

SHELLFISH AQUACULTURE BEST MANAGEMENT PRACTICES

LOCAL STAKEHOLDERS MEETING

29 MAY 2018
SANTA BARBARA CA



FISH & GAME COMMISSION

DEPARTMENT OF FISH AND WILDLIFE



SHELLFISH HISTORY IN CA

OYSTER CULTURE IN CALIFORNIA GOES BACK TO EARLY STATEHOOD (OYSTER ACT 1851)

VARIOUS REGIONS IN NORTHERN & SOUTHERN CALIFORNIA LONG HISTORIES & LEGACIES OF SHELLFISH CULTURE

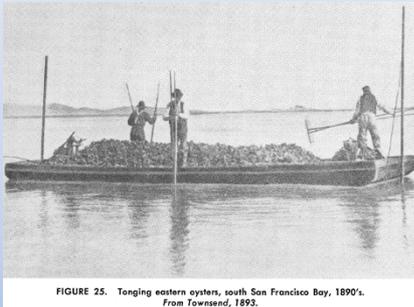
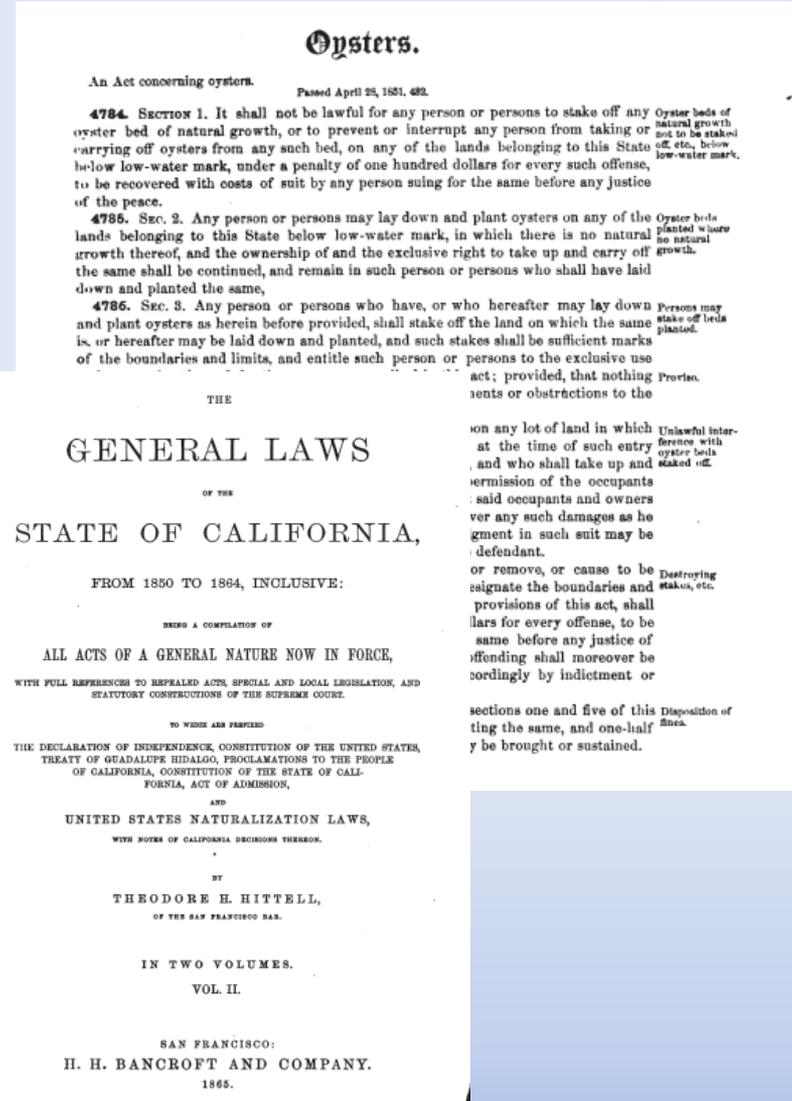
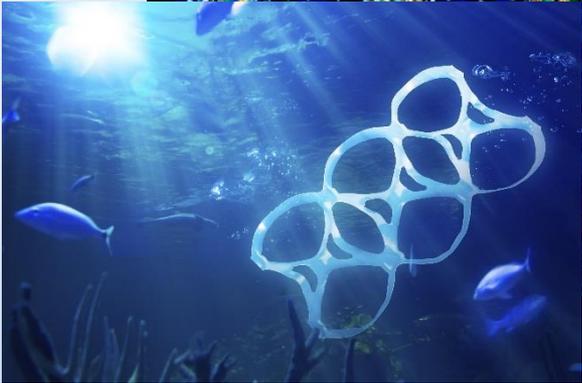


FIGURE 25. TONGING eastern oysters, south San Francisco Bay, 1890's. From Townsend, 1893.





CHANGE IS CONSTANT

TECHNOLOGY

MARKET & BUSINESS

OCEAN CONDITIONS

NEIGHBORS & SOCIETY

ANTICIPATE CHANGE

&

ADAPTIVELY MANAGE

BEST MANAGEMENT PRACTICES

MANY REGULATORY ADVANTAGES:

OPERATIONS

FLEXIBILITY

GROWER BUY-IN

ADAPTABLE

PROPOSED BY MANY

ALL WITH INTERESTS & RESPONSIBILITIES

BEST MANAGEMENT PRACTICES FOR THE VIRGINIA SHELLFISH CULTURE INDUSTRY

PREPARED BY:
Michael Osterberg and Mark Luckenbach
Virginia Institute of Marine Science
College of William and Mary
Gloucester Point, VA

WITH COOPERATION FROM:
A.J. Erskine, Bevans Oyster Company, Kinsale, VA
Doug McMinn, Chesapeake Bay Oyster Company, Wake, VA
Mike Peirson, Cherrystone AquaFarms, Cheriton, VA
Tom Walker, J.C. Walker Brothers, Willis Wharf, VA

VIMS Marine Resource Report Number 2008-10

SEPTEMBER 2008



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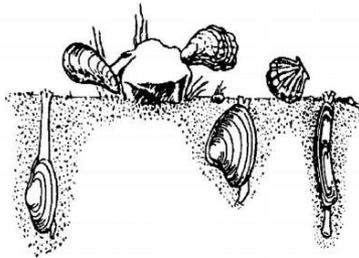
VIMS Marine Resource Report Number 2008-10

SEPTEMBER 2008



Best Management Practices for the Shellfish Culture Industry in Southeastern Massachusetts

(Version 09-04a)



Developed by:
Massachusetts shellfish growers
in collaboration with
the SouthEastern Massachusetts Aquaculture Center
with support provided by the Massachusetts
Department of Agricultural Resources and the
USDA Risk Management Agency



Compiled & Edited by:
Dale F. Leavitt
SEMAC & Roger Williams University
Bristol, RI 02809

BEST MANAGEMENT PRACTICES FOR THE VIRGINIA SHELLFISH CULTURE INDUSTRY

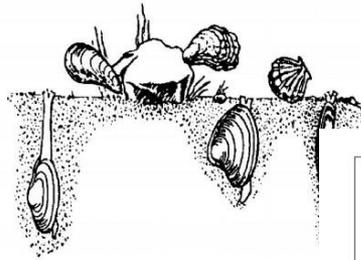
CBP/TRS-282-06



Best Management Practices for Sediment Control and Water Clarity Enhancement
October 2006

Best Management Practices for the Shellfish Culture Industry in Southeastern Massachusetts

(Version 09-04a)



ASC Bivalve Standard

Version 1.0 Jan 2012

Aquaculture Facility Certification

Mollusk Farms
Best Aquaculture Practices Certification Standards, Guidelines



Best Management Practices for the East Coast Shellfish Aquaculture Industry



RECOMMENDED MANAGEMENT PRACTICES FOR AQUATIC FARMS

AGRICULTURAL MANAGEMENT PRACTICES (AMPS)
AQUATIC ORGANISM HEALTH MANAGEMENT PLAN

Developed by:
Massachusetts shellfish growers in collaboration with the Eastern Massachusetts Aquaculture Center with support provided by the Massachusetts Department of Agricultural Resources and the USDA Risk Management Agency

Compiled & Edited by:
Dale F. Leavitt
EMAC & Roger Williams University
Bristol, RI 02809



Environmental Policy

PACIFIC COAST SHELLFISH GROWERS ASSOCIATION

June 2001



PACIFIC COAST SHELLFISH GROWERS ASSOCIATION
PARTNERS WITH MOTHER NATURE

HOME ABOUT PCSGA OUR GROWERS NEWS & EVENTS RESOURCES ALL ABOUT SHELLFISH

CULINARY GUIDE MEMBERS

ENVIRONMENTAL POLICY



ECOSYSTEM SERVICES PHOTO COMPETITION
Submissions due 15th of every month



Maine Aquaculture Association

Code of Practice

SHELLFISH AQUACULTURE BMPs MUST BALANCE

SEAFOOD DEMAND



BUSINESS ENTERPRISE



PUBLIC TRUST TIDELANDS



WITH COMMITMENT

STANDARDIZED LEASE TEMPLATE AND REGULATORY COMPLIANCE

SPECIFIC BMPs IN LEASES LESS FLEXIBLE WITH DRAWN-OUT IMPLEMENTATION

REQUIREMENT TO ADHERE TO BMP PLANS REQ'D BY A NEW REGULATION WOULD HAVE COVERAGE IN LEASE REQUIREMENTS (INCORP. BY REFERENCE, LEASE SEC. 30) UPON PROMULGATION OF NEW REGULATION

RECORDING REQUESTED BY AND)
WHEN RECORDED MAIL TO:)
)
State of California)
Fish and Game State)
1416 Ninth Street, 13th Floor)
Sacramento, CA 95814)

Space Above Line for Recorder's Use Only

LEASE GRANTING THE EXCLUSIVE PRIVILEGE OF CONDUCTING AQUACULTURE AT STATE WATER BOTTOM NO. M-000-00

THIS LEASE GRANTING THE EXCLUSIVE PRIVILEGE OF CONDUCTING AQUACULTURE AT STATE WATER BOTTOM NO. M-000-00 ("Lease") is made and entered into as of [DATE], by and between [NAME], ("Tenant") and the California Fish and Game Commission ("State") with reference to the following facts:

RECITALS

Tenant wishes to lease a State Water Bottom for the purpose of propagating, cultivating, maintaining and harvesting aquatic plants and/or animals in marine waters of the state.

Fish and Game Code section 15400 authorizes the State to lease to any person the exclusive privilege to conduct aquaculture in any designated State Water Bottom if it determines that such lease is in the public interest.

[New lease]: On [DATE] the State awarded the lease for State Water Bottom No. M-000-00 to Tenant.

[Renewal]: On [DATE(s)] the State authorized renewal of the Lease for State Water Bottom No. M-000-00 to Tenant.

[Other]: On [DATE] [Note here any other significant events concerning the lease, e.g. amendment, assignment or designation of successor-in-interest.]

TERMS AND CONDITIONS

1. **LEASE.** The State hereby grants to Tenant the exclusive privilege to conduct aquaculture upon State Water Bottom No. M-000-00, subject to the terms and conditions of this Lease.

2. **DESCRIPTION.** This Lease covers that area comprising approximately 000.00 acres designated as State Water Bottom No. M-000-00 and shown on the Map and Description attached as **Exhibit A**, which is made a part of this Lease by this reference.

Proposed best practices for Tomales Bay Oyster Farmers

1. Each grower must use
Collected and abandoned
Unique bag color
Unique wire color
2. Have staff positions
Rotate all staff in
3. Growers must strive
4. Replace litter-making
If copper wire is
5. Prohibit the use of pesticides
Birds peck and collect
Use crab buoys
6. Prohibit the current
All bags must be
7. Prohibit tools from lease
areas surrounding the
Fencepost drive
Gloves
Water bottles
PVC pipes
8. If an idea does not work
No messes left behind
9. At a minimum, monitor
Twice a month
Walk shoreline
areas
10. Update leases so that
funds for ongoing, shoreline
repair – generally make
circumstances.

Submitted at Fish & Game Commission mtg, Santa Rosa CA – by John Finger
Apr 2015

PROPOSED BEST PRACTICES FOR TOMALES BAY SHELLFISH FARMERS

1. Regularly educate staff
litter.
2. Growers must strive to ensure
debris are minimized.
3. Avoid the use of single-use
principles of reduction, reuse,
long life span, preferably
4. Strive to phase out the use of
buoys/floats properly in
5. When tossing out loose
bags are either heavy enough to
prevent drifting/movement
tossed out.
6. Avoid leaving tools, loose
surrounding areas for loss
staged on leases shall be
burial.
7. If a culture method is used
promptly removed.
8. At a minimum, leases are
gear on a monthly basis
storm events.
9. Growers will participate in
shoreline and wetlands
shellfish gear collected
volume.
10. Growers will work with
bay wide clean up efforts
at all times.
11. A review of lease escrow
adequate funds are available
the right to perform the
decrease the balance in

PROPOSED BEST PRACTICES

Once adopted, the below list of
and legally binding for all aqua
and Game Commission shall in
compliance with the BMPs. The
annual basis (at a minimum) to
potential improvements.¹ Ideal
winter storm season. The final
basis, as technology improves (

1. Growers² shall implement
shall include regular staff
environmental stewards
marine debris elimination
and agencies regarding
2. All staff shall be trained
near growing leases on
3. Staff and contractors shall
4. Leases and surrounding
Following high winds a
possible or within two weeks
5. Growers shall organize
the bay shoreline and waste
debris collected, including
documented, with the grower
6. Growers will aim to work
coordinate quarterly bay
non-shellfish items) at least
7. A monthly grower self-
BMP compliance. This

¹ The Department of Fish and Game
² The term "Growers" is defined to
³ The term "Staff" is defined to
personnel, owners, and operators
⁴ For intertidal leases, patrols shall
mud is promptly collected.

Environmental Action Commission
415-663-9312



Proposed Best Management Practices (BMPs) for Tomales Bay Shellfish Farmers

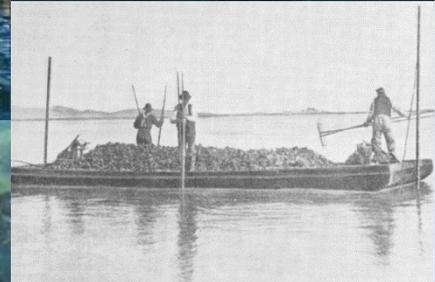
Submitted by Richard James for the 20 July, 2017 MRC meeting in Santa Rosa
7 July, 2017

These BMPs shall be an integral part of each lease. The practices shall be mandatory practices meant to ensure Tomales Bay and the ocean in general is kept free of lost plastic and other debris from aquaculture operations.

To have the intended effect of reducing litter in Tomales Bay attributed to aquaculture, it is imperative that these practices be adequately and regularly enforced.

1. Growers shall uniquely and clearly identify all of their gear with company name and phone number. Possible means of uniquely marking gear include: unique colors of bags, wires, PVC pipes, rope, and "branding info into gear."
2. Growers shall train all employees in concepts of Leave No Trace, see <http://LNT.org>, or similar training about environmental stewardship.
3. Growers shall continually improve gear and methods in a quest for zero loss of gear.
4. Growers shall replace single use items (i.e. zip-ties, copper wires) with more durable items such as stainless halibut clips.
5. Growers shall NOT use floats that are easily degraded by ultraviolet rays or pecked by birds in search of food.
6. Growers shall securely tie large groups of non-floating bags together when deploying bags for future securing to anchor lines to ensure they do not drift.
7. Growers shall remove tools each day after working on lease areas, including: fencepost drivers, gloves, water bottles, PVC pipes, wires, and ropes.
8. Growers shall promptly (within 60 days) remove culture structures and other items comprising a method that did not work as desired or is no longer used.
9. Growers shall patrol lease areas and the shores of Tomales Bay on a bi-monthly basis, twice monthly during windy or heavy surf times. Patrols must occur at both high and low tides to ensure gear buried in the mud is promptly collected.
10. Growers shall uniquely and clearly identify all of their boats and barges. Boats should be clearly identifiable with binoculars from a distance of 1 mile. Unique color, large letter and/or number or combinations of these may work.

DIFFERENT METHODS PAST - NOW - FUTURE



BMP PLANS – TODAY'S GOAL

SPECIFIC BMPs

CORE ELEMENTS

RECOMMENDATIONS

What core elements of shellfish aquaculture best management practices should comprise BMP Plans ?

commercial shellfish aquaculture = business enterprises,
operated in public waters - held in the public trust
by the regulating agencies

BMP PLANS – TODAY’S GOAL

NEED FOR BEST MANAGEMENT PRACTICES – WHICH ONES?

- Minimize pollution and/or environmental impacts
- Safeguard environment and guide sustainable shellfish production
- Adaptively manage with consistency and reasonable predictability
- Acknowledge multiple uses and users of state waters

SPECIFIC BMPs **CORE ELEMENTS**

BEST MANAGEMENT PRACTICES

‘DO THINGS THIS WAY’

(“OPERATIONAL OR DESIGN DETAILS”)

VS.

PERFORMANCE STANDARDS

‘DESIRED OUTCOME’ OR ‘END RESULT’

(“THEMES” OR “CATEGORIES”)

BEST MANAGEMENT PRACTICES

EXAMPLE CORE ELEMENTS

- **Site selection and access**
- **Materials, Operations, and Maintenance**
 - Robust designs
 - Operational discipline
- **Maintenance of environmental quality**
 - Habitat, Water quality, Species
- **Disease prevention and management - biosecurity**

**BEST MANAGEMENT PRACTICES
LESSONS FROM ELSEWHERE
APPLIED HERE IN SB CHANNEL**

UCSB student team funded and focused on this topic



PROCESS JUST BEGINNING

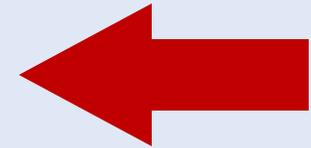
JULY 2017

PUBLIC STAKEHOLDERS MEETING (TOMALES BAY)

+ MARINE RESOURCES COMMITTEE (F&G COMMISSION SUB-CMTE)

29 MAY 2018 (SANTA BARBARA)

PUBLIC STAKEHOLDERS MEETING



JULY 2018

MARINE RESOURCES COMMITTEE (SAN CLEMENTE)

INITIAL STATEMENT OF REASONS (ISOR)

= BEGINNING OF FORMAL PROCESS

WRITTEN COMMENTS



Aquaculture
MATTERS



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STATE AQUACULTURE COORDINATOR

CA DEPT FISH AND WILDLIFE

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**BEST MANAGEMENT PRACTICES
LESSONS FROM ELSEWHERE
APPLIED HERE IN SB CHANNEL**

UCSB student team funded and focused on this topic



A close-up photograph of a metal pulley system on a boat. The pulley is dark and has several sharp teeth on its side. It is attached to a blue metal frame. The background shows the ocean with sunlight reflecting on the water, and distant mountains under a hazy sky. The text "California Offshore Aquaculture Project (COSAP)" is overlaid on the bottom right of the image in white font on an orange background.

California Offshore Aquaculture Project (COSAP)



About COSAP

Creating an information hub for offshore shellfish farming in the Santa Barbara Channel



Today's Outline

- 1) an overview BMPs
- 2) what we've learned from stakeholder interviews
- 3) takeaways from the BMP literature
- 4) a few, key areas of scientific literature as it relates to management decisions
- 5) and what we're planning to contribute by the end of the year

What Are BMPs?

"Best Management Practices (BMPs) are general overarching principles and specific procedures used to guide the day-to-day operation of aquaculture businesses to improve production while preserving the environment."

- NOAA



Methods

Understanding

Permitting

developing permitting guidance report for state and federal compliance

Stakeholder

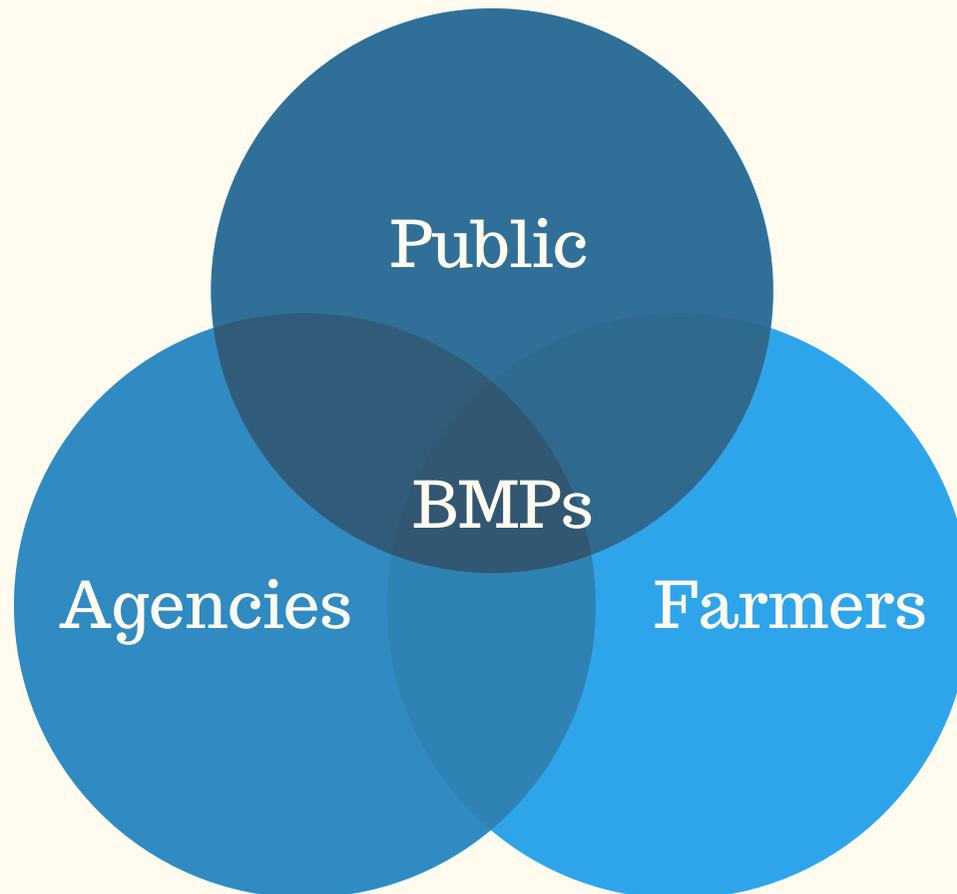
Interviews

10 interviews across state and federal government, associations, farmers and scientists

Literature Review

Dissected 5 papers for shellfish BMPs and identified 12 common categories

Permitting & Stakeholder Review



Mining the literature

What is offshore aquaculture?

Froehlich, H.E. et al., 2017. Offshore aquaculture: I know it when I see it. *Frontiers in Marine Science*, 4.

Public & Community

Fairbanks, L., 2016. Moving mussels offshore? Perceptions of offshore aquaculture policy and expansion in New England. *Ocean & coastal management*, 130, pp.1–12.

Murray, G. & D'Anna, L., 2015. Seeing shellfish from the seashore: The importance of values and place in perceptions of aquaculture and marine social–ecological system interactions. *Marine Policy*, 62, pp.125–133.

Knapp, G. & Rubino, M.C., 2016. The political economics of marine aquaculture in the united states. *Reviews in Fisheries Science & Aquaculture*, 24(3), pp.213–229.

Water Column

Hydronamic Implications of Offshore Mussel Farms. Available at: <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1435580> [Accessed April 30, 2018].

Wu, Y., Washburn, L. & Jones, B.H., 1994. Buoyant plume dispersion in a coastal environment: evolving plume structure and dynamics. *Continental Shelf Research*, 14(9), pp.1001–1023.

Fisheries Interactions

Gibbs, M.T., 2004. Interactions between bivalve shellfish farms fishery resources. *Aquaculture*, 240(1-4), pp.267–296.

Benthic Environments

Christensen, P.B. et al., 2003. Impacts of longline mussel farming on oxygen and nitrogen dynamics and biological communities of coastal sediments. *Aquaculture*, 218(1-4), pp.567–588.

Sequeira, A. et al., 2008. Trade-offs between shellfish aquaculture and benthic biodiversity: A modelling approach for sustainable management. *Aquaculture*, 274(2-4), pp.313–328.

Plastic Interactions & Impacts

Wang, Z. et al., 2018. Sorption behaviors of phenanthrene on the microplastics identified in a mariculture farm in Xiangshan Bay, southeastern China. *Science of The Total Environment*, 628-629, pp.1617–1626.

Exploring Nearshore Shellfish Farming

Forrest, B.M. et al., 2009. Bivalve aquaculture in estuaries: Review and synthesis of oyster cultivation effects. *Aquaculture*, 298(1-2), pp.1–15.



TAKEAWAYS FROM BMP REPORTS

Identified BMP categories

1. Water Quality
2. Site selection
3. Disease prevention and containment
4. **Substrate impact**
5. **Fouling and predator control**
6. Seed sourcing
7. **Marine debris**
8. Good neighbor
9. Gear maintenance
10. Employee hiring guidelines
11. Fuel spills prevention and plan
12. Buoys and Markers/ Light

substrate impact

- organic matter is likely to fall on the seafloor (Ferriera et al. 2007; Price & Morris, 2013)
- impacts are complex, in small amounts it can be positive, in large amounts negative
- if any problem, most likely to occur in shallow, sheltered bays
- there are low risks of significant organic enrichment in well-managed marine farms, especially in areas of high current and depth (Lovatelli et al. 2013)



Marine Debris

There are no global estimates of the amount of plastic waste generated by the fisheries and aquaculture sector. (FAO 2017)

Losses from fisheries and aquaculture are regularly reported in surveys of marine debris

- on beaches (Browne et al., 2015a; Nelms et al., 2017; Slip and Burton, 1991)
- floating on surface waters (Cózar et al., 2014; Thiel et al., 2003)
- located on the seafloor (Iñiguez, Conesa and Fullana, 2016)



Macrofaunal Interactions

To date there are no reported or published accounts of harmful interactions between protected species at any pilot scale or commercial farms in the offshore waters of the U.S. EEZ waters. (NOAA 2017)

However, there are BMPs that can help prevent negative interactions with wildlife.

Our Website

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COSAP

California Offshore Shellfish Aquaculture Project

A guide to permitting, management, and science for farmers and community



STATE OF THE INDUSTRY

What does shellfish farming look like around the globe?

[Read More](#)



PERMITTING PROCESS

Who needs a permit? How do you get that? Is that legal???

[Read More](#)



BEST MANAGEMENT PRACTICES

What does it mean to be the best and how do you get there?

[Read More](#)



RESOURCES

What's the science? How do I...?

[Read More](#)

Understanding Permitting

[Home](#)

[State of the Industry](#)

[Permits](#)

[BMPs](#)

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Regulations Permits and Agencies

The permitting process for aquaculture certification involves several Local, State, and Federal agencies. Without the proper guidance and tools, this process can be arduous, time consuming, and costly. Fortunately, we've done all the research and networking necessary to lessen confusion and help keep your waters clear.

These pages were put together to help guide and inform prospective offshore shellfish aquaculture farmers in the Santa Barbara Channel. Compiled is a list of all necessary permits required and the sponsoring agencies attached to these regulations.

PERMITS

AGENCIES

Literature Page

[Home](#) [State of the Industry](#) [Permits](#) [BMPs](#) [Resources](#) [Contact](#)

Resources and Research

Here you'll find a number of scientific literature sources that relate to farming management decisions. This list is growing and changing as science evolves, but it can serve as a foundation of knowledge for folks looking to understand offshore shellfish farming

These pages are organized into different categories that reflect several branches of aquaculture. All of the literature we have used is peer-reviewed and reputable. Click on the categories below to learn more about each subject.



Water Column



Benthic Environment



Public & Community

thanks to

w/ support from



w/ photos by
MARCO MAZZA