONFLICT OF INTEREST CODE	782.1			D/A			E 1/1										
*	SB	SF	MR	COMMERCIAL HAGFISH BARREL TRAPS	180.6(b)	D/A					E 1/1										
*	MR	CW	WLB	NONGAME ANIMALS - GENERAL PROVISIONS	472	D/A					E 1/1										
*	MR	CW	LED	UPLAND GAME BIRD SPECIAL HUNT DRAWING	702, 715 (new)	D		A			E 1/1				E 4/1						
		SF	FGC	TRIBAL TAKE IN MPAs	632	N		D		A					E 4/1						
	MR	SF	MR	RECREATIONAL GROUNDFISH	27.20 et al.	N		D		A	E 1/1										
*	SB	CW	LED	ENHANCE PENALTIES FOR GAME ILLEGAL TAKE	748.6 (new)	N				A		E 2/1									
*	MR	JS	WLB	FALCONRY CLEAN-UP	670	N		D		A					E 4/1						
	MR	JS	WLB	BIG GAME TAG QUOTA REPORTING PROCESS	360, 361, 362, 363, 364													N		D	
*			MR	KELP AND ALGAE HARVEST MANAGEMENT	165, 165.5, 704				V												
*			MR	COMMERCIAL SEA CUCUMBER [2016]	128																
*		ST	MR	COMMERCIAL SEA URCHIN (PHASE II) [TBD]	120.7																
*				POSSESS GAME / PROCESS INTO FOOD [TBD]	TBD																
*			OGC	AZA/ZAA [TBD]	671.1																

EM = Emergency, EE = Emergency Expires, E = Anticipated Effective Date (RED "E" = expedited OAL review), N = Notice Hearing, D = Discussion Hearing, A = Adoption Hearing, V =Vetting, R = Committee Recommendation, WRC = Wildlife Resources Committee, MRC = Marine Resources Committee