Alaska Mariculture Task Force

Established by Governor Walker's Administrative Order #280

Directive: *"to provide recommendations to develop a viable and sustainable mariculture industry producing shellfish and aquatic plants for the long-term benefit of Alaska's economy, environment and communities*

AGENDA – *Draft2*

June 27, 2017, 8:30am-12:30pm

DCCED Commissioner's Conference Room, 333 W Willoughby 9th Floor, Juneau, AK

Teleconference info: 1-800-315-6338 access code: 29660

Skype contact: linda.mattson@alaska.gov

1) Roll Call
2) Review and approve agenda
3) Review and approve minutes: May 24, 2017 (attached)
4) Public introductions & comments
5) Old business:
    a. McDowell Group discussion of Phase II:
        i. Report on progress to date – Phase II - Ch. 1 revisions
        ii. Presentation of Phase II - Ch. 2 - draft
        iii. Discuss in context of outline of Phase II (attached)
    b. Updates from Advisory Committee (AC) Chairs:
        i. Mike Stekoll – Research, Development & Environmental Info AC
        ii. Sam Rabung – Regulatory Issues AC
        iii. Angel Drobnica & Jeff Hetrick – Investment & Infrastructure AC
        iv. Paula Cullenberg – Workforce Development AC
        v. Heather McCarty – Public Education & Marketing AC
    c. Update on legislation: ***all four bills are in Senate Finance Com. until Jan. 2018***
        i. HB 76 / SB 95 - Mariculture Revolving Loan Fund
        ii. HB 128 / SB 89 – Shellfish Enhancement
    d. Grant application updates
        i. Alaska Sea Grant: 1 large, 3 small grant projects submitted
        ii. Arctic Funders Collaborative
        iii. ARPA-E
        iv. FFAR – Foundation for Food & Agriculture Research – application start July 10
        v. NPRB – Request for Research Ideas – due July 10
        vi. NOAA SK – RFP release ~Sept. 1
        vii. The Nature Conservancy / OceansAlaska
        viii. USDA: AFRI, SBIR, Beginning Farmers & Ranchers, RD, etc.

e. Communications:
    i. Past / future presentations: Aug. 1 in Craig (AFDF & Scheer)
    ii. Press release: issued 05-31-2017

6) New Business:
    a. Discuss MTF member meetings with Dr. Paul Doremus (NOAA)
    b. Discuss call with Dr. Gene Kim (USDA, Director of Interagency Working Group on Aquaculture)
    c. Discuss Senator Murkowski's work on bill (w/Charlotte Regula-Whitefield)
    d. Discuss draft "AMTF Recommendations for Mariculture Development in Alaska"
    e. Discuss Guide to Federal Aquaculture Programs and Services (2014)
    f. Discuss Aquaculture Act of 1980
    g. Discuss excerpt from Research Act of 1977
    h. Discuss updates to diagram of comprehensive planning process (attached)
    i. Appoint Drafting Committee
7) Next steps & homework assignments
8) Set next 3 meetings - date/time/place (August 23, Sept. 27, ?)
9) MTF sign form for documenting in-kind match (attached)
10) Closing Comments

Attachments:

- MTF Minutes, May 24, 2017 – DRAFT
- Phase 2 - Outline, by McDowell Group
- Phase 2 – Chapter 1, by McDowell Group
- Phase 2 – Chapter 2, by McDowell Group
- Advisory Committee Agendas/Minutes/Notes (see MTF website)
- Recommendations (DRAFT) from ACs:
    - R&D
    - Regulatory
    - Investment & Infrastructure
    - Workforce Development
- HB 76 / SB 95– Mariculture Revolving Loan Fund Bill (see page link)
- HB 128 / SB 89 - Shellfish Enhancement Bill (see page link)
- 05-31-17 Press Release – FINAL
- 2017 Aquatic Farm Application Summary
- Alaska Marine Policy Forum - May, 2017, pgs. 1-2
- DRAFT - AMTF Recommendations for Mariculture Development in Alaska
- Guide to Federal Aquaculture Programs and Services (2014)
- Aquaculture Act of 1980
- Research Act of 1977 (excerpt)
- Diagram of Comprehensive Planning Process – Updated (TBD)
- NOAA In-Kind Match Form

THE STATE of ALASKA
GOVERNOR BILL WALKER

Department of Commerce, Community, and Economic Development
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Alaska Mariculture Task Force (MTF) Meeting Minutes
May 24, 2017

Attendees
Mariculture Task Force members attending: Julie Decker, Angel Drobnica, Sam Rabung, Mike Stekoll, Heather McCarty, Eric Wyatt, Micaela Fowler (delegate for Chris Hladick). Late: Kate Sullivan
Members of the Public: Tamsen Peeples- Premium Oceanic, Kirsten Shelton-Walker McDowell Group, Charlotte Regula-Whitefield- Knauss Fellow at Senator Murkowski's office, Tomi Marsh, Patrick Simpson- Silver Bay Seafoods, Lorne Donke
Cynthia Pring-ham, and Michelle Morris- Department of Fish and Game
Linda Mattson - Department of Commerce, Community, and Economic Development

Materials distributed to task force members included: Agenda for May 26 meeting, minutes from April 26 meeting, Outline of Phase 2 by McDowell Group, Petersburg Mariculture Q&A, Draft-Press Release- Legislation and new permit applications, 2017 Aquatic Farm Application Summary, Updated Diagram of Comprehensive Planning Process, Washington Shellfish Initiative Phase 2 Overview and Work Plan

8:35am Vice-Chair Julie Decker called meeting to order

Agenda was reviewed and approved
- Sam Rabung motioned to approve the agenda as amended, Mike Stekoll seconded

April 26 meeting minutes were reviewed
- Sam Rabung motioned to approved the minutes, Heather McCarty seconded

Public Introductions & Comment
Public Comments opened at 8:38am
Tamsen Peeples gave an update on the Larson Bay harvest from Kodiak in which 20,000 pounds of sugar and ribbon kelp were harvested
Public Comment closed at 8:43am

Old Business: McDowell Group Discussion
Kirsten Shelton-Walker provided an update to McDowell's work on their report
- They are working toward their June 28th deadline for chapters 2 and 3 and are prepared to have those chapters to present at or prior to the deadline but stressed that the report is a work in progress
- Chapter 1 will be submitted to the MTF after it has been finalized
- Heather asked what the timeline was for chapter 1 to be finalized

    - Kirsten and the McDowell group will continue to work with the AC's to finalize chapter 1
    - McDowell group plans to give the MTF time to edit the report prior to producing a final
- Eric asked about whether or not the McDowell group would cover issues that were not covered by the AC's
    - Kirsten explained that they might not capture all of this issues in the document which is why it was still a draft
    - Some of the issues that are not addressed in Chapter 1 will be addressed in Chapter 2
    - Kirsten suggested that at the June 28 MTF meeting, they review the document to address holes that need to be filled

Old Business: Updates from Advisory Committee Chairs

Mike Stekoll: Research, Development, and Environmental Information- had a meeting on May 19

- They have five potential documents that they are working on
    - Near-term priorities document
    - Mid-term priorities document
    - Long-term priorities document
    - Existing resources and future needs document
    - Document that addresses the things that need to be done to set up a mariculture enterprise
- They are focusing on the near-term priorities which according to their timeline, are two years out. Midterm priorities are five years out and long-term priorities are ten years out.
- Julie Decker asked whether or not the timeline approach identified in this AC would work for all AC recommendations
    - Sam Rabung explained that they crafted the recommendations of the Regulatory Issues AC in order of importance versus a timeline as a timeline can be fluid
    - Julie recommended that we keep this item in mind for the final document with regards to organization
    - Heather mentioned that the final product would maybe be a hybrid of the two

Sam Rabung: Regulatory Issues

- Have not met since they crafted their final recommendations. They are standing by.

Angel Drobnica & Jeff Hetrick: Investment & Infrastructure AC- met on May 1

- Worked on 11 recommendations at the AC meeting, updated some, and added a couple
- As the recommendations have not yet been approved by the AC, they are not yet final, AC chairs will present them to the full task force when they have been approved.
- Fine HM recommendation

Paula Cullenberg: Workforce Development AC- not present; no update

Heather McCarty: Public Education and Marketing AC

- Met with Kirsten of the McDowell Group to see how the AC recommendations and McDowell's recommendations will fit together
- Heather will send the recommendations to the whole task force once they are finalized

Updates on Legislation

- Bills did not pass the full body but all four are in Senate Finance for next year
- Julie encouraged MTF Members to contact the sponsors of the legislation and thank them and to encourage them to continue the work in this area
- Heather mentioned that the task force made huge headway and that the bills are well positioned for next year

Grant Application Updates

- ARPA-E: two grants were submitted to the Department of Energy on May 15th
- Alaska Sea Grant has not yet heard on anything on their application to NOAA
- Michelle from Fish and Game mentioned that Ms. Brenda Konar of the University of Alaska Fairbanks who has been working on a Sea Grant proposal for kelp harvesting. Brenda is looking for letters of support. Michelle will send Julie Decker Ms. Konar's contact information so that they can talk further.
- Mike Stekoll mentioned that a group in Southern California has submitted an ARPA-E application to put together a modeling for site selection
- Eric Wyatt informed the task force that The Nature Conservancy in partnership with OceansAlaska has put in for a grant with the wildlife conservation society that has to do with a kelp demonstration farm.

Communications

Future Presentations

- Mike is presenting in Cape Town South Africa at the end of June
- Mike is presenting on algae at the International Phycological Conference in Poland at the end of August
- Charlotte mentioned that at the end of June there will be a congressional briefing with the National Sea Grant Association
- NOAA Aquaculture Extension workshop in Boise, ID in June

Discussion on press release regarding legislation

- Eric expressed concern about the tone of the press release and requested that the length be shortened. He was also not comfortable with the size feasibility study information being included in the press release
- Sam suggested that the press release be shortened to be more of a summary
- Pat from Silver Bay Seafoods requested that the applicants be allowed to work with their respective shareholder groups before the MTF gets too far in-front of these efforts
- Kate mentioned that the MTF should be mindful of the concerns that could be raised by different user groups if the information on the permits is sent out in the press release
- Angel requested that the MTF keep the progress of the bills and the thank you in the press release
- Eric agreed with Sam's assessment to change the order of the press release and asked that the MTF be allowed to approve any edits via email so that momentum is continued
- Kate motioned to change the press release to tone down the language on the permit applications, to highlight the kelp harvest and to shorten the length. Heather seconded
- Julie proposed a friendly amendment that the updated draft press release be sent to the MTF for electronic approval before making public. Heather seconded the amendment

- MTF edits to press release due to Julie Decker on Friday, May 26 so that the press release can go out on Tuesday, May 30.
- Press release will be on DCCED Letterhead and go out from the DCCED Commissioner's Office. Linda Mattson will be the contact person and will funnel any questions to Julie Decker

New Business
Discussion: 2017 Aquatic Farm Applications

- The Department of Natural Resources receives all applications for State of Alaska land, and the Department of Fish & Game receives all applications for non-State land
- Eric explained that it is common for sea cucumbers to grow better under suspended culture oyster farms. He was also curious to know if permits for divers harvesting those products was allowed. He mentioned that a FAQ sheet to address different groups would be helpful to answer those questions.
    - Sam explained that there are several prerequisites for F&G permitting and that one of the ones is that a new farm site cannot have a significant negative effect on an existing or traditional fishery. They cannot permit new farms if there is an existing fishery which will be negative impacted. There is much information on the F&G website as well as their statutes and regulations.
- Kate requested that the MTF be sure to be prepared for any questions that may come up from stakeholders and that we prepare an FAQ for the MTF website.
- Heather asked who will actually put the FAQ's together and suggested that the MTF have a process to proceed
- Eric suggested that maybe Sea Grant might have the information that would answer some of the FAQ's
- Julie will ask Paula Cullenberg before committing them and emphasized that communication efforts should focus on places like Sitka, Kodiak, and Craig
- Heather volunteered her AC to work on the FAQ's and to bring them back at the next meeting
- Eric suggested that the MTF look at any existing information that is already public knowledge and incorporate them into the FAQ's
- Kate will work with Sam Rabung and Cynthia Pring-Ham from F&G and will send her ideas to Heather so that she can work on them

Discuss Washington Shellfish Initiative- Phase 2

- Charlotte from Senator Murkowski's office updated the MTF on ideas developing at the federal level as to what a federal aquaculture initiative would look like. They are also taking ideas from a 1980 federal aquaculture law (Aquaculture Act 1980) as to what it would look like.
- Senator Murkowski's office has begun to seek input from Alaskan stakeholders on what Alaskans would like to see from this initiative
- Julie asked Charlotte if she could send the 1980 aquaculture law to the MTF as well as if there was a timeline for compiling data for this initiative
- Charlotte will send the law and does not have an official timeline but are looking at dates from July to September
- Heather moved that the MTF draft a letter to the Congressional Delegation and others to address interest and concerns in federal aquaculture issues. Sam seconded

    - Julie will draft the letter with help from Eric
    - They will bring the draft letter back to the MTF for approval at the next meeting
- Sam suggested that the MTF get feedback from Governor Walker's office to be sure that they are aware of the letter and ensure their support.

Discuss diagram of comprehensive planning process

- MTF Members held a discussion on the securing funding bubble on the comprehensive planning process. No decisions were made at this time
- Sam Rabung reminded task force members that they should name a drafting committee for the final plan. More discussion to be had at a later date

Form to document MTF member time for in-kind match to NOAA Grant

- Form was passed around to the task force members to indicate their time worked

Next Steps and Homework

Next meeting dates:

June 27, 2017 from 8:30am to 12:30pm
August 23, 2017 from 8:30am to 12:30pm
PLANNING PURPOSES: September 27, 2017

11:26am Meeting adjourned by Co-Chair Decker

Alaska Mariculture Initiative: Economic Analysis to Inform the Comprehensive Plan: Phase 2 Report Outline

Executive Summary

Introduction

(McDowell Group)

Purpose and Scope of Phase 2

Mariculture Defined

Methodology

Report Organization

Chapter 1. Alaska's Mariculture Industry Today

(McDowell Group)

Shellfish (numbers of permits, operating farms, production volume and value, prices, trends, farming practices, current markets and market conditions)

Macroalgae (status of development efforts, production levels, farming practices, etc)

Enhancement Activity (overview of current research activity, plans, goals, budgets)

Integrated Operations (multi-species farm practices, vertical integration, etc.)

Summary Status of Alaska's Mariculture Industry

Chapter 2. Alaska's Mariculture Development Challenges and Opportunities

(McDowell Group and MTF Advisory Committees)

Barriers to Entry

Research Needs/Gaps

Regulatory Framework

Operating Costs/Logistics/Production Inputs

Access to Capital/Capital Requirements

Access to Markets and Market Development

Chapter 3. Investment Sources

(McDowell Group and MTF Advisory Committees)

Current Mariculture Financing Overview

Overview of Investment Strategies

Overview of Investment Opportunities

Sources of Capital **(Private, Public, Public-Private Partnerships, Tribal, other)**

Current State and Federal Funding Environment

Chapter 4. Economic Model for Development of Alaska's Mariculture Industry

(McDowell Group)

Farm Model Assumptions and Inputs

- Development scenarios, 30-year horizon
  - Pace of new farm development
  - Scale of farming operations (small, mid-size, large)
- Critical variables and sources of uncertainty

Farm Economic Impact Model Outputs

- Farm-gate and wholesale production volumes and values
- Employment and labor income (direct and indirect)
- State lease fees and harvest tax revenues

Farm Economic Impact Return on Capital Investment

Enhancement Model Assumptions and Inputs

- Annual investment in research/enhancement activity
- Timing and scale of enhance common property harvests
- Critical variables and sources of uncertainty

Enhancement Economic Impact Model Outputs

- Ex-vessel and first wholesale value of enhanced common property harvests
- Direct and indirect economic impacts (labor income, taxes) of enhanced common property harvests

Chapter 5. Strategic Development Goals, Pathways, and Outcomes

(McDowell Group and MTF Advisory Committees)

Economic Analysis of Potential Investment Strategies

- Farm Investment
- Enhancement Investment

Recommendations for Phase 3 Analysis

Chapter 1. Alaska's Mariculture Industry Today

This chapter describes the mariculture industry in Alaska, with a focus on current production and research and development activity.

Photo credit: Bob Koenitzer.

The Aquatic Farm Act[1] authorizes the Commissioner of Alaska Department of Fish and Game (ADF&G) to issue permits for construction or operation of aquatic farms, and hatcheries to supply aquatic plants or shellfish to aquatic farms. The intent of the program was to create an industry in the state that would contribute to the economy and strengthen competitiveness of Alaska seafood in the world marketplace, broadening the diversity of products and providing year-round supplies of premium quality seafood. The law limited aquatic farming to shellfish and aquatic plants, prohibiting farming of finfish in the state.

The statewide Aquatic Farm Program is jointly administered by three state agencies: Department of Natural Resources (DNR), ADF&G, and Department of Environmental Conservation (DEC). Each of these agencies plays a specific role in authorizing and managing aquatic farm activities within Alaska.

ADF&G certifies and permits seed entering the state for aquatic farming, ensures mariculture operations do not significantly alter established fishery resources, determines wild stock populations prior to permitting aquatic farm species, and issues permits for the transport of seed and mariculture products.

The DNR authorizes the use of tide and submerged land and seeks to balance use of the land for mariculture with traditional uses of the area, upland owner access, public access, and navigation of public waters as required under Article VIII of the Alaska State Constitution.

The DEC certifies water quality for areas where aquatic farm products are produced and tests and certifies products before they are permitted to enter the commercial market to ensure they are safe for human consumption.

Most tide and submerged lands within Alaska's coastline are a common property resource managed upon multiple use principals and sustained yield requirements. The State of Alaska Constitution require resource decisions to be vetted thru a public process and noticed for public input to balance resource management decisions with the best interests of the State of Alaska.

[1] Section 19, Chapter 145, SLA 1988.

As of 2016, mariculture activity in Alaska consists of approximately 75 operations, including 65 authorized farms, seven nurseries, and three hatcheries. Most operations are located along the coastline in either Southeast or Southcentral.

Current organisms permitted for mariculture include shellfish species and macroalgae, though few of these species are produced for market in Alaska at this time.

Table 1. Organisms Approved for Culture at Permitted Operations

Aquatic Farms and Nurseries	
Shellfish	Pacific Oyster, Blue Mussel, Geoduck, Littleneck Clam, Purple-Hinged Rock Scallop, Pink Scallop, Spiny Scallop, Cockle, Green Sea Urchin, Purple Sea Urchin, Red Sea Urchin, Sea Cucumber, Abalone
Macroalgae	Sugar Kelp, Giant Kelp, Bull Kelp, Ribbon Kelp, Red Ribbon Kelp, Three Ribbed Kelp, Nori, Sea Lettuce
Hatcheries	
Shellfish	Pacific Oyster, Blue Mussel, Geoduck, Littleneck Clam, Purple-Hinged Rock Scallop, Cockle, Pacific Razor Clam, Butter Clam, Blue King Crab, Red King Crab
Macroalgae	Dark Sea Lettuce, Dulse, Kombu, Nori, Ribbon Kelp, Sea Lettuce, Three Ribbed Kelp, Sugar Kelp, Bullwhip Kelp

Source: ADF&G.



Photo credits (from left to right): Alutiiq Pride Shellfish Hatchery, Bob Koenitzer, and Bob Koenitzer.

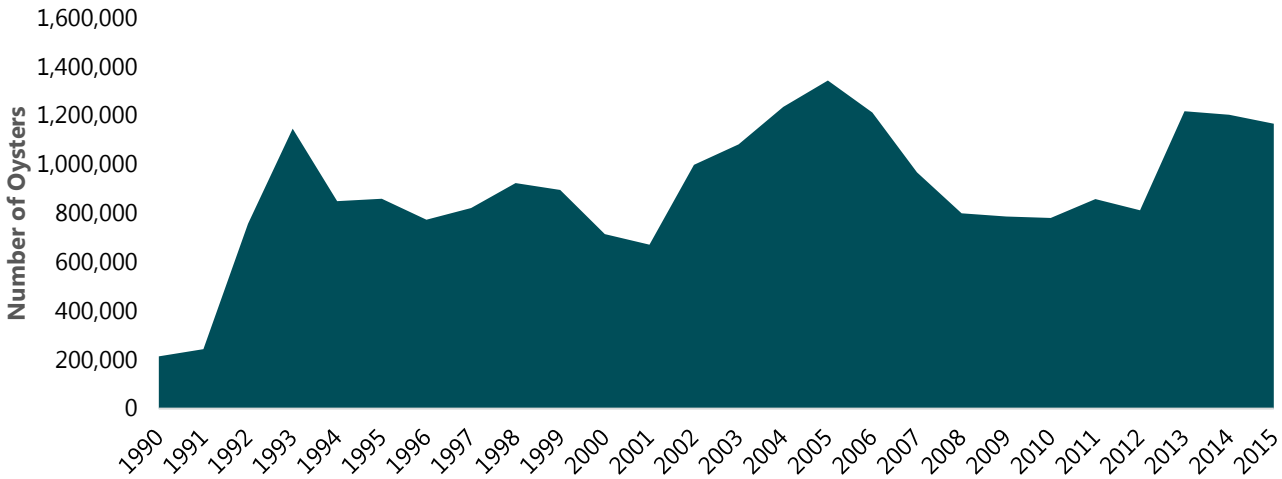
Production

Over the past 25 years, many organisms have been produced and sold from Alaska mariculture operations, though some at a very small scale. Since 1990, production has included Pacific oyster, geoduck, blue mussel, green sea urchin, littleneck clam, pink scallop, purple-hinged scallop, spiny scallop, red ribbon, sea cucumber, bull kelp, and sugar kelp.

Today, mariculture production in Alaska is primarily focused on oysters, with 31 permitted oyster farms in 2015, almost 1.2 million oysters sold, and statewide inventory of 15 million. In 2017, 43 farms are permitted. In terms of production volume, oysters are followed by blue mussels, with four permitted farms, almost 17,000 pounds sold in 2015, and an inventory of 8 million mussels. In 2015, 16 permitted operations for geoducks accounted for 910,000 in inventory for this slow-growing species. Finally, while Pacific littleneck clam production once topped 68,000 pounds sold, there were no sales in 2015.

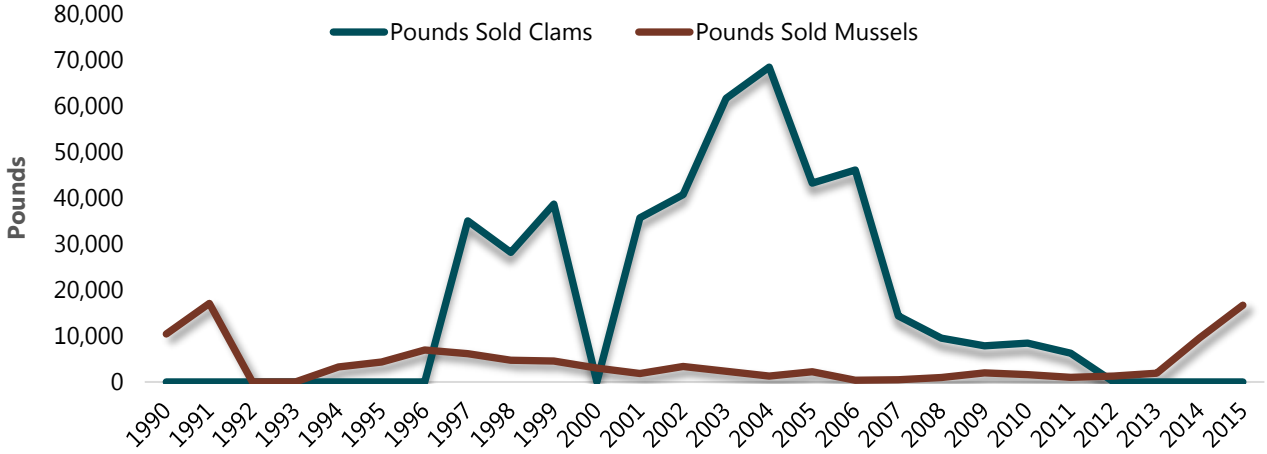
In addition to these shellfish species, sugar kelp harvests are planned for spring 2017.

Figure 1. Oyster Production in Alaska, 1990-2015



Source: ADF&G.

Figure 2. Clam and Mussel Production in Alaska, 1990-2015

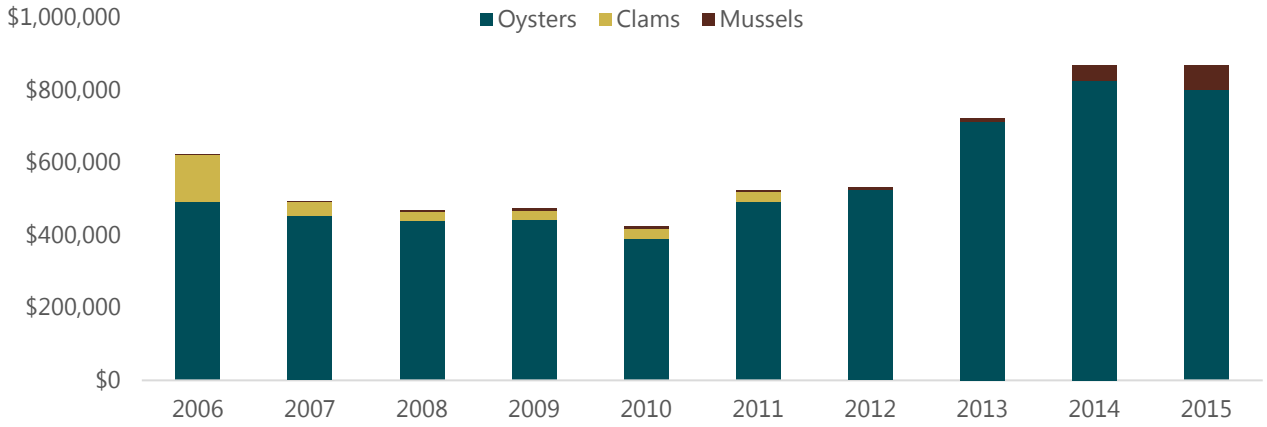


Note: For years with fewer than three operators reporting, production numbers are confidential and reported as zero.
Source: ADF&G.

Sales

Overall sales of shellfish and aquatic plants, including seed, topped $1.1 million in 2015. Aquatic farm oyster sales totaled almost $800,000, along with $71,000 in mussel sales, for a combined total of $870,000 in shellfish sales. Of that value, $421,000 in sales occurred from oyster production in Southeast, with the remainder (oyster and mussel) in Southcentral. No sales of farmed clams (including geoducks) occurred in 2015.

Figure 3. Alaska Aquatic Farm Sales, by Species, 2006-2015



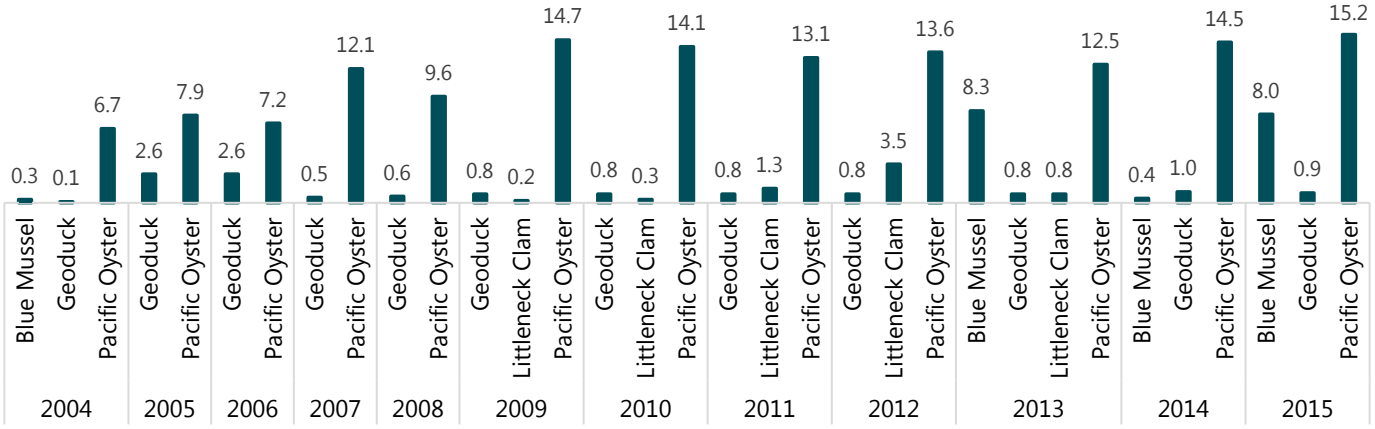
Note: For years with fewer than three operators reporting, production numbers are confidential and reported as zero.
Source: ADF&G and DNR.

In addition to farm sales, hatcheries and nurseries logged $267,000 in sales statewide, all of oyster larvae or seed. This included $215,000 in sales from Southeast operations, and $51,000 from Southcentral.

Inventory

Since 2004, mariculture product inventory has mostly consisted of Pacific oysters, blue mussels, littleneck clams, geoducks, and a small number of purple-hinged rock scallops. Kelp inventory began to grow in 2016.

Figure 4. Alaska Aquatic Farm Shellfish Inventory, Number in Millions, 2004-2015



Note: For years with fewer than three operators reporting, production numbers are confidential and reported as zero. Data is not reported above for species with less than .1 million in inventory.
Source: ADF&G.

While no other species are currently in production, several are or have been in research and development stages, including kelp, king crab, abalone, sea urchin, and sea cucumber.

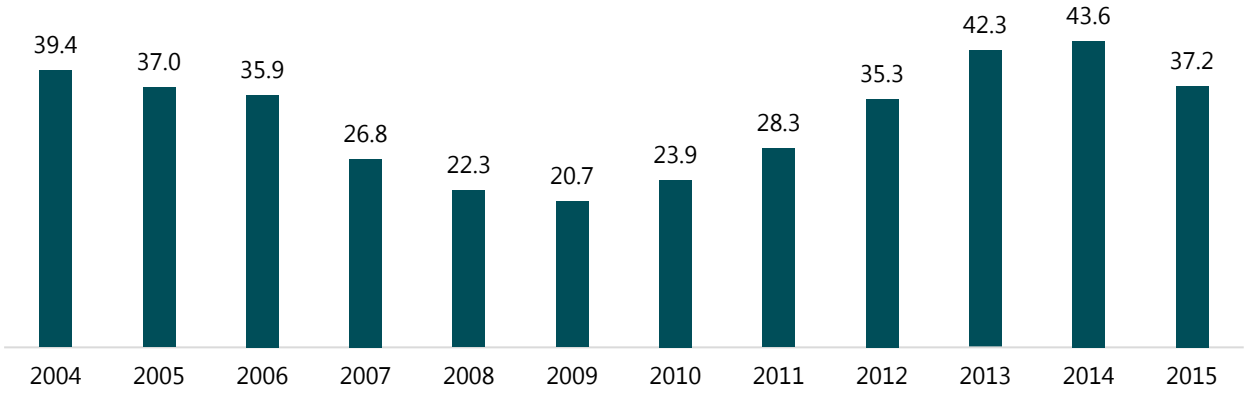
Employment

Alaska aquatic farm employment included a total of 138 positions in 2015, down from 185 in 2014. Two-thirds of these positions were employees, with permit holders and owners making up most of the other positions. In

total, workers worked a total of 9,664 workdays in 2015, down from 11,345 in 2014. A combined 37.2 FTE were employed in 2015, down from 43.6 in 2014.

Mariculture employment in hatcheries and nurseries totaled 36 in 2015, with 3,420 total workdays. Nine out of ten (92 percent) of hatchery and nursery positions were filled by employees

Figure 5. Total Annual Alaska Aquatic Farm FTE, 2004-2015



Source: ADF&G.

Organization of the Chapter

The following sections of this report detail the status and important trends for each species in the Alaska mariculture industry. Particular attention is given to species currently in production and with inventory. Research and development on other species with promise for Alaska are also discussed. Each species is in different stages of development in the state and, therefore, each section is organized to convey the most current available information for that species. When possible, costs of production, volumes produced, values of product, and current and potential markets are addressed.

The following sections are included in this chapter, in order of current production volume. The final section provides an overview of research and development efforts for king crab, abalone, and other mariculture species.

- Oyster Industry
- Mussel Industry
- Geoduck Industry
- Kelp Industry
- Species in Development

Oyster Development Status and Potential

Oyster farming is the most well-developed component of the mariculture industry in the state. Oyster sales represented slightly less than three-quarters of all mariculture revenue in 2015.

Oysters (*Crassostrea gigas)* do not spawn in the wild in Alaska. Thus, oyster seed is sourced from outside the state for grow-out in Alaska nurseries and farms. The 31 farms permitted in 2015 may be classified into three size categories based on 2015 revenue; there were 13 small farms (less than $25,000 in sales), three medium farms ($25,000 to $49,999) and, six large farms ($50,000 to $200,000).

Photo credit: ADF&G.

While total industry net profit is unknown, individual businesses profits are likely modest, particularly for small farms. Many of these small farms are considered hobby or lifestyle farms, allowing the operators to work and perhaps live in remote locations and supplement other sources of income. Following is a more detailed analysis of Alaska's oyster industry.

Oyster Production and Value

As of February 2017, 43 farms were permitted to grow oysters in Alaska. Among the 31 farms permitted in 2015, 22 reported oyster sales that year, the most recent year for which harvest data is available.

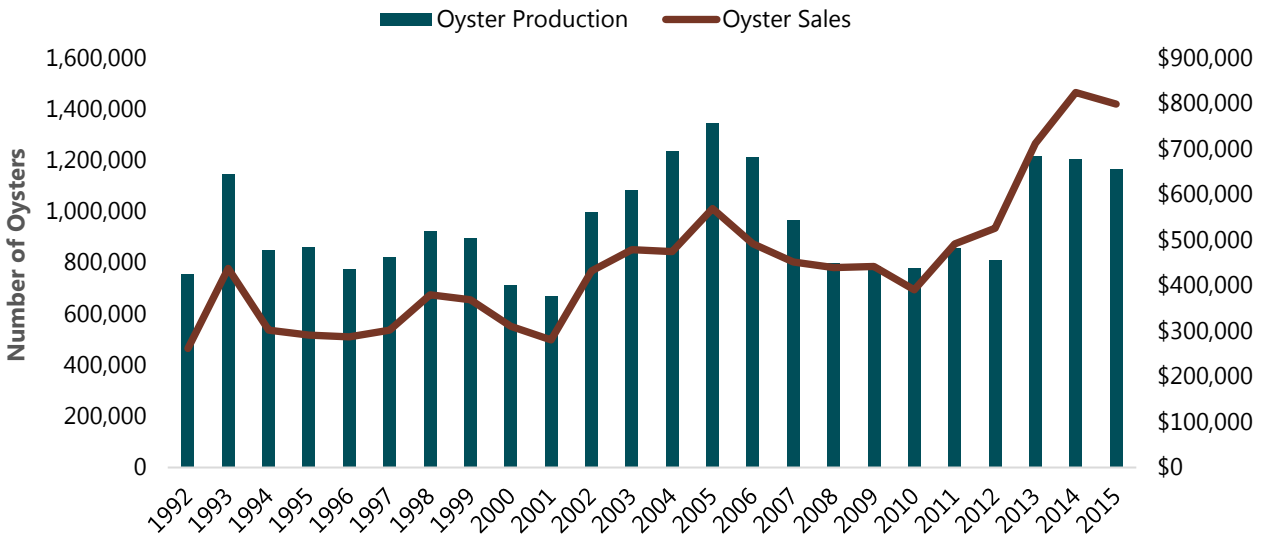
Table 2. Alaska Farms with Oyster Sales, 2011-2015

Year	Permitted Farms	Farms Reporting Sales
2015	31	22
2014	32	26
2013	35	27
2012	34	26
2011	32	27

Source: ADF&G.

In total, farmers produced an annual average of 954,000 oysters between 1992 and 2015. Oyster production in Alaska peaked in 2005, when 1,334,934 oysters were produced, then declined to 781,000 in 2010. It is unclear what led to the peak and subsequent decline, though closure of a farm and lack of oyster seed may have been a factor. Oyster production and sales have increased significantly since 2012. Annual sales from 2013 to 2015 were close to 1.2 million oysters, slightly below industry production in the 2003 to 2006 period. Statewide oyster production in 2015 totaled 1.17 million. Revenue from oyster sales increased steadily to about $800,000 in 2014 and 2015.

Figure 6. Statewide Oyster Production and Value, 1992-2015

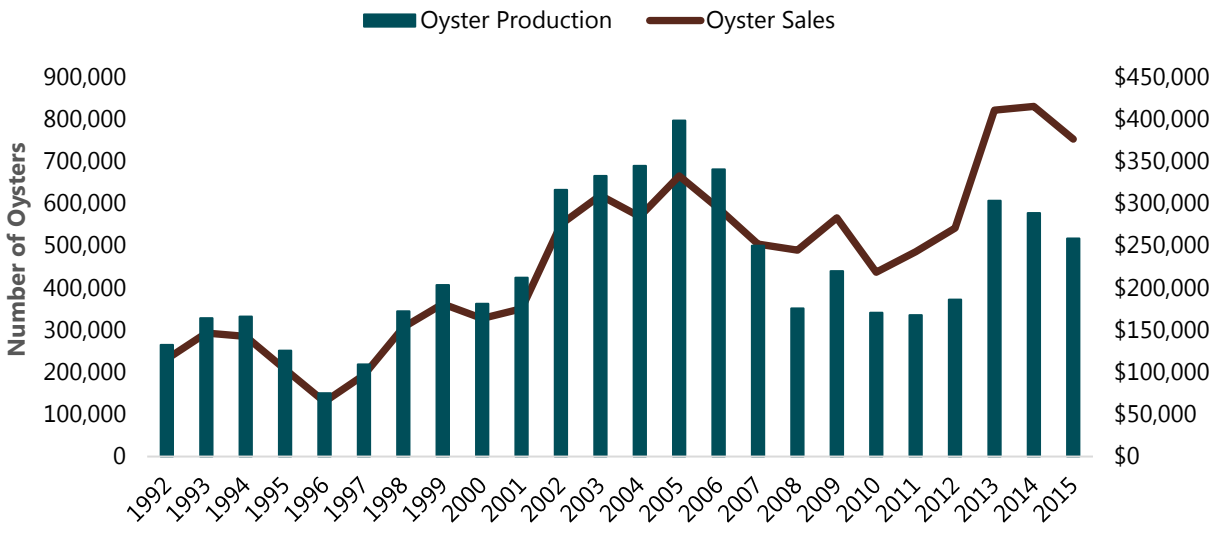


Source: ADF&G and DNR.

REGIONAL PRODUCTION AND SALES

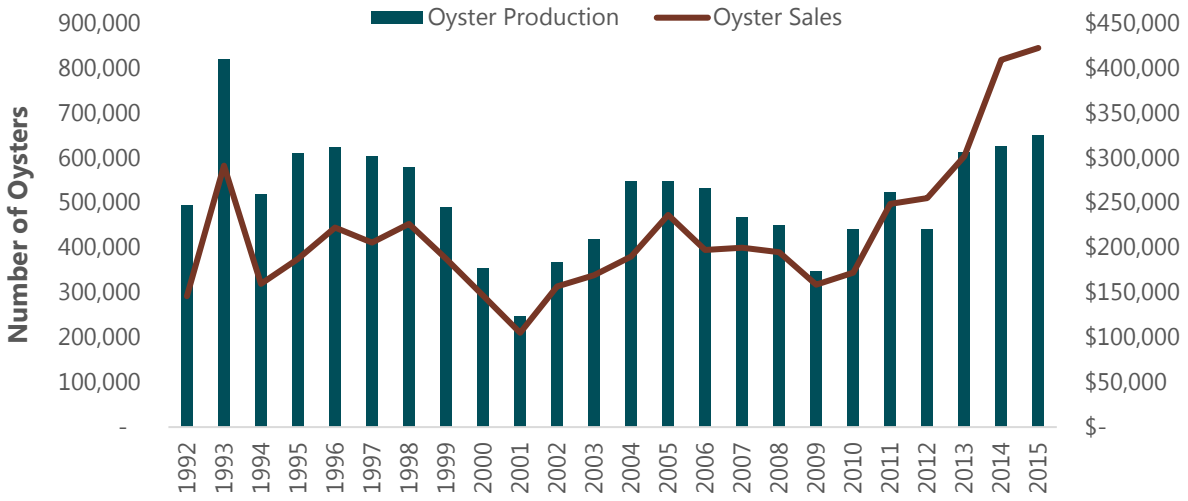
Slightly more than half of the state's oysters produced from 2011 to 2015 (54 percent) came from Southeast, while 46 percent were grown in Southcentral. For the same period, Southcentral generated 51 percent of statewide oyster sales revenue.

Figure 7. Southcentral Oyster Production and Value, 1992-2015



Source: ADF&G and DNR.

Figure 8. Southeast Oyster Production and Value, 1992-2015



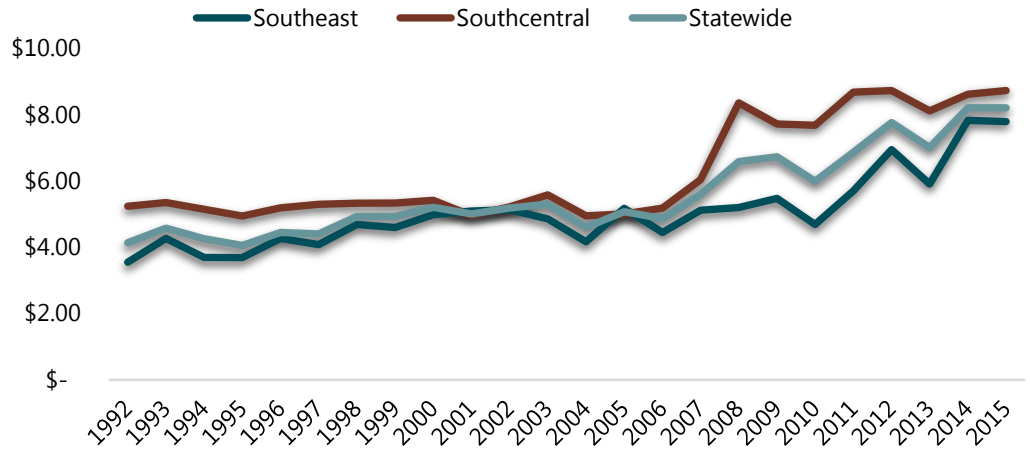
Source: ADF&G and DNR.

Oyster Prices

The average price per dozen Alaskan oysters was $8.21 in 2015. Southcentral farmers sold oysters for an average $8.73 per dozen, while Southeast farmers sold for an average $7.80. Prices statewide have risen relatively steadily from $4.86 per dozen oysters in 2006.

Between 2000 and 2005, oyster prices in Southcentral and Southeast were relatively similar. In 2006, Southcentral prices began to significantly outpace prices received by Southeast farmers. The price gap between the regions narrowed in 2014 and 2015. Statewide, from 1992 to 2015, price per dozen has outpaced inflation (98 percent increase versus 68 percent inflation).[2]

Figure 9. Alaska Oyster Price per Dozen, Statewide and by Region, 1992-2015



Note: Prices are nominal.
Source: ADF&G and DNR.

[2] Based on Anchorage CPI.

Oyster Inventory

Alaska oyster farm inventory as of 2015 was slightly more than 15.2 million oysters, an increase of about 22 percent over 2013. A relative abundance of oyster seed, and a new large grower in Southeast, suggests inventory may continue to increase in the near future.

Table 3. Alaska Statewide Oyster Inventory, 2011-2015

Year	Inventory
2015	15,211,352
2014	14,494,889
2013	12,522,981
2012	13,585,632
2011	13,134,556

Source: ADF&G.

Oyster Farm Operations

Most Alaska oysters are grown in lantern nets (hung from buoys or from ropes strung from buoy-to-buoy), or in trays suspended from rafts. One farm grows oysters on the ocean floor in the intertidal zone (areas where the sea floor is exposed at low tide). Each farm in the state operates somewhat differently. Farmers learn over time what equipment and techniques work best for their specific location. Availability of funding for equipment such as tumblers, sorters, and mechanized machinery is also a factor in operational efficiency. The following description generally reflects the process of growing, harvesting, and processing oysters, though it may not reflect all the specific processes used on all farms.

Photo Credit: Tom Henderson.

Oysters typically take two to five years to grow from seed (generally 5mm to 20mm) to a saleable size. Growth rates depend on a variety of factors including; quality of seed, water temperature, food availability, density of oysters, amount of handling, time of year the seed is planted, and other environmental factors. Producers interviewed for this study stated that grow-out times have declined over the last decade as farming practices have evolved.

During the grow-out period, oysters must be periodically inspected and cleaned to remove barnacles, tube worms, and other growth from the shell. Unhealthy product is discarded. Currently, many farmers use tumblers to clean and sort oysters. In addition to removing growth, tumbling trims the shell edges, resulting in a deeper cup which is more desirable in the marketplace. Oysters can be hand scrubbed, though that process is laborious and inefficient. After cleaning, the oysters are sorted by size and returned to trays or nets. The cleaning and sorting process occurs multiple times before oysters reach marketable size.

LABOR REQUIREMENTS

Oyster farms in Alaska are primarily small operations. Many farms are tended solely by the owner, while larger operations employ additional labor. According to ADF&G, for oyster farms with sales in 2015, on average, 3.95 workers (including owners) were employed per farm, working a total of 329 days per farm. Average FTE per farm was 1.26.

Table 4. Alaska Oyster Farms with Sales, Production and Employment, 2011-2015

Year	Number of Farms Reporting*	Total Oysters Sold	Average Number of Workers	Average Days Worked	Average Number of Days per Worker	Average FTE's
2015	21	1,167,254	3.95	329	83	1.26
2014	26	1,203,904	3.42	266	78	1.02
2013	27	1,218,861	3.89	281	72	1.06
2012	26	812,448	3.27	285	87	1.10
2011	25	858,357	3.36	215	64	0.83

*Note: Not all farms with sales reported employment data in 2011 and 2015.
Source: ADF&G.

FARM SIZE

Oyster farms may be measured in terms of acreage or volume of production and sales. However, farm size by sales provides the best measure to evaluate the current industry in Alaska, as some larger farms by acreage are only producing a small number of oysters, while some smaller farms are achieving higher production. The following tables highlight a variety of measures by farm size for both acreage and sales.

Farm Size by Acreage

Of the 22 farms selling oysters in 2015, slightly more than half (55 percent) were permitted for up to four acres, nearly one-third were between four and 12 acres, and 14 percent were over 12 acres. The three largest farms produced more than one-third of oysters and sales in 2015.

Table 5. Alaska Oyster Farm Size by Acreage, 2015

Farm Size	Number of Permits	% of Total Permits	Average Farm Acreage	Total Production (no. of oysters)	% of Total Production	Total Sales	% of Total Sales
Small (0-3.99 acres)	12	55%	1.64	332,810	29%	$228,545	29%
Medium (4-11.99 acres)	7	32%	6.21	421,032	36%	$284,643	36%
Large (12-24 acres)	3	14%	19.57	413,404	35%	$285,546	36%
Total	**22**	**100%**	**5.54**	**1,167,246**	**100%**	**$798,733**	**100%**

Source: ADF&G, including farm categories, and DNR.

Farm Size by Sales

In 2015, six farms reported sales between $50,000 and $200,000. These farms were responsible for slightly more than three-quarters of all oyster production and sales.

Table 6. Alaska Oyster Farm Size by Sales, 2015

Total Sales	Number of Permits	% of Total Permits	Average Farm Acreage	Total Production	% of Total Production	Total Sales	% of Total Sales
$50,000 - $200,000	6	27%	12.08	893,812	76.6%	$603,604	76%
$25,000 - $49,999	3	14%	5.94	146,082	12.5%	$103,721	13%
$10,000 - $24,999	4	18%	3.74	78,173	6.7%	$57,111	7%
$5,000 - $9,999	3	14%	2.50	32,673	2.8%	$20,365	3%
$1 - $4,999	6	27%	1.51	16,506	1.4%	$13,933	2%
Total	**22**	**100%**	**5.54**	**1,167,246**	**100.0%**	**$798,733**	**100%**

Source: ADF&G and DNR.
Note: Columns may not add due to rounding.

HARVESTING, PROCESSING, AND PACKAGING

When oysters have reached a marketable size, operators often (but not always) "harden" the oysters. Hardening involves holding oysters in bags in intertidal areas. As the tides come and go, the oysters strengthen their abductor muscles. This results in tighter shells and better moisture retention, and longer shelf life. After hardening, the oysters are again sorted and returned to trays or nets for a period of recovery. Hardening produces a higher-quality oyster, though the process increases labor costs as the process can take up to two months. An exception to this methodology is the single permitted intertidal farm. This operation spreads seed directly onto the ocean floor and the oysters are naturally hardened by the tides.

Photo credit: ADF&G.

Once hardened and allowed to recover, oysters are ready for testing and sale. Typically, the farmer pulls enough oysters to cover anticipated demand for the next two weeks. The oysters are removed from trays or nets and moved to an ADEC approved processing area (either on location or land-based). Oysters are typically held in a cooler either boxed, ready for shipping, or in bulk. A sample from the lot is sent to an approved lab in Anchorage for PSP testing. Typically, test results are returned within 36 to 48 hours. Once the operator has approval, oysters are packaged and prepared for shipping.

Packaging and shipping is dependent on the location of the buyer. Packaging is generally done in wet-lock boxes with liners and freezer gel packs included. If shipping duration is longer than 12 hours, insulation may be added to the box. Oyster temperatures are measured when they reach their final destination to assure proper handling. The farmers generally bear the cost of packaging materials.

TRANSPORTATION

Two primary hurdles for growers attempting to sell to the Lower 48 are transportation cost and logistics. While Alaska oysters are a premium product, added cost of freight drives prices up to a point where they become less competitive with Washington or British Columbia oysters. Shipping oysters from a remote dock in Alaska to destinations in the lower 48 can incur shipping charges of $2 to $4 per pound, and perhaps more for East Coast destinations. Additionally, some buyers incur delivery charges from the nearest airport to their location. The result is that buyer's cost for Alaska oysters can exceed the cost of other high-quality Pacific Northwest oysters by $3 or more per dozen depending on the destination. Alaska growers operate on relatively thin margins and it can be a challenge to reduce prices to offset transportation expenses and still generate a profit.

Photo credit: OceansAlaska.

Multiple modes of transportation may be utilized in delivering oysters to market, depending on destination. Alaska oyster farms are primarily located in remote areas, requiring water transport to the nearest dock. Oysters are either processed and packed at the remote facility or sent to a shore-based facility for packaging. Most oysters are landed in small communities where the product must then be shipped via small plane or ferry to a hub community for sales or to be transferred to jet aircraft to be delivered to the final destination. Typically, oysters are priced per dozen, FOB the closest dock to the aquatic farm. This means that transportation costs between the dock and the destination are the responsibility of the buyer.

Some oysters are shipped in bulk to wholesalers, others are shipped directly to end users such as restaurants, grocery stores, and other retailers. Multiple factors affect shipping costs for the purchaser, including number of boxes, oysters per box, number of carriers, and distance to destination.

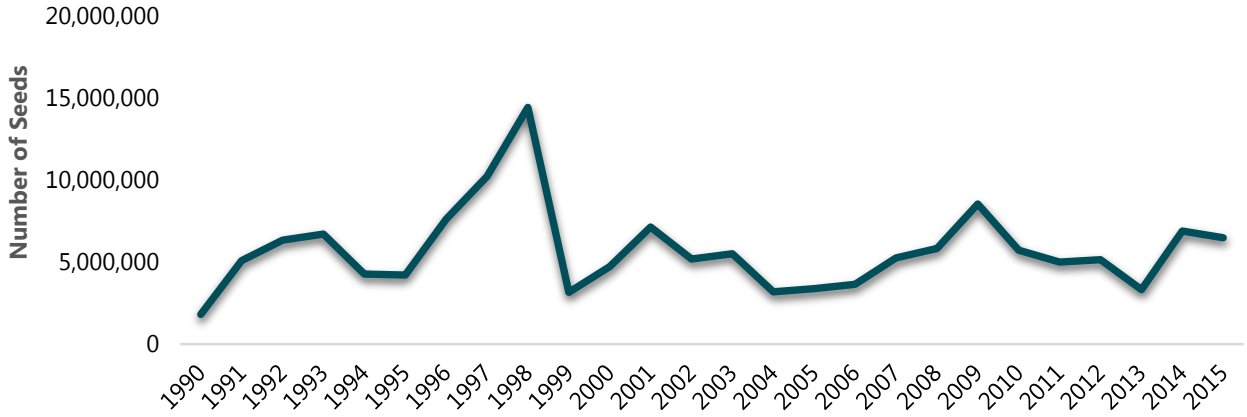
Oyster Seed

Three permitted shellfish hatcheries operate in the state, OceansAlaska, Katchemak Shellfish Mariculture Association, and Alutiiq Pride Shellfish Hatchery (APSH). OceansAlaska has never successfully spawned oysters. APSH has successfully spawned oysters, though due to the high cost of production they are currently not hatching oyster seed. APSH does not intend to spawn oysters in the foreseeable future as it is cost prohibitive at low production levels (mainly due to the cost of heating water) compared to purchasing larvae from out of state. APSH will produce oysters when the demand for 2-3 mm seed exceeds 8 million.

All oyster seed purchased by Alaskan farmers comes to Alaska as larvae from an ADF&G-certified source outside of the state. Currently, there is only one certified source of larvae for Alaska, Hawaiian Shellfish, LLC. As of 2015, only OceansAlaska is importing larvae and growing oyster seed for sale. OceansAlaska sets the larvae and grows them out until they are ready for sale to a permitted nursery. There are seven ADF&G permitted nurseries in the state, four of them are permitted for seed sales to farmers. Nurseries hold the small seed in a floating upweller system (FLUPSY) for further grow-out. Seed size at the time of sale to a farmer varies but is generally 5mm to 20mm. Seed availability has been an issue for farmers in the past and some have concern that with only one provider of larvae and one hatchery producing seed, the state's seed security is tenuous.

Seed acquisition by farmers peaked in 2007 (10.2 million) and 2008 (14.5 million), then declined precipitously. The lowest level of seed acquisition between 2011 and 2015 was 3.3 million in 2013. Acquisition increased significantly in 2014 (6.9 million) and 2015 (6.5 million).

Figure 10. Alaska Aquatic Farm Pacific Oyster Seed Acquisitions, 1990-2015

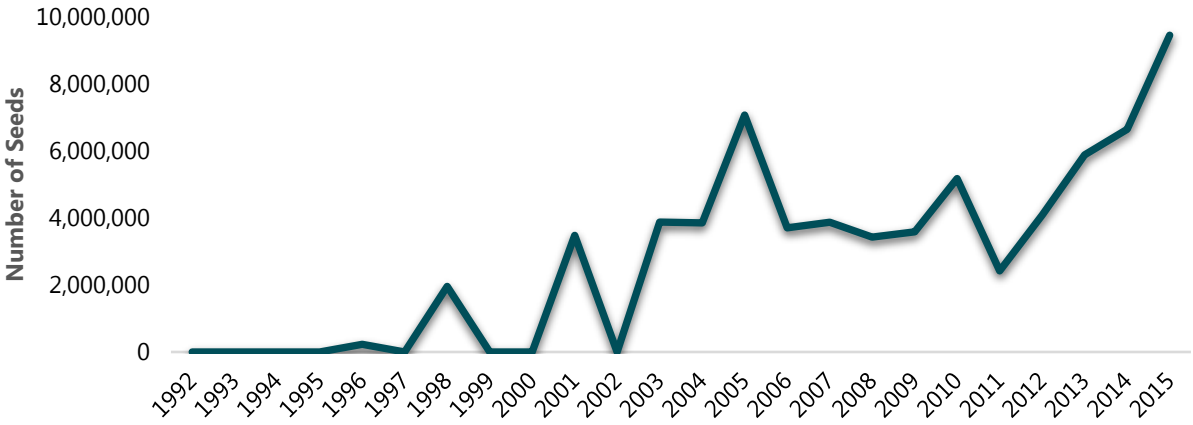


Note: Acquisitions includes data for count of permits 3 and greater.
Source: ADF&G.

OYSTER SEED STOCK

Pacific oyster seed inventory for hatchery and nursery operations reached the highest ever recorded at 10.3 million in 2015, an increase of 42 percent from 2014.

Figure 11. Statewide Hatchery and Nursery Operations Seedstock Production, 1992-2015



Note: Seedstock production includes data for count of permits 3 and greater.
Source: ADF&G.

Oyster Markets

Globally, oysters are sold live, shucked, frozen, cooked and canned, brined, smoked and canned in oil, dried, breaded and frozen, reduced for oyster sauce, and in a range of other value-added products. The highest value for an individual oyster is when sold fresh on the half-shell, though most world oyster production is sold in processed form rather than on the half-shell or fresh shucked market. Nearly all of Alaska's current oyster production is sold on the half-shell market.

Photo credit: Virginia Sea Grant.

MARKETS FOR ALASKA OYSTERS

The State of Alaska does not track oyster sales by location. Interviews with farmers and other knowledgeable sources resulted in an estimate that three-quarters of Alaska oysters are sold and consumed within the state.[3] Consumption of oysters increases significantly in the summer months when Alaska hosts roughly 1.8 million visitors. Concurrently, the volume of oysters produced in the summer months is significantly higher than for the remainder of the year.

Primary markets outside Alaska are located on the West Coast, with less volume sent farther east. These markets include both wholesale distributors and restaurants. Little or no Alaska oysters are currently shipped to locations outside the U.S.

Growers interviewed for this study report that, at this point, they can sell all their product in the state. However, there is some concern in the industry that demand within Alaska may be reaching a saturation point. This is especially the case during fall, winter, and spring, as in-state oyster demand is significantly lower that time of year. Historically, there have been fewer farmers harvesting in the winter months, though some evidence suggests that winter production may be increasing.

Additionally, a new farm entering production in Southeast plans to produce a significantly higher volume than current industry participants. If the operation produces oysters at the volume anticipated, it may impact Southeast markets in terms of price.

If Alaska oyster production increases significantly beyond 1.2 million oysters, at some point growers will likely need to expand to markets outside of Alaska and/or look for new product forms.

[3] Based on interviews with a selection of Alaska oyster farmers and wholesale buyers. Not all farmers were interviewed for this report.

Oyster Production in Canada

The Canadian oyster industry is active on Prince Edward Island, in Nova Scotia, New Brunswick, and British Columbia. Canada produced 11,153 metrics tons, live weight, of oysters in 2015, valued at $36.5 million (CAD). British Columbia produced 6,587 metrics tons, live weight, of oysters in 2015, valued at $14.4 million (CAD).

Table 7. Canada and British Columbia Oyster Production, Metric Tons, and Value (CAD), 2010-2015

	Canada		British Columbia	
Year	Production (mt)	Value (000's)	Production (mt)	Value (000's)
2015	11,153	$36,547	6,587	$14,425
2014	10,662	$30,646	6,184	$13,015
2013	10,835	$28,469	6,452	$12,498
2012	10,497	$24,228	6,487	$10,251
2011	9,779	$18,541	6,242	$8,380
2010	11,113	$18,876	7,550	$8,957

Source: Statistics Canada.

United States Oyster Production

The U.S. produced 124,986 metric tons of live weight oysters in 2014. Exports of live oysters from the U.S. grew from 2.6 million kilos, with a value of nearly $18 million in 2012, to 3.1 million kilos, with a value of $22.6 million in 2014.

Table 8. U.S. Oyster Exports, 2012 – 2014 (Value in USD)

	2012 kg	2012 Value	2013 kg	2013 Value	2014 kg	2014 Value
Live/Fresh Oysters	2,554,610	$17,988,360	2,661,708	$18,945,423	3,099,486	$22,594,774
% Change			**4%**	**5%**	**16%**	**19%**

Source: National Marine Fisheries Service, Fisheries Statistics and Economics Division.

U.S. Oyster Exports by Country

In 2014, nearly half (46 percent) of U.S. exports of live oysters by weight were to Canada. The second largest U.S. market was China at 23 percent. The third and fourth largest markets for live oysters were Malaysia (9 percent) and Singapore (8 percent).

Table 9. U.S. Live/Fresh Oyster Exports, by Country, 2014

Country	Volume Exported kg	Value (USD)	% of Total Volume Exported
Canada	1,420,347	$12,955,148	46%
China	723,547	$4,844,729	23%
Malaysia	265,459	$1,219,855	9%
Singapore	262,178	$1,373,638	8%
All Others	427,955	$2,201,404	14%
Total Export	**3,099,486**	**$22,594,774**	

Source: National Marine Fisheries Service, Fisheries Statistics and Economics Division.

U.S. Oyster Imports

Most U.S. oyster imports (89 percent) were farmed product in 2014. The U.S imported a total of 4.1 million kilos of live weight oysters in 2014, a 15 percent increase from 2012. Total 2014 import value was $24.6 million (USD).

Table 10. U.S. Oyster Imports in U.S. ($), 2012-2014

	2012 kg	2012 Value	2013 kg	2013 Value	2014 kg	2014 Value
Live/fresh farmed	3,384,475	$17,871,139	2,958,376	$18,766,401	3,666,561	$21,770,034
Live/fresh wild	195,537	$1,019,249	578,200	$3,281,567	436,429	$2,800,816
Total	3,580,012	$18,890,388	3,536,576	$22,047,968	4,102,990	$24,570,850
% Change			**-1%**	**17%**	**16%**	**11%**

Source: National Marine Fisheries Service, Fisheries Statistics and Economics Division

In 2014, more than half (57 percent) of U.S. farmed oyster imports, by weight, came from Canada. Mexico also provided a significant volume of U.S. oyster imports at 41 percent.

Table 11. U.S. Oyster Imports, Live/Farmed by Country, 2014

Country	Volume Imported (kg)	Value	% of Total Volume Imported
Canada	2,092,639	$15,725,111	57%
Mexico	1,498,148	$5,473,806	41%
South Korea	56,078	$503,602	2%
All Others	19,696	$67,515	1%
Total Imports	**3,666,561**	**$21,770,034**	

Source: National Marine Fisheries Service, Fisheries Statistics and Economics Division.

Global Oyster Production

World oyster production totaled nearly 5.2 million metric tons, live weight, in 2015, a 15 percent increase from 2010. The majority of oysters harvested globally are farmed. China produced 85 percent of the world's oyster supply in 2015, while the U.S. ranked fourth in production with 125,000 metric tons.

Table 12. World Oyster Production, Metric Tons, 2010-2014

Land Area	2010	2011	2012	2013	2014
China	3,642,829	3,756,310	3,948,817	4,218,644	4,352,053
Republic of Korea	267,776	281,022	284,856	239,779	283,232
Japan	200,298	165,910	161,116	164,139	184,100
United States of America	137,630	97,889	131,853	128,658	124,986
France	96,040	84,454	82,910	77,511	76,610
Taiwan Province of China	36,056	34,643	26,923	27,793	25,276
Philippines	22,525	21,462	20,648	22,070	22,355
Thailand	28,090	8,377	16,129	17,595	17,187
Canada	11,114	9,779	10,497	9,975	12,604
Australia	14,931	13,927	12,559	12,530	11,403
All Others	29,766	28,760	28,054	29,889	35,142
Total production	**4,487,055**	**4,502,533**	**4,724,362**	**4,948,582**	**5,144,948**

Source: FAO.

Mussel Development Status and Potential

Blue mussels (*Mytilus trossulus*) are viewed by many in the Alaska aquatic farm industry as an area with significant growth potential. Mussels have a shorter grow-out period to marketable size than oysters. For oyster growers, adding mussels to their operation may provide supplemental income while the oysters grow to a saleable size. Mussels also naturally reproduce in Alaska, providing free spat for farmers and, therefore, reducing operational expenses. Significant demand for mussels also makes this product appealing to growers.

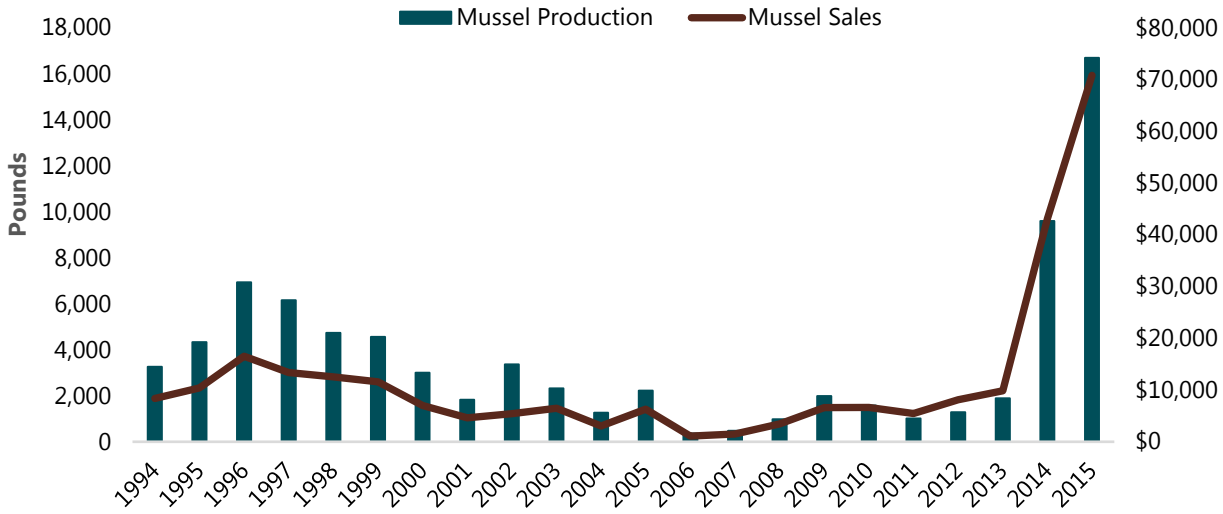
Mussel Production and Value

Between 1992 and 2014, an average 2,700 pounds of mussels were harvested and sold annually in Alaska. Most of those sales were incidental rather than cultivated, meaning that farmers harvested product that naturally set on their floats or other equipment, rather than trying to grow mussels. In 2015, only four farms were permitted to produce mussels, down from five in 2013 and 2014.

Photo Credit: Alutiiq Pride Shellfish Hatchery.

In 2012, a project was launched to better understand mussel growing technology and jump-start the industry (see Alaska Mussel Technology Transfer Project [AMTTP]) following the tables below). As a result, mussel production increased from 1,889 pounds in 2013 to 9,594 pounds in 2014, and jumped to 16,688 pounds in 2015. Revenues from mussel sales increased from $9,837 in 2013 to $43,112 in 2014 and to $70,800 in 2015.

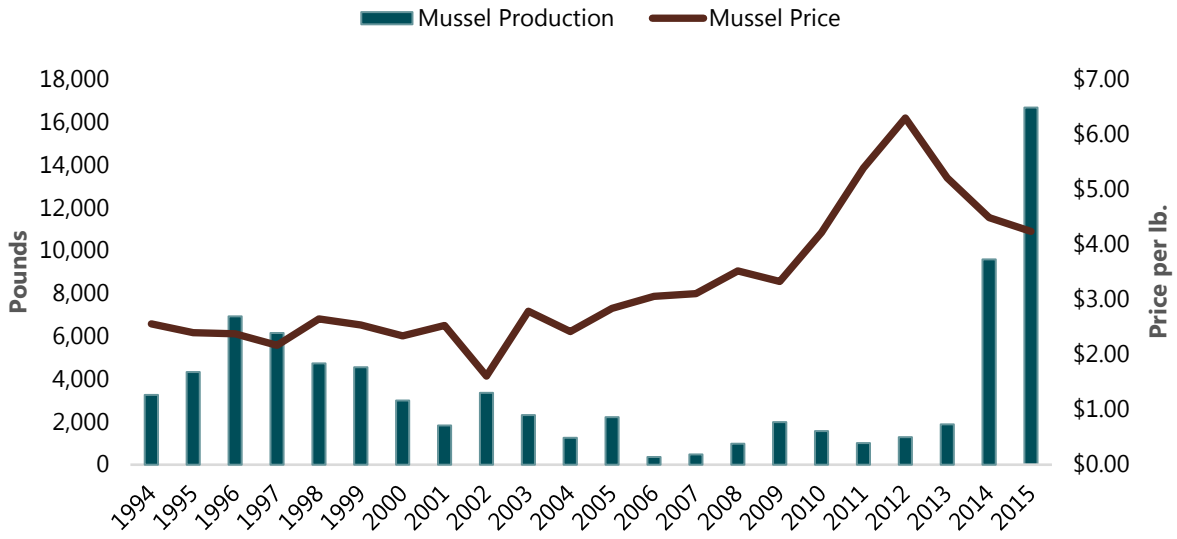
Figure 12. Alaska Mussel Production and Sales, 1994-2015



Note: For years with fewer than three operators reporting, production numbers are confidential and reported as zero
Source: ADF&G and DNR.

The average price per pound declined from $5.21 in 2013 to $4.49 in 2014 and to $4.24 in 2015. The decline was likely related to the significant increase in supply over that period.

Figure 13. Alaska Mussel Production and Average Price per Pound, 1994-2015



Source: ADF&G and DNR.

Mussel Inventory

Alaska's cultivated blue mussel inventory as of 2015 was slightly more than 8 million. The inventory has grown significantly since 2011, when it totaled only 7,198. Mussel inventory rose in 2013 to 8 million, fell to 425,000 in 2014 and rose again to 8 million in 2015.[4] It is unknown why inventory fluctuated year to year, though possible reasons include variation in volume of natural larval sets (that can vary significantly from year to year) and possible variations in farm counting methodology.

Table 13. Statewide Mussel Inventory, 2011-2015

Year	Inventory
2015	8,017,400
2014	424,520
2013	8,269,540
2012	10,200
2011	7,198

Source: ADF&G.

Mussel Farm Operations

Mussels typically spawn during the summer months in Alaska. Following spawning, the shelled larvae are free swimming. The larvae will eventually attach itself to any surface available but prefer rough textured surfaces. Synthetic ropes are a favorable medium for the larvae to attach. As they grow, they are transformed into "spat." Spat can move about until they locate a suitable location with adequate food. Mussels feed naturally by filtering

[4] Data provided by ADF&G is self-reported by farmers.

food from the water. If grown too closely, competition for food may inhibit growth. Water temperature also is a factor in mussel growth.

Purposeful mussel farming in Alaska involves capturing the spat after it sets. Ropes suspended from rafts capture the set. Once mussels have grown to a certain size, they are mechanically stripped from the ropes and stored in mesh bags hung from a raft by ropes to grow to a saleable size. To process efficiently, pulling the ropes, harvesting, cleaning, and sorting a large volume of mussels requires mechanical lifting devices and sorters.

Mussels must undergo the same testing process for PSP as oysters and other shellfish.

ALASKA MUSSEL FARMING DEMONSTRATION PROJECT (AMFDP)

In 2012, Halibut Cove Community Organization received a $300,000 state grant to develop a large-scale test farm for mussel production.

Photo Credit: NOAA.

The project was intended to demonstrate the economic and technical feasibility of large-scale mussel farming in Alaska. Alaskan Shellfish Growers Association (ASGA) and Alaska Shellfish Farms (ASF) were to implement the project with technical assistance from the Alaska Sea Grant Marine Advisory Program (MAP), including marketing and business planning. Grant recipients estimated they would produce $560,000 in annual gross sales within two years and eventually produce 1.2 million pounds annually of high quality mussels worth $2 million. They also estimated the operation would employ ten local residents. ASGA and MAP were to write a mussel farmer's manual designed to assist with future mussel farm development in the state.

Alaska Sea Farms was tasked with construction and operation of four 40' x 40' mussel rafts, from which mussels would be grown suspended on lines hung from the rafts, surrounded by predator nets. Initially, two rafts were to be used for seed collection in July from wild sets before all four were stocked with seed for grow-out to market size. Each raft was estimated to be capable of producing 70,000 pounds of mussels in 18 to 24 months.

Project plans state that mussel processing equipment is necessary for production of any volume of product, as harvesting and processing can be labor-intensive without equipment. A hopper feed conveyer is used to declump and grade mussels. This equipment provides market sized product for a debysser to remove seed mussels. Mussels are then graded and placed in harvest sacks in mussel roll sizer equipment and then stored in containers with flowing seawater until shipping time. Such equipment allows for harvest of one ton of mussels in 4 hours.

The current and future status of the demonstration project and production are not known. The growers involved in the project were not available to be interviewed for this study. The first crop of mussels was scheduled to be harvested in late 2014, and data shows an increase in mussel inventory and sales around that time. According to a wholesaler report no mussels have been sold by the grower since mid-to-late 2016.

MUSSEL MARKETS AND DEMAND

Based on interviews for this study, there appears to be significant in-state demand for mussels. One wholesaler estimated that the Southcentral market alone could absorb 1,500 to 2,000 pounds of mussels per week during the summer. Assuming significantly lower fall, winter, and spring sales, annual statewide demand could reach 60,000 to 70,000 pounds or more, significantly higher than 2016 production of about 17,000 pounds.

With short self-lives (approximately 5 days), and transportation hurdles, selling product outside the state will be challenging. The premier mussel grower on the West Coast, Penn Cove, harvests mussels to order and ships them quickly. It would be a logistical challenge for Alaska growers to replicate that business model.

Geoduck Development Status and Potential

Geoducks (*Panopea generosa*) are a species of large saltwater clam prized in Asia for the meat of its siphon (long neck), which can exceed three feet in length. Geoducks are indigenous to the West Coast of the U.S. and Canada, with commercially harvested and farmed product available from Washington, British Columbia, and Alaska. Juveniles will dig up to three feet deep in the ocean bed and live their entire lives in that position. The clam extends its siphon up to the ocean bottom and acquires nutrients by filtering seawater. Mature live geoducks typically weigh from two to four pounds but can grow larger. The clams are long-lived, with some specimens living more than 140 years. The average age of commercially harvested geoducks in Alaska is 44 years. The highest value is received for the sale of live product.

Geoduck Harvest and Value

FARMED

As of February 2017, 19 aquatic farms in Alaska were permitted for geoducks, as well as two permitted hatcheries and two nursery operations. All permitted farm sites are in Southeast, with the majority in the Ketchikan/ Prince of Wales (POW) area. One site is located near Sitka, one north of Juneau, and one south of Juneau.

Photo credit: SARFDA.

There is one permitted nursery located in Ketchikan and one near Sitka. Nurseries serve as holding facilities to allow juvenile seed to acclimate to local waters and grow-out before being planted.

The Alutiiq Pride Shellfish Hatchery developed methods to hatch and rear geoduck seed. OceansAlaska in Ketchikan is permitted as a hatchery but has not been successful in spawning.

Since 2010, ADF&G has reported farmed geoduck harvest and value combined with all other clam harvests and value. Because of strict confidentially regulations, ADF&G cannot report production or sales when less than three growers report. This has resulted in no useable data for analysis of farmed geoduck production and sales. Following is an analysis of the commercial dive harvest of geoducks in Alaska. The data provides some insight into the level of effort and value of geoducks.

WILD

The number of geoduck permits fished between 2006 and 2015 ranged from a high of 70 in 2012 to a low of 55 in 2009. The annual average number of permits fished for the ten-year period was 63.

Table 14. Commercial Geoduck Permits Fished, Calendar Year, 2006-2015

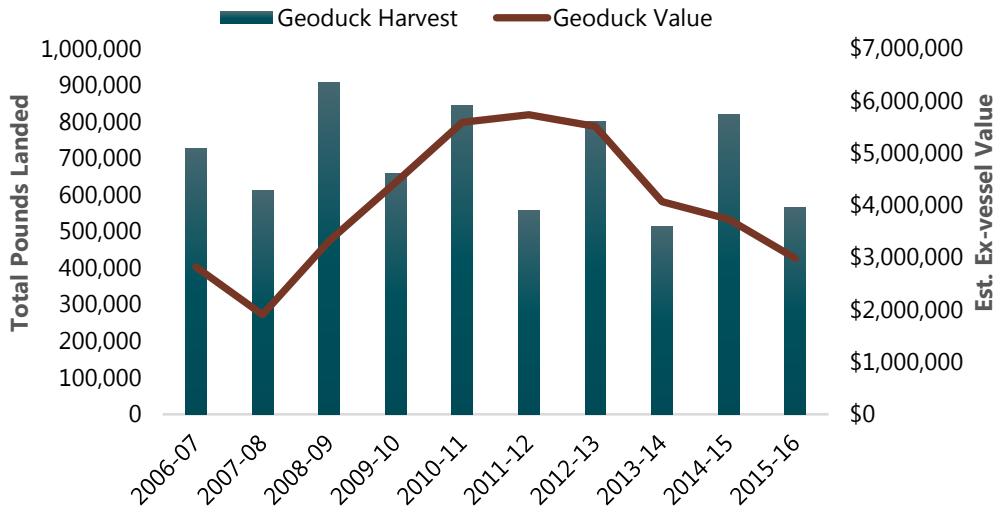
Year	Total Permits Fished
2015	60
2014	61
2013	69
2012	70
2011	61
2010	69
2009	55
2008	57
2007	62
2006	61

Source: CFEC.

Between 2006 and 2016, wild geoduck harvest volume varied significantly, ranging from a high of nearly 907,000 pounds in 2008-2009, to a low of 514,000 pounds in 2013-2014. Seasonal harvest for the ten-year period averaged 700,000 pounds.

Estimated ex-vessel value ranged from a high of $5.7 million in the 2011-2012 season to a low of $1.9 million in the 2007-2008 season. Average annual harvest value for the ten-year period totaled $4 million. Ex-vessel value for the 2015-2016 season was $3 million.

Figure 14. Alaska Wild Geoduck Harvest and Value, 2006-2015

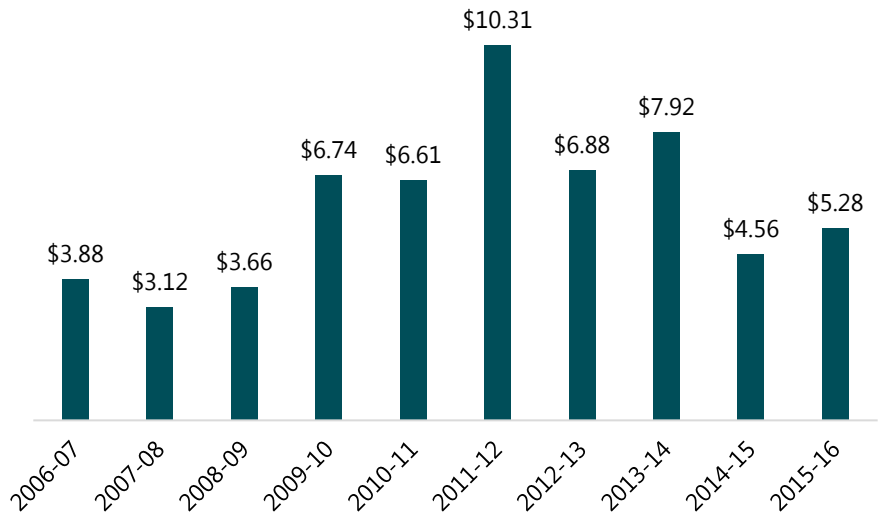


Source: ADF&G.

GEODUCK PRICES

Average geoduck prices vary widely. Between 2006/2007 and 2015/2016, price per pound ranged from a high of $10.31 in 2011-2012 to a low of $3.12 in 2007-2008. Average price per pound for the ten-year period was $5.90. Price for the 2015-2016 season was $5.28 per pound.

Figure 15. Geoduck Wild Harvest Average Price per Pound, 2006-2016



Source: ADF&G.

Geoduck Farm Inventory

ADF&G reports geoduck farm inventory totaled 910,926 in 2015, a 6 percent decrease from 968,526 in 2014.

The current volume of harvestable geoducks in unknown. Due to the slow growth of the clams, inventory will reach harvestable size over a period of many years. Farmers also have the option of harvesting when market prices are favorable.

Table 15. Geoduck Inventory, 2011-2015

Year	Number of Animals
2015	910,926
2014	968,526
2013	837,296
2012	832,244
2011	819,976

Source: ADF&G.

For purposes of understanding total resource value, if the total 2015 inventory were harvestable and weighed an average of 2.5 pounds, the farm inventory would be about 2.3 million pounds. At a price of $5 per pound, this inventory would have a total value of approximately $11.4 million. This estimated value could be significantly higher or lower depending on clam size at harvest and prevailing market prices at the time of sale.

Geoduck Farming Operations

Farming the giant clams began in the early 1990s in Washington and in 2000 in Alaska. Geoduck larvae are raised in hatcheries to an approximate size of one to three millimeters. The small clams are called spat or seed. The small seed can be planted, but in most cases, spend additional time in a nursery to allow for acclimation to local waters and grow-out to a larger size. Spat is generally three to 20 mm in size when planted. Growers report that larger and healthier seeds have a better chance of survival. Poor quality seed can result in significant mortality rates.

Geoduck farming in Alaska can occur in intertidal or subtidal areas (where the sea floor is never exposed). Intertidal farming involves placing the seed in PVC tubes inserted in the seabed. Two to five seed are usually planted in each tube with hope of one to four surviving to maturity. Tube openings are covered with protective nets to discourage predators. The nets are removed when the clam has burrowed into the ocean floor.

Subtidal farming involves planting the spat directly in the ocean floor (without tubes), covered with a predator exclusion device. The exclusion devices are mats or mesh tarps that covers the seabed and keep predators away from the clams. The exclusion device is removed when the clam has burrowed into the ocean bottom.

Research related to time required for a geoduck to reach harvestable size is ongoing. Anecdotally, geoducks could reach a harvestable size in eight to ten years. The clams appear to be slower growing in northern Southeast than in southern Southeast.

Subtidal geoducks are harvested by divers using pressurized hoses to blast the bottom material away from the clam.

Geoduck Seed

Growers interviewed for this study report seed availability in Alaska has varied. Alaska hatcheries with geoduck seed report there is little to no demand for their product or that they did not sell in 2015 or 2016. This resulted in no current source for geoduck seed.

OceansAlaska had a successful spawn in 2016. The seed grew well for 22 days. Unusually warm weather resulted in higher than normal water temperatures and the spat died. OceansAlaska plans to acquire spat from APSH in 2017 and attempt to grow them to plantable size. They hope that will allow the spat to acclimatize better to local waters and provide a higher quality product. A facility representative reported that there is not a huge demand for geoduck seed, perhaps 500,000 currently. The market for geoduck seed outside Alaska is very limited. They plan to start with a small volume of spat and work on the process. Additionally, OceansAlaska has limited space to grow geoduck, without hindering their ability to expand oyster production.

Geoduck Markets

Most of the geoduck harvest is sold in China and other Asian markets. A smaller, unknown quality is sold within Alaska, the U.S., and to other international markets. In December 2013, China banned importation of shellfish from Alaska and Washington citing inorganic arsenic found in a shipment of Washington geoducks. The ban severely impacted geoduck markets, divers, and farmers in Alaska and Washington. The ban was lifted in June 2016.

In 2014, the U.S. produced 5,534 metric tons of geoducks (farmed and wild), while Canada produced 1,494 metric tons (farmed and wild). Overall harvest in 2014 was 7,028 metric tons, up 18 percent from 5,997 metric tons in 2012, but only slightly higher than the 6,949 metric tons harvested in 2010.

Table 16. Pacific Geoduck Harvest, U.S. and Canada, in Metric Tons, 2010-2014

Year	Canada	U.S.	Total
2014	1,494	5,534	**7,028**
2013	1,346	5,194	**6,540**
2012	997	5,000	**5,997**
2011	1,562	5,114	**6,676**
2010	1,330	5,619	**6,949**

Note: Includes wild and farmed product.
Source: Food and Agriculture Organization of the United Nations, Fisheries and Aquaculture Department.

Seaweed Development Status and Potential

A variety of seaweed species are currently approved for cultivation on aquatic farms and nurseries in Alaska, including sugar kelp, giant kelp, bull kelp, ribbon kelp, red ribbon seaweed, three ribbed kelp, nori, and sea lettuce. Species approved for hatchery operations include dark sea lettuce (*Ulvaria obscura)*, dulse (*Palmaria mollis)*, kombu, nori (*Pyropia sp.)*, ribbon kelp (*Alaria marginata*), sea lettuce (*Ulva lactuca)*, three-ribbed kelp (*Cymathaere triplicata)*, sugar kelp (*Saccharina latissima)*, and bull kelp (*Nereocystis luetkeana)*.

Photo credit: Bob Koenitzer.

Kelp, a name that applies to many subtidal brown seaweed species, is the only type of seaweed currently in production in Alaska; 2017 will mark the state's first material cultured harvest volume. Alaska's seaweed farmers are currently focusing on sugar kelp (*Saccharina latissima*) and ribbon kelp (*Alaria marginata)*. Though kelp species are not the most valuable type of seaweed, they grow fast, thrive in Alaska waters, and are cultured during a time of year that may complement the fish harvest season.

With growing market demand, seaweed appears to have a lot of potential in Alaska. The industry presents numerous attractive attributes for development in the state:

- Plentiful, accessible undeveloped coastline
- A potential workforce with necessary marine skills
- Local fleets that could provide effective harvesting platforms
- A product that grows quickly, can be planted in the fall and harvested in the spring (times of the year when fishermen are typically in between fisheries)

At the same time, many unknowns exist in this nascent Alaska industry, such as growth rates, actual market demand/prices, processing procedures, and best industry practices for growing/harvesting/processing.

Kelp Production and Value

In 2017, fourteen aquatic farmers in Alaska are permitted to grow kelp, though only three are actively culturing plants. Kodiak is home to two kelp farms, with the other active site located near Ketchikan.

In addition to farm production, a small volume of wild kelp is harvested in Southeast for use in locally produced niche products/markets. Coastal areas are occasionally opened for commercial harvest, though achieving any significant scale or schedule of production will likely occur via permitted farms. For example, Wild Alaska Kelp Company, which currently produces products from wet kelp, such as salsa, currently harvests wild kelp and is transitioning into a kelp farm model.

KELP PRICES

According to Premium Oceanic, sugar kelp prices range from $0.25 to $1.00 per pound (for wet kelp), though "if you can produce wet (sugar) kelp in Alaska for less than $0.50 per pound. the world is your oyster."[5]

More generally, seaweed pricing works according to a market hierarchy similar to seafood. Pharmaceutical products, which are specialized and almost always sold in small volumes, can be the highest priced at over $100,000 per metric ton. Food and nutritional supplements offer the next highest value. Dried seaweed products fit for human consumption can fetch over $10,000 per metric ton. Seaweed powders are also valuable ingredients for livestock and aquaculture feed manufacturers, though they are usually valued at less than $4,000 per metric ton. Biofuels are at the bottom of the market hierarchy. Kelp can be used to produce biofuels like ethanol; however, the yield is such that dried kelp powder prices would probably have to be around $50 per metric ton to be competitive with petroleum-based fuels.[6] Many projects have looked at creating systems capable of producing kelp biofuels efficiently, but none has achieved commercial success.

The human ingredient/food market may make the most sense for Alaska farmers, as it offers the best mix of higher prices and larger market volumes. Seaweed fit for human consumption imported from China and South Korea (likely powder-like material) averaged $11,400 per metric ton and $10,500 per metric ton, respectively, in 2016. A price of $11,000 per metric ton of dried kelp powder is equivalent to $5.00 per pound. Applying a yield of 20 percent and converting the price to a wet basis produces a wet value of $1.00 per pound. This is not an ex-vessel proxy price, as it does not include costs involved with processing, storage, shipping, and sales.

KELP PRODUCTION VALUES

As seaweed farming is just developing in Alaska, no historical value and production volume data exist. However, interviews with industry participants and research on farms in other regions provide some basis for estimating a range of potential production values.

In addition to prices (which will fluctuate with market conditions), another critical variable is yield per acre. Table 16 outlines one range of possible production values.

Table 17. Estimated Kelp Production Value per 100 Acres

	5 rows/acre	10 rows/acre	20 rows/acre
Wet Pounds Produced[1]	783,750	1,567,500	3,135,000
Estimated Ex-Vessel Wet Price per Pound	$0.60	$0.60	$0.60
Farm Revenue	$470,250	$940,500	$1,881,000
First Wholesale Value of Dried Powder per Metric Ton	$12,000	$12,000	$12,000
Dried Powder Produced (Metric Tons)	71	142	284
First Wholesale Value of Dried Powder per Pound	$5.44	$5.44	$5.44
First Wholesale Value per Wet Pound[2]	$1.09	$1.09	$1.09
First Wholesale Revenue (less ex-vessel payments)	$382,958	$768,075	$1,536,150
First Wholesale Revenue	**$853,208**	**$1,708,575**	**$3,417,150**

[1] Assumes 209 ft. rows producing 7.5 pounds of wet product per linear foot.
[2] Assuming 20 percent yield, going from wet product to dried powder.
Source: McDowell Group estimates.

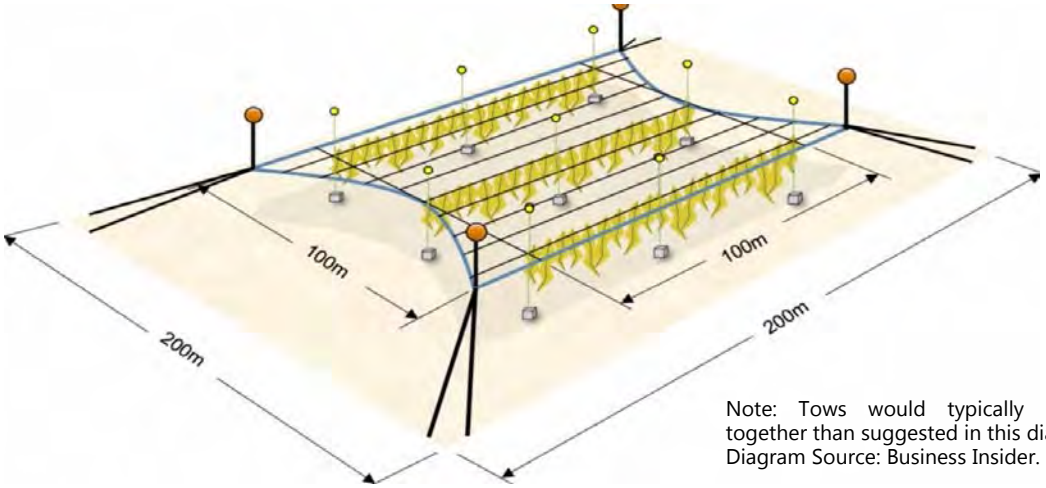
[5] Perry, personal communication.
[6] Lenstra, Jip; Van Hal, Jaap; and Reith, Hans. "Economic aspects of open ocean seaweed cultivation." Energy Research Center of the Netherlands. Presented at the Alg'n Chem 2011, Montpellier, France.

Kelp Farming Operations

Kelp are grown from partially submerged longlines attached to floats (see diagram below). Kelp seeds are spread onto small diameter twine at a nursery facility. Seeded twine is sent to farms spooled around PVC pipe. Farmers wrap twine around partially submerged longlines (usually 4-8 feet). Kelp is usually planted in the fall (September or October) and typically take five to seven months to reach harvestable size.

Plants are harvested prior to spore production to achieve optimal quality. Harvests typically employ winches, hooks, rollers, or net bags. Boats with a block and plenty of deck space, like seiners, are an excellent harvest platform. Some farms in Maine and Connecticut practice "3-D" farming, which is essentially a polyculture approach where kelps, mussels, scallops, and oysters are grown along the same line.

Figure 16. Kelp Farming Operations



Note: Tows would typically be closer together than suggested in this diagram.
Diagram Source: Business Insider.

Once harvested, wet kelp may be cut and frozen or processed into a dry, stable powder with a grinding/drying machine. Kelp powder may be stored for over a year without refrigeration, allowing for drastically lower shipping and storage costs compared to frozen or fresh products.

Research is ongoing into how well kelp will grow in Alaska, and on ideal density per unit of space. Some aquatic farms space rows only a few yards apart while others may leave over 40 feet between rows, depending on the harvesting methods and equipment used. This growing density presents major implications for yields per acre.

As operations scale up, there will likely be greater capital investments in processing equipment and new or refurbished buildings where seaweed may be processed and stored. Initially, Alaska's lone kelp buyer plans on using a mobile, trailer-mounted processing unit that will be transported to farm sites around the state. This approach makes greater use of the processing unit, though if volumes increase another processing machine may be necessary. Farmers may also decide to become wholesalers and process their own product, which would require localized processing facilities.

Initial capital expenditure requirements for kelp farming include buying lines/buoys and processing machinery used to dry and grind seaweed. Relatively low capital investment requirements and ability to utilize existing

labor and vessels outside of the fishing season are reasons many are optimistic the industry can flourish in Alaska.[7]

Kelp Markets

Alaska Markets

All three Alaska kelp farms plan to sell 2017 production to San Francisco-based Premium Oceanic, LLC, a company with seaweed production facilities in Mexico. The company, which is the only large-scale seaweed buyer operating in Alaska, operates under the brand name Blue Evolution. The company produces a CPG (consumer packaged good) pasta product line that includes sea lettuce.[8]

Photo credit: Blue Evolution.

Premium Oceanic, which also sources seaweed from onshore grow-out facilities in Mexico, has identified potential for high volume production in Alaska.[9] Alaska has access to more undeveloped coastline than other areas in the lower 48, where achieving larger farm sizes would likely meet with resistance. Marine skills of coastal Alaskans and vessels potentially available for use are also important advantages over other areas in North America or Europe. To expand its product line beyond pasta, Premium Oceanic is also investigating other markets where kelp powder could be an ingredient.

The company owns a mobile drying/processing unit capable of transforming mass quantities of wet Alaskan kelp into a stable powder format. The company reports a desire to expand production in Alaska, although producing seed is challenging due to strict regulations about sourcing plants from local areas. If kelp ventures succeed, Alaska could face competition from British Columbia and eastern U.S. states, which may dilute the market and lead to lower prices.

U.S. and Global Markets

Alaska producers will likely target North American markets, rather than compete with low-cost Asian producers or European producers in their native markets. With virtually no domestic production, most seaweed utilized in the U.S. (and Canada) comes from imports. Last year the U.S. imported 40,259 metric tons of seaweed and

[7] Future projections concerning value and economic costs/benefits will rely heavily on hypothetical assumptions gleaned from interviews with industry.
[8] Blue Evolution.
[9] Personal communication.

intermediate products derived from seaweed worth $205 million.[10] Seaweed imports fell 16 percent by value in 2016 but were relatively stable in previous years. Carrageenan-based thickeners have trended down in volume and value since 2014, possibly due to research linking them to a myriad of health problems.[11] This downward trend is likely to accelerate following a November 2016 ban by the National Organic Standards Board that stipulates carrageenan-based additives will no longer be allowed for use in foods carrying the "USDA Organic" label. The ban and research findings should not impact demand for kelp; however, as carrageenan is typically derived from Asian green or red seaweeds (such as Euchema and Elkhorn Sea Moss).

Table 18. U.S. Seaweed Imports by Product Type, 2012-2016

Volume (Metric Tons)	2012	2013	2014	2015	2016
Agar	1,428	1,420	1,417	1,565	1,383
Seaweed/Algae (not for Human Consumption)	19,539	23,652	18,030	14,826	20,959
Seaweed/Algae (for Human Consumption)	7,789	6,370	7,180	10,711	8,701
Seaweed Carrageenan-based Thickeners	10,245	9,105	9,965	9,981	9,216
Total	**39,002**	**40,547**	**36,592**	**37,084**	**40,259**
Value ($Millions)	**2012**	**2013**	**2014**	**2015**	**2016**
Agar	$29	$32	$34	$38	$32
Seaweed/Algae (not for Human Consumption)	43	49	47	36	38
Seaweed/Algae (for Human Consumption)	51	61	61	73	58
Seaweed Carrageenan-based Thickeners	89	88	102	96	76
Total	**$212**	**$230**	**$244**	**$244**	**$205**

Source: NMFS Trade Data.

The U.S. imported seaweed products from 38 different countries in 2016. These import statistics provide some indications of potential value of Alaska kelp. It is likely that much of the kelp the U.S. imports from China consists of dried kelp powder or flakes. The U.S. imported 1,922 metric tons of seaweed and other algae fit for human consumption in 2016, worth $21.9 million. This works out to $11,369 per (dried) metric ton, or $0.77 per wet pound assuming a 15 percent dry/wet yield. It is important to again note that $0.77 per pound may not be a good proxy for "ex-vessel" Alaska kelp prices, as the import unit value includes processing, storage, shipping, and other operating costs. Still, the value of Chinese product (fit for human consumption) would likely represent at least the lower end of Alaska's potential wholesale value range.

Asian countries account for most seaweed consumption, though the market for kelp and other sea vegetables is expanding rapidly in the U.S. and Europe. This expansion is fueled by changing consumer eating patterns, broadening palates, and seaweed's anointment as a "superfood." Plant based diets, specifically veganism, are on the rise – up 360 percent in the last decade - and that trend shows no sign of slowing down.[12] U.S. retail sales of kelp chips and crackers were valued at over $250 million in 2014.[13]

Kelp is growing in popularity, from nutritionists who tout its many health benefits, to chefs who welcome its unique taste profile, to environmentalists who value its ability to absorb carbon dioxide and reduce ocean

[10] NMFS Trade Data.
[11] http://www.npr.org/sections/thesalt/2016/12/12/504558025/carrageenan-backlash-why-food-firms-are-ousting-a-popular-additive.
[12] http://www.telegraph.co.uk/wellbeing/diet/say-goodbye-kale-superfood-trends-2017-five-new-ingredients/
[13] http://www.nbcnews.com/news/us-news/red-tape-slows-bloom-seaweed-farming-s-green-revolution-n613526

acidification. In addition, nutraceutical and cosmetic companies are also using kelp and other marine plants more.[14] Kelp's list of marketable qualities includes:

- Food – Detoxification, Anti-Oxidants, and Chelating Properties: helps the human body draw out waste, toxins, and heavy metals and reduces inflammation. Also helps to purify blood.
- Food – Healthy Thyroid, Healthy Waistlines: kelp contains relatively high levels of iodine, which is essential for the thyroid gland and regulating metabolism. Iodine deficiency is a concern in both developing and developed countries, especially with people consuming more sea salt (and less iodized salt) as well as the addition of bromine to some foods, which blocks iodine absorption.[15]
- Food – Alkalizing Acidic Bodies: seaweeds can help alkalize blood, neutralizing the effects of our modern diet as well as reducing the acids in foods where they are added as an ingredient.
- Food – Bioavailable Nutrients: kelp contain high amounts of potassium, magnesium, calcium, iron, vitamins, amino acids, omega-3 fats, and fiber which are absorbed easier by human bodies than pill-based supplements.
- Skin – High-end Elixirs: popular skin creams can reduce wrinkles and reduce skin blotches.
- Environment – Cleaning the Air and Oceans: kelp absorbs five times as much carbon dioxide as land-based plants, filters nitrogen/phosphorus, and reduces ocean acidification.[16]
- Environment – Habitat Supports Life: kelp farms provide habitat for fish, increasing local ocean productivity
- Infrastructure – Protection from the Storms: kelp farms can slow down storm surges.
- Biofuel – Kelp-anol: Researchers around the world have been working with macroalgaes like kelp on biofuel production methods.
- Animal Feeds – Growing Healthier Everything: kelp/seaweed can produce demonstrable benefits when added to feeds for aquaculture and animals, even at low percentages (2 percent), making it a valuable feed additive.

[14] http://www.cosmeticsdesign.com/Formulation-Science/Researchers-at-work-on-new-kelp-source-for-natural-cosmetics
[15] https://www.ncbi.nlm.nih.gov/pubmed/19460960
[16] http://e360.yale.edu/features/new_breed_of_ocean_farmer_aims_to_revive_global_seas

Species in Research and Development

While little or no production is occurring in the Alaska mariculture industry for species other than oysters, mussels, geoducks, and kelp, several other species are under consideration for potential development. Only a few species have advanced into substantial research and development stages. A great deal of resources have been placed on king crab enhancement, while some effort is also going into sea cucumbers and abalone. Clams (aside from geoduck), purple-hinged scallops, sea urchins, and cockles are being researched.

King Crab

King crab are an important commercial species in Alaska, though stocks have declined and not rebounded in the Gulf of Alaska since the 1980s. A statewide collaborative research effort, *Alaska King Crab Research, Rehabilitation, and Biology* (AKCRRAB), is currently underway to rehabilitate stocks. Recent experimental releases of crab stock are under observation and the next and final phase of the research effort is underway. Next steps will be to attract industry investment and ensure the Alaska regulatory environment will allow for crab enhancement.

King crab enhancement has the potential to be immensely profitable. Ex-vessel prices are at a record-high and king crab products are in high demand around the globe. In addition, fishing operations and processing operations already harvest and process crab, so there wouldn't be an issue with establishing new relationships, distribution channels, or markets. Most major processing centers (Kodiak, Bering Sea, and Southeast) purchase king crab regularly and would likely welcome enhanced crab stocks due to their high market value.

Crab enhancement research is in its infancy yet has produced a wealth of information. Funding, primarily for research grants, has been shared between Community Development Quota (CDQ) groups, public agencies, and industry. Maintaining funding now will be a key factor for future success.[17] AKCRRAB's third and final phase is to invoke industry participation, now that they've developed the pathway to red king crab rearing. The AKCRRAB team has proven that gathering broodstock, incubating king crab in salt water tanks for 2 months, and outstocking them is a relatively low-cost effort.

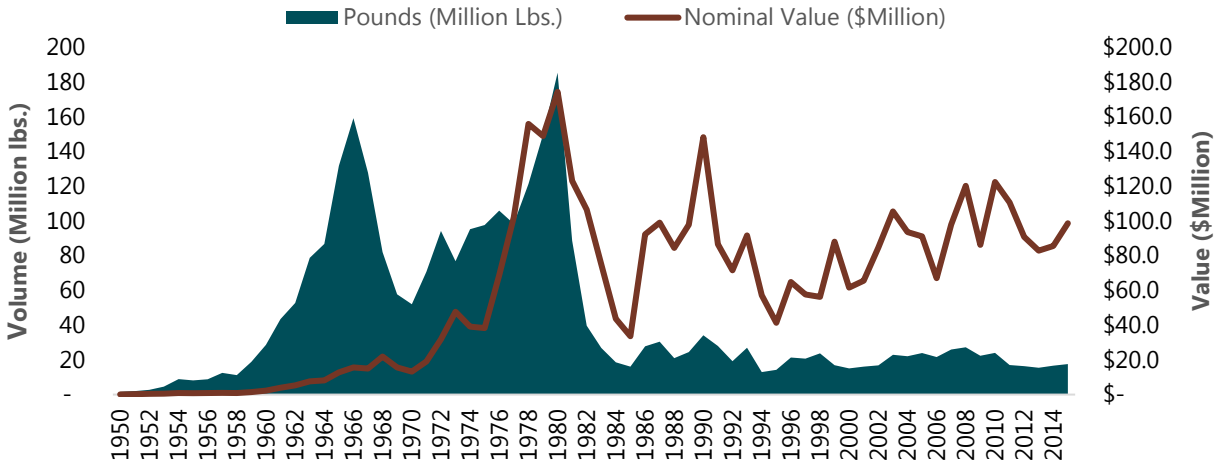
One of the challenges before commercial hatcheries can operate is developing genetic marking and monitoring methodology to differentiate wildstock from hatchery-raised crab. Scientists are unsure on how hatchery crab would impact natural stocks. The experimental outstocking conducted in the Kodiak basin remain in localized populations and the natural crab population is so depleted around Kodiak Island that scientists are unable to observe stock interactions.

INDUSTRY OVERVIEW

King crab, the largest crab species in the U.S., harvested in the Bering Sea, are a highly valuable commercial species. In 2015, king crab harvests totaled 17.5 million pounds worth $98.6 million. Crab fishing is jointly managed by NMFS and ADF&G.

[17] http://www.bsfrf.org/pdf/DraftAKCRRAB_1pager.pdf

Figure 17. King Crab Harvests and Value, 1950-2015



Source: NMFS Landings.

Red king crab (*Paralithodes camtschaticus*) inhabit a continuous, wide range from the Aleutian Chain, Bering Sea, and the Gulf of Alaska.[18] Blue king crab (*Lithodes aequispinus*) inhabit discrete areas in the Bering Sea, and tend to live in shallower water than red king crab. Both species are long-lived, typically not large enough to harvest until 7 to 9 years of age.[19] Both red and blue king crab commercial fishing peaked in the mid-1980s and stocks have not fully recovered from overfishing. Blue king crab near the Pribilof Islands are the only federally-listed overfished species in Alaska. Recently, ocean acidification and ocean temperature fluctuations have been linked to lowered king crab survival rates.[20]

RESEARCH AND DEVELOPMENT IN ALASKA

In response to declining stocks and potential environmental changes, and the highly lucrative king crab commercial fishery, king crab wild stock enhancement has been a research priority for ADF&G since 1991.[21] In particular, near the Pribilof Islands, enhanced blue king crab populations would potentially allow as a red king crab fishery this is currently closed to avoid blue king crab bycatch.[22] Additionally, coastal Alaskan communities would benefit from crab enhancement through quota allocations held by shoreside processors, fishermen, crew members, and CDQ groups.[23]

[18] http://www.afsc.noaa.gov/Education/factsheets/10_rkc_fs.pdf
[19] http://www.adfg.alaska.gov/index.cfm?adfg=wildlifenews.view_article&articles_id=544
[20] https://access.afsc.noaa.gov/pubs/posters/pdfs/pFoy02_ocean-acid-research.pdf
[21] http://www.adfg.alaska.gov/index.cfm?adfg=wildlifenews.view_article&articles_id=544
[22] http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2015/2015_status_of_stocks_updated.pdf
[23] The Western Alaska Community Development Quota (CDQ) Program allocates a percentage of all Bering Sea and Aleutian Islands quotas for groundfish, prohibited species, halibut, and crab to eligible communities. The purpose of the CDQ Program is to (i) to provide eligible western Alaska villages with the opportunity to participate and invest in fisheries in the Bering Sea and Aleutian Islands Management Area; (ii) to support economic development in western Alaska; (iii) to alleviate poverty and provide economic and social benefits for residents of western Alaska; and (iv) to achieve sustainable and diversified local economies in western Alaska. (NMFS)

NMFS operates a shellfish research laboratory in Kodiak, where scientists conduct research on king crab habitat, life cycle, behavior, and response to climate change.

Crab aquaculture operations occur around the world, though enhancement is less frequent. Examples of enhancement operations include: Maryland blue crab enhancement that began in 2002, with subsequent release of 150,000 crab. Japan attempted king crab enhancement research in the 1980s, though efforts did not continue.[24] Russians introduced king crab in the Barents Sea, where it was not native, to increase commercial fishing opportunities in the 1980s.[25]

Alaska King Crab Research, Rehabilitation, and Biology (AKCRRAB)

The first crab restoration project in Alaska, the AKCRRAB Program, is a collaborative research program with partners that include Alaska Sea Grant, fishery associations, CDQ groups, NOAA, the UAF College of Fisheries and Ocean Sciences, and private industry. This long-term research effort, which commenced in 2006, focuses on raising and releasing red and blue king crabs to enhance depressed king crab populations throughout Alaska. [26] The project also includes monitoring of ocean acidification impacts on crustaceans, such as juvenile shell growth rates.

Alutiiq Pride Shellfish Hatchery, located in Seward, is the only hatchery in Alaska that has produced crustacean larvae. When the larvae reach a certain age, they are shipped to the NOAA Kodiak Laboratory where they have recently (in 2013-2015) been released near Kodiak and Old Harbor (Kodiak Island) and monitored for survival rates. Only red king crab have been released; blue king crab efforts are behind the red crab program by three to four years due to biological differences between the species and ability to collect broodstock. Hatchery production increased from 1,000 juveniles to 100,000 juveniles between 2007 and 2010.[27] In 2014-2015, 21,000 juveniles were released. Currently the mortality rate after release is 15 percent. Since Kodiak lacks any local king crab population, monitoring efforts can assume all observed juvenile crab are AKCRRAB experiments. The next release is anticipated for 2018 and will release 100,000 juvenile crab near Kodiak. A project near Seward is under development.

AKCRRAB operates in three phases to achieve its goal of eventual rehabilitation of king crab that it hopes to accomplish by 2019.[28]

[24] https://seagrant.uaf.edu/research/projects/kingcrab/docs/presentations/Eckert-lobster-crab-enhancement.pdf
[25] http://flseagrant.ifas.ufl.edu/newsletter/2012/07/an-amazing-story-red-king-crab-introduced-to-barents-sea/
[26] https://seagrant.uaf.edu/research/projects/kingcrab/docs/presentations/Persselin-2009-comfish.pdf
[27] http://www.adfg.alaska.gov/index.cfm?adfg=wildlifenews.view_article&articles_id=544
[28] https://seagrant.uaf.edu/research/projects/kingcrab/docs/akcrrab-strategic-plan-2015-2019.pdf

- Phase I: Developing and improving methods of hatchery rearing juvenile king crab.
- Phase II: Understanding optimal release strategies, appropriate habitat, and potential impacts on existing ecosystems.
- Phase III: The final phase aims to transition AKCRRAB from a research coalition to implementation by different industry user groups.

AKCRRAB Operations

Since 2007, king crab broodstock have been collected under ADF&G research permits. The Alutiiq Pride Shellfish Hatchery monitors and cares for the adult broodstock and their offspring. Thousands of eggs hatch in early spring and the larvae become juveniles two months later. Survival rates for king crab were 31 percent in 2013.[29] Hatchery startup required $600,000 in equipment. Hatchery operations currently cost between $305,100 to $333,800 a year.[30]

Juvenile red king crab.
Photo credit: Celeste Leroux, Alaska Sea Grant.

Broodstock for hatchery production is developed from wild crab. In past years, it has been collected from Alitak Bay and Old Harbor on Kodiak Island, the Pribilof Islands, and Little Diomede. Currently, broodstock comes from Alitak Bay. From broodstock, larvae are raised in tanks at APSH in Seward for two months and then released before the juveniles become cannibalistic. A 10 percent survival rate at the juvenile stage could produce 100,000 juveniles annually.[31] Raising larvae in a controlled environment greatly reduces natural mortality.

Table 19. Estimated Costs of King Crab Enhancement, 2009

Operating Costs	$250,000
Start Up Cost	$150,000
Cost to Produce 1 Million Juveniles	$0.25/juvenile
Survival Rate	8%
Number of Survivors	80,000
50% Male	40,000
Exploitation of 15%	6,000
Typical King Crab (in lbs.)	6.5
Typical King Crab Price/lb.	$8.00
Potential Future Value	$312,000

Note: Survival rate refers to juveniles reaching adulthood (seven years).
Source: Glaser (2009). Rehabilitation of the Alaskan red king crab through large-scale hatchery culture and restock: Cost-Benefit Analysis.

[29] http://alaskaberingseacrabbers.org/article.php?article=90
[30] https://seagrant.uaf.edu/factsheets/kingcrab/kingcrab-financial-web.pdf
[31] https://seagrant.uaf.edu/research/projects/kingcrab/docs/presentations/Persselin-2009-comfish.pdf

From 2008-2010 costs for AKCRRAB research and development totaled $2.5 million in Alaska Sea Grant funds and included many other contributors.[32]

Research and Development

There is a comprehensive body of knowledge published on king crab species, including diet, effects of water temperature, effects of light, molting, and survival that contributes to a better understanding of how to successfully enhance wild stocks.[33] Since its infancy, AKCRRAB has supported eight University of Alaska Fairbanks graduate students and produced numerous scientific publications.[34] In addition, more than 30 visiting scientists have contributed to the ongoing body of research. Three Alaska Sea Grant staff and three NMFS researchers have also worked on AKCRRAB efforts.[35]

Community Investment

As AKCRRAB phases out public investment and seeks private interest, tribes and CDQ groups stand out as potential catalysts for bringing crab enhancement to fruition. CDQ groups receive crab allocations and would benefit from an increased supply of crab. Tribes representing rural communities, such as St. Paul, would greatly benefit from increased economic activity through hatchery efforts as well as fishing activity.

King crab culture requires obtaining broodstock, a facility, equipment, and expertise to hold crab for two months, and the ability to release them. St. Paul Island has a NOAA facility and expertise in crab biology. In addition, Central Bering Sea Fishermen's Association, the region's CDQ group, holds sizeable amounts of crab quota and APICDA has been involved in AKCRABB throughout the life of the project and continues to have interest in its development.

Kodiak Island's current involvement in crab enhancement and its sizable commercial crab fleet and processing facilities makes it an ideal candidate for long-term investment. The NOAA Kodiak Laboratory, which is currently extensively involved in king crab outstocking research, also houses the federal shellfish stock assessment scientists.

[32] https://seagrant.uaf.edu/factsheets/kingcrab/kingcrab-financial-web.pdf
[33] https://seagrant.uaf.edu/research/projects/kingcrab/docs/presentations/Persselin-2009-comfish.pdf
[34] https://seagrant.uaf.edu/research/projects/kingcrab/general/graduate-students.php
[35] https://seagrant.uaf.edu/research/projects/kingcrab/staff/index.php

Pinto Abalone

The pinto abalone (*Haliotis kamtschatkana*), or the northern abalone, is the only abalone species found in Alaska. This single-shelled mollusk inhabits shallow kelp beds from Southeast Alaska to California.[36] In Alaska, this species is typically found between Dixon Entrance and Icy Straits in outside waters of Southeast Alaska. This abalone species is slow-growing, with the length of time required to grow to a commercial size unknown.

A commercial fishery for pinto abalone existed in Southeast Alaska from the 1970s to the late 1990s, when it was closed due to overfishing.[37] Concurrently, a growing Southeast Alaska sea otter population placed pressure on the abalone biomass, further limiting its capacity to rebuild.[38] Pinto abalone have been listed as a "species of concern" under the Endangered Species Act, since 2004, which allows proactive conservation action to limit further stock declines.[39] Subsistence harvests of abalone in Alaska are limited to 5 abalone a year with a minimum size of 3.5 inches.[40]

INDUSTRY OVERVIEW

Abalone mariculture was developed in response to rapidly declining stocks around the world due, in part, to high demand for this mollusk. China produces most of the world's commercial abalone grown in aquaculture operations, while very little is grown in the U.S. On the U.S. West Coast, abalone mariculture is a cottage industry with several small-scale farms producing live and canned abalone that sell for up to $100 per pound.

The Alutiiq Pride Shellfish Hatchery in Seward is the only Alaska mariculture facility actively growing pinto abalone seed in an experimental basis. The current purpose of that seed would be for conservation purposes only.[41] Potential exists for abalone production to increase in Alaska, given high market prices for wild and fresh abalone and a pristine environment that is optimal for growers.

PRODUCTION AND SUPPLY

In 2014, the U.S. produced 750,000 pounds of abalone, worth $4.8 million. Abalone producers on the West Coast market their products as fresh, either as steaks or whole. Depending on the species and product form, abalone market prices range from $15-$30 for a single abalone, $125 for 1 pound of abalone steaks, and $15 for a 4.8 oz. can.[42,43,44]

To supplement domestic production, the U.S. imported approximately 1 million pounds of abalone in 2016, worth between $9 to $17 per pound. Australia accounted for 34 percent of total supply, followed by Hong Kong with 22 percent.

[36] http://www.adfg.alaska.gov/index.cfm?adfg=abalone.main
[37] http://www.fisheries.noaa.gov/pr/species/Status%20Reviews/pinto-abalone-status-review-2014.pdf
[38] http://www.haidagwaiiobserver.com/news/413095193.html
[39] http://www.fisheries.noaa.gov/pr/species/invertebrates/abalone/pinto-abalone.html
[40] http://www.adfg.alaska.gov/index.cfm?adfg=PersonalUsebyAreaSoutheastSCA.regs
[41] http://alutiiqpridehatchery.com/pinto-abalone/
[42] http://bigislandabalone.com/buyonline.html
[43] https://www.giovannisfishmarket.com/seafood-online/abalone/live-abalone.aspx
[44] https://www.giovannisfishmarket.com/seafood-online/abalone/abalone-steaks-one-pound.aspx?IID=816308

Table 20. Top U.S. Abalone Import Source, 2016

Country	Value ($Millions)	Quantity (Lbs.)	Avg. Price Per Lb.
Australia	$4.3	359,350	$11.97
Hong Kong	$2.5	240,301	$10.20
Mexico	$2.1	154,322	$13.55
Chile	$1.3	141,094	$9.04
China	$1.7	141,094	$12.17
South Korea	$0.2	11,023	$17.83
Other	$0.2	22,046	$9.61
Total	**$12.2**	**1,069,230**	**$11.45**

Note: Includes live, fresh, chilled, and non-specified abalone products.
Source: Global Trade Atlas.

Global Production

Abalone mariculture operations produce approximately two-thirds of the annual world commercial abalone supply. In 2014, global mariculture supply of abalone totaled 516,618 metric tons, of which 70 percent was produced in farming operations.

U.S. domestic abalone production is minor in comparison to China and Korea. Chinese producers supplied 348,246 metric tons of farmed abalone, worth $678 million in 2014, or 96 percent of total farmed abalone. Korea produced 8,977 metric tons worth $39 million.

Table 21. Global Aquaculture Supply of Abalone, in Metric Tons and $000s, 2010-2014

Region	2010	2011	2012	2013	2014
China	264,349	280,052	305,040	323,224	348,246
Korea	6,228	6,779	6,564	7,479	8,977
South Africa	1,015	1,036	1,111	1,100	1,150
Chile	794	841	853	1,134	1,146
Australia	1,985	491	605	724	859
U.S.	250	250	250	201	341
Other	80	114	101	77	87
Total Aquaculture Volume (mt)	**274,701**	**289,563**	**314,524**	**333,939**	**360,806**
Total Aquaculture and Wild (mt)	**431,806**	**435,487**	**472,796**	**500,291**	**516,618**
Pct. Aquaculture	**64%**	**66%**	**67%**	**67%**	**70%**

Note: Data contains some conches and winkles.
Source: FAO Fish Stats.

Globally, abalone are typically sold alive, which is when they are the freshest. Farmers have sold them deshelled in frozen vacuum packs and in cans. China and Japan consumers use dried abalone for its alleged medicinal and aphrodisiac qualities, in addition to a wide variety of other dishes. Abalone flavor is so popular in Asia that there is a faux vegetarian version available.[45]

[45] https://giantonline.com.sg/catalog/product/view/name/vegetarian-abalone-285g-5016909

Table 22. Global Aquaculture Supply of Abalone, in $000s, 2010-2014

Region	2010	2011	2012	2013	2014
China	$389,557	$481,047	$552,478	$643,102	$678,634
Korea	$197,708	$215,713	$213,237	$226,285	$282,115
South Africa	$48,596	$40,867	$49,509	$41,710	$38,702
Chile	$26,202	$29,274	$65,833	$81,018	$105,266
Australia	$14,197	$16,917	$19,879	$22,937	$24,195
U.S.	$8,818	$8,818	$8,818	$8,538	$4,818
Other	$2,020	$3,788	$2,756	$2,305	$2,870
Total Value ($000s)	**$687,098**	**$796,424**	**$912,509**	**$1,025,896**	**$1,136,599**

Note: Data contains some conches and winkles.
Source: FAO Fish Stats.

ALASKA ABALONE FARMING

Alutiiq Pride Shellfish Hatchery is producing seed for pinto abalone with a focus on species preservation. However, there may be potential for mirroring commercial mariculture efforts for abalone that California and British Columbia farmers have successfully developed.

Since abalone farming is not occurring in Alaska, operating cost information is not available. However, potential farmers might consider several factors:

- Abalone farmers in California see a profit margin of 15-18 percent per abalone above their operating costs and the common price they receive per live abalone is $15.
- Abalone are a slow-growing species. Based on industry interviews, shellfish farmers would see more success with abalone rearing after first building a base of a faster growing species like oysters or mussels.
- Careful planning to protect farmed abalone from natural predators, like sea otters, could be important.
- Costs to grow abalone are likely comparable to other shellfish operations, like geoducks, which take several years to mature but are more valuable on a per pound basis than oysters or clams.

The Cultured Abalone Farm

The Cultured Abalone Farm (Goleta, CA) is a land-based operation that consists of 400 1,000 gallon tanks that produce 1,500 pounds of abalone each week. They are fed a composite diet of local kelp and are sold at $15 per pound whole and live to buyers. They typically operate at a 15-18 percent margin on gross sales.

The following table provides a hypothetical operating model for abalone production. It is based on interviews with California abalone farmers, who are permitted to grow up to 500,000 abalone each. Prices were assumed to be approximately $20 per pound with producers growing between 60,000-80,000 with seed purchased from

Alutiiq Pride Shellfish Hatchery[46]. Based on these assumptions, annual gross revenue from abalone sales would be between $1.2-1.6 million per farm. In California, the cost of producing one abalone is $3.50-$12, depending if operations are ocean or land-based.

Table 23. Potential Alaska Abalone Production

Annual Production	60,000-80,000 abalone
Average Farmgate Value per Pound	$15-23/lb. $20/lb. average
Annual Earnings	$1.2-1.6 million
Profit Margin	15-18% of Revenue
Annual Labor Cost	50% of operating costs
Employment	9-12 year-round employees

Source: McDowell Group estimates.

Alaska producers could anticipate entering a market where abalone prices range between $15 to $30 per pound. It is likely that Alaska-produced abalone prices could be in the upper range due to their quality and the price premium that Alaska seafood can often demands.

[46] Abalone would need to be added as a permitted species for culture to APSH' operational permit before they could sell seed.

Sea Cucumbers

Sea cucumbers, also known globally as bêche-de-mer, are a delicacy in Asian countries. Commercially, hundreds of sea cucumbers species are priced and graded by size, species, and imperfections. In addition to food consumption, they are also used in biomedical and pharmaceutical applications.

Giant red sea cucumbers (*Parastichopus californicus*) are the only commercially harvested sea cucumber in Alaska. The species, found in the Pacific Ocean from Mexico to the Aleutian Islands, can grow up to 50 cm (19 inches) long.[47] Giant red sea cucumbers reach adult size and sexually maturity after 4 years.[48]

Photo credit: ADF&G.

In 2015, sea cucumber mariculture contributed 83 percent to the world supply. The remaining 17 percent was wild harvest. Sea cucumber mariculture operations vary, with many regions practicing "poly-culture." As sea cucumbers are filter-feeders, they consume detritus from other species, making them potentially useful for minimizing waste from farms or processing plant discharge zones. Sea cucumber mariculture may also be used to enhance wild stocks.

PRODUCTION AND VALUE

Currently no commercial sea cucumber mariculture operations exist in Alaska, though a wild harvest does occur.

Farmed Sea Cucumbers

Sea cucumber mariculture is in its infancy in Alaska and the rest of the U.S., with most U.S. production from wild harvest. In Alaska, sea cucumber mariculture efforts are in the research and development phase.[49] Southeast Alaska Regional Dive Fisheries Association (SARDFA) supports sea cucumber enhancement research in Seward at APSH and in Ketchikan.

SARDFA is interested in developing mariculture to address sea cucumber population declines due to a rise in sea otter populations in Southeast. SARDFA is concerned sea otter depredation of sea cucumbers will decimate the population to the extent that commercial fishing access will close entirely in Southeast. Since poly-culture has been successful with sea cucumbers, SARDFA has expressed interested in working with oyster farms or salmon hatcheries.

Operations in other areas of the world may help inform efforts in Alaska. Many countries produce hatchery-raised sea cucumbers for both enhancement and commercial production, with much of the effort in China, other Asian countries, and the Pacific Islands including Australia and New Zealand.[50] In 2015, China produced 98

[47] http://www.adfg.alaska.gov/index.cfm?adfg=redseacucumber.main
[48] http://peninsulaclarion.com/news/2011-07-17/spawning-sea-possibilities?utm_source=Morris%20Digital%20Works&utm_medium=email&utm_campaign=Recurring_Daily%20Headlines
[49] http://alutiiqpridehatchery.com/sea-cucumber/
[50] http://seagrant.umaine.edu/files/pdf-global/SeaCucumberManual_062614.pdf

percent of total sea cucumber global supply, totaling 205,791 metric tons, worth $715 million. In China, sea cucumbers are raised in artificial ponds and man-made tide pools.

Table 24. Global Supply of Farmed Sea Cucumbers, in Metric Tons, 2011-2015

Region	2011	2012	2013	2014	2015
China	137,754	170,830	193,705	200,969	205,791
Indonesia	219	475	206	138	2,029
Other	213	211	237	918	128
Total Mariculture Volume (mt)	**138,186**	**171,516**	**194,148**	**202,025**	**207,948**
Total Mariculture and Wild (mt)	**181,092**	**211,670**	**232,909**	**238,137**	**250,940**
Pct. Mariculture	**76%**	**81%**	**83%**	**85%**	**83%**

Source: FAO Fish Stats.

Table 25. Value of Global Supply of Farmed Sea Cucumbers, in $000s, 2011-2015

Region	2010	2011	2012	2013	2014
China	$478,006	$592,780	$672,156	$697,362	$714,095
Indonesia	$3,119	$6,328	$2,473	$1,455	$18,817
Other	$1,586	$1,576	$1,711	$5,906	$1,274
Total Value ($000s)	**$482,712**	**$600,684**	**$676,340**	**$704,723**	**$734,186**

Source: FAO Fish Stats.

Wild Harvest Sea Cucumbers

The U.S. only produces wild harvest sea cucumbers and contributes a small fraction to global supply. Alaska harvests the most sea cucumbers in the country, followed by Washington, Maine, and California. Global wild sea cucumber harvest information may be found in Appendix A.

Table 26. U.S. Wild Sea Cucumber Landings, Metric Tons and Value, by Region, 2013–2015

	2013 mt	2013 Value	2014 mt	2014 Value	2015 mt	2015 Value
Alaska	752	$6,523,020	546	$4,815,197	740	$5,747,153
East Coast	483	$305,580	230	$177,080	9	$18,511
West Coast	477	$3,811,179	444	$3,846,897	505	$5,182,903
Total Harvested	**1,712**	**$10,639,779**	**1,220**	**$8,839,174**	**1,253**	**$10,948,567**

Source: National Marine Fisheries Service, Fisheries Statistics and Economics Division.

In Alaska, commercial dive harvests began near Ketchikan in 1983. In addition to harvest in the commercial dive fishery, the species is a traditional subsistence food. Commercial diving for sea cucumbers is largely concentrated in Southeast, with smaller fisheries in Kodiak and Chignik.[51] Divers use scuba gear to hand pick sea cucumbers off benthic (sea floor) habitats and transport them to the surface in mesh bags.[52] ADF&G rotates fishery areas every three years to prevent overharvest. Stock assessments are partially-funded by SARDFA.

[51] http://www.adfg.alaska.gov/index.cfm?adfg=CommercialByFisheryDive.seacucumber
[52] http://www.adfg.alaska.gov/index.cfm?adfg=redseacucumber.main

Statewide harvests averaged slightly over 1.6 million pounds per year between the winter 2011/12 and 2015/16 seasons.[53] Harvests in Southeast Alaska averaged 1.5 million pounds per year, with about 186 divers participating. In 2016, the season average price per pound for sea cucumbers in Southeast was $4.00. The fishery's value has increased recently due to rising prices in China, the top importer of Alaska's sea cucumbers.

Table 27. Southeast Alaska Sea Cucumber Harvests, 2011-2016

Season	Guideline Harvest Level (lbs.)	Total Landed (lbs.)	Average Price/lb.	Ex vessel Value	Number of Divers
2011/12	999,000	1,023,834	$5.06	$5,180,600	189
2012/13	1,476,000	1,512,895	$4.05	$6,127,225	199
2013/14	1,472,600	1,556,983	$3.97	$6,181,223	198
2014/15	1,084,800	1,073,554	$4.00	$4,294,216	171
2015/16	1,439,900	1,525,387	$3.50	$5,338,855	175

Source: ADF&G Commercial Fishing Division.
Note: Some harvest data is not included in this table due to confidentiality restrictions.

SEA CUCUMBER PROCESSING AND OPERATIONS

China and Japan were the first to develop successful hatchery technology for sea cucumbers. Operations require broodstock and tanks with circulating seawater. The animals are held in shallow pens and cages on the seafloor in open water or grown in ponds. In China, large concrete ponds with natural tidal flows hold sea cucumbers that feed on algae and other natural food sources. In New Zealand, many aquaculture farms combine mussels and sea cucumbers. Sea cucumbers subsist on the detritus of mussels.

In Alaska, SARDFA provides APSH adult sea cucumbers as broodstock, from which the hatchery develops seed and then ships juveniles to Alaska Shellfish Hatchery in Ketchikan where the seed grow in a controlled environment.[54] In 2016, APSH successfully shipped a batch of young cucumbers to Ketchikan, and after a period of acclimation, the cucumbers were reared in a pen on the ocean floor near the facility as part of a research project. The test was successful and the cucumbers grew to three or four inches over a summer. No hard data is available on mortality rates or on time to grow sea cucumbers to marketable size.

Photo credit: Kirsten Shelton.

Sea cucumbers are processed into frozen or fresh muscle strips and dried skins or sections. The skin is cooked and then dried into a product known as trepang or bêche-de-mer. Sea cucumbers are sold in a variety of product forms, the predominant being frozen, salted, or dried.

[53] Based on annual ADF&G harvest data for years not confidential. Kodiak and Chignik harvests are purchased by a single buyer, which makes harvest data confidential. According to an ADF&G contact, GHL of 140,000 lbs. in Kodiak and 20,000 lbs. in Chignik is consistently met each year.
[54] http://alutiiqpridehatchery.com/sea-cucumber/

MARKETS

Sea cucumber products are marketed primarily in Asia, with a small niche in Asian food markets in the U.S. Primary markets are China and Japan, where the sea cucumber is valued for "aphrodisiac qualities." Wild Alaska sea cucumbers tend to be much larger and have higher nutritional value, and therefore command a premium price in the Chinese market.[55]

Table 28. U.S. Sea Cucumber Exports, by Product Type, 2013 – 2015

	2013 kg	2013 Value	2014 kg	2014 Value	2015 kg	2015 Value
Frozen/Salted/Dried	1,198,566	$30.8	428,688	$16.1	435,009	$13.6
Live/Fresh	277,677	$3.5	137,619	$1.8	95,985	$1.1
Prepared/Preserved	804,197	$6.7	452,760	$4.3	179,261	$1.6
Total Exports	**2,280,440**	**$41.0**	**1,019,067**	**$22.2**	**710,255**	**$16.3**

Source: National Marine Fisheries Service, Fisheries Statistics and Economics Division.

Table 29. U.S. Sea Cucumber Exports, by Country, 2013 – 2015

	2013 kg	2013 Value	2014 kg	2014 Value	2015 kg	2015 Value
China	1,854,415	$33.7	672,325	$14.7	444,668	$10.2
Canada	134,757	$1.6	101,003	$1.5	103,359	$1.8
South Korea	169,825	$3.8	144,836	$3.8	99,974	$3.1
Vietnam	93,741	$1.6	31,077	$0.7	44,625	$0.8
Other	27,702	$0.3	69,826	$1.5	17,629	$0.4
Total	**2,280,440**	**$41.0**	**1,019,067**	**$22.2**	**710,255**	**$16.3**

Source: National Marine Fisheries Service, Fisheries Statistics and Economics Division.

[55] https://www.scribd.com/document/74857876/MCDOWELL-GROUP-2011-Sea-Otter-Impacts-Report

Clams

Several clam species, aside from geoducks, are of interest for mariculture in Alaska. These include Pacific littleneck clams, razor clams, butter clams, and cockles.

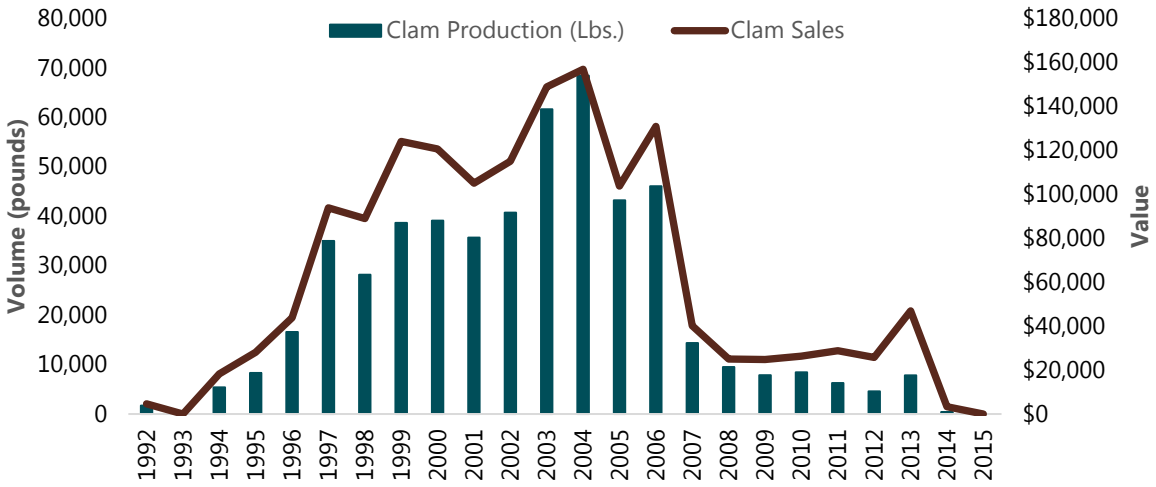
PRODUCTION AND VALUE

ADF&G has approved on-bottom aquatic farm sites for clams since 1999. In 2015, there were four permits in Alaska to culture clam (aside from geoducks) and one hatchery was permitted to grow seed.[56] Alutiiq Pride Shellfish Hatchery has developed a process to rear and grow clams.

Littleneck clams, also known as steamer clams, have been farmed more than other clam species in the state, with a peak of $157,000 worth of littleneck clams sold in 2004. Since 2004, clam production and sales have declined significantly. In 2010, ADF&G began reporting farmed geoduck harvest in combination with other clams, complicating analysis of harvest trends for both species. It is known, however, that no littleneck clams were sold in 2015. Anecdotally, farmers have identified several potential issues related to declining clam mariculture harvests after 2004:

- Predation, especially by sea otters and sea stars, has been a factor at some sites.
- Farms can harvest wildstock on farm sites. After a period, the amount of wildstock available may have declined.
- Survival rates of hatchery raised clams has been variable.
- Slow growth rates for hatchery reared clams can delay return on investment, reducing interest in farming this product.

Figure 18. Alaska Clam Production and Sales, 1994-2015



Note: All clam sales through 2009 are for Pacific littleneck clams. Beginning in 2010, clam sales include both Pacific littleneck clams and Pacific geoduck clams.
Source: ADF&G and DNR.

[56] http://www.adfg.alaska.gov/index.cfm?adfg=fishingaquaticfarming.aquaticfarminfo_permit_status

LITTLENECK CLAMS

Interest in farming Pacific littleneck clams (*Protothaca staminea*) in Alaska is focused on diversifying product lines in current mariculture operations, as well as enhancing wild stocks.[57]

Littleneck clams grow in protected, mud beaches, burrowing about 6 inches deep. Clam farm sites exist on swathes of these non-rocky beaches, with a potential challenge being to contain farmed clams from wild populations.

Grow-out time for aquatic farm stock from seedstock to a marketable size is three to seven years. Recent research conducted by ADF&G suggests predator exclusion netting can enhance Pacific littleneck clam survival and growth in Southeast Alaska.

Spat is not currently commercially available for littleneck clams, though, as noted above, APSH has sold seed in the past and produced clams for many years. The hatchery has developed culture and grow out techniques for this species. The hatchery also seeded over 1 million clams at Tatitlek and other villages in lower Cook Inlet in 2000 and 2001, with variable success and growth, for research and bioenhancement purposes.[58] Current research and bioenhancement is occurring in Port Graham.

RAZOR CLAMS

Razor clams (*Siliqua patula*) can grow up to 7 inches and are found in sandy beaches from California to the Aleutian Islands.

Photo credit: ADF&G.

Historically, razor clams were harvested commercially near Cordova from 1916 until the 1950s.[59] The species was a popular canned shellfish item in grocery stores until less expensive substitutes outcompeted them. The local Cordova population was overexploited during this period.

Today, the largest commercial wild fishery for razor clams in the state occurs in lower Cook Inlet, where the harvest has ranged between 625,000 and 1.3 million clams annually since 1973.[60] The species is fished commercially for crab bait and for consumption.[61] The most recent data available shows the ex-vessel price for razor clams at $0.65/lb.[62]

In 2004, razor clams produced at APSH were planted near the village of Eyak, near Cordova, for enhancement purposes.[63]

[57] https://seagrant.uaf.edu/map/aquaculture/shellfish/presentations/Introduction%20to%20clam%20farming.pdf.
[58] http://www.sf.adfg.state.ak.us/FedAidPDFs/RIR.5J.2004.05.pdf.
[59] http://www.adfg.alaska.gov/static/fishing/PDFs/aquaticfarming/razor_clam_pws.pdf.
[60] http://www.adfg.alaska.gov/index.cfm?adfg=ByAreaSouthcentralLowerCookInlet.research.
[61] http://www.adfg.alaska.gov/index.cfm?adfg=razorclam.uses.
[62] ADF&G (COAR).
[63] http://www.adfg.alaska.gov/static/fishing/PDFs/aquaticfarming/eyak_razorclam_report.pdf.

APSH has raised this species from seed with success, though it is assumed razor clams would fulfill local enhancement goals rather than be farmed for commercial harvest.

BUTTER CLAMS

Butter clams (*Saxidomus gigantea*) are found from Alaska to California. This species grows up to five inches in length. Ideal butter clam habitat occurs in sandy beaches in protected bays. The clam burrows deeper than littleneck clams, up to 12 inches.[64] Katchemak Bay hosts a notable concentration of butter clams.

Like razor and littleneck, butter clams are popular for personal use and subsistence. A commercial fishery for butter clams does not currently occur in the state.

APSH has grown butter clams successfully for two years (2015-2017), with high survival and growth rates. The hatchery expects butter clams to be a viable product for aquatic farming in Alaska. APSH's first experimental outstocking of butter clams for research and bioenhancement purposes will occur in spring 2017. One challenge with butter clams is their propensity to retain PSP.

COCKLES

Cockles (*Clinocardium nuttallii*) are a traditional subsistence and personal use shellfish resource in Alaska. Cockles range from the Bering Sea to Southern California and can grow up to 6 inches.[65] A variety of cockle species around the world are in demand for their sweet, mild-flavor that can be used in a variety of dishes.

Cockles are not typically a target for commercial harvest because they occur in low concentrations that have not been profitable to harvest. In the U.S., no commercial fishery for cockles occurs, only personal use and subsistence. In Alaska, cockles are often harvested with a rake or garden shovel in shallow water.

APSH raised cockles, both commercially and for research, with promising results. The species grows quickly, reaching market size in 12 to 16 months, and does well in lantern nets. Cockle shelf-life is short, which will be a hurdle if the species is developed commercially. They are a mobile species, making containment for a commercial operation an issue to address as well.

Three Alaska farms are currently permitted to raise cockles, though due to confidentiality restrictions it is unclear whether they are producing.[66]

U.S. PRODUCTION

Like oysters and mussels, clam mariculture is common throughout the world. In the U.S., approximately 11 percent of clams are farmed. In 2014, 10.4 million pounds of clams were produced on farms in the country, worth $120.7 million.[67] Including farmed and wild-caught clams, 90.7 million pounds of clams were commercially landed, worth $214.7 million.[68]

[64] https://www.adfg.alaska.gov/static-sf/Region2/pdfpubs/HardshellClams.pdf
[65] http://nsgl.gso.uri.edu/aku/akug98002.pdf
[66] http://www.adfg.alaska.gov/index.cfm?adfg=fishingaquaticfarming.aquaticfarminfo_permit_status
[67] https://www.st.nmfs.noaa.gov/Assets/commercial/fus/fus15/documents/03_%20Aquaculture2015.pdf.
[68] https://www.st.nmfs.noaa.gov/Assets/commercial/fus/fus15/documents/02_Commercial2015.pdf.

Purple-Hinged Rock Scallops

Purple-hinged rock scallops (*Crassadoma gigantea*) are intertidal bivalves that range from Southeast Alaska to Mexico.[69] This species of scallop is smaller, at up to 10 inches in height, than the only commercially harvested scallop species in Alaska, the Pacific weathervane scallop.[70] Unlike the weathervane, purple-hinged rock scallops may be successfully reared in mariculture because of their unique ability among scallop species to permanently attach to rocky substrates. [71]

Scallops, common in the U.S. and worldwide, are delicacies, consumed for their sweet, mild meat. In 2015, over 35.8 million pounds of wild-harvest scallops were landed in the U.S., worth $440.5 million.[72] Edible meat yield is 10 percent from live weight. Prices are higher for larger scallops.

In Alaska, most wild scallop harvest occurs near Kodiak with dredge gear. Additional beds in Cook Inlet, Prince William Sound, and Southeast are closed or limited to fishing due to low yields. Alaska scallops are directly marketed to food service businesses, restaurants, and retail establishments. Harvest for the 2014/15 season totaled 308,888 pounds of shucked meat.[73]

Photo credit: Joth Davis.

Scallops are produced in aquaculture around the world, including Canada and Washington.[74] In Alaska, there have been attempts to farm all three types of scallops that live in Alaska waters. Weathervane, the largest and the only ones commercially harvested, are difficult to farm and remain only wild-caught. Bay scallops, commonly sold live and whole, have also not been commercially produced in Alaska through mariculture. Rock scallops have the most potential for hatchery production because they readily attach to substrate and grow to marketable size in approximately three to five years.[75] Rock scallop spat can be hatchery produced. The one downside to rock scallops is their habit of cementing to hard surfaces, which can destroy gear during harvest.[76]

In 2015, four Alaska farms were permitted to raise rock scallops.[77] Alaska Sea Grant and APSH collaborated on two batches of rock scallop seed production for research purposes. A research endeavor for lantern net grow-out was successful for bay scallops. Rock scallop research is currently underway using similar techniques to grow seed to maturity.

[69] Purple-hinged rock scallops, giant rock scallops, and rock scallops all refer to the same species *Crassadoma gigantea.*
[70] http://nsgl.gso.uri.edu/aku/akug98002.pdf.
[71] http://nsgl.gso.uri.edu/aku/akug98002.pdf.
[72] https://www.st.nmfs.noaa.gov/Assets/commercial/fus/fus15/documents/02_Commercial2015.pdf.
[73] https://www.npfmc.org/wp-content/PDFdocuments/resources/SAFE/ScallopSAFE/ScallopSAFE2016.pdf.
[74] http://www.dfo-mpo.gc.ca/aquaculture/farmed-elevage/listing-eng.htm.
[75] http://alutiiqpridehatchery.com/alaska-shellfish-farming/.
[76] http://www.adfg.alaska.gov/static/fishing/PDFs/aquaticfarming/growing_shellfish_in_alaska.pdf.
[77] http://www.adfg.alaska.gov/index.cfm?adfg=fishingaquaticfarming.aquaticfarminfo_permit_status.

Sea Urchins

Fresh whole sea urchins are consumed in many countries, including Chile, Hong Kong, and Southern Europe.[78] Sea urchin 'uni' (gonads) are prized in Japan, served primarily in sushi restaurants. Urchins are sourced from many countries, including Chile, China, Mexico, Russia, and the U.S.

Sea urchin mariculture research efforts have emerged in response to overfishing in less-regulated countries. China and Chile are two of the largest commercial producers of farmed sea urchins.

All sea urchin harvests in the U.S. are by divers. In 2015, over 11.1 million pounds of wild-harvest sea urchins were landed in the U.S., worth $13.1 million.[79] California produces the most sea urchins, followed by Maine.

Three varieties of sea urchins grow in Alaska, green, purple, and red. In 2015, four farms were permitted to culture green sea urchins. One farm was permitted to culture purple and one to culture red sea urchins.[80] Due to confidentiality, the status of these efforts is not included in published data.

The red sea urchin (*Strongylocentrotus franciscanus*), the larger sea urchin species in Alaska, is the target of the state's largest urchin fishery in Southeast Alaska. A commercial fishery for green sea urchin (*Strongylocentrotus droebachiensis)* in Southeast was assessed in 1999, though a biomass survey deemed the population too small for commercial harvest.[81,82] According to available data, fisheries for sea urchins in Kodiak and other regions have opened intermittently, though no current harvests occur outside of Southeast.

Since 2012, the annual Guideline Harvest Level for sea urchins averaged 3.5 million pounds, with total harvest landed by divers at approximately 550,000 pounds. For the 2015/16 season, 12 divers participated.

Table 30. Southeast Alaska Red Sea Urchin Harvests, 2012-2017

Season	Guideline Harvest Level (lbs.)	Total Landed (lbs.)	Average Price/lb.	Ex vessel Value	Number of Divers
2012/13	3,275,300	357,679	$0.37	$133,082	8
2013/14	3,275,300	544,591	$0.47	$253,410	10
2014/15	3,310,700	634,430	$0.37	$231,758	12
2015/16	3,838,900	677,202	$0.49	$336,513	12

Source: ADF&G Commercial Fishing Division.

[78] http://nsgl.gso.uri.edu/casg/casgr05025.pdf
[79] https://www.st.nmfs.noaa.gov/Assets/commercial/fus/fus15/documents/02_Commercial2015.pdf
[80] http://www.adfg.alaska.gov/static/fishing/PDFs/aquaticfarming/2015_af_highlights.pdf
[81] http://www.adfg.alaska.gov/index.cfm?adfg=CommercialByFisheryDive.seaurchin
[82] https://www.nationalfisherman.com/alaska/market-report-alaska-sea-urchins/

Chapter 2: Alaska Mariculture Development

The state of Alaska, with over 34,000 miles of predominantly undeveloped coastline, an established seafood industry, and culture of sustainable fisheries resource management is in many respects an ideal location for development of a robust mariculture industry. In turn, new mariculture operations offer Alaska's coastal communities a chance for jobs and economic activity that is often compatible with current seafood industry-related knowledge and infrastructure.

While potential for growth is high, as reported in Chapter 1 of this report, total mariculture commercial sales (almost exclusively oysters, clams, and mussels) remain below $1 million per year with little sustained growth over the past few decades. Most mariculture activity in Alaska beyond oysters and mussels is in the research and development stage, with no other species in commercial production. The first material commercial harvest of kelp production in 2017 may mark an important mariculture milestone in an industry that has otherwise struggled to achieve its potential.

This chapter provides insight into barriers to mariculture development in Alaska, and opportunities to break down those barriers so the potential for a thriving mariculture industry in Alaska may be realized. These include barriers and opportunities related to:

- Initial entry into the Alaska mariculture industry
    - Knowledge Transfer and Information Resources
    - Access to Capital
    - Site Selection, Availability, and Access
- Operating factors
    - Seed Security
    - Infrastructure
    - Environmental Factors
    - Workforce Development
    - Access to Markets and Market Development
    - Regulatory Framework
- Research and development

The Alaska Governor's Mariculture Task Force advisory committees analyzed specific aspects of the mariculture industry to develop recommendations and priorities for the industry moving forward. The committee work is summarized and incorporated into this chapter, with complete lists of committee recommendations and priorities included in Appendix A.

Entry into the Alaska Mariculture Industry

Looking ahead, Alaska's mariculture industry may include a range of new entrants as production grows, from small and mid-sized independent businesses, to existing seafood processing companies, to industry participants from other areas, such as the Pacific Northwest, who may expand operations into Alaska. Each type of entrant may need to overcome a variety of barriers to operate in Alaska. This might include need for information on the biology, growing conditions, and factors impacting production of species; financing, site selection, and permitting; transportation and infrastructure; operating regulations; and markets.

Knowledge Transfer and Information Resources

Alaska mariculture industry participants, researchers, and policymakers have endeavored for decades to bridge barriers to successful mariculture business operation in the state. Such work has led to a wide-ranging, and still expanding, body of knowledge about species, operating models, and systems influencing mariculture operation outcomes. Such knowledge is extremely valuable for new entrants into the industry, particularly during business planning and permitting and loan application processes.

Information of interest to new entrants may include financing options, financial planning strategies, site selection parameters, gear and equipment choices and farm layout, logistics, growing and harvesting practices, labor requirements and training, marketing options, and other industry best practices. Consolidation of such information into documents accessible to new entrants and into training and professional development programs will assist with knowledge transfer important to growth of the industry.

ADVISORY COMMITTEE RECOMMENDATIONS

1. **Mariculture Industry Literature**
   Publicly available manuals that document existing information useful to starting a mariculture business in Alaska will provide a means for researchers and experienced industry professionals to share information with new entrants. Such "how-to" manuals may be species specific and some may focus on more industry-wide issues, such as the logistics of business operations in remote locations.

2. **Mariculture Professional and Business Development**
   An Alaska mariculture business development training program could help new producers apply for loans and develop business plans. The program, as currently envisioned, would include a set of training modules to develop skill sets and teach best practices to prospective operators and employees, and to enhance knowledge for those already in the industry. Such modules will build on current knowledge and materials developed by mariculture specialists in Alaska. A demonstration farm may be an effective part of this effort.

   A certificate or credential for completing such a program may be useful for farmers in attracting loans and securing leases, and when recruiting and training employees. As many mariculture operations in Alaska are located in remote areas, an online distance-learning component to the training will be necessary. Additionally, from a workforce development standpoint, such a program would support and train existing participants in the mariculture industry as well as act as a tool for recruitment of new entrants.

3. **Seafood Industry Outreach Program**
   Mariculture presents potential business diversification opportunities for Alaska seafood industry participants, including processors and hatcheries. While synergies between fishing and mariculture operations exist, information on compatible and conflicting operating conditions need to be better understood. Outreach to the seafood industry may help kindle interest in mariculture. Such outreach could be augmented by an informative map of mariculture sites and specifications as discussed below in the *Site Selection, Availability, and Access* section of this chapter.

4. **Mariculture Business Planning Tools**
   A web-based tool, or series of tools, to provide information on the existing mariculture industry, including number of farms, years of operation, species grown, farm size, region, etc. For specific farm site available to new entrants, the tool would include capability for break-even analysis planning that can be used to explore the effects of farm scale, production intensity, scope, and location on financial viability of operations. A concurrent tool could provide risk management analysis to integrate consideration of production risk (survival, growth, etc.) and financial risk (input costs, price volatility, etc.).

Access to Capital

For some species, such as mussels, capital costs associated with specialized equipment may be prohibitive for small growers. Others find it hard to secure loans for species with long grow-out periods. There is a need for realistic loan programs that offer consistent and stable funding sources suited to mariculture operations.

ADVISORY COMMITTEE RECOMMENDATIONS

1. **Investment Information**

   An information manual that may be helpful to new entrants into mariculture, as discussed above in the Knowledge Transfer section of this report, would be one that focuses on securing investment. The manual could include basic statistics, information on the regulatory process, identification and evaluation of potential funding sources, and other relevant information.

2. **Analyze and Plan for Industry Capital Needs**
   Several public sources of funding currently assist mariculture operations. These include the State of Alaska Mariculture Revolving Loan Fund, Alaska Industrial Development and Export Authority (AIDEA) programs, and U.S. Department of Agriculture (USDA) loans.

   The State revolving loan fund is currently not fully utilized, though additional, and perhaps more flexible sources of capital may also be needed as the industry grows. A first step toward understanding capital needs for a growing mariculture industry may be a closer analysis of existing programs to understand how they meet the needs of industry participants and potential entrants. Once industry needs are better understood, a combination of private and public sources of capital may be explored. Two options identified during the MTF advisory committee are private/public revolving loan funds and cooperative investment structures (see the following two recommendations for details).

3. **Private/Public Revolving Loan Funds**
   A private/public revolving loan fund program to assist with mariculture business planning and start-up costs may provide revenue needed to help new entrants access the industry at a feasible scale. Such a fund may provide a flexible source of capital that can be used in combination with more conventional sources and help borrowers leverage additional funding from private sources.

4. **Cooperative Investment Structures**
   Cooperative structures may enhance individual mariculture operations and the overall industry. This structure involves shared benefits and risks and may provide participants access to industry information and advancements, infrastructure, and markets that would otherwise be more difficult to acquire. Identified during the MTF committee process as a potential means of building financial resiliency in an emerging Alaska mariculture industry, a cooperative structure may also help counter barriers involving economies of scales, equipment needs, and selling product.[1]

Site Selection, Availability, and Access

Availability and access to suitable sites for operations is a key factor in the success of a mariculture industry. Alaska's geography and limited infrastructure present significant challenges to often remote mariculture operations, especially related to transportation, high energy costs, and access to labor and markets. Additionally, environmental conditions for product growth and harvest are important, and often site-specific, factors for operators to consider when choosing a location for operations.

When choosing a site, operators need accurate and accessible information about the site, as well as a means of analyzing site specifications relative to their operation. A clear and accessible method to secure permits and comply with regulations for the site is also necessary.

[1] The Intertribal Agriculture Council may serve as a good source for development of a mariculture cooperative in Alaska.

ADVISORY COMMITTEE RECOMMENDATIONS

Information Resources

1. **Interactive Information Map**

   The Alaska Department of Fish and Game provides resources for mariculture industry participants, including a handout on selecting a site for shellfish growers and maps with the location of existing operations. This information may be enhanced through development of an interactive map tool designed to inform site and species selection. Such a product, as currently proposed by Sea Grant, could provide information on ocean conditions, bathymetry, existing support infrastructure for processing and shipping, and other factors important to site selection. A comprehensive map of mariculture sites could also help identify research needs.

2. **Access to Data**

   Whether part of the interactive map described above, or separately, public access to an active list of environmental data currently collected at mariculture sites will be useful to mariculture industry participants and researchers. A lack of open access to environmental data hinders the ability of mariculture operators to plan, select appropriate sites, and problem-solve. DEC has been developing an open data exchange/viewing site since April 2016. If completion of this site is not feasible within DEC resources, industry may be able to establish an authorized industry-wide database or assist DEC with creating one that can provide this service.

3. **Expand Data Collection**

   Collection of physical and biological data that is currently not available may enhance site selection and mariculture operation success. Data necessary for site selection by species or production method of interest could include information to avoid areas with PSP, large wildlife populations, anadromous streams, higher freshwater influx, and other important factors for the industry. Such information could be included in online information and mapping tools as previously described in this section.

4. **Research on Biophysical Factors**

   Further research may help define and refine what data is especially important for mariculture operations. Oceanography studies of existing growing areas, in cooperation with the farmers, may help increase understanding of biophysical factors contributing to operations, such as shellfish growth rates and meat yields, as an example.

Statutes and Regulations

Aquatic farming is the only legal form of mariculture in Alaska. In addition, small scale research and ADFG projects are currently underway on stock restoration, rehabilitation, and enhancement. Legislation introduced and considered in the State legislature in 2017, though not yet passed, would have allowed for shellfish rehabilitation and enhancement. See Appendix A for a discussion of the constitutional, legal, and administrative framework for mariculture in Alaska.

Regulatory and legal hurdles create barriers for mariculture in a number of ways, as identified by the MTF advisory committees, and summarized below with recommendation for addressing the barriers.

1. **Support Commercial Shellfish Enhancement and Restoration and Continue Research**
   Mariculture enhancement and restoration projects are currently in the research phase in Alaska, as described in Chapter 1 of this report, for species such as king crab and abalone. Legislation that allows for research to progress to commercial application in the state could provide important opportunities for common property fisheries and potentially help mitigate impacts of climate change on commercially valuable crab fisheries.

2. **Account for Varied Species Grow Out Periods in Regulation**
   In current Alaska regulation, farmers must demonstrate commercial viability by year five of a lease. As some species grow to marketable size after five years, amendment of this benchmark to reflect a realistic timeline for slower growing species would make such operations more feasible.

3. **Expand Possibilities for Importation of Seed from Outside of Alaska**
   Currently, seed importation from outside of Alaska is limited to only Pacific oysters from the Pacific Northwest and weathervane scallops produced from parents taken from SE Alaska and Yakutat areas. Amendments to State regulations prohibiting important and release of live fish could allow for seed important for other species.[2]

4. **Adopt Regulations to Allow for Use of Sterile Stock or Other Species that Will Not Reproduce**
   At this point, State regulations State regulations limit the distance from the donor stock acquisition location that progeny may be grown out. Large minimum donor stock numbers to ensure genetic diversity in progeny are also required. Such genetic requirements limit wide distribution of indigenous organisms for farm stock.

   a) While indigenous stock used on farms that can reproduce naturally in those same waters may potentially impact natural production of that species locally, if triploid (sterile) stock is used, or if the species does not occur or reproduce naturally in an area, there are no genetic concerns. Adoption of regulation to clearly state that sterile stock, and species that do not occur or reproduce naturally within a significant distance of a farm growing area, are not subject to the ADF&G genetic policy would allow for use of these stocks.

   b) At times, a lack of genetic stock structure data for a species forces precautionary restrictions on transport of indigenous organisms used as mariculture seed. If a timeline for action to gain information is required in regulation when such a situation occurs, such restrictions may at times be safely lifted.

5. **Amend Regulations to Assist with Start-Up Bonding, Insurance, and Lease Fees**
   Bonding, insurance, and annual land use fees present a hurdle for mariculture operations, particularly for farms that are not yet at a stage to sell product.

   a) A mechanism or funding source to offset lease costs could be tied into aquatic farm loan programs and provide start up financing for new farmers. An amended regulation to allow for deferring a portion of fees, or for a graduated increase in lease fees, could be instituted until a site is producing.

   b) Maintenance of a consistent lease fee during a farm lease period, only changing it if necessary when the lease is renewed or transferred, would provide a more consistent business environment for operators.

   c) Farmers with demonstrated training or experience, or new farmers that locate near an established farm, might be considered for a reduced bond amount since they will be lower risk.

   d) Commercial Liability Insurance and Worker's Compensation Insurance requirements are expensive for mariculture operators. Legislation to create insurance coverage for commercial farmers or encourage broad insurance policies to be adopted by industry-sponsored groups or organizations that cover members could help provide a more cost-effective option.

[2] The MTF Regulatory Issues Advisory Committee recommends following the weathervane scallop model.

Permitting and Fees

1. **Amend Aquaculture Permit Applications to Simplify and Allow for Operations Flexibility**
   The current aquaculture permit application process is viewed as requiring excessive detail and speculative information in applications and plans. This issue, in turn, results in inflexibility for species and gear diversification during operations. A simplified application process that adheres to language in statute and regulation and requests only information with an identified purpose and need could ease this burden for operators and new applicants.

2. **Incorporate Allowances for Mariculture Training in Permit Applications**
   One reason for the oversight and stringent requirements imposed upon mariculture permit applicants is the challenge of determining if a potential operator has the knowledge and/or experience to run a mariculture operation. Agency regulations could be amended to accept industry-driven training, that includes a standardized set of skills and knowledge, as qualification.

3. **Amend the Lease Fee Structure to Account for Surface Acreage**
   In regulation, mariculture farm lease size includes the entire foot print of the farm site, including anchors and scope of lines. Such a calculation method expands lease sizes, particularly for larger farms, which increases cost per surface acre farmed and ties up additional surface area not actually being farmed. Regulations that separate actively farmed lease acreage, such as surface water footprints, from on bottom acreage needed to secure infrastructure may improve this situation.

Mariculture Operating Factors

Operating costs and logistics, environmental factors, infrastructure, workforce development, access to markets, and regulations can all present challenges to mariculture operations. Though Alaska's mariculture industry is in its early stages of development, successful operations in the state provide valuable information to help break through some barriers and grow the industry. In addition, the MTF and others have gathered industry knowledge from around the world to help inform Alaska's efforts.

Seed Security

Seed security and quality is a factor many Alaska mariculture operations struggle with due to historical fluctuations in both availability and quality, limited sources for seed, and research and development needs.

ADVISORY COMMITTEE RECOMMENDATIONS

1. **Develop Alaska-Grown Seed Capacity for the Oyster Industry**
   Systems to spawn oysters do exist in Alaska, at Alutiiq Pride Shellfish Hatchery (APSH) and OceansAlaska (OA). Funding to develop capacity to set sufficient quantities of oyster seed to satisfy Alaska demand and to provide for sales outside of Alaska, with the immediate goal being to have an in-state source of larvae, will be an important step in oyster seed security for Alaska operators.

   Also, future ability for nurseries and operators to raise smaller seed than is currently standard is of interest to the industry.

2. **Continue Research and Development of Seaweed Seed Production**
   Research is ongoing in Alaska on seed production, some next steps include determination of best practices for obtaining parent plants for seed production and researching strain selection.

3. **Develop a Source for Geoduck Seed**
   While there is currently no source for geoduck seed in Alaska, and quality of seed available in the state has reportedly varied, OceansAlaska is currently working with APSH to acquire seed and grow them to plantable size. Continued development of a source for seed will be essential to development of this industry.

Infrastructure

ADVISORY COMMITTEE RECOMMENDATIONS

Location/Partnerships

1. **Explore Efficiencies in Location of Operations**
   The concepts of cluster farms and regional processing centers may be implemented to provide methods to efficiently transport and process product.

2. **Explore Synergies with Existing Seafood Industry Infrastructure**
   Many aspects of the seafood industry, including equipment, knowledge, location, and skills, overlap with mariculture needs. As the seafood industry is well established in the state, there may be opportunities to share infrastructure for mariculture during the off-season for other seafood operations.

Nurseries

1. **Develop more efficient and low-cost oyster nursery options**
   Expansion of existing research and development efforts to establish methods and equipment to increase efficiencies in oyster nursery systems will help provide lower-cost options for mariculture operators.

Production Technology

1. **Publish and Disseminate Current Production Techniques and Technologies**
   Production technology specific to each mariculture species continues to be improved and refined, while further research and development needs continue. Dissemination of current information and continuation of research on production technology are both important factors for new entrants and existing operators in the Alaska mariculture industry.

2. **Support Production Technology Research Priorities**
   Identified production technology research includes:

   a) Strategies and best practices to reduce labor and time necessary to produce product.
   b) Improvements in production and processing methods to increase throughput.
   c) Value-added product forms, including freezing techniques to extend shelf life.
   d) Hatchery production of mussel seed.
   e) Predator control methods (see discussion below in Environmental Factors).

Environmental Factors

Environmental influences can significantly affect mariculture operations by impacting human health and/or growth conditions for product. Such impacts may translate to significant financial implications for operators.

ADVISORY COMMITTEE RECOMMENDATIONS

Paralytic Shellfish Poisoning (PSP)

PSP issues continue to cause concern in the Alaska shellfish industry. Testing for PSP is often slow and expensive, causing significant production delays as samples are sent to the DEC lab, located in Anchorage. Additionally, it is challenging for remote operators to transport water samples to the laboratory within required time and temperature constraints.

1. **Improve PSP Testing**
   A new PSP field test under development may help remedy current logistical issues with PSP testing, with research in Sitka on development of an in-field test particularly promising. Recommended improvements to the PSP testing situation include:

a) Support certification of additional private labs and testing methods in the state to facilitate ease of transport, faster results, and more cost-effective testing.

b) Support research into holding samples for depuration and certification of process.

c) Identify appropriate regions to increase spatial extent of PSP testing (e.g. Kodiak Island) to address potential for underdeveloped opportunities for shellfish farms.

d) Identify and support research to assess mechanism of PSP loading (cyst density) in mariculture species.

2. **Collect and Distribute Data on PSP in Alaska**
   Aside from testing improvements, a wider understanding of PSP occurrence and causation will assist mariculture operators. Such understanding may be accomplished through further data collection on where and when PSP occurs and research into causes. Also, establishment of a public platform to access Paralytic Shellfish Poisoning (PSP) data will provide wider understanding of this issue.

Vibrio Bacteria

Alaskan oysters can host a form of bacteria which causes gastroenteritis, and in rare cases can be fatal. The bacteria can also be carried by marine organisms such as shrimp and crabs.

1. **Research and Communicate Vibrio Bacteria Findings**
   Development of methods to monitor and mitigate Vibrio bacteria occurrences are important for human health and marketing. While methods are being developed, distribution of DEC's Vibrio plan for farmers may be useful.[3]

Other Genetic and Disease Issues

1. **Blue Mussel Research**
   Genetic and disease issues that prohibit/inhibit blue mussel growth to market size in Southeast Alaska needs to be investigated.

2. **Fecal Coliform**
   Research and develop methods to mitigate harvest disruptions due to wild animal fecal coliform in remote areas will be useful to mariculture operators.

Predation

1. **Improve Predation Protection Techniques and Technologies**
   Natural predators, including otters, sea ducks, and sea stars prey on unprotected some forms of mariculture product. Physical protections and regular monitoring are used to abate predation. However, predator protection technology may be improved and refined for situations specific to Alaska's marine environment.

Ocean Acidification

Research into the impacts of ocean acidification on shellfish spat and on ocean conditions is ongoing.[4]

1. **Monitor Ocean Conditions**

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[3] http://dec.alaska.gov/eh/fss/seafood/Shellfish_Home.html.
[4] https://seagrant.uaf.edu/map/aquaculture/shellfish/techtraining/2016/ocean-acidification-foy.pdf.

Continuation or initiation of ocean condition monitoring in all Alaska coastal regions with feasible mariculture opportunities that may be affected by ocean acidification will provide more information about this issue and help understand impacts on mariculture.

Workforce Development

Remoteness, seasonality, and lack of resources for training and professional development present difficulties for mariculture operations in attracting and maintaining high-quality labor. An increase in the number and size of mariculture operations in Alaska will require development of a cohort of skilled owners and laborers who are available for work at these often-remote sites. In addition, to grow the industry, new operators must be attracted through raising awareness about mariculture careers, without compromising existing businesses. To develop a workforce with the skills and knowledge necessary to run mariculture operations, investment in training opportunities will be important. Such workforce development may be accomplished through the following recommendations.

ADVISORY COMMITTEE RECOMMENDATIONS

1. **Establish an Alaska Mariculture Specialist Position**
   A Mariculture Specialist position could function as a point person for industry training, research, recruitment, and support of new farmers in the state. The position will require understanding needs of the industry and help direct industry-driven research to meet workforce objectives.

2. **Institute a Mariculture Workforce Development Training Program**
   This program, as described above the professional development discussion in the Knowledge Transfer section of this chapter, will help grow and educate the mariculture workforce. Additionally, a long-term apprenticeship program could provide a more in-depth understanding of the industry for potential participants and serve as a labor source for existing operations.

3. **Track and Evaluate Workforce Training Efforts**
   To improve and refine effectiveness of workforce development efforts, it will be important to track participation in training programs. Subsequent placement into mariculture-related positions and careers should also be tracked. Evaluation of programs by participants, mariculture industry owners and operators who hire trained employees, can also provide useful feedback.

4. **Raise Awareness about Mariculture Careers**
   Targeted industry career awareness efforts, including to high schools and universities, may be incorporated into mariculture public education efforts. Also, mariculture may be incorporated in STEM education.

Access to Markets and Market Development

McDowell Group research has confirmed that Alaska's unique "wild" mystique, coupled with the image of pristine Alaska waters, provides an important marketing platform for tapping a potentially large market for high-quality Alaska products. However, consistent production and reliable delivery of a high-quality product are essential in sustained market development. Reliable and efficient distribution with competitive pricing will be the biggest challenges for Alaska's mariculture industry as it seeks to profitably expand into new and larger markets.

Market development will occur at wholesale and retail levels. Wholesale markets offer the potential to sell large volumes of product, reducing the unit cost of marketing, harvesting, testing, packaging, handling, and shipping. These wholesale markets require that growers be willing to settle for lower prices than direct sales to retail buyers.

Competitive pricing will depend on efficient, cost-effective, and reliable transportation of product to buyers. The cost of shipping can represent a significant constraint on the net unit price earned by operators. For

Alaska producers, freight costs might represent one-third of the delivered cost in some out-of-state markets.

Investment in cooperative marketing programs may be required to build on Alaska's inherent brand value and generate the price premiums necessary to overcome higher costs of operating in Alaska and moving product to distant markets.

MARKET INTELLIGENCE

It is important to recognize that no single marketing strategy or market development plan can serve all the varied mariculture species or products potentially produced in Alaska. Nevertheless, further development of markets for Alaska's mariculture products must begin with a detailed understanding of potential markets, including:

- Current local, regional, domestic buyers/consumers and their specific needs
- Competing producers and competitive advantages/disadvantages
- Consumption and production trends
- Current prices and price trends
- Cost barriers associated with serving various markets

Gathering this kind of market intelligence is often beyond the resources of start-up operators. Cooperative or publicly-supported research can serve to inform new entrants and established operators alike.

ADVISORY COMMITTEE RECOMMENDATIONS

1. **Develop Downstream Market Support**
   Continued engagement with ASMI will be very important in evaluating new products/species marketing strategies to fit within the broader Alaska seafood market.

2. **Conduct Market and Product Research**
   Outlook and trends for product prices and demand for Alaskan mariculture products will help inform marketing plans.

Regulatory Framework

Many mariculture operators report the Alaska regulatory environment has improved over recent years, though the process can still be laborious and has reportedly significantly impacted profits margins for some operations, particularly small ones.

1. **Ensure Sufficient Bonding to Adequately Clean Up Abandoned Sites**
   State statutes require bonds to pay for potential defaulted lease fees on mariculture sites and cleanup for sites if abandoned by a leaseholder. The current minimum bond amount is not adequate surety to clean up sites.

   a) Legislation that would create a bond pool to be utilized for cleanup of abandoned site and pay default fees could, if adequately funded, provide adequate coverage for site clean-up and potentially reduce individual bond requirements.

   b) Create legal authority for agreements with other operators to clean up a defaulted site. Incentives for successful site restoration could include site security bonds from the defaulted site, and the site gear and inventory.

2. **Establish Representation for the Mariculture Industry**
   Currently, no entity is authorized to representative mariculture operators and the industry. An entity established, through legislation, to represent the industry could coordinate outreach within the industry and interaction with regulatory agencies and marketing bodies.

Research and Development

The MTF Research, Development, and Environmental Information Advisory Committee developed a list of near-term priorities for mariculture in Alaska. Many of these priorities are discussed throughout this chapter, and they are provided in detail in Appendix A. The committee's work is summarized in this section as well.

Current Species

OYSTERS, PACIFIC

1. **Research focused on oyster spawning in Alaska**
    a) Develop capacity to spawn oysters in Alaska.
    b) Research and develop methods and ability to buffer incoming seawater with calcium aragonite (a form of CaCO3).
    c) Develop region specific broodstock breeding program.

2. **Research focused on oyster larvae setting and growth to nursery size in Alaska.**
    a) Develop capacity to set sufficient quantities of oyster seed to satisfy Alaska growers' demand and to provide for sales outside of Alaska.

    Alaska Sea Grant submitted a grant proposal to NOAA to support further development of oyster larvae setting capacity and best practices and researching b, c, d, and e below.

    b) Research efficacy of seed fluidizers.
    c) Research live feed vs. commercially available algae concentrate.
    d) Research and develop methods to combat colonial ciliates in the hatchery.
    e) Research comparison of differing sea water filtering systems.
    f) Compare growth rates and survival of over wintered oyster seed to farm market size vs. newly set oysters.
    g) Determine economic viability of shellfish hatcheries.

3. **Research focused on oyster nursery stage**
    a) Research and develop low cost nursery options for farmers.
    b) Research and develop methods and equipment to increase efficiencies of nursery systems.
    c) Develop and disseminate ability for nurseries and farmers to successfully raise smaller seed than is currently standard.

4. **Research focused on oyster farms**
    a) Develop improvements in production technology.
    b) Research and develop value added products aimed at export markets.

MUSSELS, BLUE

1. **Identify genetic and disease issues that prohibit/inhibit the growing of blue mussels to market size in Southeast Alaska.**

2. **Continue research on production technology.**
    a) Publish and disseminate current production techniques already researched in Alaska.
    b) Develop hatchery production of mussel seed.
    c) Develop predator control methods.

3. **Develop frozen product form and other value-added products and methods.**

4. **Develop improvements in production and processing methods to increase throughput.**

SEAWEED

1. **Research the population genetics of seaweeds of current and future commercial importance to better understand how seaweed farms might affect the natural populations.**
   a) Priorities should be the population genetics of *Saccharina latissima* and *Alaria marginata* especially in the areas along the Gulf of Alaska.

2. **Research to determine the best practices for obtaining parent plants for seed production.**
   a) Research on collecting parent seed stock from natural populations.
   b) Research on using parent seed stock from maricultured outplants.
   c) ADF&G ongoing genetic research will partly address some of these issues.

3. **Research on strain selection.**
   a) Currently this can only be done as non-commercial research with limitations on outplanting select strains.

4. **Market and product research for sugar and ribbon kelp**

5. **Research on hatchery optimization for large scale production of seeded string**

6. **Research needed on optimal timing of outplanting and harvest (at different sites in Alaska).**

7. **Research on the optimal conditions for growth (depth of outplant, nutrients, temperature, light, salinity, current).**

8. **Site selection research.**

9. **Oceanographic monitoring at existing growing sites, including nitrogen, phosphate, salinity, temperature, turbidity and currents.**

KING CRAB

While legislative changes are attempted to allow for commercial application of shellfish enhancement and restoration, research may proceed. In part, such research may occur through the priorities developed by the Alaska King Crab Research Rehabilitation and Biology Program (see Appendix A for detailed priorities).

1. **Refine rearing protocols for red and blue king crab.**
   a) Optimize rearing conditions and hatchery techniques to both improve survival rates and reduce production costs.
   b) Optimize rearing conditions and hatchery techniques to reduce behavioral, morphological, and physiological differences between hatchery and wild crabs to minimize potential competitive interactions with future outplanting.

2. **Understand the behavioral, morphological, and physiological differences between hatchery-reared and wild juvenile king crab and potential competitive interactions.**
   a) Determine if morphological and behavioral differences are present between hatchery-reared and wild king crab juveniles and identify any potential competitive interactions or advantages.
   b) Continue to compare bioenergetics of hatchery-reared and wild king crab juveniles to understand health and energy allocation and identify any potential competitive interactions or advantages.

3. **Determine optimal nursery habitats to maximize growth and survival of juvenile king crab in both the hatchery and once outplanted.**

a) Identify the habitat requirements of juvenile king crab through their first year of life, including foraging, structural, and biological habitat attributes, as well as ontogenetic shifts, with continued laboratory and field studies.
b) Develop best practices for transporting large numbers of juvenile king crab to remote sites without incurring high mortalities or harming their health.

4. **Assess likelihood of outplanting success based on biological and environmental interactions. Transport to and successfully maintain live juveniles in a shore-based facility in the Pribilof Islands.**
   a) Conduct tethering experiments in the Pribilof Islands to assess optimal habitats, crab size, relative predation and seasonal conditions for outplanting success.
   b) Quantify predation pressure at potential release sites in the Pribilof Islands and during experimental releases in Kodiak.
   c) Survey habitat, environment, and juvenile red and blue king crab density at potential release sites in the Pribilof Islands.
   d) Monitor predation, prey availability, and competitive interactions before and after controlled release events and evaluate predator control devices.

5. **Investigate fate of hatchery-produced juvenile king crab during release experiments.**
   a) Design and test in the lab, nursery structures that may provide an artificial habitat to reduce initial mortality upon release for hatchery-produced juvenile king crab in the marine environment.
   b) Continue to assess the behavior and marine survival of hatchery-produced juvenile king crab released into the wild at sites with appropriate habitat near Kodiak Island.
   c) Investigate larger controlled releases (~100,000 juveniles per site) to evaluate if crabs can be rehabilitated on an embayment scale in Kodiak.
   d) Assess the behavior and marine survival of hatchery-produced juvenile king crab released into the wild at sites with appropriate habitat near the Pribilof Islands.

6. **Project operational costs for producing juvenile red and blue king crab for enhancing depressed wild crab stocks, including hatchery, nursery, and stocking phases.**
   a) Continue to document hatchery operational costs from acquiring broodstock through production of C3 juveniles.
   b) Develop and publish cost projections for the culture of C3 juveniles for different survival rates and levels of production.
   c) Develop and publish projected costs of operating various stocking and nursery projects.

7. **Determine funding mechanisms and identify any potential changes in state law and regulations necessary to allow crab harvesters and/or coastal communities to conduct king crab rehabilitation activities.**

   a) Work with legislators and state agencies to research the potential legal framework for crab harvesters or coastal communities to form an association, such as a private-nonprofit corporation, to conduct rehabilitation activities.
   b) Work with legislators and state agencies to research the following: Who will pay? What changes to state law are necessary to provide for a voluntary assessment similar to the salmon rehabilitation program? Is it possible to have cost recovery harvests of enhanced king crab to offset costs? If so, what changes in statutes are necessary?
   c) Begin implementation of any necessary changes in law and policy.
   d) Legislation defining enhancement management processes was introduced but not passed in 2016 and 2017.

8. **Work with potential user groups to develop preliminary collaborations with community and/or industry groups interested in forming rehabilitation associations.**

New Species

The industry may benefit from identification of new species that present potential economic opportunity in Alaska based on previous studies or successful mariculture in other regions and encouragement of private and public research and development.

Industry-Wide Research and Development

In addition to research to address specific barriers or take advantage of opportunities in Alaska mariculture, there is also an identified need for industry-wide research to inform and grow the industry in the state.[5]

ENVIRONMENTAL DATA COLLECTION

Bivalves and Public Health Issues

1. **Research and develop methods to monitor and mitigate Vibrio P. and harvest disruptions due to wild animal fecal coliform.**

2. **Develop low-cost PSP testing methods and a public platform to access Paralytic Shellfish Poisoning (PSP) data, including occurrence of PSP and causation in Alaskan waters.**

3. **Identify appropriate regions to increase spatial extent of PSP testing (e.g. Kodiak Island) to address potential for underdeveloped opportunities for shellfish farms.**

Site selection and site-specific measurements

1. **Develop prioritized physical and biological data collection necessary for site selection and operation by species or method of interest.**

2. **Conduct basic oceanography studies of existing growing areas in cooperation with farmers to understand biophysical factors contributing to shellfish growth rates and meat yields.**

3. **Identify and support research to assess mechanism of PSP loading in different species.**

Regional Measurements

1. **Develop prioritized physical and biological data collection necessary to provide regional and seasonal information to assist with farm or enhancement operations.**
    a) Include an active list of data currently being monitored at each site and work with regional groups (e.g. AOOS) to host a database and website for public data access.

2. **Develop or maintain carbonate chemistry monitoring in all coastal regions with feasible mariculture opportunities that may be affected by ocean acidification.**

ECONOMIC DATA AND PARTNERSHIPS

1. **Develop mariculture business planning tools.**
   Development of a web-based break-even analysis and risk management planning tools can assist operators and those considering entry into the industry.

2. **Create regional and social impact models.**
   Development of regional and social impact models to highlight the role of mariculture operations in local and regional economies, including employment and income impacts, will help identify the importance of mariculture and to increase awareness of the industry.

3. **Identify management strategies.**

[5] Recommendations in this section come from both the Investment and Infrastructure and the Research Advisory Committees.

A need for research to identify strategies for production and price risk has been identified.

4. **Explore horizontal and vertical integration.**
   Horizontal and vertical integration or coordination studies may illuminate these strategies as mechanisms for developing stronger markets, reducing input factor costs, and mitigating risk in the mariculture industry.

5. **Encourage industry partnerships.**
   Partnerships with state and local governments, industry, Alaska Native tribes, Community Development Quota organizations, NGOs, and communities can help leverage local expertise, knowledge, and funding sources for growing the mariculture industry. Following examples of other countries that have developed a successful mariculture industry, an appointed lead organization tasked with coordinating private, public, and governmental relationships can be critical in carrying industry strategies forward. Such strategies would likely include the comprehensive plan developed by the Mariculture Task Force.

6. **Continue to learn from mariculture industries around the world.**
   Alaska mariculture industry participant and policymaker tours to other areas around the world may help provide lessons learned from mariculture businesses that may be applied in Alaska. Information sharing in the early stages of mariculture development between existing growers and potential investors, both in-state and externally, may also play an important role in the efficient growth of the industry.

EDUCATION TO PROMOTION OF REGIONAL SCALE OPPORTUNITIES

1. **Identify educational opportunities in coastal communities.**

2. **Identify and develop workshops on mariculture opportunities and provide training opportunities in multiple aspects of farms or enhancement operations.**

3. **Develop demonstration farms for seaweed and shellfish mariculture.**

4. **Identify mechanisms for technology transfer to interested entities.**

5. **Integrate mariculture into STEM education.**

Appendix A

This appendix contains notes and recommendations by each of the MTF advisory committees. The following documents are included in this section.

- Regulatory and Legal Framework of Mariculture in Alaska (authored by Regulatory Advisory Committee)
- Regulatory Issues Advisory Committee Recommendations
- Investment and Infrastructure Advisory Committee Recommendations
- Research, Development and Environmental Information Committee Recommendations
- Workforce Development Advisory Committee Recommendations

Regulatory Legal Framework of Mariculture in Alaska

Constitution

Alaska is a common property resource state and the Alaska Constitution includes provisions relating to common use. Most tide and submerged lands within Alaska's 40,000 miles of coastline are a common property resource managed upon multiple use principals and sustained yield requirements. The State of Alaska Constitution requires resource decisions to be vetted thru a public process and noticed for public input to balance resource management decisions with the best interests of the State of Alaska. Management of replenishable resources for sustained yield is enshrined in Article 8, Section 4, of the constitution. Article 8, Section 15, specifically prohibits exclusive right of fishery; however, this section was amended in 1972 to provide exemptions for the state to both limit entry into fisheries for conservation and economic reasons, and to provide for the efficient development of aquaculture in Alaska. Article 8 also provides for the use of state lands and waters, with certain assurances, in Sections 8 and 14. Article 7 requires that the legislature provide for the promotion and protection of the public's health.

Statute

Several statutes have been approved by the Alaska Legislature that provide for mariculture activities in the State. The fisheries rehabilitation, enhancement and development statute (AS 16.05.092) went into effect in 1971, directing the Alaska Department of Fish and Game (ADFG), in part, to encourage private investment in the development and economic utilization of fisheries resources, and through rehabilitation, enhancement and development programs, do all things necessary to ensure perpetual and increasing production and use of the aquatic resources of the state.

The Aquatic Farm Act (Section 19, Chapter 145, SLA 1988) was signed into law on June 8, 1988, authorizing the Commissioner of ADFG to issue permits for the construction or operation of aquatic farms, and hatcheries to supply aquatic plants or shellfish to aquatic farms (AS 16.40.100 - 199). The intent was to create an industry that would contribute to the state's economy and strengthen the competitiveness of Alaska seafood in the world marketplace, broadening the diversity of products and providing year-round supplies of premium quality seafood. The law limited aquatic farming to shellfish and aquatic plants and in 1990 CSHB 432 became law, prohibiting farming of finfish in the state (AS 16.40.210).

Statute also authorizes Alaska Department of Natural Resources (DNR) to make land and water available through lease for aquatic farming subject to bonding or other security (AS 38.05.083). All lease applications and proposed decisions are required to be noticed for public comment per AS 38.05.945 before a final decision is rendered by DNR.

Statutes that direct the Alaska Department of Environmental Conservation (DEC) to provide for food safety are found in the Alaska Food, Drug, and Cosmetic Act in AS 17.20.

There is currently no statutory authorization to issue permits for shellfish rehabilitation and enhancement projects, however, bills were introduced in 2016 and again in 2017 to achieve this.

Administration of the Alaska Aquatic Farm Program

Three State agencies jointly administered the Alaska Aquatic Farm Program: the Department of Natural Resources (DNR), the Alaska Department of Fish and Game (ADFG), and the Department of Environmental Conservation (DEC). Each of these state agencies has a specific role in authorizing and managing aquatic farm activities within Alaska.

The DNR authorizes the use of tide and submerged land and seeks to balance use of the land for the development of aquatic farming with traditional uses of the area, upland owner access, public access, and navigation of public waters as required under Article VIII of the Alaska State Constitution. The department is required to balance disposal of interest (lease) decisions with traditional and existing uses within a given area to ensure proposed farm sites are compatible. If approved, leases authorize a specific footprint and infrastructure to remain on state land to support aquatic farming activities. DNR is required to charge no less than appraised fair market value for lease fees which require annual land use fees. Lease holders are also required to post a bond to cover the costs to the department of restoring leased sites in the event the site is abandoned. Other requirements include providing proof of commercial liability insurance and meeting the commercial use requirements outlined within 11 AAC 63.030(b) within five years of lease issuance. DNR aquatic farm regulatory guidance is contained in 11 AAC 63.010 – 050.

The ADFG issues permits for the operation of aquatic farms and aquatic farm hatcheries, acquisition of stock, and transport of seed and aquatic farm products; certifies and permits seed coming into the state and transported within state for aquatic farming, ensures aquatic farming does not significantly alter established fishery or other existing uses of resources, does not significantly affect fisheries, wildlife or their habitats in an adverse manner, and determines wild stock populations prior to permitting aquatic farm species. ADFG employs the "precautionary principle" when authorizing use of resources to ensure sustained natural productivity of common property resources. Specific ADFG aquatic farm regulatory guidance is contained in 5 AAC 41.001 – 400.

To protect human health, the DEC classifies growing areas, issues permits, conducts inspections, investigates complaints, conducts outreach and training, and monitors bacteria and toxins in shellfish harvest areas (growing waters) and shellfish products. Primarily, two programs within DEC are involved: the Food Safety and Sanitation program (FSS), the state's Shellfish Sanitation Authority, and the Environmental Health Laboratory (EHL), which provides the FSS program analytical support to carry out its responsibilities. DEC regulates the shellfish industry through adoption by reference at 18 AAC 34 of a document called the National Shellfish Sanitation Program Model Ordinance (NSSP MO). The NSSP MO specifies sanitation requirements for harvesters, dealers, and shucker/packers and outlines State regulatory program requirements so that shellfish grown and harvested in Alaska may be sold interstate.

Regulatory Issues Advisory Committee Recommendations

The table below presents the Regulatory Issues Advisory Committee's recommendations to address regulatory challenges to mariculture in Alaska. These recommendations were identified through broad participation with farmers, industry representatives and state agencies, and are organized by priority groupings of 1) Near Term needs; 2) Intermediate Term needs; and 3) Long Term needs. Many of these suggestions require legislation, funding, or both. These nonbinding recommendations are offered to the Mariculture Task Force for consideration and do not commit any industry representative or agency to additional action beyond these recommendations.

Agency	Regulatory Issue	Recommendation	Priority
ADFG	Shellfish stock restoration, rehabilitation, and enhancement projects are not legal in Alaska, other than for small scale research or for ADF&G projects.	Pass legislation creating authority to issue permits for this type of activity (2016 HB300/SB172; 2017 HB128/SB89)	1
ADFG	Importation of seed from outside of Alaska is limited to only Pacific Oysters from the pacific Northwest, and to Weathervane Scallops produced from parents taken from SE Alaska and Yakutat areas.	Amend regulation (5 AAC 41.070 Prohibitions on importation and release of live fish) to allow for other species using the weathervane scallop model.	2
ADFG	Genetic requirements are restrictive and limit wide distribution of indigenous organisms for farm stock. These requirements include limitations on the distance from the donor stock acquisition location that progeny may be grown out at, and large minimum donor stock numbers to ensure genetic diversity in progeny.	A) Indigenous stock used on farms that can reproduce naturally in those same waters may potentially impact natural production of that species locally. However, if triploid (sterile) stock is used, or if the species does not occur or reproduce naturally in an area, there are no genetic concerns. Adopt regulation to clearly state that sterile stock, and species that do not occur or reproduce naturally within some significant distance of the farm growing area, are not subject to the ADF&G genetic policy.	2
		B) Adopt regulation to require a timeline for action to gain information when a lack of genetic stock structure data for a species forces precautionary restrictions on transport of indigenous organisms used as mariculture seed.	2
ADFG	Aquatic (wild) stock acquisition is limited to only *initial needs* in Statute (AS 16.40.120(f)(1)) and regulation (5 AAC 41.290(b) and (d)).	Donor stock of indigenous species may need to be collected on a continual basis to propagate and produce seedstock for aquatic farms and nurseries and for growout of natural set on farmsites. Amend the statute and regulations to remove the word "initial".	3
ADFG	Requiring excessive detail and speculative information on applications and plans, and inflexibility to species and gear diversification in real time.	Adhere to the actual language in statute and regulation to avoid "over reach". Any information requested should have an identified purpose and need. Additional requirements or restrictions should be promulgated through statutory and regulatory change processes rather than personal interpretations.	1
DNR	Bonding, insurance, and annual land use fees are challenging for farmers to pay, especially new farmers not selling product yet.	Establish a mechanism or funding source to offset lease costs. This could be tied into aquatic farm loan programs and provide start up financing for new farmers. Amend regulation to allow for deferring a portion of fees, or for a graduated increase in lease fees, until farm site is producing.	1

Agency	Regulatory Issue	Recommendation	Priority
DNR		B) Farmers with demonstrated training or experience working a farm, or new farmers that locate near an established farm, should be considered for a reduced bond amount since they will be lower risk.	2
		C) Adopt industry sponsored training or best practice standards to ensure new farmers understand aquatic farm site selection, husbandry practices, marketing and financial planning requirements. This may increase success of the new farmer but may not remove bonding requirements.	3
DNR	DNR statute AS 38.05.083(e) & regulation 11 AAC 63.080 require bonds to pay any defaulted lease fees and cleanup a site if abandoned by the leaseholder. The minimum bond amount of $2500 is not adequate surety to clean up sites.	A) Pass legislation to create a bond pool which could be utilized to cleanup abandoned farms and pay default fees. A bond pool could reduce individual bond requirements if it were adequately funded.	2
		B) Obtain legal authority to enter into agreement with another farmer(s) to clean up a defaulted farmsite, incentivized by offering the defaulted farms security bond, gear and inventory as compensation upon successful restoration of the defaulted farmsite.	2
DNR	Commercial Liability Insurance and Worker's Compensation Insurance requirements are expensive for farmers.	Pass legislation to create insurance coverage for commercial farmers or encourage broad insurance policies to be adopted by industry sponsored groups or organizations that cover its members.	2
DNR	The commercial use requirement (11 AAC 63.030(b) is a low benchmark for farmers to demonstrate their farms commercial viability by year 5 of a lease. This benchmark does not work for all species.	Amend 11 AAC 63.030(b) to consider a longer term for farms producing only slow growing species such as geoduck and a shorter term for farms producing only fast-growing species such as seaweed.	1
DNR	Lease size is required to encompass the entire foot print of the farm site including anchors and scope of lines. This expands lease size substantially for larger farmers which increases cost per surface acre farmed and ties up additional surface area not actually being farmed.	Amend regulations to separate actively farmed lease acreage, such as surface water footprints, from the on-bottom acreage needed to secure infrastructure such as the anchors, lines and scope for purposes of calculating the lease fee.	2
DNR	Escalating lease fees during the lease period makes it difficult to plan the operations/expenses of the farm.	Only change the lease fee when the lease is renewed or transferred. Do not change the lease fee during the effective period of the lease.	1
DEC	There is a lack of open access to collected and reported environmental data. Farmers, and others, need open access to this data to conduct individual analysis and to assist DEC and others conducting problem-solving efforts.	Make the data visible, or if it is not utilized and stored, do not require that it be collected and submitted. DEC has been working towards providing for an open data exchange/viewing site since April of 2016. If this is not feasible within DECs resources, allow industry to establish an authorized industry-wide database or assist DEC with creating one that can provide this service.	1
DEC	Growing water sampling and PSP testing is slow and expensive. It is extremely challenging for many farmers to transport water samples to the DEC laboratory in Anchorage within the time and temperature constraints required.	Support certification of additional private labs and testing methods to facilitate ease of transport, faster results and more cost-effective testing.	1

Agency	Regulatory Issue	Recommendation	Priority
DEC		Support research into holding for depuration and certification of process.	2
All	Communication is not organized to reach all farmers and industry representatives. There is no authorized body representative of farmers and industry to work with agencies in drafting and implementing rules and regulations.	Pass legislation to establish a comprehensive board or group to represent farmers and industry in interactions with regulatory agencies.	2
All	There is a seemingly adversarial role by some regulators towards mariculture. Recognizing that departments operate within many strict guidelines, regulations, statutes, and manpower and fiscal constraints, and that many of those are necessary to protect the public, there is an impression that some individual regulators tend to interpret guidance more stringently than is required or was intended, or that enforcement of a flawed rule or regulation is easier than seeking a beneficial solution.	Direct regulatory agencies to adopt an advocacy approach to the mariculture industry for the benefit of the State. Regulators should seek to make improvements to bureaucratic rules and regulations that needlessly impede the growth of the industry while still fulfilling their responsibilities to protect the people and resources of the state.	1
All	There is no assurance to the State that an aquatic farmer is qualified or capable. Regulatory agencies have a responsibility to the people of the State to ensure that resources are used wisely. One reason for the oversight and stringent requirements imposed upon aquatic farmers by the State is that there is no way to determine if a farmer has the knowledge and/or experience to operate a farm.	Amend agency regulations to provide for acceptance of industry-driven training as qualification. Aquatic farmers are currently developing a series of training and accreditation efforts that will provide a better trained workforce and better, more knowledgeable, farmers/operators who will have standardized skills and knowledge, as a minimum. When this program is fully developed and implemented, this accreditation/certification should be accepted and used by state agencies to demonstrate an applicant has the knowledge and skill sets required to work on, or operate, a successful farm. This should be considered an endorsement for favorable consideration of the farmers aquatic farm permit application, lower bonds, initially smaller lease rates, loan guarantees, etc.	3

Investment & Infrastructure Committee Recommendations

Infrastructure

RECOMMENDATION 1

Develop an interactive map tool and/or fact sheet to help inform site and species selection. (Near-term)

The I/I AC understands that there is a Sea Grant proposal to begin a regional mapping project and that the first phase of the project may begin in 2017. The AC committee supports this project and has discussed that the lack of a cohesive and accessible site containing information on issues such as; ocean conditions, bathymetry and existing support infrastructure for processing and shipping has created significant barriers for potential investors to adequately select sites and formulate business plans. A mapping tool will alleviate some of these limitations, while highlighting remaining research gaps and potential future inputs as they become available.

RECOMMENDATION 2

Develop a seafood processor/salmon hatchery outreach program to inform existing infrastructure owners of potential mariculture and business diversification opportunities. (Mid-term)

Alaska's seafood operators have had to surpass significant challenges with remoteness, transportation, high energy costs and labor. An emerging mariculture industry will face similar challenges and will benefit from extracting lessons learned and building partnerships with existing operators. Numerous seafood processors throughout the state have expressed interest in exploring diversification opportunities through mariculture development. Many potential synergies exist, but information on compatible and potential conflicting conditions need to be better understood. This outreach program would likely follow the completion of the mapping project. The existing expertise of salmon hatcheries could lend well to mariculture seed production and operations.

RECOMMENDATION 3

Explore potential frameworks and regulatory mechanisms for funding hatchery operations.

These could include voluntary assessments, marketing tax, value-added tax, fish tax, etc. Reference to the language in HB 128 (allowing a mechanism for self -assessment), as well as HB 76 (allowing non-profits to assess) should be included in the plan.

Investment

RECOMMENDATION 1

Support amendments to the Mariculture Revolving Loan fund to include hatchery eligibility. Encourage opportunities for increased support and funding of hatchery development. (Near-term)

Under the leadership of AFDF, AC and MTF members have advocated for advancing legislation to amend the mariculture revolving loan fund during the 2017/8 legislative session. The I/I AC believes that legislation is needed to allow for fuller utilization of the existing mariculture revolving loan fund and to fill an important funding gap for hatcheries. The committee also believes that there should be a continued effort to align industry needs with private and public funding opportunities.

RECOMMENDATION 2

Support shellfish enhancement enabling legislation. (Near-term)

As with the revolving loan fund legislation, AC and MTF members have been advocating for legislation that would provide a regulatory framework for shellfish enhancement and restoration efforts. This legislation is critical in advancing the AKCRRAB program out of research phase and into implementation. Future enhancement projects could provide important opportunities for common property fisheries and potentially help mitigate impacts of climate change on commercially valuable crab fisheries. The I/I AC believes this legislation will be key to advancing a successful mariculture industry.

RECOMMENDATION 3

Develop an investment package that includes -basic statistics, information on the regulatory process, funding sources etc. (Near-term)

The I/I AC has evaluated various public and private programs applicable to mariculture development in Alaska. The committee feels it would be helpful to create a tool for potential investors that identifies these sources, along with other information that would be pertinent to the development of a business plan.

RECOMMENDATION 4

Promote cooperative investment structures (Long-term)

Cooperative structures are designed to provide member level benefits that may be reflected on a social, cultural and/or economic level. Coops typically offer their members a wide variety of benefits such as access to markets, shared information on technological advancements and efficiencies, shared risk, innovation, common facilities, etc. This type of structure could help build the financial resiliency of an emerging mariculture industry and may be an important component to consider in establishing economies of scales, collective purchasing and in developing selling strength. The committee discussed that the Intertribal Agriculture Council may be a good resource to assist in developing a model for Alaska.

The work product coming out of this recommendation should be a compilation of information related the logistical formation of a coop, available resources and an assessment of relevant existing models. Items specifically mentioned for inclusion:

- Legal entity required for membership
- Antitrust issues

RECOMMENDATION 5

Explore the potential to seed a private/public revolving loan fund program for mariculture planning purposes and start-up costs. Prioritize options to seed additional funding into existing funds. (Mid-term)

Revolving loan funds provide access to a flexible source of capital that can be used in combination with more conventional sources. While the state's revolving loan fund is not presently being fully utilized, the anticipated growth of the industry may quickly surpass the amount of support that the fund provides. A complimentary revolving fund could provide an important bridge for new borrowers trying to leverage private sources. The fund could be initially capitalized through economic development organizations, federal grant programs or local governments.

The committee believes it important to note that prior to the creation of a new loan program, existing programs should be analyzed for their ability to meet the needs of industry participants and evaluated for potential expansion.

RECOMMENDATION 6

Develop a business development training program, which dovetails with workforce development, to help new producers successfully apply for loans and develop business plans. (Mid-term)

The I/I AC discussed the challenges that new entrants faced in developing the business plans required of most lending agencies. The group discussed the value of training opportunities catered specifically to producing and understanding financial projections.

The committee noted that it is important to integrate any new program with technical workforce training and that business and accounting training needs to be catered specifically to mariculture as opposed to a more general farming training which may have limited applicability to the unique circumstances of the industry. Committee members mentioned a specific challenge regarding mariculture related accounting for capitalizing labor on balance sheets.

RECOMMENDATION 7

Facilitate partnerships with state and local governments, industry, Alaska Native tribes, Community Development Quota organizations, NGOs and communities. Identify a dedicated lead organization. (Mid-term)

Developing strategic partnerships will help leverage local expertise, knowledge and funding sources.

The committee discussed that other countries that have developed a successful mariculture industry have identified a lead organization that is tasked with coordinating private, public and governmental relationships. These organizations have been critical in carrying strategy forward. At this point, it is unclear who will be charged with implementing the MTF's recommendations. The committee discussed that if this entity was a government agency, it should be one not conflicted with trying to manage as well as advocate. The group also discussed that a logical choice would be AFDF.

RECOMMENDATION 8

Include in the comprehensive plan, a statement of commitment from the State of Alaska expressing support for sustainable mariculture growth and defining its role in helping industry to development and invest. (Near-term)

The AC discussed how the success of the industry is dependent on the state's continued commitment to provide sufficient funding to agencies that are critical to regulating and supporting mariculture efforts. The AC also discussed that that it may be important for the state to reinforce its position on mariculture as a form of agriculture for the purposes of leveraging USDA funds. The committee discussed the value in trying to define an appropriate role for government in the development of the industry.

RECOMMENDATION 9

Support Alaska delegation tours to share and extract lessons learned from mariculture operations and businesses from around the globe. (Mid-term)

Information sharing in the early stages of mariculture development between existing growers and potential investors, both in-state and externally, will play an important role in the efficient growth of the industry.

RECOMMENDATION 10

Develop a fact sheet on survival and growth rates of various mariculture species. (Long-term)

AC members from out of state discussed that the general lack of information on growth rates, survival and predation presented a significant impediment to their ability to develop business plans for investing in Alaska. The committee discussed how some information on growth rates may be available from ADFG and that a comprehensive product may necessitate a willingness from existing operators to share their experience and knowledge base. These types of inputs may be appropriate for a subsequent phase of the interactive mapping project. Region specific information is critical.

RECOMMENDATION 11

Develop downstream market support.

The committee discussed the unknowns of future marketing components, particularly for aquatic plants, and that continued engagement with ASMI will be very important.

RECOMMENDATION 12

Following the development of the comprehensive plan, coordinate conversations with federal representatives to ensure alignment of state and federal priorities.

For example, the new NOAA administrator publicly expressed interest in reducing the US' seafood trade deficit. The committee discussed the importance of aligning federal initiatives with Alaska's mariculture opportunities.

Research, Development and Environmental Information Committee Recommendations

Near term priorities are defined as priorities for species of immediate interest (1-2 years) for mariculture in Alaska along with specific issues that need to be addressed to create a viable commercial enterprise for each species. For an overview of the near, intermediate, and long-term priorities for mariculture in Alaska see the document entitled Existing Research and Future Needs for Alaska Mariculture.

Pacific Oysters

1. Research focused on oyster spawning in Alaska
    a. Develop capacity to spawn oysters in Alaska
    Physical systems to spawn exist at Alutiiq Pride Shellfish Hatchery (APSH) and OceansAlaska (OA); access to certified broodstock; currently conditioning broodstock at OceansAlaska; proposed partnership with Alaska Sea Grant (ASG) for funding to initiate spawning on more than a test basis. Note: Seed from certified broodstock that is permitted to be imported into Washington and California has much larger demand than seed only permitted for planting in state. Some farms in Pacific Northwest value a completely independent source of oyster seed.
    b. Research and develop methods and ability to buffer incoming seawater with calcium aragonite (a form of $CaCO_3$).
    Buffering seawater into culture tanks with sodium carbonate is current practice at OceansAlaska. However, drip concentration is adjusted by measuring pH. Direct measurement of calcium aragonite concentration will lead to more accurate buffering data and practice.
    c. Develop region specific broodstock breeding program.
    Spawning of Alaska broodstock can lead in small steps toward a simple breeding program. The immediate goal is to have an in-state source of larvae and to start discussion of breeding program genetic.

2. Research focused on oyster larvae setting and growth to nursery size in Alaska.
    a. Develop capacity to set sufficient quantities of oyster seed to satisfy Alaska growers demand and to provide for sales outside of Alaska.
        - This is currently underway at OceansAlaska and there is recently some interest in additional private setting facilities.
        - Alaska Sea Grant has submitted a grant proposal to NOAA to support further development of oyster larvae setting capacity and best practices and researching b, c, d and e below.
    b. Research efficacy of seed fluidizers.
    c. Research live feed vs. commercially available algae concentrate.
    d. Research and develop methods to combat colonial ciliates in the hatchery.
    Basic experimentation with chlorine and ascorbic acid to combat ciliates at OceansAlaska.

e. Research comparison of differing sea water filtering systems.
f. Compare growth rates and survival of over wintered oyster seed to farm market size vs. newly set oysters.
g. Determine economic viability of shellfish hatcheries.
British Columbia Shellfish Aquaculture Industry did a hatchery feasibility report on this topic: https://www2.viu.ca/csr/documents/HatcheryFeasibilityReport080606CSR_002.pdf.

3. Research focused on oyster nursery stage
    a. Research and develop low cost nursery options for farmers.
    Some work on this has already been developed at OceansAlaska with fish tote based upwellers.
    b. Research and develop methods and equipment to increase efficiencies of nursery systems. Successful private efforts (namely Jim Aguiar) in the past centered around floating upweller systems (FLUPSYs) and collaboration with Alaska Sea Grant to some degree on this.
    c. Develop and disseminate ability for nurseries and farmers to successfully raise smaller seed than is currently standard.
    Private efforts have been underway, but nothing seems definitive.

4. Research focused on oyster farms
    a. Develop improvements in production technology.
        - Identify strategies and best practices to reduce the cost of labor and time to produce aquatic farm product.
        - Alaska Sea Grant efforts in the past; mostly private efforts with info sometimes shared at Alaska Shellfish Growers Association annual meeting.
    b. Research and develop value added products aimed at export markets.
    Some work on TVO (top valve off) frozen oysters done by Alaska Sea Grant/Fishery Industrial Technology Center (renamed as the Kodiak Seafood and Marine Science Center).

Blue Mussels

1. Identify genetic and disease issues that prohibit/inhibit the growing of blue mussels to market size in Southeast Alaska.

2. Continue research on production technology.
    a. Publish and disseminate current production techniques already researched in Alaska.
    b. Develop hatchery production of mussel seed.
    c. Develop predator control methods.

3. Develop frozen product form and other value-added products and methods. Frozen product form is widely accepted as mussels are traditionally cooked for eating and frozen product has acceptable quality

parameters; freezing technology is widely known/practiced in Alaska; theoretically Alaska frozen mussels could compete with Irish mussels in the world market.

   a. Research other ways to create value added products with mussels.

4. Develop improvements in production and processing methods to increase throughput.
   a. Mussel farming (internationally) lends itself to a degree of mechanization more so than oyster production; which may lead to better competitive advantage in an Alaska's labor poor environment.

Shellfish Enhancement

KING CRAB *(PARALITHODES CAMTSCHATICUS; PARALITHODES PLATYPUS)*

The following king crab research priorities were developed by the Alaska King Crab Research Rehabilitation and Biology Program.

1. Refine rearing protocols for red and blue king crab by:
   a. Optimizing rearing conditions and hatchery techniques to both improve survival rates and reduce production costs.
      Has been done for red king crab but needs to be refined for blue king crab at the Alutiiq Pride Shellfish Hatchery.
   b. Optimize rearing conditions and hatchery techniques to reduce behavioral, morphological, and physiological differences between hatchery and wild crabs to minimize potential competitive interactions with future outplanting.
      Work has started at UAF and NOAA but additional work needed.

2. Understand the behavioral, morphological, and physiological differences between hatchery-reared and wild juvenile king crab and potential competitive interactions.
   a. Determine if morphological and behavioral differences are present between hatchery-reared and wild king crab juveniles and identify any potential competitive interactions or advantages.
   b. Continue to compare bioenergetics of hatchery-reared and wild king crab juveniles to understand health and energy allocation and identify any potential competitive interactions or advantages.
      Early work done by NOAA and University of Oregon but additional work needed in collaboration with outstocking experiments.

3. Determine optimal nursery habitats to maximize growth and survival of juvenile king crab in both the hatchery and once outplanted.
   a. Identify the habitat requirements of juvenile king crab through their first year of life, including foraging, structural, and biological habitat attributes, as well as ontogenetic shifts, with continued laboratory and field studies.

- Initial habitat suitability index models done but more refined studies needed to assess requirements at outstocking densities.
- Further develop king crab habitat suitability models for red king crab and begin development of models for blue king crab based upon laboratory and field studies for research use, as a guide to selecting potential release sites.

b. Develop best practices for transporting large numbers of juvenile king crab to remote sites without incurring high mortalities or harming their health.

4. Assess likelihood of outplanting success based on biological and environmental interactions.
    a. Transport to and successfully maintain live juveniles in a shore-based facility in the Pribilof Islands. Facilities are being developed with tribal government collaborations.
    b. Conduct tethering experiments in the Pribilof Islands to assess optimal habitats, crab size, relative predation and seasonal conditions for outplanting success.
    c. Quantify predation pressure at potential release sites in the Pribilof Islands and during experimental releases in Kodiak. This work is currently ongoing by NOAA in Kodiak. A joint UAF-NOAA research project is underway in St. Paul.
    d. Survey habitat, environment, and juvenile red and blue king crab density at potential release sites in the Pribilof Islands. A joint UAF-NOAA research project is underway in St. Paul.
    e. Monitor predation, prey availability, and competitive interactions before and after controlled release events and evaluate predator control devices.

5. Investigate fate of hatchery-produced juvenile king crab during release experiments.
    a. Design and test in the lab, nursery structures that may provide an artificial habitat to reduce initial mortality upon release for hatchery-produced juvenile king crab in the marine environment. Initial studies underway by NOAA in summer 2017.
    b. Continue to assess the behavior and marine survival of hatchery-produced juvenile king crab released into the wild at sites with appropriate habitat near Kodiak Island.
    c. Investigate larger controlled releases (~100,000 juveniles per site) to evaluate if crabs can be rehabilitated on an embayment scale in Kodiak.
    d. Assess the behavior and marine survival of hatchery-produced juvenile king crab released into the wild at sites with appropriate habitat near the Pribilof Islands.

6. Project operational costs for producing juvenile red and blue king crab for enhancing depressed wild crab stocks, including hatchery, nursery, and stocking phases.
    a. Continue to document hatchery operational costs from acquiring broodstock through production of C3 juveniles.
    b. Develop and publish cost projections for the culture of C3 juveniles for different survival rates and levels of production.
    c. Develop and publish projected costs of operating various stocking and nursery projects.

7. Determine funding mechanisms and identify any potential changes in state law and regulations necessary to allow crab harvesters and/or coastal communities to conduct king crab rehabilitation activities.
    a. Work with legislators and state agencies to research the potential legal framework for crab harvesters or coastal communities to form an association, such as a private-nonprofit corporation, to conduct rehabilitation activities.
    b. Work with legislators and state agencies to research the following: Who will pay? What changes to state law are necessary to provide for a voluntary assessment similar to the salmon rehabilitation program? Is it possible to have cost recovery harvests of enhanced king crab to offset costs? If so, what changes in statutes are necessary?
    c. Begin implementation of any necessary changes in law and policy.
    Legislation defining enhancement management processes was introduced but not passed in 2016 and 2017.

8. Work with potential user groups to develop preliminary collaborations with community and/or industry groups interested in forming rehabilitation associations.

Seaweed

SACCHARINA LATISSIMA (SUGAR KELP) AND ALARIA MARGINATA (RIBBON KELP)

1. Research the population genetics of seaweeds of current and future commercial importance to better understand how seaweed farms might affect the natural populations.
    a. Priorities should be the population genetics of Saccharina latissima and Alaria marginata especially in the areas along the Gulf of Alaska. Some of this research is currently being done by ADF&G genetics group.

2. Research to determine the best practices for obtaining parent plants for seed production
    a. Research on collecting parent seed stock from natural populations
    b. Research on using parent seed stock from maricultured outplants.
    c. ADF&G ongoing genetic research will partly address some of these issues

3. Research on strain selection.
    b. Currently this can only be done as non-commercial research with limitations on outplanting select strains. Some of this research is being done at University of Alaska Southeast (UAS) with ASG and Blue Evolution (BE) funding.

4. Market and product research for sugar and ribbon kelp
    a. Unknown if anyone is doing this.

5. Research on hatchery optimization for large scale production of seeded string
    a. BE and UAS are involved in this.

6. Research needed on optimal timing of outplanting and harvest (at different sites in Alaska).
    a. Some of this is being done by UAS and BE.

7. Research on the optimal conditions for growth (depth of outplant, nutrients, temperature, light, salinity, current).
    a. Some of this is being done by UAS, but other sites need to be outplanted and monitored.

8. Site selection research.

9. Oceanographic monitoring at existing growing sites, including nitrogen, phosphate, salinity, temperature, turbidity and currents.
    a. Some of this being done by UAS and may be part of an ARPA-E grant in the near future.

New Species Mariculture

1. Begin the process to identify new species that present potential economic opportunity in Alaska based on previous studies or successful mariculture in other regions.

Environmental Data Collection to Support Mariculture

BIVALVES AND PUBLIC HEALTH ISSUES

1. Rigorously research and develop methods to monitor and mitigate *Vibrio P.* occurrences.
    a. DEC has developed *Vibrio P.* plan for farmers when this occurs (http://dec.alaska.gov/eh/fss/seafood/Shellfish_Home.html).

2. Research and develop methods to mitigate harvest disruptions due to wild animal fecal coliform in remote areas. Grant funding proposal Alaska Sea Grant/Pacific Shellfish Institute in WA.

3. Develop public platform to access Paralytic Shellfish Poisoning (PSP) data.
    a. Proposed action on this by Alaska Sea Grant. AOOS and SEATOR may be helpful with this.

4. Research and develop low cost PSP testing methods.
    a. SEATOR (http://www.seator.org/) in Sitka is pursuing certification to conduct certified PSP testing which would reduce the testing burden on the State Environmental Health Lab and could lead to further R&D opportunities.

5 Identify appropriate regions to increase spatial extent of PSP testing (e.g. Kodiak Island) to address potential for underdeveloped opportunities for shellfish farms.

6 Develop a data base of the occurrence of PSP and causation in Alaskan waters.

SITE SELECTION

1. Develop prioritized physical and biological data collection necessary for site selection by species (bivalve, crab, seaweed) or method (farm, enhancement) of interest. This would include information to avoid areas with PSP, large wildlife populations, anadromous streams, higher freshwater influx etc.

2. Do basic oceanography studies of existing growing areas in cooperation with the farmers to understand biophysical factors contributing to shellfish growth rates and meat yields.

3. Identify and support research to assess mechanism of PSP loading (cyst density) in different species (e.g. oysters, geoducks).

SITE SPECIFIC MEASUREMENTS

1. Develop prioritized physical and biological data collection necessary for site operation by species (bivalve, crab, seaweed) or method (farm, enhancement) of interest.

2. Develop an active list of what is currently being monitored at each site and work with regional groups (e.g. AOOS) to host the database and website for public data access.

REGIONAL MEASUREMENTS

1. Develop prioritized physical and biological data collection necessary to provide regional and seasonal information to assist with farm or enhancement operations.

2. Identify regional groups (e.g. AOOS) to host a mariculture database and website for access by the farmers and the public.

3. In addition to other physical measurements, develop or maintain carbonate chemistry monitoring in all coastal regions with feasible mariculture opportunities that may be affected by ocean acidification. Locations include:
    a. OceansAlaska Ketchikan (http://www.ipacoa.org/; http://nvs.nanoos.org/ShellfishGrowers) is currently monitoring carbonate chemistry including alkalinity, CO_2, TCO_2, Aragonite saturation, pH, salinity, and temperature.

b. AMHS M/V Columbia has been outfitted with an underway CO_2 system on the passenger ferry Columbia that services SE Alaska communities (Haines, Skagway, Juneau, Sitka, Petersburg, Wrangell, and Ketchikan).
c. SEATOR Sitka (www.seator.org) is currently monitoring carbonate chemistry including alkalinity, CO_2, TCO_2, Aragonite saturation, pH, salinity, and temperature.
d. APSH Seward is currently monitoring carbonate chemistry including alkalinity, CO_2, TCO_2, Aragonite saturation, pH, salinity, and temperature. APSH also processes discrete samples and has reached climate data ratings.
e. Kasitsna Bay Laboratory has a discrete carbonate chemistry monitoring program.
f. Prince William Sound Science Center is routinely monitoring oxygen but should expand to match capacity at other regions.
g. NOAA Kodiak Laboratory will be monitoring carbonate chemistry in FY18 and should include additional monitoring including alkalinity, CO_2, TCO_2, Aragonite saturation, pH, salinity, and temperature.

Economic Data Collection to Support Mariculture

1. Development of a web-based break-even analysis planning tool that can be used to explore the effects of farm scale, production intensity, scope, and location on financial viability of shellfish mariculture operations. Includes an analysis of production efficiency related to farm operation and technology.

2. Development of regional and social impact models to highlight the role of aquatic farms in local and regional economies including employment and income impacts.

3. Development of risk management tools to integrate consideration of production risk (survival, growth, etc.) and financial risk (input costs, price volatility, etc.).

4. There is need for research designed to identify strategies for management of production and price risk.

5. Studies to explore role of horizontal and vertical integration or coordination as mechanisms for developing stronger markets, reducing input factor costs, and mitigating risk.

6. Outlook and trends for product prices and demand for Alaskan mariculture products.

7. Economic profile of the existing mariculture industry, including the number of farms, the years of operation, the species grown, farm size, region, etc.

8. Establish goals for industry growth.

9. Investigate existing fisheries infrastructure for possible use in mariculture.

Education to Promote Regional Scale Mariculture Opportunities

1. Identify educational opportunities in coastal communities.
2. Identify and develop workshops on mariculture opportunities.
    a. Conduct a workshop on seaweed identification and opportunities in southeast Alaska, Seward and Kodiak.
3. Provide training opportunities in multiple aspects of farms or enhancement operations.
4. Assist with business plan development.
5. Develop demonstration farms for seaweed and shellfish mariculture.
6. Identify mechanisms for technology transfer to interested entities. e.g. red king crab
7. Integrate mariculture into STEM education.
8. Investigate possibility of personal use oyster mariculture (gardening), including regulatory issues.

Workforce Development Committee Recommendations

RECOMMENDATION 1

Encourage the hire of an Aquaculture Specialist to finalize training materials, develop and coordinate training opportunities to meet workforce objectives. Paula asked, do we want to designate the Aquaculture Specialist a Sea Grant specialist versus a state agency employee or traditional academic faculty member? General consensus is yes, that Sea Grant is the best fit because we are looking for someone who understands the needs of industry and can help direct industry-driven research. Eric noted that linking the specialist with Sea Grant will help enable ongoing Sea Grant aquaculture funding. Reid mentioned that Sea Grant's link to industry and science is the model and is a better approach than making the position academic. Jim mentioned that a Sea Grant person could focus on helping new farmers getting certified and approved. Eric encouraged a new aquaculture specialist visit all farms and projects right off the bat to get a sense of what is going on and understand lessons learned. Consensus to keep Sea Grant in the recommendation and to include an aquaculture specialist in the current proposal being developed to National Sea Grant.

RECOMMENDATION 2

Finalize modules and skill sets needed for individuals to work on shellfish/seaweed farms using best practices. Paula noted that the aquaculture specialist would be tasked with developing these modules and skill sets for training and developing training and professional development program. She also recognized that a lot of materials are available and have been developed by John Kiser, Ray RaLonde already that are available. Reid noted that, as with salmon enhancement training, credit is not useful. Maybe recommend non-credit. However, John noted that some form of University credential is important. Jim agreed that some type of credential linked to training may help with ease of getting loans and leases. Eric noted that certification without credit is possible, i.e. a credential in how to operate a flupsy could be useful. Jim discussed the usefulness of online training and the need to make sure classes are compatible with the shellfish farming lifestyle. Tomi talked about the value of remote training classes for professional development while on the farm. Maybe an Introduction to Shellfish Farming for workers. Reid then talked about the use of iPads by the UAS Fisheries Technology Program, allowing for a suite of classes to be taken on an iPad without the need for internet connection. Consensus to add remote access to coursework to the recommendation as both a professional development and recruitment/retention tool.

RECOMMENDATION 3

Develop a hands-on "Introduction to Shellfish/Seaweed Farming" workforce development training program in partnership with Central Council of Tlingit and Haida, Alaska Sea Grant, growers and other partners. Objective is to develop a cohort of skilled farmers who could either work on a farm or eventually start their own farm. Call it an "intensive". Reid said that they are starting to do intensive training as well with salmon enhancement program. Myrna, divide the intensive into discrete training modules with a set curriculum so that it is compatible with a workforce training program. Include basic skill building such as safety, boat operation, etc.

Make sure it takes advantage of the earlier training. Make sure this leads into the next step. Maybe develop a letter of attendance or certificate or something to give people access to programs such as a certification course.

Near Term Priorities for Mariculture in Alaska
(DRAFT)

Prepared for the Research, Development and Environmental Information Advisory Committee of the Alaska Mariculture Task Force. May-June 2017.

Near term priorities are defined as priorities for species of immediate interest (1-2 years) for mariculture in Alaska along with specific issues that need to be addressed to create a viable commercial enterprise for each species. For an overview of the near, intermediate, and long term priorities for mariculture in Alaska see the document entitled Existing Research and Future Needs for Alaska Mariculture.

I. Near term research priorities for shellfish farming in Alaska

Oysters, Pacific

1. Research focused on oyster spawning in Alaska
   a. Develop capacity to spawn oysters in Alaska
      i. Physical systems to spawn exist at Alutiiq Pride Shellfish Hatchery (APSH) and OceansAlaska (OA); access to certified broodstock; currently conditioning broodstock at OceansAlaska; proposed partnership with Alaska Sea Grant (ASG) for funding to initiate spawning on more than a test basis. Note: Seed from certified broodstock that is permitted to be imported into Washington and California has much larger demand than seed only permitted for planting in state. Some farms in Pacific Northwest value a completely independent source of oyster seed.
   b. Research and develop methods and ability to buffer incoming seawater with calcium aragonite (a form of $CaCO_3$).
      i. Buffering seawater into culture tanks with sodium carbonate is current practice at OA. However, drip concentration is adjusted by measuring pH. Direct measurement of calcium aragonite concentration will lead to more accurate buffering data and practice.
   c. Develop region specific broodstock breeding program.
      i. Spawning of Alaska broodstock can lead in small steps toward a simple breeding program. The immediate goal is to have an in-state source of larvae and to start discussion of breeding program genetic.
2. Research focused on oyster larvae setting and growth to nursery size in Alaska.
   a. Develop capacity to set sufficient quantities of oyster seed to satisfy Alaska growers demand and to provide for sales outside of Alaska.
      i. This is currently underway at OceansAlaska, and there is recently some interest in additional private setting facilities
      ii. Alaska Sea Grant has submitted a grant proposal to NOAA to support further development of oyster larvae setting capacity and best practices and researching b,c,d and e below.
   b. Research efficacy of seed fluidizers.
   c. Research live feed vs. commercially available algae concentrate.

d. Research and develop methods to combat colonial ciliates in the hatchery.
    i. Basic experimentation with chlorine and ascorbic acid to combat ciliates at OceansAlaska
e. Research comparison of differing sea water filtering systems.
f. Compare growth rates and survival of over wintered oyster seed to farm market size vs. newly set oysters.
g. Determine economic viability of shellfish hatcheries.
    i. British Columbia Shellfish Aquaculture Industry did a hatchery feasibility report on this topic: https://www2.viu.ca/csr/documents/HatcheryFeasibilityReport080606CSR_002.pdf

3. Research focused on oyster nursery stage
    a. Research and develop low cost nursery options for farmers.
        i. Some work on this has already been developed at OceansAlaska with fish tote based upwellers.
    b. Research and develop methods and equipment to increase efficiencies of nursery systems.
        i. Successful private efforts (namely Jim Aguiar) in the past centered around floating upweller systems (FLUPSYs) and collaboration with Alaska Sea Grant to some degree on this.
    c. Develop and disseminate ability for nurseries and farmers to successfully raise smaller seed than is currently standard.
        i. Private efforts have been underway, but nothing seems definitive.
4. Research focused on oyster farms
    a. Develop improvements in production technology.
        i. Identify strategies and best practices to reduce the cost of labor and time to produce aquatic farm product.
        ii. Alaska Sea Grant efforts in the past; mostly private efforts with info sometimes shared at Alaska Shellfish Growers Association annual meeting.
    b. Research and develop value added products aimed at export markets
        i. some work on TVO (top valve off) frozen oysters done by Alaska Sea Grant/Fishery Industrial Technology Center (renamed as the Kodiak Seafood and Marine Science Center).

Mussels, Blue

1. Identify genetic and disease issues that prohibit/inhibit the growing of blue mussels to market size in Southeast Alaska.
2. Continue research on production technology.
    a. Publish and disseminate current production techniques already researched in Alaska.
    b. Develop hatchery production of mussel seed.
    c. Develop predator control methods.
3. Develop frozen product form and other value added products and methods. Frozen product form is widely accepted as mussels are traditionally cooked for eating and frozen product has acceptable quality parameters; freezing technology is widely known/practiced in Alaska; theoretically Alaska frozen mussels could compete with Irish mussels in the world market.

a. Research other ways to create value added products with mussels.
4. Develop improvements in production and processing methods to increase throughput.
    a. Mussel farming (internationally) lends itself to a degree of mechanization more so than oyster production; which may lead to better competitive advantage in a Alaska's labor poor environment.

II. Near term research priorities for shellfish <u>enhancement</u> in Alaska

<u>King crab (Paralithodes camtschaticus; Paralithodes platypus)</u> (priorities developed by the Alaska King Crab Research Rehabilitation and Biology Program)

1. Refine rearing protocols for red and blue king crab by:
    a. Optimizing rearing conditions and hatchery techniques to both improve survival rates and reduce production costs.
        i. Has been done for red king crab but needs to be refined for blue king crab at the Alutiiq Pride Shellfish Hatchery.
    b. Optimize rearing conditions and hatchery techniques to reduce behavioral, morphological, and physiological differences between hatchery and wild crabs in order to minimize potential competitive interactions with future outplanting.
        i. Work has started at UAF and NOAA but additional work needed.
2. Understand the behavioral, morphological, and physiological differences between hatchery-reared and wild juvenile king crab and potential competitive interactions.
    a. Determine if morphological and behavioral differences are present between hatchery-reared and wild king crab juveniles and identify any potential competitive interactions or advantages.
    b. Continue to compare bioenergetics of hatchery-reared and wild king crab juveniles to understand health and energy allocation and identify any potential competitive interactions or advantages.
        i. Early work done by NOAA and University of Oregon but additional work needed in collaboration with outstocking experiments.
3. Determine optimal nursery habitats to maximize growth and survival of juvenile king crab in both the hatchery and once outplanted.
    a. Identify the habitat requirements of juvenile king crab through their first year of life, including foraging, structural, and biological habitat attributes, as well as ontogenetic shifts, with continued laboratory and field studies.
        i. Initial habitat suitability index models done but more refined studies needed to assess requirements at outstocking densities.
        ii. Further develop king crab habitat suitability models for red king crab and begin development of models for blue king crab based upon laboratory and field studies for research use, as a guide to selecting potential release sites.
    b. Develop best practices for transporting large numbers of juvenile king crab to remote sites without incurring high mortalities or harming their health.
4. Assess likelihood of outplanting success based on biological and environmental interactions.
    a. Transport to and successfully maintain live juveniles in a shore-based facility in the Pribilof Islands.
        i. Facilities are being developed with tribal government collaborations.

b. Conduct tethering experiments in the Pribilof Islands to assess optimal habitats, crab size, relative predation and seasonal conditions for outplanting success.
c. Quantify predation pressure at potential release sites in the Pribilof Islands and during experimental releases in Kodiak.
    i. This work is currently ongoing by NOAA in Kodiak. A joint UAF-NOAA research project is underway in St. Paul.
d. Survey habitat, environment, and juvenile red and blue king crab density at potential release sites in the Pribilof Islands.
    i. A joint UAF-NOAA research project is underway in St. Paul.
e. Monitor predation, prey availability, and competitive interactions before and after controlled release events and evaluate predator control devices.

5. Investigate fate of hatchery-produced juvenile king crab during release experiments.
    a. Design and test in the lab, nursery structures that may provide an artificial habitat to reduce initial mortality upon release for hatchery-produced juvenile king crab in the marine environment.
        i. Initial studies underway by NOAA in summer 2017.
    b. Continue to assess the behavior and marine survival of hatchery-produced juvenile king crab released into the wild at sites with appropriate habitat near Kodiak Island.
    c. Investigate larger controlled releases (~100,000 juveniles per site) to evaluate if crabs can be rehabilitated on an embayment scale in Kodiak.
    d. Assess the behavior and marine survival of hatchery-produced juvenile king crab released into the wild at sites with appropriate habitat near the Pribilof Islands.
6. Project operational costs for producing juvenile red and blue king crab for enhancing depressed wild crab stocks, including hatchery, nursery, and stocking phases.
    a. Continue to document hatchery operational costs from acquiring broodstock through production of C3 juveniles.
    b. Develop and publish cost projections for the culture of C3 juveniles for different survival rates and levels of production.
    c. Develop and publish projected costs of operating various stocking and nursery projects.
7. Determine funding mechanisms and identify any potential changes in state law and regulations necessary to allow crab harvesters and/or coastal communities to conduct king crab rehabilitation activities.
    a. Work with legislators and state agencies to research the potential legal framework for crab harvesters or coastal communities to form an association, such as a private-nonprofit corporation, to conduct rehabilitation activities.
    b. Work with legislators and state agencies to research the following: Who will pay? What changes to state law are necessary to provide for a voluntary assessment similar to the salmon rehabilitation program? Is it possible to have cost recovery harvests of enhanced king crab to offset costs? If so, what changes in statutes are necessary?
    c. Begin implementation of any necessary changes in law and policy.
        i. Legislation defining enhancement management processes was introduced but not passed in 2016 and 2017.
8. Work with potential user groups to develop preliminary collaborations with community and/or industry groups interested in forming rehabilitation associations.

III. Near term research priorities for seaweed mariculture in Alaska

Saccharina latissima (sugar kelp) and Alaria marginata (ribbon kelp)

1. Research the population genetics of seaweeds of current and future commercial importance in order to better understand how seaweed farms might affect the natural populations.
    a. Priorities should be the population genetics of *Saccharina latissima* and *Alaria marginata* especially in the areas along the Gulf of Alaska.
        i. Some of this research is currently being done by ADF&G genetics group.
2. Research to determine the best practices for obtaining parent plants for seed production.
    a. Research on collecting parent seed stock from natural populations.
    b. Research on using parent seed stock from maricultured outplants.
    c. ADF&G ongoing genetic research will partly address some of these issues
3. Research on strain selection.
    a. Currently this can only be done as non-commercial research with limitations on outplanting select strains.
        i. Some of this research is being done at University of Alaska Southeast (UAS) with ASG and Blue Evolution (BE) funding.
4. Market and product research for sugar and ribbon kelp
    a. Unknown if anyone is doing this.
5. Research on hatchery optimization for large scale production of seeded string
    a. BE and UAS are involved in this.
6. Research needed on optimal timing of outplanting and harvest (at different sites in Alaska).
    a. Some of this is being done by UAS and BE.
7. Research on the optimal conditions for growth (depth of outplant, nutrients, temperature, light, salinity, current).
    a. Some of this is being done by UAS, but other sites need to be outplanted and monitored.
8. Site selection research.
9. Oceanographic monitoring at existing growing sites, including nitrogen, phosphate, salinity, temperature, turbidity and currents.
    a. Some of this being done by UAS and may be part of an ARPA-E grant in the near future.

IV. Near term research priorities for new species mariculture in Alaska

General

1. Begin the process to identify new species that present potential economic opportunity in Alaska based on previous studies or successful mariculture in other regions.

V. Near term research priorities for environmental data collection to support mariculture in Alaska

Bivalves and public health issues

1. Rigorously research and develop methods to monitor and mitigate *Vibrio P.* occurrences.

    a. DEC has developed *Vibrio P*. plan for farmers when this occurs (http://dec.alaska.gov/eh/fss/seafood/Shellfish_Home.html).
2. Research and develop methods to mitigate harvest disruptions due to wild animal fecal coliform in remote areas.
    a. Grant funding proposal Alaska Sea Grant/Pacific Shellfish Institute in WA.
3. Develop public platform to access Paralytic Shellfish Poisoning (PSP) data.
    a. Proposed action on this by Alaska Sea Grant. AOOS and SEATOR may be helpful with this.
4. Research and develop low cost PSP testing methods.
    a. SEATOR (http://www.seator.org/) in Sitka is pursuing certification to conduct certified PSP testing which would reduce the testing burden on the State Environmental Health Lab and could lead to further R&D opportunities.
5. Identify appropriate regions to increase spatial extent of PSP testing (e.g. Kodiak Island) to address potential for underdeveloped opportunities for shellfish farms.
6. Develop a data base of the occurrence of PSP and causation in Alaskan waters.,

Site selection

1. Develop prioritized physical and biological data collection necessary for site selection by species (bivalve, crab, seaweed) or method (farm, enhancement) of interest. This would include information to avoid areas with PSP, large wildlife populations, anadromous streams, higher freshwater influx etc.
2. Do basic oceanography studies of existing growing areas in cooperation with the farmers to understand biophysical factors contributing to shellfish growth rates and meat yields.
3. Identify and support research to assess mechanism of PSP loading (cyst density) in different species (e.g. oysters, geoducks).

Site specific measurements

1. Develop prioritized physical and biological data collection necessary for site operation by species (bivalve, crab, seaweed) or method (farm, enhancement) of interest.
2. Develop an active list of what is currently being monitored at each site and work with regional groups (e.g. AOOS) to host the database and website for public data access.

Regional measurements

1. Develop prioritized physical and biological data collection necessary to provide regional and seasonal information to assist with farm or enhancement operations.
2. Identify regional groups (e.g. AOOS) to host a mariculture database and website for access by the farmers and the public.
3. In addition to other physical measurements, develop or maintain carbonate chemistry monitoring in all coastal regions with feasible mariculture opportunities that may be affected by ocean acidification. Locations include:
    a. OceansAlaska Ketchikan (_____
    _____

d. APSH Seward is currently monitoring carbonate chemistry including alkalinity, CO_2, TCO_2, Aragonite saturation, pH, salinity, and temperature. APSH also processes discrete samples and has reached climate data ratings.
e. Kasitsna Bay Laboratory has a discrete carbonate chemistry monitoring program.
f. Prince William Sound Science Center is routinely monitoring oxygen but should expand to match capacity at other regions.
g. NOAA Kodiak Laboratory will be monitoring carbonate chemistry in FY18 and should include additional monitoring including alkalinity, CO_2, TCO_2, Aragonite saturation, pH, salinity, and temperature.

VI. Near term research priorities for economic data collection to support mariculture in Alaska

General

1. Development of a web-based break-even analysis planning tool that can be used to explore the effects of farm scale, production intensity, scope, and location on financial viability of shellfish mariculture operations. Includes an analysis of production efficiency related to farm operation and technology.
2. Development of regional and social impact models to highlight the role of aquatic farms in local and regional economies including employment and income impacts.
3. Development of risk management tools to integrate consideration of production risk (survival, growth, etc.) and financial risk (input costs, price volatility, etc.).
4. There is need for research designed to identify strategies for management of production and price risk.
5. Studies to explore role of horizontal and vertical integration or coordination as mechanisms for developing stronger markets, reducing input factor costs, and mitigating risk.
6. Outlook and trends for product prices and demand for Alaskan mariculture products.
7. Economic profile of the existing mariculture industry, including the number of farms, the years of operation, the species grown, farm size, region, etc.
8. Establish goals for industry growth.
9. Investigate existing fisheries infrastructure for possible use in mariculture.

VII. Near term research priorities for education to promote regional scale mariculture opportunities in Alaska

1. Identify educational opportunities in coastal communities
2. Identify and develop workshops on particular mariculture opportunities.
    a. Conduct a workshop on seaweed identification and opportunities in southeast Alaska, Seward and Kodiak.
3. Provide training opportunities in multiple aspects of farms or enhancement operations
    a. Assist with business plan development.
    b. Develop demonstration farms for seaweed and shellfish mariculture.
4. Identify mechanisms for technology transfer to interested entities.
    a. e.g. red king crab
    b. kelp
5. Integrate mariculture into STEM education.

6. Investigate possibility of personal use oyster mariculture (gardening), including regulatory issues.

Alaska Mariculture Task Force

Regulatory Issues Advisory Committee Recommendations

4/25/2017

The Alaska Mariculture Task Force (MTF) Regulatory Issues Advisory Committee (AC) met five times between September 2016 and April 2017 to identify perceived regulatory challenges to the growth of the mariculture industry in Alaska and to develop recommendations for actions to address these challenges. Members and contributors to the AC included: Sam Rabung (Chair, ADFG); Jim Aguiar (Aquatic Farmer); Adam Smith (DNR); John Kiser (Aquatic Farmer); Kim Stryker (DEC); Eric Wyatt (Aquatic Farmer); Christy Colles (DNR); Chris Whitehead (Sitka Tribe); Julie Decker (AFDF); Clark Cox (DNR); Paul Fuhs (Aquatic Farmer); Eric O'Brien (Aquatic Farmer).

What is Mariculture?

Mariculture, simply put, is marine aquaculture or the culture of marine organisms. Mariculture includes both rehabilitation and enhancement of wild fisheries and aquatic farming. Rehabilitation and enhancement is the culturing of marine organisms for release into the wild to benefit common property wild capture fisheries. Aquatic Farming is the culturing of marine organisms in captivity or under positive control to benefit private business.

Shellfish rehabilitation and enhancement permits are currently not authorized in Alaska, therefore the only legal form of mariculture in Alaska as of this writing is aquatic farming. Most of the aquatic farm product currently grown in Alaska is Pacific oysters and blue mussels. However, as the industry continues to expand and culture techniques are refined, it is anticipated other products such as the geoduck clam, littleneck clams, and marine plants will gain prominence within the industry.

Brief Legal Background for Mariculture in Alaska

Constitution

Alaska is a common property resource state and the Alaska Constitution includes provisions relating to common use. Most tide and submerged lands within Alaska's 40,000 miles of coastline are a common property resource managed upon multiple use principals and sustained yield requirements. The State of Alaska Constitution requires resource decisions to be vetted thru a public process and noticed for public input to balance resource management decisions with the best interests of the State of Alaska. Management of replenishable resources for sustained yield is enshrined in Article 8, Section 4, of the constitution. Article 8, Section 15, specifically prohibits exclusive right of fishery; however, this section was amended in 1972 to provide exemptions for the state to both limit entry into fisheries for conservation and economic reasons, and to provide for the efficient development of aquaculture in Alaska. Article 8 also provides for the use of state lands and waters, with certain assurances, in Sections 8 and 14. Article 7 requires that the legislature provide for the promotion and protection of the public's health.

Statute

Several statutes have been approved by the Alaska Legislature that provide for mariculture activities in the State. The fisheries rehabilitation, enhancement and development statute (AS 16.05.092) went into effect in 1971, directing the Alaska Department of Fish and Game (ADFG), in part, to encourage private investment in the development and economic utilization of fisheries resources, and through rehabilitation,

enhancement and development programs, do all things necessary to ensure perpetual and increasing production and use of the aquatic resources of the state.

The Aquatic Farm Act (Section 19, Chapter 145, SLA 1988) was signed into law on June 8, 1988, authorizing the Commissioner of ADFG to issue permits for the construction or operation of aquatic farms, and hatcheries to supply aquatic plants or shellfish to aquatic farms (AS 16.40.100 - 199). The intent was to create an industry that would contribute to the state's economy and strengthen the competitiveness of Alaska seafood in the world marketplace, broadening the diversity of products and providing year-round supplies of premium quality seafood. The law limited aquatic farming to shellfish and aquatic plants and in 1990 CSHB 432 became law, prohibiting farming of finfish in the state (AS 16.40.210).

Statute also authorizes Alaska Department of Natural Resources (DNR) to make land and water available through lease for aquatic farming subject to bonding or other security (AS 38.05.083). All lease applications and proposed decisions are required to be noticed for public comment per AS 38.05.945 before a final decision is rendered by DNR.

Statutes that direct the Alaska Department of Environmental Conservation (DEC) to provide for food safety are found in the Alaska Food, Drug, and Cosmetic Act in AS 17.20.

There is currently no statutory authorization to issue permits for shellfish rehabilitation and enhancement projects, however, bills were introduced in 2016 and again in 2017 to achieve this.

Statewide Aquatic Farm Program and Agency Roles

The statewide program is jointly administered by three state agencies: the Department of Natural Resources (DNR), the Alaska Department of Fish and Game (ADFG), and the Department of Environmental Conservation (DEC). Each of these state agencies has a specific role in authorizing and managing aquatic farm activities within Alaska.

The DNR authorizes the use of tide and submerged land and seeks to balance use of the land for the development of aquatic farming with traditional uses of the area, upland owner access, public access, and navigation of public waters as required under Article VIII of the Alaska State Constitution. The department is required to balance disposal of interest (lease) decisions with traditional and existing uses within a given area to ensure proposed farm sites are compatible. If approved, leases authorize a specific footprint and infrastructure to remain on state land to support aquatic farming activities. DNR is required to charge no less than appraised fair market value for lease fees which require annual land use fees. Lease holders are also required to post a bond to cover the costs to the department of restoring leased sites in the event the site is abandoned. Other requirements include providing proof of commercial liability insurance and meeting the commercial use requirements outlined within 11 AAC 63.030(b) within five years of lease issuance. DNR aquatic farm regulatory guidance is contained in 11 AAC 63.010 – 050.

The ADFG issues permits for the operation of aquatic farms and aquatic farm hatcheries, acquisition of stock, and transport of seed and aquatic farm products; certifies and permits seed coming into the state and transported within state for aquatic farming, ensures aquatic farming does not significantly alter established fishery or other existing uses of resources, does not significantly affect fisheries, wildlife or their habitats in an adverse manner, and determines wild stock populations prior to permitting aquatic farm species. ADFG employs the “precautionary principle” when authorizing use of resources in order to ensure sustained natural productivity of common property resources. Specific ADFG aquatic farm regulatory guidance is contained in 5 AAC 41.001 – 400.

To protect human health, the DEC classifies growing areas, issues permits, conducts inspections, investigates complaints, conducts outreach and training, and monitors bacteria and toxins in shellfish harvest areas (growing waters) and shellfish products. Primarily, two programs within DEC are involved: the Food Safety and Sanitation program (FSS), the state's Shellfish Sanitation Authority, and the Environmental Health Laboratory (EHL), which provides the FSS program analytical support to carry out its responsibilities. DEC regulates the shellfish industry through adoption by reference at 18 AAC 34 of a document called the National Shellfish Sanitation Program Model Ordinance (NSSP MO). The NSSP MO specifies sanitation requirements for harvesters, dealers, and shucker/packers and outlines State regulatory program requirements so that shellfish grown and harvested in Alaska may be sold interstate.

Regulatory Issues Advisory Committee Recommendations

The table below presents the Regulatory Issues Advisory Committee's recommendations to address regulatory challenges to mariculture in Alaska. These recommendations were identified through broad participation with farmers, industry representatives and state agencies, and are organized by priority groupings of 1) Near Term needs; 2) Intermediate Term needs; and 3) Long Term needs. *Many of these suggestions require legislation, funding, or both. These nonbinding recommendations are offered to the Mariculture Task Force for consideration and do not commit any industry representative or agency to additional action beyond these recommendations.*

Alaska Mariculture Taskforce

Regulatory Issues Advisory Committee

Recommendations to Address Regulatory Challenges to Mariculture in Alaska

4/25/2017

	Agency	Regulatory Issue	Recommendation to Address	Priority
1	ADFG	Shellfish stock restoration, rehabilitation, and enhancement projects are not legal in Alaska, other than for small scale research or for ADF&G projects.	Pass legislation creating authority to issue permits for this type of activity (2016 HB300/SB172; 2017 HB128/SB89)	**1**
2	ADFG	Importation of seed from outside of Alaska is limited to only Pacific Oysters from the pacific Northwest, and to Weathervane Scallops produced from parents taken from SE Alaska and Yakutat areas.	Amend regulation (5 AAC 41.070 Prohibitions on importation and release of live fish) to allow for other species using the Weathervane Scallop model.	**2**
3	ADFG	Genetic requirements are restrictive and limit wide distribution of indigenous organisms for farm stock. These requirements include limitations on the distance from the donor stock acquisition location that progeny may be grown out at, and large minimum donor stock numbers to ensure genetic diversity in progeny.	A) Indigenous stock used on farms that can reproduce naturally in those same waters may potentially impact natural production of that species locally. However, if triploid (sterile) stock is used, or if the species does not occur or reproduce naturally in an area, there are no genetic concerns. Adopt regulation to clearly state that sterile stock, and species that do not occur or reproduce naturally within some significant distance of the farm growing area, are not subject to the ADF&G genetic policy.	**2**
			B) Adopt regulation to require a timeline for action to gain information when a lack of genetic stock structure data for a species forces precautionary restrictions on transport of indigenous organisms used as mariculture seed.	**2**

4	ADFG	Aquatic (wild) stock acquisition is limited to only ***initial*** needs in Statute (AS 16.40.120(f)(1)) and regulation (5 AAC 41.290(b) and (d)).	Donor stock of indigenous species may need to be collected on a continual basis to propagate and produce seedstock for aquatic farms and nurseries and for growout of natural set on farmsites. Amend the statute and regulations to remove the word “initial”.	**3**
5	ADFG	Requiring excessive detail and speculative information on applications and plans, and inflexibility to species and gear diversification in real time.	Adhere to the actual language in statute and regulation in order to avoid "over reach". Any information requested should have an identified purpose and need. Additional requirements or restrictions should be promulgated through statutory and regulatory change processes rather than personal interpretations.	**1**
6	DNR	Bonding, insurance, and annual land use fees are challenging for farmers to pay, especially new farmers not selling product yet.	A) Establish a mechanism or funding source to offset lease costs. This could be tied into aquatic farm loan programs and provide start up financing for new farmers. Amend regulation to allow for deferring a portion of fees, or for a graduated increase in lease fees, until farmsite is producing.	**1**
			B) Farmers with demonstrated training or experience working a farm, or new farmers that locate near an established farm, should be considered for a reduced bond amount since they will be lower risk.	**2**
			C) Adopt industry sponsored training or best practice standards to ensure new farmers understand aquatic farm site selection, husbandary practices, marketing and financial planning requirements. This may increase success of the new farmer but may not remove bonding requirements.	**3**

7	DNR	DNR statute AS 38.05.083(e) & regulation 11 AAC 63.080 require bonds to pay any defaulted lease fees and cleanup a site if abandoned by the leaseholder. The minimum bond amount of $2500 is not adequate surety to clean up sites.	A) Pass legislation to create a bond pool which could be utlized to cleanup abandoned farms and pay default fees. A bond pool could reduce individual bond requirements if it were adequately funded.	**2**
			B) Obtain legal authority to enter into agreement with another farmer(s) to clean up a defaulted farmsite, incentivized by offering the defaulted farms security bond, gear and inventory as compensation upon successful restoration of the defaulted farmsite.	**2**
8	DNR	Commerical Liability Insurance and Worker's Compensation Insurance requirements are expensive for farmers.	Pass legislation to create insurance coverage for commerical farmers or encourage broad insurance policies to be adopted by industry sponsored groups or organizations that cover its members.	**2**
9	DNR	The commerical use requirement (11 AAC 63.030(b) is a low benchmark for farmers to demonstrate their farms commerical viability by year 5 of a lease. This benchmark does not work for all species.	Amend 11 AAC 63.030(b) to consider a longer term for farms producing only slow growing species such as geoduck and a shorter term for farms producing only fast growing species such as seaweed.	**1**
10	DNR	Lease size is required to encompass the entire foot print of the farm site including anchors and scope of lines. This expands lease size substantially for larger farmers which increases cost per surface acre farmed and ties up additional surface area not actually being farmed.	Amend regulations to separate actively farmed lease acreage, such as surface water footprints, from the on bottom acreage needed to secure infastructure such as the anchors, lines and scope for puposes of calculating the lease fee.	**2**
11	DNR	Escalating lease fees during the lease period makes it difficult to plan the operations/expenses of the farm.	Only change the lease fee when the lease is renewed or transferred. Do not change the lease fee during the effective period of the lease.	**1**

12	DEC	There is a lack of open access to collected and reported environmental data. Farmers, and others, need open access to this data in order to conduct individual analysis and to assist DEC and others conducting problem-solving efforts.	Make the data visible, or if it is not utilized and stored, do not require that it be collected and submitted. DEC has been working towards providing for an open data exchange/viewing site since April of 2016. If this is not feasible within DECs resources, allow industry to establish an authorized industry-wide database or assist DEC with creating one that can provide this service.	**1**
13	DEC	Growing water sampling and PSP testing is slow and expensive. It is extremely challenging for many farmers to transport water samples to the DEC laboratory in Anchorage within the time and temperature constraints required.	A) Support certification of additional private labs and testing methods in order to facilitate ease of transport, faster results and more cost effective testing.	**1**
			B) Support research into holding for depuration and certification of process.	**2**
14	All	Communication is not organized to reach all farmers and industry representatives. There is no authorized body representative of farmers and industry to work with agencies in drafting and implementing rules and regulations.	Pass legislation to establish a comprehensive board or group to represent farmers and industry in interactions with regulatory agencies.	**2**
15	All	There is a seemingly adversarial role by some regulators towards mariculture. Recognizing that departments operate within many strict guidelines, regulations, statutes, and manpower and fiscal constraints, and that many of those are necessary to protect the public, there is an impression that some individual regulators tend to interpret guidance more stringently than is required or was intended, or that enforcement of a flawed rule or regulation is easier than seeking a beneficial solution.	Direct regulatory agencies to adopt an advocacy approach to the mariculture industry for the benefit of the State. Regulators should seek to make improvements to bureaucratic rules and regulations that needlessly impede the growth of the industry while still fulfilling their responsibilities to protect the people and resources of the state.	**1**

16	All	There is no assurance to the State that an aquatic farmer is qualified or capable. Regulatory agencies have a responsibility to the people of the State to ensure that resources are used wisely. One reason for the oversight and stringent requirements imposed upon aquatic farmers by the State is that there is no way to determine if a farmer has the knowledge and/or experience to operate a farm.	Amend agency regulations to provide for acceptance of industry-driven training as qualification. Aquatic farmers are currently developing a series of training and accreditation efforts that will provide a better trained workforce and better, more knowledgeable, farmers/operators who will have standardized skills and knowledge, as a minimum. When this program is fully developed and implemented, this accreditation/certification should be accepted and used by state agencies to demonstrate an applicant has the knowledge and skill sets required to work on, or operate, a successful farm. This should be considered an endorsement for favorable consideration of the farmers aquatic farm permit application, lower bonds, initially smaller lease rates, loan guarantees, etc.	**3**

Investment and Infrastructure Advisory Committee Meeting

May 1, 2017

Attendance: Erik Obrien, Julie Decker, Tomi Marsh, Jeff Hetrick, Jeff Curry, Mark Scheer, Trevor Sande

The AC meeting was focused on committee recommendations developed to date. Underlined language represents new discussion.

-Investment and Infrastructure AC Recommendations

Infrastructure

Recommendation 1:

Develop an interactive map tool and/or fact sheet to help inform site and species selection. (Near-term)

The I/I AC understands that there is a Seagrant proposal to begin a regional mapping project and that the first phase of the project may begin in 2017. The AC committee supports this project and has discussed that the lack of a cohesive and accessible site containing information on issues such as; ocean conditions, bathymetry and existing support infrastructure for processing and shipping has created significant barriers for potential investors to adequately select sites and formulate business plans. A mapping tool will alleviate some of these limitations, while highlighting remaining research gaps and potential future inputs as they become available.

Recommendation 2:

Develop a seafood processor/salmon hatchery outreach program to inform existing infrastructure owners of potential mariculture and business diversification opportunities. (Mid-term)

Alaska's seafood operators have had to surpass significant challenges with remoteness, transportation, high energy costs and labor. An emerging mariculture industry will face similar challenges and will benefit from extracting lessons learned and building partnerships with existing operators. Numerous seafood processors throughout the state have expressed interest in exploring diversification opportunities through mariculture development. Many potential synergies exist, but information on compatible and potential conflicting conditions need to be better understood. This outreach program would likely follow the completion of the mapping project. The existing expertise of salmon hatcheries could lend well to mariculture seed production and operations.

Recommendation 3

Explore potential frameworks and regulatory mechanisms for funding hatchery operations.

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These could include voluntary assessments, marketing tax, value-added tax, fish tax, etc. Reference to the language in HB 128 (allowing a mechanism for self -assessment), as well as HB 76 (allowing non-profits to assess) should be included in the plan.

Investment: Secure and promote investment in Mariculture

Recommendation 1:

Support amendments to the Mariculture Revolving Loan fund to include hatchery eligibility. Encourage opportunities for increased support and funding of hatchery development. (Near-term)

Under the leadership of AFDF, AC and MTF members have advocated for advancing legislation to amend the mariculture revolving loan fund during the 2017/8 legislative session. The I/I AC believes that legislation is needed to allow for fuller utilization of the existing mariculture revolving loan fund and to fill an important funding gap for hatcheries. The committee also believes that there should be a continued effort to align industry needs with private and public funding opportunities.

Recommendation 2:

Support Shellfish Enhancement enabling legislation. (Near-term)

As with the revolving loan fund legislation, AC and MTF members have been advocating for legislation that would provide a regulatory framework for shellfish enhancement and restoration efforts. This legislation is critical in advancing the AKCRRAB program out of research phase and into implementation. Future enhancement projects could provide important opportunities for common property fisheries and potentially help mitigate impacts of climate change on commercially valuable crab fisheries. The I/I AC believes this legislation will be key to advancing a successful mariculture industry.

Recommendation 3:

~~*Develop a single website location with a comprehensive list of funding sources for mariculture related development*~~. Develop an investment package that includes basic statistics, information on the regulatory process, funding sources etc. (Near-term)

The I/I AC has evaluated various public and private programs applicable to mariculture development in Alaska. The committee feels it would be helpful ~~for~~ to create a ~~have a single~~ tool for potential investors that identifies these sources, along with other information that would be pertinent to the development of a business plan. ~~or site outlining~~ ~~these sources~~.

Recommendation 4:

Promote Cooperative Investment Structures (Long-term)

Cooperative structures are designed to provide member level benefits that may be reflected on a social, cultural and/or economic level. Coops typically offer their members a wide variety of benefits such as access to markets, shared information on technological advancements and efficiencies, shared risk,

innovation, common facilities, etc. This type of structure could ~~build~~ help build the financial resiliency of an emerging mariculture industry and may be an important component to consider in establishing economies of scales, collective purchasing and in developing selling strength. The committee discussed that the Intertribal Agriculture Council may be a good resource to assist in developing a model for Alaska.

The work product coming out of this recommendation should be a compilation of information related the logistical formation of a coop, available resources and an assessment of relevant existing models. Items specifically mentioned for inclusion:

- Legal entity required for membership
- Antitrust issues

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Recommendation 5:

Explore the potential to seed a private/public revolving loan fund program for mariculture planning purposes and start-up costs. Prioritize options to seed additional funding into existing funds. (Mid-term)

Revolving loan funds provide access to a flexible source of capital that can be used in combination with more conventional sources. While the state's revolving loan fund is not presently being fully utilized, the anticipated growth of the industry may quickly surpass the amount of support that the fund provides. A complimentary revolving fund could provide an important bridge for new borrowers trying to leverage private sources. The fund could be initially capitalized through economic development organizations, federal grant programs or local governments.

The committee believes it important to note that prior to the creation of a new loan program, existing programs should be analyzed for their ability to meet the needs of industry participants and evaluated for potential expansion.

Recommendation 6:

Develop a business development training program, which dovetails with workforce development, to help new producers successfully apply for loans and develop business plans. (Mid-term)

The I/I AC discussed the challenges that new entrants faced in developing the business plans required of most lending agencies. The group discussed the value of training opportunities catered specifically to producing and understanding financial projections.

The committee noted that it is important to integrate any new program with technical workforce training and that business and accounting training needs to be catered specifically to mariculture as opposed to a more general farmer's training which may have limited applicability to the unique circumstances of the industry. Committee members mentioned a specific challenge regarding mariculture related accounting was capitalizing labor on balance sheets.

Recommendation 7:

Facilitate partnerships with state and local governments, industry, Alaska Native tribes, Community Development Quota organizations, NGOs and communities. Identify a dedicated lead organization. (Mid-term)

Developing strategic partnerships will help leverage local expertise, knowledge and funding sources.

The committee discussed that other countries that have developed a successful mariculture industry have identified a lead organization that is tasked with coordinating private, public and governmental relationships. These organizations have been critical in carrying strategy forward. At this point, it is unclear who will be charged with implementing the MTF's recommendations. The committee discussed that if this entity was a government agency, it should be one not conflicted with trying to manage as well as advocate. The group also discussed that a logical choice would be AFDF.

Recommendation 8:

Include in the comprehensive plan, a statement of commitment from the State of Alaska expressing support for sustainable mariculture growth and defining its role in helping industry to development and invest. (Near-term)

The AC discussed how the success of the industry is dependent on the state's continued commitment to provide sufficient funding to agencies that are critical to regulating and supporting mariculture efforts. The AC also discussed that that it may be important for the state to reinforce its position on mariculture as a form of agriculture for the purposes of leveraging USDA funds. The committee discussed the value in trying to define an appropriate role for government in the development of the industry.

Recommendation 9:

Support Alaska delegation tours to share and extract lessons learned from mariculture operations and businesses from around the globe. (Mid-term)

Information sharing in the early stages of mariculture development between existing growers and potential investors, both in-state and externally, will play an important role in the efficient growth of the industry.

Recommendation 10:

Develop a fact sheet on survival and growth rates of various mariculture species. (Long-term)

AC members from out of state discussed that the general lack of information on growth rates, survival and predation presented a significant impediment to their ability to develop business plans for investing in Alaska. The committee discussed how some information on growth rates may be available from ADFG and that a comprehensive product may necessitate a willingness from existing operators to share their experience and knowledge base. These types of inputs may be appropriate for a subsequent phase of the interactive mapping project. Region specific information is critical.

Recommendation 11

Develop downstream market support.

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The committee discussed the unknowns of future marketing components, particularly for aquatic plants, and that continued engagement with ASMI will be very important.

Recommendation 12

Following the development of the comprehensive plan, coordinate conversations with federal representatives to ensure alignment of state and federal priorities.

For example, the new NOAA administrator publicly expressed interest in reducing the US' seafood trade deficit. The committee discussed the importance of aligning federal initiatives with Alaska's opportunities.

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Alaska Mariculture Task Force

Mariculture Workforce Development Advisory Committee Recommendations
June 19, 2017

The Alaska Mariculture Task Force Workforce Development Advisory Committee met four times between October 2016 and May 2017 to identify ways to support workforce development in the state's mariculture industry and develop recommendations to address challenges. Members and contributors included: Paula Cullenberg, Alaska Sea Grant, chair; Eric Wyatt, Blue Starr Oyster Co.; Jim Aguiar, Eagle Shellfish Farms; Myrna Gardner, Central Council Tlingit Haida Indian Tribes of Alaska (CCTHITA); John Kiser, Rocky Bay Oysters; Tomi Marsh, OceansAlaska; Reid Brewer, UA Southeast; Julie Decker, AFDF; Adam Smith and Christi Colles, Alaska Department of Natural Resources; Barbara Brown, Dept. of Labor and Workforce Development; Sam Rabung, Alaska Department of Fish and Game; Kirsten Shelton Walker, McDowell Group.

Objectives for Workforce Development

The group identified three objectives for workforce development in the mariculture industry:

1. Increase profits and business success for those already in the industry;
2. Ensure hatcheries and nurseries and farms have a skilled workforce to draw from;
3. Inform, recruit and retain new entries into the industry.

Alaska Mariculture Workforce Development Advisory Committee Recommendations:

1. Encourage the hire of a Mariculture Specialist.
2. Develop and circulate mariculture skill-building resources. Offer professional development to growers, available remotely and in-person.
3. Offer an intensive, hands-on "Introduction to Shellfish/Seaweed Farming" boot camp.
4. Develop a mariculture apprenticeship/mentorship program.
5. Participate in industry career awareness/career exposure activities.
6. Evaluate and track participant progress. Include mariculture workforce impacts in economic and employment analyses.

Alaska's Mariculture Workforce

Direct employment at aquatic farm operations in Alaska includes owners, partners, employees, interns and family members. Paid positions can include part time, full-time, seasonal and year round. Most operations include volunteers, family members or interns to help keep labor costs down. Hatchery and nursery operations generally use paid full-time and seasonal employees.

In 2015, 138 people were working at shellfish farms; 55 were paid employees. Paid positions, including laborers, participated in 3,500 workdays (average 63 days or 12-13 weeks) and total workdays (including non-paid owners, etc.) were 9,600.

Hatchery and nursery operations had 36 workers; 3,420 days of paid workers (average 95 days employment or 23 weeks). Eleven positions worked more than 150 days and 92% of the positions were reported as laborers. Overall seed supply employment opportunities grew in 2015 with an increase in number of workers and number of days working.

Workforce development is needed for new operators, workers at farms, and hatchery workers. Skills needed by mariculture operators include: growing, harvesting, processing, marketing, meeting regulations and financial management.

In 2014, the Alaska Maritime Workforce Development Plan for the state was published. Shellfish farmers surveyed during the development of the plan identified the following action steps to expand the workforce:

- Increase awareness about small business loans to support entrepreneurs, by providing information about what loans are available and points of contacts and other references that can provide access to capital.
- Provide access and support for financial management and business training.
- Explore the need for a program similar to the reduced loan fee incentive for an Alaska Housing Finance Corporation loan, linking financing to financial training.

Challenges to the shellfish/seaweed farming workforce, identified by the Advisory Committee include: remote and often isolated farm locations, intense work condensed into a small season, physically demanding and repetitive work, outdoor work in all weather, low wages if an employee and/or small business owner responsibilities.

The Advisory Committee identified the need to target key populations such as Alaskans used to weather conditions, veterans, fishermen, and rural youth to meet workforce needs. Since Alaska would like to see the mariculture industry grow, incentives and workforce development programs should be developed to encourage more Alaskans to follow this career pathway.

Current workforce training and education

Mariculture farmers in Alaska are not required to have any particular certification or training to operate their businesses. Hatchery workers often have some level of post-secondary education, although that requirement is not consistent in Alaska. However, training and professional development is a critical part of recruiting a quality workforce and ensuring self-employed farmers gain the most value from their businesses. Currently, there are some, but limited, opportunities for professional development and training in mariculture in Alaska, listed below. Some training is offered in other states and a brief overview is provided here.

Alaska Sea Grant (UAF) offers workshops, technical assistance and training for Alaskans on a wide range of coastal issues and hosts an aquaculture website which is a good resource site for beginning and current farmers. For many years, Ray RaLonde served as a statewide Aquaculture Specialist for the Alaska Sea Grant's Marine Advisory Program. RaLonde worked with the shellfish farming industry on training, permitting, researching best growout practices and market opportunities. He retired in October 2015 and his position has not been refilled due to budget restrictions.

UAS offers an occupational endorsement, a certificate and an associate degree in Fisheries Technology that targets technicians at salmon hatcheries or fisheries technicians at state or federal agencies. While the program has offered a shellfish farming class in the past, it currently has no directed program focused on mariculture.

Training materials developed both by RaLonde and by UAS' one class on shellfish farming are available as well as module outlines developed by shellfish farmer, John Kiser. As of this writing, there is no capacity to teach any shellfish or seaweed farming training classes in Alaska.

The Virginia Institute of Marine Sciences has an Oyster Aquaculture Training Program http://www.vims.edu/research/units/centerspartners/abc/oat/index.php Participants rotate through the stages of oyster aquaculture from the hatchery to field grow out operations. Brief classroom lectures on major topics provide background information. This program will also include field trips to other research facilities and industry sites.

The Oyster Aquaculture Training (OAT) program is funded by non-State private funding. It offers prospective shellfish aquaculturists an opportunity to learn about all aspects of oyster culture, from hatchery to field operations—essentially, it is oyster culture "boot camp." In the past, many of these trainees have ended up in local businesses, and some have gone far afield. Consideration is afforded to all applicants who demonstrate a desire and aptitude for oyster aquaculture. The program draws from a national pool.

Maryland Extension has a broad suite of classes: http://extension.umd.edu/aquaculture/educational-programs Maine Sea Grant has extensive seaweed culture resources, other Sea Grant programs around the country have a range of aquaculture resource materials.

Roger Williams College, through instructor, Dale Leavitt also teaches a beginning shellfish growing class. In 2016, Leavitt offered the class via distance for the first time.

Alaska Mariculture Workforce Development Advisory Committee Recommendations:

1. **Encourage the hire of a Mariculture Specialist.**

The Advisory Committee noted the lack of capacity dedicated to developing the shellfish/seaweed farming workforce in Alaska. A Mariculture Specialist would be a catalyst for workforce development including: fine-tuning training materials, develop and coordinate training opportunities to meet workforce objectives. The Committee recommends that the Mariculture Specialist be part of Alaska Sea Grant's Marine Advisory faculty due to Sea Grant's connections with industry and the ability to help direct industry-driven research.

2. **Develop mariculture skill-building resources. Offer professional development to growers, available remotely and in-person.**

Class curricula, training modules and skill building resources have been developed over the years in Alaska. However, some are out of date and somewhat difficult to assemble. These teaching materials need to be updated, loaded online and made available remotely, as professional development to farmers and advancement for farm workers throughout the year. Hands-on, in-person training should be made available to farmers at annual meetings and on site as resources permit. While recognizing that University credit or a degree is not needed to be successful in mariculture, the value of some sort of University "credentials" should be explored.

3. **Offer an intensive, hands-on "Introduction to Shellfish/Seaweed Farming" boot camp.**

The objective of the hands-on "boot camp" is to provide an intensive, real world exposure to mariculture as a career. While some participants will choose not to pursue mariculture, others may become a cohort of Alaskans who could either work on a farm or eventually start their own farms. The "boot camp" will be a partnership with Central Council of Tlingit and Haida Indian Tribes of Alaska, other tribal workforce programs, Alaska Sea Grant, growers and other partners.

4. **Develop a mariculture apprenticeship/mentorship program.**

Some progress has been made in developing a mariculture apprenticeship program in Alaska. A traditional apprenticeship program, sponsored by the Alaska Department of Labor and Workforce Development, requires a step-wise plan for advancement as well as a link to formal training program. This may or may not be possible on a small, potentially remote shellfish farm. An informal apprenticeship or mentorship program supported with tribal workforce funds or by other means such as gradual development of a farm site may also be developed and could prove more flexible for a small business owner. Without federal apprenticeship funds available, other resources will need to be available to support a program, i.e. favorable loan terms for example. Once developed, an apprenticeship/mentorship should link to the "boot camp" and result in some type of certificate of completion to document skills.

5. **Participate in industry career awareness/career exposure activities.**

Numerous high schools in coastal Alaska incorporate career awareness into their education programs. Mariculture as a career opportunity should be included. Information describing this career, the pros and cons of the job, potential earning and an educational

pathway should be developed and shared with high schools as well as made available more broadly online. Maritime Works and the University of Alaska's Fisheries, Seafood and Maritime Initiative both have websites developed to provide information on maritime careers. The Future Farmers of Alaska has had a mariculture strand intermittently, coordinated by Alaska Sea Grant and FFA. This structured hands-on mariculture career exposure as well as other hands-on programs should be encouraged.

6. **Evaluate and track participant progress. Include mariculture workforce impacts in economic and employment analyses.**

With Alaska's current small mariculture workforce, it should be simple to track the progress of participants in workforce training programs. This will enable the programs to be evaluated and improved. It will also enable Alaska to more fully understand and describe the workforce. Economic and employment analyses often underreport or leave out mariculture operators altogether due to lack of information. More clearly describing the workforce enables the true value for the industry to be described.

Potential Workforce Development partners: Central Council Tlingit and Haida Indian Tribes of Alaska, Haa Aani, Alaska Sea Grant, Alaska FFA, Alaska Shellfish Growers Association, University of Alaska Southeast Fishery Technology Program.

Chris Hladick
Commissioner
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STATE OF ALASKA
DEPARTMENT OF COMMERCE, COMMUNITY & ECONOMIC DEVELOPMENT

Press Release

COMMISSIONER'S OFFICE

FOR IMMEDIATE RELEASE **No. 17-015**

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Alaska Mariculture Task Force Announces Indications of Mariculture Growth

State receives applications for new oyster and kelp farms; first commercial harvest of Alaska-grown seaweed; Alaska Legislature advances four bills to support responsible mariculture growth

May 31, 2017, Juneau – The Alaska Mariculture Task Force, established by Governor Walker in 2016, announced that Alaska has recently experienced tangible indications of mariculture growth.

New farms planned

The State of Alaska recently received applications for over 1,000 acres of new oyster and kelp farms. These permit applications are an indicator that there is developing interest and growth in the mariculture industry in Alaska. The applications include new aquatic farm sites in Southeast, Southcentral, and Southwest Alaska.

"Members of the Task Force have dedicated tremendous time and effort toward advancing this industry for Alaska," said Commissioner Chris Hladick of the Alaska Department of Commerce, Community, and Economic Development. "The Task Force is encouraged to see the number of applications being submitted for new oyster and kelp farms."

Seaweed farm harvests

Over the past month, three new farms have harvested Alaska-grown seaweed for the first time. The harvests occurred on farms in Ketchikan and Kodiak owned by Alaskans. Although farmers report that there is much still to be learned about efficiently growing and harvesting seaweed, they are optimistic about the future and have plans to expand production.

Mariculture legislation progress

During this session, the Alaska Legislature advanced four bills to support responsible growth of the mariculture industry. House Bill 128 and Senate Bill 89 are companion bills which would allow non-profits to pursue shellfish enhancement and restoration projects with oversight by the Alaska Department of Fish and Game. HB 76 and SB 95 are companion bills to amend the Mariculture Revolving Loan Fund to include eligibility for hatcheries in order to support and encourage in-state seed production of shellfish and seaweed. All four bills received broad support from fishermen, communities, economic development organizations, community development quota groups, and the Alaska Mariculture Task Force.

The Alaska Mariculture Task Force would like to thank all those who worked on the bills, including the sponsors and co-sponsors and the agency staffs. Supporters hope the bills will pass expeditiously during the 2018 Legislative session.

For more information regarding these mariculture developments, please contact Linda Mattson at the Alaska Department of Commerce, Community and Economic Development at 907-465-2500 or linda.mattson@alaska.gov

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2017 Aquatic Farm Application Summary

Original spreadsheet from Karen Cougan, DNR - 269-8543

Updated on 5/16/2017 by ADF&G, Cynthia Pring-Ham - 465-6150

ADL	Name (Contact and Company)	Application Type	DNR Received	Acres	Location	Nearest Community	Region	Organisms to Be Cultured
107829	Gregg Parsley, Shikat Bay Oysters, Inc	Amendment	3/1/2017	6	Shikat Bay	Naukati, POW	SE	Kelp (to be added)
106998	Ernieand Carol Gladsjo, Jinhi Bay Oysters	Amendment	4/20/2017	0.19	Jihni Bay	Naukati, POW	SE	Pacific oyster currently, None to be added
227591	Carl R. Liebes, Early Tide Seafarms, LLC	Amendment	4/27/2017	6	Bear Cove, Kachemak Bay	Homer	SC	Pacific oyster currently, None to be added
105346	Greg McMillian, Keta Seafoods	Amendment	5/1/2017	4	Western shore of Peratrovich Island	Klawock, POW	SE	Kelp (to be added)
107362	Cornelis Bakker, Cornelis Bakker, Inc.	Renewal	3/22/2017	2.8	Black Island	Ketchikan	SE	Geoducks currently
232720	Erik O'Brien, Efficient Coastal Resources	New (Lease) & Amendment (Operation Permit)	1/8/2017	198	Larsen Bay	Larsen Bay, Kodiak Island	WE	Kelp (not specified)
232715	Greg and Weatherly Bates, Alaska Shellfish Farms	New	1/9/2017	0.8	Jakolof Bay , Kachemak Bay	Seldovia, Homer	SC	Pacific oysters
232733	Rob Baer, Alaska Ground Swell, LLC	New	2/14/2017	10	Onion Bay adjacent Raspberry Island	Port Lions, Kodiak Island	WE	Sugar and Ribbon Kelp
None	Bill Fejes, Polar Seafoods	New	3/3/2017	15.23	Northeast arm of Uganik Bay	Uganik, Kodiak Island	WE	Pacific oysters
232746	Nicholas Mangini, Kodiak Island Sustainable Seaweed	New (Lease) & Amendment (Operation Permit)	3/13/2017	17	Women's Bay	Kodiak	WE	Kelp (not specified)
232885	Mark Scheer, Premium Aquatics, LLC	New	4/27/2017	318	Bucarreki Bay, adjacent Madrea de Dios	Craig	SE	Pacific oysters, Kelp (not specified)
232886	Troy Denkinger, Silver Bay Seafoods	New	4/28/2017	182	Olga Pt, Krestof Sound	Sitka	SE	Pacific oysters
232887	Troy Denkinger, Silver Bay Seafoods	New	4/28/2017	163	Beehive Island, Nakwasina Sound	Sitka	SE	Pacific oysters
None	Tmi Marsh, OceansAlaska	New	4/28/2017	22.96	George Inlet	George Inlet, Ketchikan	SE	Sugar and Ribbon Kelp
232900	Garry White	New	5/1/2017	4.13	Siginaka Islands, Sitka Sound	Sitka	SE	Pacific oysters
232894	Alf Pryor, Dead Humpy Creations	New	5/1/2017	50.85	Near Woody Island Channel	Kodiak	WE	Sugar and Ribbon Kelp
232893	Roderick Jensen, Sustainable Alaska Farms Enterprise, LLC	New	5/1/2017	24.35	Simpson Bay	Cordova, PWS	SC	Pacific oysters
232899	Seawan Gehleach, Simpson Bay Oyster Company	New	5/1/2017	14.35	Simpson Bay	Cordova, PWS	SC	Pacific oysters
232902	Beau Perry, Premium Oceanic	New	5/1/2017	34.9	Middle Bay	Kodiak	WE	Sugar Kelp
232909	Alexander Schutz, PWS Enterprise LLC	New	5/1/2017	15.25	Cedar Bay	PWS	SC	Pacific oysters

POW - Prince of Wales; PWS - Prince William Sound; SE - Southeast Region; SC - Southcentral Region; WE - Westward Region

Application Type	Numbers
Aquatic Farm Amendment	4
Aquatic Farm Renewal	1
Aquatic Farm New	15
Total applications (all types)	20

(Note: 2 applications for new aquatic farm operations are on private conveyed lands and no DNR lease is required.

New Aquatic Farm Applications Only*

Region	Numbers
Southeast (SE)	5
Southcentral (SC)	4
Westward (WE)	6
Total applications (New Operations Only)	15

* Amendment and Renewal not included

Organisms to be Cultured (New Aquatic Farms Only)*

Organisms	Numbers
Kelp Only	6
Pacific oysters Only	8
Pacific oysters and Kelp combined	1

* Amendment and Renewal not included

Alaska Marine Policy Forum

Summary from Wednesday, May 24, 2017
Host: Molly McCammon
Notes by Holly Kent

The Alaska Marine Policy Forum is a bimonthly teleconference for Alaskans to network and share information about marine policy, budgets, and legislation at state, national, and international levels, sponsored by Alaska Sea Grant and the Alaska Ocean Observing System. Contact Sue.Keller@alaska.edu to be added to the list serve to receive a reminder and agenda for the next call, and summary notes following each call.

Alex Schenk, Sen. Sullivan's office

- The senator's office is still collecting co-sponsors for his marine debris bill; there are 10 to date. The house version of the bill will be introduced in the house next week by Representatives Young and Bonamici.
- The senator is looking forward to Capitol Hill Ocean Week in D.C., June 13-15. He will be hosting a marine debris hearing on June 13.
- Alex reiterated that the President's budget is just a starting point and that Congress is ultimately tasked with passing the budget and will make the final decision. The senator sent a letter to the budget committee last week outlining their concerns.
- When work is done with the marine debris bill their office will move on to the Magnuson-Stevens reauthorization.
- The senator's office welcomes letters of support for programs due to be impacted by the President's budget.

Ephraim Froehlich, Sen. Lisa Murkowski's office
Charlotte Regula-Whitefield, Sea Grant Knauss Marine Policy Fellow

- Ephraim reiterated Alex's comments on the budget and said that the senator is happy to see level funding for the IOOS Program, but very concerned about the impact to:
    - National Estuarine Research Reserves
    - Sea Grant
    - NOAA's Arctic Research Program
    - National Weather Service
    - Fisheries and management
    - Pacific Coast Salmon Recovery Fund
    - Marine Mammal Commission

  The senator is sending out an updated letter to the budget committee regarding these priorities, and they would be happy to receive letters of support for these areas from groups like the North Pacific Research Board. They have already received letters of support for the Marine Mammal Commission with 50 high level signatures.
- Senator Murkowski attended an Ocean Caucus event on May 23 sponsored by the Baltimore Aquarium highlighting ocean acidification. The event was well attended with more than 70 attendees.
- The upcoming Ocean Week is a good time for folks to document their concerns regarding the President's budget and pass on to the senator.

- Charlotte has been working on aquaculture as a means of closing the trade deficit and is looking for additional input from Alaskans. Her contact information is;

  Charlotte Regula-Whitefield, Ph.D.
  National Sea Grant Knauss Fellow
  Office of United States Senator Lisa Murkowski
  522 Hart Office Building, Washington, DC 20510
  Direct phone: 202-224-6139
  Charlotte_Regula-Whitefield@murkowski.senate.gov
  cmregulawhitefield@alaska.edu
- Senator Murkowski will be attending a Department of Homeland Security budget hearing on May 25 with Secretaries Kelly (USDHS) and Acosta (USDOL) and will be focusing on the H2B visa issue impacting the fish processing industry. She will be pressing Secretary Kelly for a fix to the problem.
- The Vessel Incidental Discharge Act just passed out of the committee last week with big changes. Senator Cantwell is now in discussion with industry representatives and regulatory agencies in Washington state regarding some of these changes in the language of the act. Erik Elam of Senator Sullivan's office has the lead on this issue.

Barbara Blake, Lt Governor Mallott's office

- The state has received an increase in the number and size of mariculture permits this year which may indicate that the Governor's Alaska Mariculture Task Force has had an impact.
- A new position has been added to the Governor's office to work on climate change issues.
- Danielle Meeker is the Alaska Sea Grant fellow who will start this August for one year.
- The Transboundary Citizen's Advisory Workgroup will meet on May 25 in Juneau. The Lt. Governor will be meeting with Canadian fisheries officials on June 25 in Canada to discuss climate change, treaties, and transboundary issues.
- The Governor reversed last year's Administrative Order on the Commercial Fisheries Entry Commission, and introduced legislation last week to make changes to salaries and make the positions non-exempt.
- Barbara helped prepare the salmon disaster budget request to the Department of Commerce, and it has been sent to the Senate Appropriations Committee.
- The National Ocean Council is still in a holding pattern, although Director Deerin Babb-Brott had his contract extended for a year. The state is still looking toward some kind of regional ocean planning effort, and starting to think about what it might look like for the state.

Molly McCammon, Alaska Ocean Observing System

- Molly reported that she has heard that some federal agency people have been directed to start implementing the President's budget that calls for the elimination of their program. If the budget has not been approved by the deadline of October 1, then Congress passes a continuing resolution until it does. Ephraim said any budgetary Continuing Resolution must be based on a prior year budget passed by Congress. Therefore, programs CANNOT be eliminated or phased out UNTIL Congress has passed a new budget. There seems to be some mixed interpretations of this, and Ephraim will check in to the issue further.

Presentation on Marine Debris: Microplastics by Amy V. Uhrin, Chief Scientist at NOAA Marine Debris Division. PowerPoint slides are attached as a PDF.

Next Alaska Marine Policy call: July 26, 2017, 1 pm Alaska time

Upcoming Events

June 5-13 North Pacific Fishery Management Council meeting, Juneau
June 13-15 Capitol Hill Ocean Week

Alaska Mariculture Task Force
Recommendations for Mariculture Development in Alaska
June 8, 2017 – WORKING DRAFT

[*NOTE: The following is a working draft of a coordinated response on behalf of the Alaska Mariculture Task Force in response to recent increased interest by Congress, NOAA and other federal entities in expediting mariculture in the U.S. as part of a strategy to decrease the seafood trade deficit*.]

Introduction to the Alaska Mariculture Task Force:

At the request of industry and communities, Governor Bill Walker established the Alaska Mariculture Task Force (Task Force) on February 26, 2016 by Administrative Order #280. The Governor directed the Task Force to develop recommendations for the development of a viable and sustainable mariculture industry producing shellfish and aquatic plants for the long-term benefit of Alaska's economy, environment, and communities. The AO lays out guiding principles and essential elements of a comprehensive plan towards this goal which is to be completed by March 1, 2018.

Guiding Principles:

The Task Force is directed to use the following guiding principles in the development of its recommendations:

1) mariculture is defined as enhancement of wild fisheries and aquatic farming of shellfish and aquatic plants. Mariculture does not include finfish farming, which is prohibited in Alaska by law.
2) the development of the mariculture industry will
    a. be compatible with Alaska's reputation as a world leader in responsible and sustainable management of its seafood resources;
    b. be stakeholder-driven;
    c. coordinate and integrate with those entities conducting ocean monitoring in order to inform research and management of changing ocean conditions;
    d. include analysis of successful models that may be applicable to Alaska.
3) The comprehensive recommendations of the task force shall address, at a minimum
    a. public and private investment;
    b. regulatory issues;
    c. research and development needs;
    d. environmental changes;
    e. public education; and
    f. workforce development
4) The task force may establish advisory committees to assist in addressing the previously stated essential elements of the recommendations.

Although the comprehensive planning process is not complete yet, the Task Force has identified the following findings and recommendations.

General Findings and Recommendations:

When considering a Federal Aquaculture Initiative, the Task Force recommends that NOAA and other federal agencies take a regional approach which recognizes the various differences in state initiatives and priorities.

Alaska has over 30,000 miles of coast, which is more than all of the other states combined. All development to date has occurred in nearshore/state waters (0-3 miles). Economic challenges, concern for interaction with wild fisheries, in combination with tremendous nearshore waters potential, make offshore/federal waters development less likely in Alaska in the short and mid-term.

The existing industry produces approximately $1 million in sales annually. However, Alaska is seeing recent tangible signs of increased interest (see attached summary of farm applications in 2017). If the farm applications submitted in 2017 are approved it will quadruple the number of acres farmed in Alaska in one year.

A need exists to balance and encourage future small, medium and large business development in order to have a stable foundation which will support the infrastructure required to thrive.

Significant support for mariculture development has come from NOAA through the Alaska Sea Grant program as well as Saltonstall-Kennedy funds received by AFDF in 2014for the Alaska Mariculture Initiative. Increased capacity is necessary to fully realize and expedite mariculture development in Alaska. Initially, resources are needed to complete the planning process, which has increased in size and scope since NOAA's initial grant funding was received for the Alaska Mariculture Initiative.

After completion of the comprehensive plan, resources will be needed to support the implementation of the plan in the mid-term. The Task Force requests NOAA support implementation of Alaska's comprehensive plan in areas where federal and state interests are aligned.

A lead organization will need to be identified/created in order to coordinate and organize implementation of the statewide comprehensive plan. Industry needs to be in a leadership role. Coordination with federal agencies would be enhanced through the utilization of a NOAA aquaculture coordination in the Alaska region [Note: all other regions have an existing aquaculture coordinator]. Alaska also needs to replace the Aquaculture Extension Agent within Alaska Sea Grant. [Note: Alaska Sea Grant has submitted three small and one larger project proposals for funding from the national Sea Grant office.]

Alignment of Federal agency programs and proactive identification of funding programs that match with needs identified in the comprehensive plan will help encourage and support mariculture development (e.g. USDA, NOAA (Sea Grant, SK grants, Office of Aquaculture), EDA, NSF, DOL, etc).

Investment and Infrastructure:

Shellfish and seaweed hatcheries are a critical piece of infrastructure necessary for the industry to grow. The financial support of these operations, however, is difficult during this

developmental stage. Industry in Alaska is too small to financially support these operations entirely through seed sales, yet expansion of the industry is entirely dependent upon secure seed production. Short-term financial support will stabilize operations, provide seed security, and break the chicken-or-egg stage which will allow the industry to grow.

Development of an interactive GIS mapping tool which layers relevant existing oceanographic, satellite, and social data and allows users to analyze new sites for productivity, conflicting uses, and efficiency would help reduce risks for new businesses to enter mariculture.

Public Education & Marketing:

As interest increases in mariculture, more and larger aquatic farm applications will be submitted to regulatory agencies (see attached summary from 2017). Public education and outreach efforts are critical to increasing public acceptance of new sites. Using a variety of factual sources, supportive stakeholder groups, and expert presenters will increase acceptance of facts.

Additional investment in expansion of marketing programs for new species will be required to build on Alaska's inherent brand value and effective public-private partnership (the Alaska Seafood Marketing Institute) in order to generate the price premiums necessary to overcome higher costs of farming in Alaska and moving product to market. ASMI will also need to consider how to alter messaging to incorporate the Alaska-grown theme of these new products.

Regulatory:

In some ways, Alaska's regulatory environment for aquatic farm permitting is less onerous than other regions in the U.S. However, challenges have still been indentified in Alaska that can be addressed over time in order to improve the regulatory environment. For example, a state law is required in order to provide statutory authority to ADF&G to allow for shellfish fishery enhancement. Additional water quality data is required relative to fecal coliform during high rainfall in order to allow ADEC regulators to consider alteration of its related policies. Genetic information on seaweed stocks is key to broad growth of that species for commercial production.

Federal agencies which are required to be consulted on specific topics (e.g. ESA, etc) during Alaska's near-shore permitting process need adequate support to respond in a efficient and proactive review process.

Research, Development & Environmental Information:

R & D needs vary depending primarily by species. The following species are under some stage of R&D in Alaska: Pacific oysters, blue mussels, seaweeds (sugar, ribbon and bull kelp), blue and red king crab, sea cucumber, geoduck, razor clam, and abalone.

NOAA is currently working in partnership with private industry on a small scale to support these research needs through Cooperative Research And Development Agreements (CRADA). These types of partnerships can be expanded in the future to meet some of the near-term R&D needs of the industry. National Sea Grant funds are contributing to seaweed genetic and seeding processes research.

Workforce Development:

Flexible training workshops and short courses for hatchery, nursery and aquatic farm workers are critical to growing a workforce in coastal Alaska with the skills necessary for a competitive industry. A number of entities are well-positioned to play a role in either demonstration farms or classrooms (Alaska Sea Grant, private non-profit hatchery facilities, tribal entities and public or private demonstration farms).

Guide to Federal Aquaculture Programs and Services

Product of the Interagency Working Group on Aquaculture

Objective

The National Aquaculture Act of 1980 (16 U.S.C. 2801, *et seq.*), section 4(e)(5) requires that a catalog be developed and made available describing all Federal programs and activities that directly or indirectly encourage, support, or assist U.S. aquaculture. This *Guide* was prepared by the Interagency Working Group on Aquaculture (formerly the Joint Subcommittee on Aquaculture) under the National Science and Technology Council's Life Sciences Subcommittee with the goal of fulfilling this requirement.

Coordination of Federal Aquaculture-related Programs

The National Aquaculture Act of 1980 provided for an interagency coordinating body to provide leadership and to facilitate the coordination of federal programs associated with aquaculture in the Federal government. This is done through the Interagency Working Group on Aquaculture (IWG-A), which reports to the National Science and Technology Council (NSTC) and the Office of Science and Technology Policy (OSTP) in the Executive Office of the President.

This *Guide* is intended to be a dynamic document subject to periodic updates. Suggestions for updates are welcome and can be sent to mmayeaux@nifa.usda.gov.

Assistance and Services
Subject Matter Index

Grant and Loan Portals and Information
- Catalog of Federal Domestic Assistance
- Grants.gov
- Small Business Innovation Research Programs

Business and Farm Grant and Loan Programs
- Farm Services Agency
- Rural Development
- Economic Development Administration
- Farm Credit Administration
- NOAA Fisheries Finance Program
- DOE Loan Programs
- US EPA Grant Programs
- National Science Foundation Grants
- Small Business Administration

Disaster Assistance Programs
- Disasterassistance.gov
- USDA FSA Disaster Assistance Programs
- U.S. Small Business Administration (SBA)

Information Services
- USDA National Agricultural Library
- NOAA National Sea Grant Library
- Department of Interior Library

International Assistance and Services
- USDA Foreign Agricultural Service
- NMFS International Services
- United States Agency for International Development (USAID)

Marketing Services
- USDA Agricultural Marketing Service
- USDA Foreign Agricultural Service
- NMFS Seafood Marketing and Trade

Import/Export Services
- Export.gov
- Animal and Plant Health Inspection Service (APHIS)
- DOC International Trade Administration
- US Fish and Wildlife Service (FWS)

Aquaculture Statistics
- USDA ERS
- National Agriculture Statistics Service
- Census of Aquaculture
- NOAA NMFS Fisheries Statistics Division

Research Assistance and Services
- Agriculture Research Services
- National Institute of Food and Agriculture
- National Centers for Coastal Ocean Science
- National Marine Fisheries Services
- National Sea Grant College Program
- U.S. Fish and Wildlife Services
- U.S. Geological Survey
- NSF

Regulatory Agencies and Information
- Regulations.gov
- USDA Animal and Plant Health Inspection Service (APHIS)
- National Marine Fisheries Service (NMFS)
- Food and Drug Administration (FDA)
- U.S. Fish and Wildlife Services (USFWS)
- U.S. Army Corps of Engineers
- Environmental Protection Agency (EPA)

Aquaculture Extension
- USDA Cooperative Extension System
- NOAA Sea Grant Marine Advisory Program

Aquatic Animal and Plant Health Assistance and Services
- National Aquatic Animal Health Plan
- Animal and Plant Health Inspection Service (APHIS
- USDA ARS Aquatic Animal Health Program
- Aquatic Animal Drug Application Program (AADAP)
- USFWS National Fish Health Centers

National Research Support Programs
- National Research Support Program-7 (NRSP-7)
- National Animal Genome Research Program (NRSP-8)

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- Agricultural Marketing Service (AMS)
- Animal and Plant Health Inspection Service (APHIS)
- Agricultural Research Service (ARS)
- Economic Research Service (ERS)
- Foreign Agricultural Service (FAS)
- Farm Service Agency (FSA)
- Federal-State Marketing Improvement Plan (FSMIP)
- National Agricultural Statistics Service (NASS)
- National Institute of Food and Agriculture (NIFA)
- Natural Resources Conservation Service (NRCS)
- Risk Management Agency (RMA)
- Rural Development (RD)

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- Office of Aquaculture
- Office of Habitat Conservation
- Office of Oceanic and Atmospheric Research
- Office of Protected Resources
- Office of Science and Technology
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- Economic Development Administration
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Department of Health and Human Services (DHHS)
- U.S. Food and Drug Administration (FDA)
  - Center for Food Safety and Applied Nutrition (CFSAN)
  - Center for Veterinary Medicine (CVM)

Department of Interior (DOI)
- United States Fish and Wildlife Service (USFWS)
- United States Geological Survey (USGS)

Department of State (DoS)
- Bureau of Ocean's Environment and Science

National Science Foundation (NSF)

U.S. Environmental Protection Agency (EPA)
- Water Quality Programs
- Monitoring Shellfish Waters
- Effluent Discharge Standards
- National Pollutant Discharge Elimination System
- Permits

U. S. Army Corps of Engineers (USACE)

U.S. Agency for International Development (USAID)

Federal Aquaculture Assistance and Services

Grant and Loan Portals and Information

Catalog of Federal Domestic Assistance (CFDA)

The Catalog of Federal Domestic Assistance (CFDA) provides a full listing of all federal programs available to state and local governments (including the District of Columbia); federally recognized Indian tribal governments; territories (and possessions) of the United States; domestic public, quasi- public, private for-profit and non-profit organizations and institutions; specialized groups; and individuals. Using the search term "aquaculture" might not return all of the programs that may fund aquaculture-related applications, so success may rely upon "reading-between-the-lines" of some program descriptions.

Grants.gov

All applications for grants and loans from the federal government must be submitted through Grants.gov. Grants.gov is also a resource to search for grants, loans, and other federal application procedures including research, education, and extension proposals. The U.S. Department of Health and Human Services is the managing partner for Grants.gov, an initiative that is having an unparalleled impact on the grant community. To learn more about Grants.gov and to determine if you are eligible for grant opportunities, go to the Grants.gov website for information offered on this site.

Grants.gov does not provide personal financial assistance; it is only the portal for which to apply for federal assistance. To learn where to find personal help, check the Government Benefits, Student Loans and Small Business Start-up Loans websites

Small Business Innovation Research (SBIR) programs

The Small Business Innovation Research (SBIR) programs are highly competitive programs that encourage domestic small businesses to engage in Federal Research/Research and Development (R/R&D) that has the potential for commercialization. Through a competitive awards-based program, SBIR enables small businesses to explore their technological potential and provides the incentive to profit from its commercialization. By including qualified small businesses in the nation's R&D arena, high-tech innovation is stimulated and the United States gains entrepreneurial spirit as it meets its specific research and development needs. SBIR programs in NOAA, NIST, NSF, and USDA are most likely to accept and possibly fund aquaculture-related proposals from eligible small businesses.

SBIR-Participating Agencies

Each year, Federal agencies with extramural research and development (R&D) budgets that exceed $100 million are required to allocate 2.5 percent of their R&D budget to these programs. Currently, eleven Federal agencies participate in the program:

- Department of Agriculture
- Department of Commerce - National Institute of Standards and Technology
- Department of Commerce - National Oceanic and Atmospheric Administration
- Department of Defense
- Department of Education
- Department of Energy
- Department of Health and Human Services – National Institutes of Health
- Department of Homeland Security
- Department of Transportation
- Environmental Protection Agency
- National Aeronautics and Space Administration
- National Science Foundation

Each agency administers its own individual SBIR program within guidelines established by Congress. These agencies designate R&D topics in their solicitations and accept proposals from small businesses. Awards are made on a competitive basis after proposal evaluation.

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Business and Farm Grant and Loan Programs

U.S. Department of Agriculture

Farm Service Agency (FSA)

FSA assists agricultural producers, which includes aquaculture, and landowners in achieving a high level of stewardship of soil, water, air, and wildlife resources on America's farmland and ranches and provides a safety net to the American farmer through the following programs:

The Emergency Conservation Program (ECP) shares with agricultural producers the cost of rehabilitating eligible farmlands damaged by natural disaster. During severe drought, ECP also provides emergency water assistance — both for livestock (fish) and for existing irrigation systems for orchards and vineyards.

Emergency Loan Assistance to eligible farmers to help cover production and physical losses in counties declared as disaster areas by the President or designated by the Secretary of Agriculture. The FSA Administrator may also authorize Emergency Loan assistance to cover physical losses only.

Farm Loan Programs

The FSA administers Farm Loan Programs which offer direct and guaranteed farm ownership and operating loan programs to farmers, including farmers of aquatic animals, who are temporarily unable to obtain private,

commercial credit. Often, these are beginning farmers who can't qualify for conventional loans because they have insufficient financial resources. The Agency also helps established farmers who have suffered financial setbacks from natural disasters, or whose resources are too limited to maintain profitable farming operations. Under the guaranteed loan program, the Agency guarantees loans made by conventional agricultural lenders for up to 95 percent of principal. Farmers interested in guaranteed loans must apply to a conventional lender who then arranges for the FSA guarantee.

The FSA makes and guarantees farm ownership and operating loans and provides technical management assistance to family farmers and ranchers. Farm ownership loans may be used to buy, improve, or enlarge farms, including buildings, ponds, wells, and water systems. Farm operating loans may be used to pay for items needed for a successful operation such as farm and home equipment, feed, fuel, chemicals, and hired labor.

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Rural Development

Loans:

- Business and Industry (B&I) Guaranteed Loans
- Intermediary Relending Program (IRP)
- Rural Energy for America Program Guaranteed Loan Program (REAP Loans)(Section 9007)
- Rural Economic Development Loan And Grant (REDLG)

Grants:

- Repowering Assistance Program (Section 9004)
- Rural Business Enterprise Grant Program (RBEG)
- Rural Energy for America Program Grants (REAP)

U.S. Department of Commerce

Economic Development Administration (EDA)

The U.S. Economic Development Administration's investment policy is designed to establish a foundation for sustainable job growth and the building of durable regional economies throughout the United States. This foundation builds upon two key economic drivers - *innovation and regional collaboration.* Innovation is key to global competitiveness, new and better jobs, a resilient economy, and the attainment of national economic goals. Regional collaboration is essential for economic recovery because regions are the centers of competition in the new global economy and those that work together to leverage resources and use their strengths to overcome weaknesses, will fare better than those that do not. EDA encourages its partners around the country to develop initiatives that advance new ideas and creative approaches to address rapidly evolving economic conditions including aquaculture.

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Farm Credit Administration (FCA)

The Farm Credit Administration (FCA) is an independent Federal agency that regulates and examines the banks, associations, and related entities of the Farm Credit System (FCS), including the Federal Agricultural Mortgage Corporation (Farmer Mac). The FCS is the largest agricultural lender in the United States. It is a nationwide network of lending institutions that are owned by their borrowers. It serves all 50 States and Puerto Rico.

The Farm Credit Administration's mission is to ensure a safe, sound, and dependable source of credit and related services for agriculture and rural America. The FCA administers a Young, Beginning, and Small Farmer/Rancher Lending program to serve the credit needs of young, beginning, and small farmers and ranchers.

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National Oceanographic and Atmospheric Administration (NOAA)

Fisheries Finance Program

The NMFS Fisheries Finance Program provides long-term financing in the form of direct loans for the cost of construction, reconstruction, expansion, and purchase of fishing and aquaculture facilities.

NOAA Small Business Innovation Research (SBIR)

Investment in aquaculture research and development is supported by NOAA's SBIR program, which encourages small businesses to leverage federal funds to invest in innovative technologies and next-generation products and processes that may lead to commercialization.

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U.S. Department of Energy

The DOE has Funding Opportunities for research and small businesses including aquaculture. The Office of Economic Impact and Diversity has information on doing business with the DOE, including viewing current business opportunities, registering to submit proposals, and obtaining information and guidance on the acquisition and financial assistance award process.

Loan Programs

The mission of Loan Program Office (LPO) is to accelerate the domestic commercial deployment of innovative and advanced clean energy technologies at a scale sufficient to contribute meaningfully to the achievement of our national clean energy objectives. The LPO provides guaranteeing loans to eligible clean energy projects (i.e., agreeing to repay the borrower's debt obligation in the event of a default), and by providing direct loans to eligible manufacturers of advanced technology vehicles and components including those used in aquaculture production.

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency has several programs involved in aquaculture. The proper management of effluents and residual wastes should be a major consideration of aquaculture systems in assuring the protection of the environment.

EPA's Water Quality Programs are concerned with setting Water Quality Criteria, Monitoring Shellfish Waters and Effluent Discharge Standards for assuring the protection of the nation's waterways and water supplies. The National Pollutant Discharge Elimination System (NPDES) issues permits for the discharge of wastewaters to surface waters, including discharges from aquaculture systems in many cases. Permits are also available from this program to use wastes as nutrients in public waters for aquaculture purposes.

Wastewater Treatment in publicly owned treatment works is amenable to the use of aquaculture systems funded, in part, by EPA's State Revolving Fund (SRF) Program. In conjunction with the U.S. Army Corps of Engineers, EPA also implements the Clean Water Act Section 404 Wetlands Protection Program aimed at protecting natural wetlands from the impacts of dredging and filling.

Chemicals and other materials to be used in aquaculture are subject to Pesticide Registration by EPA prior to marketing to the user.

Grant funding through EPA can be found here.

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U.S. National Science Foundation

The NSF Small Business Innovation Research (SBIR) program can be accessed at the following link: NSF SBIR

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U.S. Small Business Administration

The Small Business Administration (SBA) provides small businesses with an array of financing. SBA provides free, individual, face-to-face, and internet counseling for small businesses, and low-cost training to nascent entrepreneurs and established small businesses in over 1,800 locations throughout the United States and US territories.

Through its Office of Disaster Assistance, the U.S. Small Business Administration provides low-interest, long-term loans that are direct from the federal government. These loans are only available where there is a disaster declaration and cover uninsured disaster related losses. Small aquaculture enterprises are eligible for SBA's Economic Injury Disaster Loans.

Economic Injury Disaster Loan Program

Federal economic injury disaster loans for small businesses, small agricultural cooperatives, small businesses engaged in aquaculture, and most private, non-profit organizations

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Disaster Assistance Programs

Federal Disaster Assistance

DisasterAssistance.gov provides information on how you might be able to get help from the U.S. Government before, during and after a disaster. If the President of the United States makes help available to individuals in your community after a disaster, you can visit this site to apply online.

U.S. Department of Agriculture

USDA Farm Services Agency Disaster Assistance Programs

The FSA provides assistance for natural disaster losses resulting from drought, flood, fire, freeze, tornadoes, pest infestation, and other calamities. Cultured aquatic animals are considered livestock by the USDA. Fish and other aquatic animals and plants are also considers "crops" by USDA.

The Emergency Assistance for Livestock, Honeybees, and Farm- Raised Fish Program (ELAP) provides assistance for grazing losses due to blizzards and wildfires which are not adequately addressed by other disaster programs. Assistance for feed losses is also available.

The Livestock Indemnity Program (LIP) provides cash payments to eligible producers for livestock, including aquaculture for death losses in excess of normal mortality due to adverse weather.

The Non-insured Crop Disaster Assistance Program is for crops, including aquaculture crops, for which crop insurance is not available. It provides assistance for farmers who grow such crops, limiting their losses from natural disaster and helping to manage their overall business risk. NOTE: To be eligible for assistance in the event of a disaster, you must provide certain information to FSA annually, before a disaster occurs.

The Disaster Debt Set-Aside Program provides agricultural producers, including fish farmers, who have existing direct loans with FSA who are unable to make the scheduled payments to move up to one full year's payment to the end of the loan. For disaster debt set-aside data by state and fiscal year, click here.

The Supplemental Revenue Assistance Payments (SURE) program is also available to producers who suffered crop losses in counties declared a disaster by the Secretary of Agriculture.

U.S. Small Business Administration

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Economic Injury Disaster Loan Program

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Other resources:

- Department of Homeland Security (DHS) Compendium of Disaster Assistance Programs
- Benefits.gov - Disaster Relief
- Disaster Housing Assistance Program (DHAP) - HUD
- Seeking Disaster Assistance | Ready.gov

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Information Services

U.S. Department of Agriculture

National Agricultural Library (NAL)

The National Agricultural Library (NAL), part of the Agricultural Research Service of the U.S. Department of Agriculture, is one of four National Libraries in the United States. NAL is a major international source for agriculture and related information. This Web site provides access to NAL's many resources and a gateway to its associated institutions.

The Alternative Farming Systems Information Center (AFSIC) is one of several topic-oriented information centers at the National Agricultural Library (NAL). The Library, located in Beltsville, Maryland, is the foremost agricultural library in the world, and is one of four U.S. national libraries along with the Library of Congress, and the National Library of Medicine. AFSIC is supported, in part, by USDA's Sustainable Agriculture Research and Education (SARE) program. AFSIC specializes in locating and accessing information related to alternative cropping systems including sustainable, organic, low-input, biodynamic, and regenerative agriculture. AFSIC also focuses on alternative crops, such as aquaculture, new uses for traditional crops, and crops grown for industrial production.

The Water Quality Information Center at the National Agricultural Library (NAL) is part of USDA ARS. The center was established in 1990 to support USDA's coordinated plan to address water quality concerns. As the focal point of NAL's water quality efforts, the center collects, organizes, and communicates the scientific findings, educational methodologies, and public policy issues related to water quality and agriculture. The center's activities involve three areas: communications, library resources, and special projects.

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U.S. Department of Commerce

National Sea Grant Library (NSGL)

The National Sea Grant Library (NSGL) is the digital library and official archive for NOAA Sea Grant documents. It is the only comprehensive collection of Sea Grant–funded documents from over 30 programs and projects across the country. This collection encompasses a wide variety of subjects, including oceanography, marine education, aquaculture, fisheries, aquatic nuisance species, coastal hazards, seafood safety, limnology, coastal zone management, marine recreation, and law.

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U.S. Department of Interior

Department of Interior Library

The Department of Interior Library provides a full range of professional reference and research services, available to Interior employees in both the Washington, DC, area and nationwide. The collections include Departmental publications, as well as related books, journals, electronic databases and other resources that support the mission of the Department, its agencies, and bureaus.

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International Assistance and Services

U.S. Department of Agriculture

Foreign Agricultural Service

The Foreign Agricultural Service (FAS) serves U.S. agriculture's international interests by expanding export opportunities for U.S. agricultural, fish, and forest products and promoting world food security. The FAS administers several programs beneficial to the United States aquaculture industry including:

Market Access Program (MAP)
Helps finance activities to market and promote U.S. agricultural commodities and products worldwide.

Emerging Markets Program (EMP)
Provides funding for technical assistance activities to promote exports of U.S. agricultural commodities to emerging markets worldwide.

Foreign Market Development Program (FMD)
Provides cooperator organizations with cost-share funding for activities that build international demand for U.S. agricultural commodities.

Technical Assistance for Specialty Crops
Funds projects that address sanitary, phytosanitary and technical barriers that prohibit or threaten the export of U.S. specialty crops.

Scientific Exchange Programs

The Norman E. Borlaug International Agricultural Science and Technology Fellowship Program promotes food security and economic growth by providing research and training opportunities to early- and mid-career agricultural researchers and policymakers from developing and middle-income countries. USDA partners with U.S. land grant universities, international research centers, and other institutions to provide up to 12 weeks of U.S.-based training each year.

The Cochran Fellowship Program provides participants from middle-income countries, emerging markets, and emerging democracies with high-quality training to improve their local agricultural systems and strengthen and enhance trade links with the United States. Participants are mid- and senior-level professionals from both the public and private sectors who are concerned with agricultural trade, agribusiness development, management, policy, and marketing.

The Faculty Exchange Program enhances the teaching ability of agricultural educators from institutions of higher learning in developing countries. Participants come to the United States for one academic semester (4-5 months) to increase their knowledge of, and ability to teach, agricultural economics and marketing, agribusiness, and agrarian law in a market-based economy.

The Scientific Cooperation Exchange Program supports collaborative relationships between teams of scientific and technical experts from the U.S. and the People's Republic of China. The program helps to promote U.S. agricultural priorities, encourage long-term cooperation in agricultural science and technology, create a positive atmosphere for agricultural trade, and enhance overall relations between the United States and China.

The Scientific Cooperation Research Program supports joint research, extension, and education projects among domestic and international agricultural professionals. These projects address issues including agricultural trade and market access, animal and plant health, biotechnology, food safety and security, and sustainable natural resource management in the United States and internationally.

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U.S. Department of Commerce

NMFS Office of International Affairs

The NMFS Office of International Affairs works with a variety of domestic and international partners to strive to accomplish various goals and objectives in support of our mission and vision including: Promote ecosystem-based fisheries management; control fishing capacity; combat illegal, unreported, and unregulated (IUU) fishing; strengthen regional fisheries management organizations; secure equitable access for U.S. fishers to shared living marine resources; increase assistance to developing states; and ensure food security. This mission in accomplished by: participating in regional fisheries management organizations; participating in multilateral and bilateral environmental agreements/foras; participating in free trade negotiations; conducting workshops on living marine resource issues; and building partnerships to improve marine conservation and aquaculture. This office works closely with the NMFS Office of Aquaculture on international matters pertaining to research and management of international aquaculture matters.

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U.S. Agency for International Development (USAID)

The U.S. Agency for International Development (USAID) supports aquaculture research and development projects in developing countries where significant opportunities exist to utilize aquaculture to meet nutritional needs and to increase incomes and employment opportunities. It supports applied research, usually involving U.S. scientists, primarily through the Office of Agricultural and Food Security (AFS) in the Center for Economic Growth and Agricultural Development (EGAD) of the Bureau for Global programs, Field Support and Research. The research addresses critical constraints to the expansion of sustainable small-scale aquaculture in developing countries. The main mechanism through which AFS supports aquaculture research is the AQUAFISH CRSP which involves a dozen U.S. universities as well as research institutions in several developing countries. AFS also supports aquaculture research and development activities undertaken by the WorldFish Center.

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Marketing Services

U.S. Department of Agriculture

Agricultural Marketing Service

The Agricultural Marketing Service (AMS) of the USDA provides assistance to aquaculture through several programs including:

The Federal-State Marketing Improvement Program (FSMIP). This program seeks to improve the marketing of aquaculture commodities and to reduce marketing costs for the benefit of producers and consumers. Projects include work on innovative marketing techniques, testing study findings in the marketplace and developing State expertise to improve service to marketers of aquacultural products. FSMIP is a matching-funds program exclusively available on a competitive basis through State Departments of Agriculture or other State agencies, who must submit proposals directly to the program administrators.

Livestock and Seed Program (LSP) is responsible for purchasing meat and fish products in order to stabilize market conditions and furnish nutritious food to meet the needs of the Department's domestic feeding programs. Under certain excess food supply conditions, aquaculture products may qualify for this program.

The Transportation Services Division provides agricultural transportation information and analysis to help move agricultural products, including fish and fish products, to market. As part of the USDA, the Transportation Services Division informs, represents, and assists agricultural shippers and government policymakers through: reports, representation, analysis, assistance, and response to inquiries.

The Farmers Market Promotion Program (FMPP) is a competitive grant program that provides funds to assist in establishing, expanding, and promoting domestic farmers markets, roadside stands, community-supported agriculture programs, and other direct producer-to-consumer market opportunities.

The mission of the Rural Business-Cooperative Service is to enhance the quality of life for rural Americans by providing leadership in building competitive businesses including sustainable aquaculture. This program fulfills its mission by: investing financial resources and providing technical assistance to businesses and cooperatives located in rural communities; and establishing strategic alliances and partnerships that leverage public, private, and cooperative resources to create jobs and stimulate rural economic activity.

Value-Added Producer Grants (VAPG) The primary objective of the VAPG program is to help agricultural producers, including aquaculture producers, enter into value-added activities related to the processing and/or marketing of bio-based value-added products. Generating new products, creating and expanding marketing opportunities, and increasing producer income are the end goals of this program. The beginning farmer or rancher, socially-disadvantaged farmer or rancher, small- or medium-sized farm or ranch structured as a family farm, farmers or ranchers cooperative, or are proposing as a mid-tier value chain, as defined in the Program Regulation may receive priority. Grants are awarded on a competitive basis.

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Foreign Agricultural Service

The Foreign Agricultural Service (FAS) serves U.S. agriculture's international interests by expanding export opportunities for U.S. agricultural, fish, and forest products and promoting world food security. The FAS administers several programs beneficial to the U.S. aquaculture industry including:

The Emerging Markets Program assists in developing, maintaining, or expanding markets for U.S. agricultural exports in emerging markets, to improve the effectiveness of food and rural business systems in emerging markets, including potential reductions in trade barriers, and to increase prospects for U.S. trade and investment in these countries. The Program encompasses all geographic regions and uses funds and facilities of the Commodity Credit Corporation (CCC).

The Foreign Market Development (FMD) Program aids in the creation, expansion, and maintenance of long-term export markets for U.S. agricultural products including aquaculture. Under the program, USDA partners with U.S. agricultural producers and processors, who are represented by nonprofit commodity or trade associations called "cooperators," to promote U.S. commodities overseas.

The Market Access Program (MAP) helps U.S. producers, exporters, private companies, and trade organizations finance overseas marketing and promotional activities such as trade shows, market research, consumer promotions, technical assistance, trade servicing, and educational seminars.

The Emerging Markets Program (EMP) provides funding for technical assistance activities to promote exports of U.S. agricultural commodities and products to emerging markets.

The Quality Samples Program (QSP) helps U.S. agricultural trade organizations provide small samples of their products, including aquaculture products, to potential importers in emerging markets overseas.

The Commodity Credit Corporation's (CCC) Facility Guarantee Program (FGP) provides payment guarantees to facilitate the financing of manufactured goods and services exported from the U.S. to improve or establish agriculture-related facilities in emerging markets. By supporting such facilities, the FGP is designed to enhance sales of U.S. agricultural commodities and products to emerging markets where the demand for such commodities and products may be constricted due to inadequate storage, processing, or handling capabilities for such products.

The Commodity Credit Corporation (CCC), USDA, administers Export Credit Guarantee Programs for commercial financing of U.S. agricultural and aquacultural exports. The programs encourage export to buyers in countries where credit is necessary to maintain or increase U.S. sales, but where financing may not be available without CCC guarantees. The CCC administers export credit guarantee programs for commercial financing of U.S. agricultural exports to encourage exports to buyers in countries where credit is necessary to maintain or increase U.S. sales.

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NMFS Seafood Marketing & Trade

Quantifying the benefits derived by consumers from both inland and offshore fisheries is essential for assessing the cost-effectiveness of measures taken to prevent degradation of marine resources from human activities (such as fishing, pollution, and hypoxia), as well as for quantifying future benefits that may be obtained under stock rebuilding plans.. Information available on this web site: http://www.nmfs.noaa.gov/sfa/PartnershipsCommunications/tradecommercial/

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U.S. Department of Health and Human Services

Food and Drug Administration

The U.S. currently imports 80% of its seafood. FDA recognizes that the volume and variety of food products, including aquaculture products, imported into the United States is rapidly increasing, making international issues regarding safety, quality, and labeling of FDA-regulated foods a priority. The FDA Center for Veterinary Medicine (CVM) and the FDA Center for Food Safety and Applied Nutrition (CFSAN) have increased their involvement in the global public-health community and their ability to ensure that imported aquaculture-raised food is safe for U.S. consumers.

CVM, CFSAN, and the FDA Office of Regulatory Affairs (ORA) receive many inquiries from foreign entities and producers regarding the FDA's stance on aquaculture drug use. To address such inquiries, CVM, in cooperation with CFSAN, ORA, and the Joint Institute for Food Safety and Applied Nutrition (JIFSAN), is developing an interactive, web-based aquaculture educational module that will be translated and used for international outreach.

CFSAN is also developing and strengthening partnerships with international organizations, donor organizations, industry, and academia to develop a model of effective and sustainable training and capacity building that includes public health metrics. The Good Aquaculture Practices (GAqP) "train-the-trainer" course, developed in cooperation with JIFSAN, is offered to aquaculture industry, academia, and government in developing countries.

For more information about FDA international activities, please visit the following page:

CVM--http://www.fda.gov/AboutFDA/CentersOffices/OfficeofFoods/CVM/WhatWeDo/ucm282083.htm

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Import/Export Services

Export.gov

Export.gov brings together resources from across the U.S. government to assist American businesses in planning their international sales strategies and succeed in today's global marketplace.

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U.S. Department of Agriculture

Animal and Plant Health Inspection Service

The Animal and Plant Health Inspection Service (APHIS) serves to facilitate safe trade, monitor the movement of risk material, including aquaculture products, protect against the introduction of pests, regulate the import and export of animals and plants, and help exporters meet the entry requirements of other countries. Click here to view animal and plant import/export information.

Biotechnology Import and Export Information
APHIS' Biotechnology Regulatory Services (BRS) requires a permit or notification for the import of certain genetically engineered organisms.

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U.S. Department of Commerce

International Trade Administration

The Department's International Trade Administration (ITA) strengthens the competitiveness of U.S. industry, promotes trade and investment, and ensures fair trade through the rigorous enforcement of our trade laws and agreements. ITA works to improve the global business environment and helps U.S. organizations compete at home and abroad. ITA supports the National Export Initiative to sustain economic growth and support American jobs.

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U.S. Department of Interior

US Fish and Wildlife Service

The U.S. Fish & Wildlife Service issues permits under various wildlife laws and treaties at different offices at the national, regional, and/or wildlife port levels.

Permits enable the public to engage in legitimate wildlife-related activities that would otherwise be prohibited by law. Service permit programs ensure that such activities are carried out in a manner that safeguards wildlife and natural fisheries. Some permits promote conservation efforts by authorizing scientific research, generating data, or allowing wildlife management and rehabilitation activities to go forward.

Permits are handled by permitting programs in International Affairs (Management Authority), Endangered Species, Law Enforcement, and Migratory Birds. (Visit the National Wildlife Refuge web site for Special Use Permits.) For more detailed information, go to How to Obtain a Permit, FAQs/Facts, or Application Forms.

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Aquaculture Statistics

U.S. Department of Agriculture

Economic Research Service

The Economic Research Service (ERS) provides economic and other social science information and analysis for improving the performance of agriculture, aquaculture, and rural America. ERS produces this information as a service to the general public and to help Congress and the administration develop, administer, and evaluate agricultural and rural policies and programs.

The ERS Aquaculture Briefing Room provides statistics on domestically grown catfish and trout and U.S. imports and exports of fish and shellfish that may be products of aquaculture, such as salmon, shrimp, and oysters

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National Agricultural Statistics Service

The National Agricultural Statistics Service prepares and reports monthly surveys of catfish processors' round weight processed, end-of-the-month inventories, prices paid to catfish producers, and prices received by processors by methods of sales. The 15 major catfish-producing states collect producer inventory and sales data. The four largest catfish-producing States (Alabama, Arkansas, Louisiana, and Mississippi) collect data quarterly while the other 11 States collect data twice annually. Trout producer sales and losses data are collected and published for the 18 major producing states. Survey results are published each year in September. Current information can be accessed via a search engine on this web page.

Census of Aquaculture

The 1998 Census of Aquaculture was the first census of aquaculture report prepared under the direction of the U.S. Department of Agriculture (USDA), National Agricultural Statistics Service (NASS).

The 2005 Census of Aquaculture expanded the aquaculture data collected from the 2002 Census of Agriculture and provides a comprehensive picture of the aquaculture sector at the state and national level. The aquaculture census collected detailed information relating to production methods, surface water acres and sources, production, sales, point of first sale outlets, aquaculture distributed for restoration, conservation, or recreational purposes, and farm labor. Another Census of Aquaculture is planned for the 2013 crop year and should be available to the public in the fall of 2014.

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U.S. Department of Commerce

National Oceanographic and Atmospheric Administration (NOAA)

The NMFS Fisheries Statistics Division collects data and coordinates information and research programs to support the science-based stewardship of the nation's living marine resources. In addition to integrating and disseminating state and federal statistics about marine fisheries, they administer the surveys used to estimate recreational landings. Much of the statistical, economic, and demographic information collected by the federal government is made available to the public through the bureaus and offices of the Department of Commerce that are known collectively as the Economics and Statistics Administration (ESA).

The NOAA Fisheries, Fisheries Statistics Division has automated data summary programs that anyone can use to rapidly and easily summarize U.S. commercial fisheries landings. These publications also contain information on aquaculture import statistics.

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Research Assistance and Services

U.S. Department of Agriculture

Agricultural Research Service

The Agricultural Research Service (ARS) conducts research on aquaculture at 13 locations in the U.S. The research is performed by ARS scientists and a number of collaborating scientists through extramural partnerships. The mission of the ARS Aquaculture National Program 106 is to conduct high quality, relevant,

fundamental and applied aquaculture research, to improve the systems for raising domesticated aquaculture species, and to transfer technology to enhance the productivity and efficiency of U.S. producers and the quality of seafood and other aquatic animal products.

The ARS' Aquaculture Program, as described in the National Program 106 Action Plan, is to help develop and ensure an abundant, safe, and affordable supply of seafood products within a healthy, competitive, and sustainable aquaculture sector.

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National Institute of Food and Agriculture

The National Institute of Food and Agriculture (NIFA) is the agency within USDA which administers federal funds for extramural research, extension, and education. NIFA provides national leadership and support for major research and extension educational programs in support of private-sector aquaculture in cooperation with its partners.

NIFA Grants

Regional Aquaculture Centers:

- Northeastern Regional Aquaculture Center
- North Central Regional Aquaculture Center
- Western Regional Aquaculture Center
- Southern Regional Aquaculture Center
- Center for Tropical and Subtropical Aquaculture

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U.S. Department of Commerce

National Centers for Coastal Ocean Science (NCCOS)

National Ocean Service' **NCCOS** provides research, scientific information and tools to help balance the nation's ecological, social and economic goals. NCCOS researchers are developing advanced simulation models and environmental monitoring protocols to help coastal managers identify appropriate sites and effectively manage commercial aquaculture operations. NCCOS also conducts research on how minimize potential environmental impacts of cage aquaculture and is developing systems to reduce and recycle waste from tank-based recirculating aquaculture systems.

National Marine Fisheries Service

NMFS supports aquaculture research at several of its labs and science centers.

- Research in the Northeast Science Center's Milford, Connecticut Lab focuses on shellfish, algal culture, and environmental issues associated with shellfish culture such as: ocean acidification, effects of shellfish aquaculture on water quality, and effects of shellfish harvesting on the benthic environment.
- Shellfish aquaculture research at the Northwest Fisheries Science Center focuses on the effects of ocean acidification on shellfish, shellfish safety (harmful algal blooms and pathogens), and native Olympia oyster restoration. Finfish research emphasizes sablefish culture, lingcod and Atlantic salmon enhancement, alternative feeds for aquaculture, genetics, and life cycle analysis.
- Research in the Southwest Fisheries Science Center focuses on recovery of the endangered white abalone and restoration of Olympia oyster.
- The Southeast Fisheries Science Center (SEFSC) conducts multi-disciplinary research programs to provide management information to support national and regional programs of NOAA's National Marine Fisheries Service (NMFS). The SEFSC, headquartered in Miami, FL, is organized with divisions and labs across the southeast region of the U.S.:
- Research in the Pacific Islands Research Science Center primarily focuses on marine spatial planning as it pertains to offshore aquaculture.

National Sea Grant College Program

NOAA Research's National Sea Grant College Program integrates research, extension, and education through 33 state Sea Grant Programs across the U.S. coasts and Great Lakes. Aquaculture is one of the primary focuses of Sea Grant. Sea Grant leads NOAA's competitive, extramural research portfolio for aquaculture, relying on a partnership between NOAA and universities to fund aquaculture research that responds to local and state priorities (via the state Sea Grant Programs), as well as national priorities. Sea Grant Extension is a key leader for NOAA's engagement in aquaculture, with Sea Grant extension agents living and working in coastal communities, providing science-based information for local governments, industry, and citizen groups. They do this through public education, technology transfer, technical expertise, and demonstration projects to nurture sustainable marine aquaculture

U.S. Department of Interior

U.S. Fish and Wildlife Service

The U.S. Fish & Wildlife Service has responsibilities for restoring depleted fish populations, preserving endangered species, mitigating the impacts of federal water developments on fish populations, and providing scientific leadership in fishery resource management. A nationwide system of fish hatcheries, fisheries assistance offices, fish health centers, fish technology centers, fisheries research centers, and a training facility are operated to carry out these responsibilities. The Service's fisheries activities involve research, management, and culture of freshwater, andromous, estuarine, and exotic fishes of recreational, ecological, and commercial importance. The Service has established an aquaculture mission consisting of two broad functions: 1) encourage the development of private aquaculture in a manner that is compatible with responsible natural resource stewardship; and 2) make Service expertise, knowledge, and technical/scientific capabilities in fish culture and related disciplines available to the private aquaculture community.

USFWS Fisheries Science Centers:

- Leetown, WV Science Center
- Western Fisheries Research Center
- Upper Midwest Environmental Sciences Center

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U.S. Geological Survey

The U.S. Geological Survey collects a large amount of information related to availability and quality of ground-water and surface-water supplies as part of its mission to inventory the Nation's water resources. Information such as pollutant levels, aquifer locations, lake levels, stream flows, and other data useful to aquaculture is available from the USGS in a variety of forms including maps, reports, and computer output.

The Fisheries Program focuses on the study of aquatic organisms and aquatic habitats. Aquatic invertebrates, mussels, fishes, and their unique aquatic communities are investigated to provide scientific information to natural resource managers and decision makers. USGS works closely with its partners in Department of Interior Bureau's and other resource management agencies to provide scientific information to meet management needs. For instance, USGS provides fisheries research information for Fish and Wildlife Service to restore and enhance fish habitat and understand fish diseases.

Endangered species and those that are imperiled receive special research interest. Research on species diversity, life history, health and diseases, aquatic community ecology, and habitat requirements of fish and other aquatic organisms supports the management, conservation, and restoration of our Nation's aquatic resources.

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U.S. National Science Foundation

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…" NSF is the funding source for approximately 20 percent of all federally supported basic research conducted by America's colleges and universities. In many fields such as mathematics, computer science and the social sciences, NSF is the major source of federal backing for research. NSF also funds basic research important to the aquaculture industry. NSF has a Small Business Innovation Research program (SBIR)

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Regulatory Agencies and Information

Regulations.gov

Regulations.gov is the online source for all documents concerning regulatory development (rulemaking). These include documents published in the Federal Register, such as a proposed rule followed by a final rule, or an interim rule followed by an affirmation, and public comments received on these documents. During the period such documents are open for public comment, *Regulations.gov* accepts electronic comment submissions. *Regulations.gov* also includes documents such as notices, supporting materials, and significant guidance documents.

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U.S. Department of Agriculture

Animal and Plant Health Inspection Service

The Animal and Plant Health Inspection Service is a multi-faceted Agency with a broad mission area that includes protecting and promoting U.S. agricultural health, regulating genetically engineered organisms, administering the Animal Welfare Act and carrying out wildlife damage management activities. These efforts support the overall mission of USDA, which is to protect and promote food, agriculture, natural resources, and related issues.

- Regulations
- Significant Guidance Documents
- Environmental Compliance
- Environmental Documents
- Export regulations
- Import regulations

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U.S. Department of Commerce

National Marine Fisheries Service

NOAA's National Marine Fisheries Service (NMFS) is responsible for the stewardship of the nation's living marine resources and their habitat. NMFS manages, conserves, and protects living marine resources within the United States' Exclusive Economic Zone (aka federal waters; 3-200 miles from shore), and also has relevant authorities that extend into coastal waters.

NMFS' mission includes enabling sustainable marine aquaculture to produce more domestic seafood and provide economic opportunities to coastal communities. NMFS has regulatory responsibilities under the Endangered Species Act (ESA) and Essential Fish Habitat provisions of the Magnuson Stevens Fishery Management Act (MSA) to consult on federal activities, including permit applications for commercial aquaculture operations.

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U.S. Department of Health and Human Services

Food and Drug Administration

Safe and effective animal drugs and feed additives play an important role in protecting animal health and the safety of America's food supply. The FDA realizes that aquaculture is an increasingly important source of fish for human food and that it is growing. By ensuring the safety of the drugs and feed used for these fish, the FDA ensures the safety of fish used for human food.

Two Centers within the FDA work with the aquaculture industry, the Center for Veterinary Medicine (CVM) and the Center for Food Safety and Applied Nutrition (CFSAN). CVM regulates food and feed ingredients used for aquaculture-raised fish by:

- monitoring and establishing standards for feed contaminants,
- approving safe food additives, and
- managing the FDA's medicated feeds and pet food programs.

CVM also works with various government agencies and aquaculture associations to increase the number of safe and effective drugs for use by the aquaculture industry. Two tools CVM uses in this endeavor are The Minor Use and Minor Species Animal Health (MUMS) Act of 2004 and the Office of Research Aquaculture Facility.

- The Minor Use and Minor Species Animal Health (MUMS) Act of 2004 plays a critical role in making medications legally available for veterinarians and animal owners to treat minor animal species, including fish. The MUMS Act provides incentives, such as conditional approval and designation, to drug manufacturers to encourage drug development for these species.
- The state-of-the-art aquaculture facility at the CVM Office of Research enables CVM to conduct important aquaculture research, including development of chemical detection methods and animal and microbiological studies.

The Center for Food Safety and Applied Nutrition (CFSAN) ensures that domestically-produced and imported foods, including seafood, are safe, sanitary, wholesome and properly labeled. CFSAN operates several programs dedicated to the safety of wild-caught and aquaculture-raised seafood. The Fish and Fisheries Products Hazards and Controls Guidance *(the Guide) is a* cornerstone of the seafood safety program. It contains the most current science and policy on hazards affecting fish and fishery products, including aquaculture, and effective preventive and mitigation methods to prevent hazard occurrence. The Guide is the foundation of world-wide fish and fishery product regulatory programs.

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U.S. Department of Interior

US Fish and Wildlife Service

The Fisheries Program of the USFWS has played a vital role in conserving America's fisheries since 1871, and today is a key partner with States, Tribes, Federal agencies, other Service programs, and private interests in a larger effort to conserve fish and other aquatic resources.

The Program consists of almost 800 employees nationwide, located in 65 Fish and Wildlife Conservation Offices, 70 National Fish Hatcheries, 9 Fish Health Centers, 7 Fish Technology Centers and a Historic National Fish Hatchery. These employees and facilities provide a network that is unique in its broad on-the-ground geographic coverage, its array of technical and managerial capabilities, and its ability to work across political boundaries and embrace a national perspective. The Program supports the only Federal hatchery system, with extensive experience culturing more than 100 different aquatic species.

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U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers is working to strengthen the Nation's security by building and maintaining America's infrastructure and providing military facilities where service members train, work, and live.

The Clean Water Act of 1977 requires the Corps to reissue nationwide permits (NWP) every five years. The primary goal of the NWPs is to authorize, with limited delay and paperwork, certain activities that have minimal adverse effects on the environment. The Corps re-issued NWP 48 with some changes. NWP 48 has been modified to authorize expansion of existing commercial shellfish growing operations and new activities, with a 0.5 acre limit of disturbance to submerged aquatic vegetation beds. They have also removed the reporting requirement for certain on-going commercial shellfish aquaculture activities.

US Army Corps of Engineers Regions

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U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency has several programs involved in aquaculture. The proper management of effluents and residual wastes should be a major consideration of aquaculture systems in assuring the protection of the environment.

EPA's Water Quality Programs are concerned with setting Water Quality Criteria, Monitoring Shellfish Waters and Effluent Discharge Standards for assuring the protection of the nation's waterways and water supplies. The

National Pollutant Discharge Elimination System (NPDES) issues Permits for the discharge of wastewaters to surface waters, including discharges from aquaculture systems in many cases. Permits are also available from this program to use wastes as nutrients in public waters for aquaculture purposes.

Wastewater Treatment in publicly owned treatment works is amenable to the use of aquaculture systems funded, in part, by EPA's State Revolving Fund (SRF) Program. In conjunction with the U.S. Army Corps of Engineers, EPA also implements the Clean Water Act Section 404 Wetlands Protection Program aimed at protecting natural wetlands from the impacts of dredging and filling.

Chemicals and other materials to be used in aquaculture are subject to Pesticide Registration by EPA prior to marketing to the user.

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Aquaculture Extension

Cooperative Extension System

The Cooperative Extension System is a nationwide, science-based educational and outreach network. Each U.S. state and territory has a state office at its land-grant university and a network of local and/or regional offices. These offices are staffed by one or more subject-matter experts who provide useful, practical, and research-based information to agricultural producers, small business owners, youth, consumers, and others in rural areas and communities of all sizes.

The five Regional Aquaculture Centers have lists of state aquaculture extension contacts. The five Centers are listed below:

Regional Aquaculture Centers:

- Northeastern Regional Aquaculture Center (NRAC)
- North Central Regional Aquaculture Center (NCRAC)
- Western Regional Aquaculture Center (WRAC)
- Southern Regional Aquaculture Center (SRAC)
- Center for Tropical and Subtropical Aquaculture (CTSA)

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Sea Grant Marine Advisory Program

In the Sea Grant Marine Advisory Program A network of extension professionals takes Sea Grant scientific information out of the laboratory and into the field, working to enhance a coastal business, a fishery, or residents' safety and quality of life. A dedicated corps of communications and subject specialists builds public understanding of these issues for informed decision-making. Sea Grant educators bring new discoveries into the nation's schools, using them to pioneer better ways of teaching and helping to foster a new generation of scientifically literate Americans.

The National Sea Grant College Program sponsors a variety of marine research, outreach and education projects, primarily through the 30 state Sea Grant Programs.

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Aquatic Animal and Plant Health Assistance and Services

Interagency National Aquatic Animal Health Plan

Several federal agencies work together to address aquatic animal health issues, including developing a National Aquatic Animal Health Plan (NAAHP) in 2009. The NAAHP is the summation of ideas on how the federal government, in collaboration with stakeholders, should develop policies, programs, and potential regulations to address aquatic animal diseases in order to benefit aquaculture and aquatic animal resources in the United States. The federal agencies with primary responsibility for aquatic animal health are the U.S. Department of Agriculture (USDA) through its Animal and Plant Health Inspections Service, the U.S. Department of Commerce (DOC) National Marine Fisheries Service (NMFS), and the U.S. Department of the Interior (DOI) through the U.S. Fish and Wildlife Service (FWS).

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U.S. Department of Agriculture

Animal and Plant Health Inspection Service

The Animal and Plant Health Inspection Service (APHIS) provides a broad range of cooperative animal and plant health protection services to livestock and crop producers through a field force located in all 50 States and in foreign countries. APHIS provides several services to both plant and animal aquaculture and is currently considering expansion of services to animal aquaculture.

Current services include import requirements for aquatic plants to prevent the importation and dissemination of plant pests and diseases and noxious aquatic weeds into and within the United States via the Plant Protection and Quarantine Program. APHIS also participates in joint State-Federal programs to control noxious aquatic weeds in the United States and helps develop control methodology, including use of biocontrol organisms.

Aquaculture producers experiencing problems with facility damage and depredation by migratory birds and other animals receive on-site assistance from APHIS' Animal Damage Control Division.

APHIS is working with the Fish and Wildlife Service and other members of the IWG-A to delineate agency roles to best meet the aquaculture industry's aquatic animal health needs.

APHIS Services for the Aquaculture Industry:

- USDA - APHIS - Wildlife Damage Management
- US State and Territory Import Regulations for Aquaculture
- National Animal Health Monitoring System (NAHMS)
- Aquaculture Disease Information
- National Aquatic Animal Health Plan

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Agricultural Research Service

The Aquatic Animal Health Research Laboratory conducts research in the areas of bacteriology, parasitology, pathology, nutrition and immunology to solve problems in aquaculture that diminish productivity and quality of warm-water fish, primarily catfish, tilapia and hybrid striped bass.

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U.S. Department of Commerce

National Oceanographic and Atmospheric Administration (NOAA)

National Marine Fisheries Services:

- Fish Watch
- Alaska Fisheries Science Center
- Northeast Fisheries Science Center
- Southeast and Caribbean Fisheries Science Center
- Northwest Fisheries Science Center
- Southwest Fisheries Science Center
- Pacific Islands Fisheries Science Center

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U.S. Department of Interior

Aquatic Animal Drug Approval Partnership (AADAP)

The Aquatic Animal Drug Approval Partnership (AADAP) program was officially established within the US Fish and Wildlife Service's National Fish Hatchery System in January 2003 with the strong support of then

Service Director Steve Williams. The stated goal of AADAP is to ensure continued progress towards obtaining FDA-approved and EPA-compliant new animal drugs and pesticides for use in Federal, State, Tribal, and private aquaculture programs throughout the United States. As its name implies, the AADAP is a broad, partner-based program of national scope. Utilizing increased program funding and staff, the AADAP incorporates ongoing Service compassionate Investigational New Animal Drug (INAD) exemption and New Animal Drug Application (NADA) activities that were previously coordinated by the Service's National INAD Office (NIO). Ongoing and expanded activities include: INAD administration; the National INAD Program that allows for participation by non-Service facilities on Service-held INADs; and a drug research program that is focused on the generation of efficacy and target animal safety data to NADAs. Added responsibilities of AADAP include a defined role in NADA management and information transfer and dissemination. Although the NIO remains in existence, it is now a part of the AADAP Program, both of which are located in Bozeman, Montana. In somewhat generic terms, the AADAP will help to lead a coordinated national effort to generate data, analyze results, compile final study reports, disseminate information and data, and manage all other aspects of requisite data submissions to FDA in support of new animal drug approvals for aquatic species. The AADAP builds on long-standing partnerships between the Service's NIO and over 50 Federal, State, Tribal, and/or private agencies or organizations. The AADAP, in its role of obtaining new approved drugs and chemicals for aquatic species, is integral to the Service's successful stewardship of our natural resources for the enjoyment of all Americans.

US Fish and Wildlife Service

U.S. Fish & Wildlife Service Fish Health Centers (FHC) are resource centers that provide service, expertise and information supporting the Service's mission to promote and protect aquatic animal health. Their work contributes to health, survival, restoration, and enhancement of fish and other aquatic species.

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National Research Support Programs

NRSP-7: Minor Use Animal Drug Program

The National Research Support Project No. 7 (NRSP-7), administered by the USDA National Institute of Food and Agriculture, is designed to address the shortage of minor use animal drugs by funding and overseeing the efficacy, animal safety, and human food safety research, and environmental assessments required for drug approval. The scope of the program includes animals of agricultural importance and generally excludes companion animals.

The program coordinates with animal producers, drug manufacturers, FDA's Center for Veterinary Medicine (CVM), the U.S. Department of Agriculture's National Institute of Food and Agriculture (NIFA), other government agencies, universities, state Agricultural Experiment Stations, and veterinary schools to get the job done.

In addition to funding research, NRSP-7 periodically holds special workshops to provide a forum for exchange of ideas among minor species producers, drug manufacturers, researchers, and government agencies on approaches to disease problems and drug priorities.

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NRSP-8: National Animal Genome Research Program

The National Research Support Project (NRSP)-8 supports the USDA-NIFA National Animal Genome Research Program (NAGRP) which has played a major role in facilitating genomic discoveries in farm animals and aquaculture species. The recent "Blueprint for USDA Efforts in Agricultural Animal Genomics 2008-2017" portrays a pyramid in which Science to Practice is supported by Discovery Science which in turn is supported by Infrastructure. It is the mission of NRSP-8, since inception, to provide and enhance Infrastructure. This mission is accomplished providing shared genomic resources (tools, reagents, DNA, data) to its members and by leveraging its own limited resources with those from federal (NIH, USDA-NRI), international, industry and state sources. NRSP-8 stimulates and coordinates new initiatives by providing national leadership recognized by our stakeholders. Communication is critical to the shared resource model and NRSP-8 fosters communication among members and stakeholders through newsletters, email discussion groups, our bioinformatics program and contributions to meetings such as the annual International Plant and Animal Genome (PAG) conference.

The NRSP's are specifically focused on "the development of enabling technologies, support activities . . . , or the sharing of facilities needed to accomplish high priority research". As demonstrated by past activities NRSP-8 has enabled substantive progress in agricultural animal genomics research, on a multi-species basis in a variety of ways, thereby meeting the ideals and vision of the unique NRSP model to create a mechanism which provides magnified benefits, promoting collaborative partnerships and novel opportunities for high priority research. There are three key and interrelated reasons for why animal genomics is a great fit for the NRSP mechanism:

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If you notice any problems or issues with this document such as bad links, etc., please contact Max Mayeaux at: mmayeaux@nifa.usda.gov .

Federal Departments and Agencies with Aquaculture-related Programs and Services

U.S. Department of Agriculture

Agricultural Marketing Service (AMS)

The Agricultural Marketing Service (AMS) commodity programs oversee marketing agreements and orders, administer research and promotion programs, and purchase commodities, including farmed aquatic species, for Federal food programs. The AMS also administers Country of Origin Labeling (COOL) regulations that include imported wild and farmed finfish and shellfish.

National Organic Program

The AMS National Organic Program (NOP) develops, implements, and administers national production, handling, and labeling standards for organic agricultural products. The NOP also accredits certifying agents (foreign and domestic) who inspect organic production and handling operations to certify that they meet USDA standards. National Organic Standards for U.S.-produced aquaculture products are currently in development. AMS is currently working on promulgating regulations for a USDA NOP certification program for cultured aquatic animals. These new standards have to undergo federal government clearance and a public rulemaking process before they are promulgated into law.

Animal and Plant Health Inspection Service

The Animal and Plant Health Inspection Service (APHIS) mission is protecting and promoting U.S. agricultural (including aquaculture) health, regulating genetically engineered microorganisms and vaccine development, administering the Animal Welfare Act, and carrying out wildlife damage management activities. These efforts support the overall mission of USDA, which is to protect and promote food, agriculture, natural resources, and related issues.

APHIS National Center for Import-Export

Many agricultural pests and diseases exist worldwide that could be introduced into the United States through commodities such as meats, animals (including aquatic animals and their products), animal products, fruits, vegetables, plants, soil, seeds, and plant-based handicrafts, among others. Learning regulatory requirements for the import or export of aquatic animals and plants and their products can help minimize confusion, prevent costly delays, and avoid penalties and merchandise loss.

Animal Health Report

The APHIS Animal Health Report is an overview of domestic animal health in the United States. It contains information on the state of U.S. livestock, poultry, and aquaculture commodities, as well as the programs and strategies used to ensure their continued health.

National Veterinary Services Laboratories

APHIS laboratory services are provided by the National Veterinary Services Laboratories (NVSL). The NVSL provides a wide variety of information and services associated with diagnosis of domestic and foreign aquatic animal diseases, support of disease control and eradication programs, reagents for diagnostic testing, training, and laboratory certification. Veterinary Biologics

APHIS regulates veterinary biologics (vaccines, bacterins, antisera, diagnostic kits, and other products of biological origin) to ensure that the veterinary biologics available for the diagnosis, prevention, and treatment of animal diseases are pure, safe, potent, and effective. This work is done by APHIS' Center for Veterinary Biologics (CVB) and is centered around enforcement of the Virus Serum Toxin Act .

Veterinary biologics include vaccines, antibodies, diagnostic kits, and certain immune modulators. This site provides information on how to license/import a veterinary biologic, report adverse events occurring from biologic use, or find lists of licensed products for aquaculture species.

Veterinarian Accreditation

Veterinarians can go to the National Veterinary Accreditation Program (NVAP) to learn how to apply for accreditation as well as search for a variety of training materials including aquatic animal health training.

Monitoring and Surveillance

The National Animal Health Surveillance System provides links to key animal health monitoring and surveillance information issues, programs, and information sources related to aquaculture.

Veterinary Services Professional Development Training

The Professional Development Staff (PDS) is a small group of training specialists dedicated to meeting the current and future scientific and technical education and training needs of APHIS Veterinary Services personnel. In addition to staff members housed at APHIS Headquarters in Riverdale, Maryland, the PDS has staff Veterinarians and Education Technology Specialists in both the Western Region and Eastern Region to ensure that local, as well as national, needs are addressed. A veterinary aquaculture training module can be found here.

Wildlife Damage Management

The mission of USDA APHIS Wildlife Services (WS) is to provide Federal leadership and expertise to resolve wildlife conflicts, such as the double-crested cormorant issue in U.S. aquaculture industry facilities, to allow people and wildlife to coexist. WS conducts program delivery, research, and other activities through its Regional and State Offices, the National Wildlife Research Center (NWRC) and its Field Stations, as well as through its National Programs.

The APHIS WS program administers aquaculture-related programs such as the Bird Depredation program aimed at reducing losses due to avian predation in fish ponds. WS conducts its activities pursuant to Memoranda of Understanding, other agreements and legal authorities, and conducts environmental review processes to comply with the National Environmental Policy Act (NEPA). WS develops Annual Program Data Reports to provide the public with information about its wildlife damage management activities.

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Agricultural Research Service (ARS)

The Agricultural Research Service (ARS) conducts research on aquaculture at 13 locations in the United States. The research is performed by ARS scientists and a number of collaborating scientists through extramural partnerships with universities or other entities. The mission of the ARS Aquaculture National Program 106 is to conduct high-quality, relevant, fundamental and applied aquaculture research to improve the systems for raising domesticated aquaculture species and to transfer technology to enhance the productivity and efficiency of U.S. producers and the quality of seafood and other aquatic animal products.

National Agricultural Library (NAL)

The National Agricultural Library (NAL) houses one of the world's largest and most-accessible agricultural information collections and serves as the nexus for a national network of state land-grant libraries. The Alternative Farming Systems Information Center at the NAL provides information related to aquaculture.

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Economic Research Service

The Economic Research Service (ERS) is a primary source of economic information and research in the USDA. ERS statistics on domestically grown catfish and trout, and U.S. imports and exports of fish and shellfish that may be products of aquaculture, such as salmon, shrimp, and oysters are available here.

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Foreign Agricultural Service (FAS)

The Foreign Agricultural Service (FAS) links U.S. agriculture to the world to enhance export opportunities and global food security including export opportunities for U.S. produced aquaculture products. The FAS has released some reports on the status of aquaculture and fisheries and market implications in select countries.

FAS also partners with the U.S. Agency for International Development (USAID) to administer U.S. food aid programs that help people in need around the world. FAS non-emergency food aid programs help meet recipients' nutritional needs and also support agricultural, including aquaculture development and education. These food-assistance programs, combined with trade capacity-building efforts, support long-term economic development and help countries make the transition from aid recipient to commercial buyers and producers.

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Farm Service Agency (FSA)

As one of USDA's larger agencies, the Farm Service Agency (FSA) supports the Department's rural development and farming strategic goals. The Farm Security and Rural Investment Act of 2002 required FSA to implement a diverse range of programs that provide an equitable financial "safety net" for the Nation's farmers and ranchers, including aquaculture producers. FSA also helps to ensure that American agriculture remains competitive in global markets, strong and viable domestically, and responsive to conservation and

environmental issues. FSA has offices throughout the United States. Follow the FSA State Offices link to access the nearest FSA state office. These offices can provide details on available assistance and services and requirements for eligibility.

Farm Loan Programs

FSA loans can be used to purchase land, livestock (fish), equipment, feed, seed, and supplies The FSA makes direct and guaranteed farm ownership and operating loans to family-size farmers and ranchers, including aquaculture producers, who cannot obtain commercial credit from a bank, Farm Credit System institutions, or other lenders.. Loans can also be used to construct buildings or make farm improvements.

FSA loans can be provided to beginning fish farmers who cannot qualify for conventional loans because they have insufficient financial resources. FSA also helps established fish farmers who have suffered financial setbacks from natural disasters, or whose resources are too limited to maintain profitable farming operations. In many locations, aquaculture is a new enterprise or unfamiliar to FSA offices that can require more effort to understand the fish farming business.

FSA Conservation Loan Program

. The goal of FSA's Conservation Loan program is to provide access to credit for farmers, including fish farmers, who need and want to implement conservation measures on their property but do not have the "up front" funds available to implement these practices. The FSA makes and guarantees loans to promote conservation practices on fish farms that help protect natural resources throughout the United States

Disaster Assistance Programs

The FSA provides assistance for natural disaster losses resulting from drought, flood, fire, freeze, tornadoes, pest infestation, and other calamities. Many of the program services are available to aquaculture producers and operations. Some require prior signup to be eligible for program assistance. For more information, consult the nearest FSA office in your county or area.

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Federal-State Marketing Improvement Program (FSMIP)

The Federal-State Marketing Improvement Program (FSMIP) provides matching funds to state departments of agriculture, state agricultural experiment stations, and other state agencies to assist in exploring new market opportunities for U.S. food and agricultural products and to encourage research and innovation aimed at improving the efficiency and performance of the marketing system. FSMIP has a long history of funding market-related projects involving a diversity of aquaculture products and locations in the United States

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National Agricultural Statistics Service (NASS)

The USDA's National Agricultural Statistics Service (NASS) conducts hundreds of surveys every year and prepares reports covering many aspects of U.S. agriculture. The NASS provides timely, accurate, and useful statistics on U.S. agriculture production, including aquaculture. NASS conducts a Census of Agriculture every five years, providing the only source of consistent, comparable, and detailed agricultural data for major crops for every county in America. The Census of Agriculture also includes limited data on U.S. aquaculture production. As a supplement to the Census of Agriculture, NASS periodically collects detailed information on the U.S. aquaculture industry and publishes the NASS Census of Aquaculture.

These reports provide current and comprehensive data about the aquaculture sector by species, states, value, production methods, surface-water acreage and sources, production, sales, point of first sale outlets, aquaculture species distributed for restoration and conservation purposes, and for recreational use. Aquaculture farm labor statistics are also included. The first national Census of Aquaculture was for the 1998 crop year followed by the 2005 Census of Aquaculture that expanded the aquaculture data collected from the 2002 Census of Agriculture. Another national census of aquaculture is underway for the 2013 crop year and is expected to be published in the fall of 2014.

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National Institute of Food and Agriculture (NIFA)

The National Institute of Food and Agriculture (NIFA) is the agency within USDA that administers Federal funds for extramural research, extension, and education programs. NIFA provides national leadership and support for major research and extension educational programs in support of private-sector aquaculture in cooperation with its diverse partners, including the land-grant-university community, private-sector organizations, non-governmental groups, professional organizations, and other Federal and state governmental agencies. The current NIFA aquaculture research and extension base is highly diverse in terms of funding mechanisms, areas of research, and educational activities (K-12 and postsecondary). NIFA provides capacity funds to land-grant institutions to support research at Agricultural Experiment Stations and educational programs through Cooperative Extension offices at those institutions that provide matching funds to leverage the Federal investment. A complete listing of land grant institutions is available here.

NIFA, in partnership with the Cooperative Extension System, provides national leadership for extension education, information dissemination, and technology transfer programs that have been critical to the development of commercial aquaculture in the Nation. Regional program planning and cooperation have expanded and state extension specialists and educators are involved with regional and national aquaculture programs directed at producers, processors, regulatory agencies, lenders, and local and state governments. These extension educational programs have resulted in improved production-system efficiency and farm management practices as well as expanded market opportunities and have helped the private sector respond to new Federal regulations and policies.

NIFA's funding for science and technology transfer supports the development of a globally competitive U.S. aquaculture industry by: 1) improving the efficiency of aquaculture production; 2) improving aquaculture production systems; 3) improving the sustainability and environmental compatibility of aquaculture production; 4) ensuring and improving the quality, safety, and variety of aquaculture products for consumers; 5) improving the marketing of U.S. aquaculture products; and 6) improving information dissemination, technology transfer, and access to global information and technology in aquaculture.

NIFA supports a continuum of fundamental research and technology development linked to strong extension education and technology transfer programs. In addition, NIFA, at times, participates in joint solicitations for proposals with DOE, NSF, and NIH to leverage NIFA priorities and funds with those of other agencies. NIFA also funds and supports national research support programs including the: National Research Support Program (NRSP)-7, which is focused on the development of new animal drugs for minor species and minor uses; and National Animal Genome Research in the National Research Support Project 8 (NRSP-8). Both of these programs support research on aquatic species.

NIFA supports eXtension including the Freshwater Aquaculture and Marine Aquaculture Communities of Practice (CoP)

NIFA also encourages multi-state research activities such as the National Information Management and Support System including several associated with aquaculture.

Regional Aquaculture Centers

Five Regional Aquaculture Centers (RAC), administered by NIFA, were established by Congress in Title XIV of the Agriculture & Food Act of 1980 and the Food Security Act of 1985 (Subtitle L, Section 1475[d]). The Centers encourage cooperative and collaborative research and extension education programs in aquaculture with regional or national relevance. Center programs complement and strengthen existing aquaculture research and extension education programs supported by USDA through the ARS and land grant universitys' Agricultural Experiment Station System and Cooperative Extension System, by the NOAA Sea Grant College Programs, and other public research and educational institutions. The RACs fund competitively awarded and peer-reviewed research and extension projects that are based upon priority industry needs.

Regional Aquaculture Centers:

- Northeastern Regional Aquaculture Center (NRAC)
- North Central Regional Aquaculture Center (NCRAC)
- Western Regional Aquaculture Center (WRAC)
- Southern Regional Aquaculture Center (SRAC)
- Center for Tropical and Subtropical Aquaculture (CTSA)

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Natural Resources Conservation Service (NRCS)

Originally established by Congress in 1935 as the Soil Conservation Service, the Natural Resources Conservation Service (NRCS) has expanded to become a conservation leader for all natural resources, ensuring private lands are conserved, restored, and more resilient to environmental challenges like climate change. Seventy percent of the land in the United States is privately owned, making stewardship by private landowners absolutely critical to the health of our Nation's environment. NRCS works with landowners through conservation planning and assistance designed to benefit the soil, water, air, plants, and animals that result in productive lands and healthy ecosystems.

NRCS also provides information on sustainable aquaculture conservation practices. NRCS also provide financial assistance to help landowners make the right decisions for managing natural resources. NRCS provides funding opportunities for aquaculture producers through various programs. Conservation Innovation Grants (CIG) is a voluntary program intended to stimulate the development and adoption of innovative conservation approaches and technologies while leveraging federal investment in environmental enhancement and protection, in conjunction with agricultural production. Under CIG, Environmental Quality Incentives Program (EQIP) funds can be used to award competitive grants to non-federal governmental or non-governmental organizations, tribes, or individuals involved in aquaculture.

Environmental Quality Incentives Program (EQIP)

The Environmental Quality Incentives Program (EQIP) is a voluntary program that provides financial and technical assistance to agricultural producers, including fish farmers, through contracts up to a maximum term of ten years in length. These contracts provide financial assistance to help plan and implement conservation practices that address natural resource concerns and for opportunities to improve soil, water, plant, animal, air and related resources on agricultural land and non-industrial private forestland. In addition, a purpose of EQIP is to help producers meet Federal, State, Tribal and local environmental regulations.

National Conservation Practice Standards Handbook including aquaculture The NRCS conservation practice standard contains information on why and where these practice are applied, and it sets forth the minimum quality criteria that must be met during the application of that practice in order for it to achieve its intended purpose(s). State conservation practice standards are available through the Field Office Technical Guide (FOTG). If no state conservation practice standard is available in the FOTG, contact the appropriate state office or local USDA Service Center.

To contact the nearest NRCS office, go to: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/contact

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Risk Management Agency (RMA)

The role of USDA's Risk Management Agency (RMA) is to help producers manage their business risks through effective, market-based risk management solutions. RMA's mission is to promote, support, and regulate sound risk-management solutions to preserve and strengthen the economic stability of America's agricultural producers including aquaculture producers. As part of this mission, RMA operates and manages the Federal Crop Insurance Corporation (FCIC).

RMA administers pilot crop insurance for selected aquaculture commodities:

Clams: RMA has developed specific federal programs to insure specific aquaculture crops including clams in certain states. The states eligible for the pilot federal crop insurance programs for clams include: Massachusetts; Virginia; Florida; South Carolina .

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Rural Development (RD)

The USDA Rural Development (RD) program is committed to helping improve the economy and quality of life in rural America. RD's financial programs help support essential public facilities and services such as water and sewer systems, housing, health clinics, emergency service facilities and electric and telephone service. They promote economic development by supporting loans to businesses, including aquaculture-related businesses, through banks, credit unions, and community-managed lending pools. They offer technical assistance and information to help agricultural producers and cooperatives get started and improve the effectiveness of their operations. They also provide technical assistance to help communities undertake community empowerment programs.

Aquaculture producer assistance is provided in many ways, including direct or guaranteed loans, grants, technical assistance, and research and educational materials to enhance farm profitability. Visit the sites on the Rural Development Grant Assistance page for information and/or assistance

The Farm Labor Housing Loan and Grant program provides capital financing for the development of housing for domestic farm laborers including farms producing aquatic animals. Loans are made to farmers, associations of farmers, family farm corporations, Indian tribes, nonprofit organizations, public agencies, and associations of farmworkers.

Rural Development Business and Cooperative Service

The mission of the Rural Development Business and Cooperative Service Programs is to enhance the quality of life for rural Americans by providing leadership in building competitive businesses, including sustainable aquaculture cooperatives that can prosper in the global marketplace. They meet these goals by: investing financial resources and providing technical assistance to businesses and cooperatives located in rural communities; and by establishing strategic alliances and partnerships that leverage public, private, and cooperative resources to create jobs and stimulate rural economic activity.

Rural Development Business Programs

Business Programs

Through its Business Programs, RD provides business credit needs in under-served rural areas, often in partnership with private-sector lenders. The following Business Programs may be of relevance to aquaculture producers, keeping in mind that eligibility can be determined by the population size of the local community:

Loans

- Business and Industry (B&I) Guaranteed Loans
- Intermediary Relending Program (IRP)
- Rural Energy for America Program Guaranteed Loan Program (REAP Loans)(Section 9007)
- Rural Economic Development Loan And Grant (REDLG)

Grants

- Repowering Assistance Program (Section 9004)
- Rural Business Enterprise Grant Program (RBEG)
- Rural Energy for America Program Grants (REAP)
- Rural Development Energy Programs

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U.S. Department of Commerce

National Oceanic and Atmospheric Administration (NOAA)

National Marine Fisheries Service

NOAA's National Marine Fisheries Service (NMFS) is responsible for the stewardship of the nation's living marine resources and their habitat. NMFS manages, conserves, and protects living marine resources within the United States' Exclusive Economic Zone (aka federal waters; 3-200 miles from shore), and also has relevant authorities that extend into coastal waters.

NMFS' mission includes enabling sustainable marine aquaculture to produce more domestic seafood and provide economic opportunities to coastal communities. NMFS has regulatory responsibilities under the Endangered Species Act (ESA) and Essential Fish Habitat provisions of the Magnuson-Stevens Fishery Management Act (MSA) to consult on federal activities, including permit applications for commercial aquaculture operations. NMFS supports research and technology development and transfer at its science centers and through competitive grants, and through collaborative research with international partners. In addition, NMFS disseminates aquaculture-related information gained from its research. To achieve its aquaculture objectives, NMFS cooperates with federal and state agencies, industry, environmental organizations, international bodies and foreign governments, and academic partners.

Office of Aquaculture

NMFS Office of Aquaculture leads and coordinates NOAA's aquaculture activities. The office develops and implements regulations in coordination with NMFS regional offices, and the Offices of Protected Resources, Habitat Conservation, and Sustainable Fisheries. The Office of Aquaculture also engages with NOAA Science Centers to prioritize and support aquaculture research on a suite of issues.

Since 2008, NOAA has been expanding its aquaculture efforts by establishing Regional Coordinators around the country. NMFS has Regional Aquaculture Coordinators in its Northeast, Northwest, Southeast, Southwest,, and Pacific Islands Regional Offices.

Office of Habitat Conservation

The NMFS Office of Habitat Conservation consults on aquaculture permit applications to minimize and mitigate any impacts to Essential Fish Habitat. In addition, the office's Restoration Center works to restore and protect the nation's coastal and marine habitats. The Restoration Center collaborates with the NMFS Office of Aquaculture on projects that involve elements of aquaculture such as oyster habitat restoration.

Office of Oceanic and Atmospheric Research (OAR)

National Sea Grant College Program

NOAA Research's National Sea Grant College Program integrates research and outreach (e.g., extension) through 33 state Sea Grant Programs across the U.S. coasts and Great Lakes. Sea Grant leads NOAA's competitive, extramural research for aquaculture, relying on a partnership between NOAA and universities to fund aquaculture research that responds to local and state priorities (via the state Sea Grant Programs), as well as national priorities (via the National Sea Grant Office). Sea Grant Extension is a leader for NOAA's engagement in aquaculture, with extension agents living and working in coastal communities, providing science-based information on fisheries and aquaculture for local governments, industry, and citizens.

Office of Protected Resources

NMFS' Office of Protected Resources works to conserve, protect, and recover species as mandated by the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA) in conjunction with NMFS Regional Offices, Science Centers, and various partners. The Office of Protected Resources is primarily responsible for ensuring that permitted aquaculture activities comply with these laws. This includes consulting with other NMFS offices and federal agencies to ensure that their actions do not jeopardize ESA listed species or adversely modify their critical habitat; or illegally kill, injure, or harass marine mammals.

Office of Science and Technology

The NMFS Office of Science and Technology advocates for and ensures the sound scientific basis for NMFS' science programs and resource conservation and management decisions. The office produces important statistical publications such as the annual Fisheries of the United States report, which includes data on commercial and recreational fisheries and aquaculture.

NMFS Fisheries Science Centers:

- Alaska Fisheries Science Center
- Northeast Fisheries Science Center
- Southeast and Caribbean Fisheries Science Center
- Northwest Fisheries Science Center
- Southwest Fisheries Science Center
- Pacific Islands Fisheries Science Center

Office of Sustainable Fisheries

Aquaculture is a form of fishing as defined by the MSA. Therefore, aquaculture activities may be regulated through development of Fishery Management Plans (FMP) in the Exclusive Economic Zone (federal waters). Fishery management plans are developed by regional Fishery Management Councils (Councils) and implemented by NMFS. The NMFS Regional Offices work with the Councils to develop FMPs and their associated implementing regulations; and the Office of Sustainable Fisheries develops and implements fishery management actions for highly migratory species.

Economic Development Administration (EDA)

The NOS Economic Development Administration (EDA) programs are designed to help alleviate conditions of sustainable and persistent unemployment and underemployment in economically distressed areas and regions of the Nation. Such assistance is designed to help communities by stabilizing and diversifying local economies, and improving local living conditions and economic development of the area. EDA has funded aquaculture-related projects under its Public Works and Development Facilities Program and Technical Assistance Program.

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Economics and Statistics Administration (ESA)

Much of the statistical, economic, and demographic information collected by the federal government is made available to the public through the bureaus and offices of the Department of Commerce that are known collectively as the Economics and Statistics Administration (ESA). The NMFS produces an annual publication entitled Fisheries of the United States.

Fisheries Finance Program

NMFS' Fisheries Finance Program provides long-term financing for the cost of construction or reconstruction of fishing vessels, fisheries facilities, and aquaculture facilities.

National Ocean Service (NOS)

National Centers for Coastal Ocean Science (NCCOS)

NOS' NCCOS provides research, scientific information, and tools to help balance the nation's ecological, social, and economic goals. NCCOS researchers are developing advanced simulation models and environmental monitoring protocols to help coastal managers identify appropriate sites and effectively manage commercial aquaculture operations. NCCOS also conducts research on how to minimize potential environmental impacts of cage aquaculture and is developing systems to reduce and recycle waste from tank-based recirculating aquaculture systems.

Seafood Inspection Service

The NMFS Seafood Inspection Program offers professional inspection services on a fee-for-service basis that assure compliance with all applicable food regulations. The Seafood Inspection Program provides inspection services for fish, shellfish, and fishery products to the industry including imported aquaculture products.

U.S. Department of Energy

The mission of the Energy Department (DOE) is to ensure America's security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions.

The DOE has Funding Opportunities for research and small businesses including aquaculture. The Office of Economic Impact and Diversity has information on doing business with the DOE, including viewing current business opportunities, registering to submit proposals, and obtaining information and guidance on the acquisition and financial assistance award process.

Loan Programs Office (LPO)

The mission of Loan Program Office (LPO) is to accelerate the domestic commercial deployment of innovative and advanced clean energy technologies at a scale sufficient to contribute meaningfully to the achievement of our national clean energy objectives. The LPO provides guaranteeing loans to eligible clean energy projects (i.e., agreeing to repay the borrower's debt obligation in the event of a default), and by providing direct loans to eligible manufacturers of advanced technology vehicles and components including those used in aquaculture production.

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U.S. Department of Health and Human Services

Food and Drug Administration (FDA)

Safe and effective animal drugs and feed additives play an important role in protecting animal health and the safety of America's food supply. The FDA realizes that aquaculture is an increasingly important source of fish for human food. By ensuring the safety of the drugs and feeds used in aquaculture, FDA ensures the safety of cultured seafood. Two Centers within the FDA work with the aquaculture industry: the Center for Veterinary Medicine (CVM) and the Center for Food Safety and Applied Nutrition (CFSAN).

CFSAN ensures that domestic and imported foods, including seafood, are safe, sanitary, wholesome, and properly labeled. CFSAN operates several programs dedicated to the safety of wild-caught and cultured seafood. The Fish and Fisheries Products Hazards and Controls Guidance is a cornerstone of the seafood safety

program. It contains the most-current science and policy on hazards affecting fish and fishery products, including aquaculture, and effective preventive and mitigation methods to prevent hazard occurrence. This guidance is the foundation of world-wide fish and fishery product regulatory programs.

CVM regulates food and feed ingredients used for aquaculture-produced fish by:

- monitoring and establishing standards for feed contaminants,
- approving safe food additives, and
- managing the FDA's medicated feeds and pet food programs.

CVM also works with various government agencies and aquaculture associations to increase the number of safe and effective drugs for use by the aquaculture industry. Two tools CVM uses in this endeavor are: the Minor Use and Minor Species Animal Health (MUMS) Act of 2004, and the FDA CVM Office of Research's Aquaculture Facility.

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U.S. Department of Interior

U.S. Fish & Wildlife Service

The U.S. Fish & Wildlife Service has responsibilities for restoring depleted fish populations, preserving endangered species, mitigating the impacts of federal water development projects on fish populations, and providing scientific leadership in fishery resource management. A nationwide system of fish hatcheries, fisheries assistance offices, fish health centers, fish technology centers, fisheries research centers, and a training facility are operated to carry out these responsibilities. The Service's fisheries activities involve research, management, and culture of freshwater, anadromous, estuarine, and exotic fishes of recreational, ecological, and commercial importance. The Service has established an aquaculture mission consisting of two broad functions: 1) encourage the development of private aquaculture in a manner that is compatible with responsible natural resource stewardship; and 2) make Service expertise, knowledge, and technical/scientific capabilities in fish culture and related disciplines available to the private aquaculture community.

USFWS Fisheries Science Centers:

- Leetown, WV Science Center
- Western Fisheries Research Center
- Upper Midwest Environmental Sciences Center

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U.S. Geological Survey

The U.S. Geological Survey collects a large amount of information related to availability and quality of ground-water and surface-water supplies as part of its mission to inventory the Nation's resources. Information such as pollutant levels, aquifer locations, lake levels, stream flows, and other data useful to aquaculture is available from the USGS in a variety of forms including maps, reports, and computer output.

USGS Fisheries Program

The Fisheries Program focuses on the study of aquatic organisms and aquatic habitats. Aquatic invertebrates, mussels, fishes, and their unique aquatic communities are investigated to provide scientific information to natural resource managers and decision makers. USGS works closely with its partners in Department of Interior Bureau's and other resource management agencies to provide scientific information to meet management needs. For instance, USGS provides fisheries- and aquaculture-related research information for Fish and Wildlife Service to restore and enhance fish habitat and understand fish diseases.

Endangered species and those that are imperiled receive special research interest. Research on species diversity, life history, health and diseases, aquatic community ecology, and habitat requirements of fish and other aquatic organisms supports the management, conservation, and restoration of our Nation's aquatic resources.

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U.S. Department of State

Bureau of Oceans Environment and Sciences (OES)

The Department of State Bureau of Oceans, Environment, and Sciences (OES) is responsible for formulating and implementing U.S. policy on a broad range of international issues concerning living marine and aquatic resources, which includes promoting responsible and sustainable aquaculture in the international arena. The Office of Marine Conservation (OES/OMC) works within the framework of several international organizations that aim to address growing and important issues in the aquaculture sector, including the United Nations Committee on Fisheries (COFI) Sub-Committee on Aquaculture and the Asia-Pacific Economic Community (APEC) Oceans and Fisheries Working Group.

Additionally, the Department of State frequently receives inquiries about the U.S. aquaculture industry, policy, and investment opportunities from the international community. When an inquiry is received, the Department of State coordinates with federal partners to identify experts and potential partners to initiate discussions on these important issues.

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U.S. National Science Foundation

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…" NSF is the funding source for approximately 20 percent of all federally supported basic research conducted by America's colleges and universities. In many fields such as mathematics, computer science, biology, and the social sciences, NSF is the major source of federal backing for research. NFS funds basic research that has broad application for aquaculture. NSF also has a Small Business Innovation Research (SBIR) program.

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U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) has several programs involved in aquaculture. The proper management of effluents and residual wastes should be a major consideration of aquaculture systems in assuring the protection of the environment.

EPA's Water Quality Programs are concerned with setting Water Quality Criteria, Monitoring Shellfish Waters and Effluent Discharge Standards are for assuring the protection of the nation's waterways and water supplies.

The National Pollutant Discharge Elimination System (NPDES) issues permits for the discharge of wastewaters to surface waters, including discharges from aquaculture systems in many cases. Permits are available from this program to use wastes as nutrients in public waters for aquaculture purposes.

Wastewater treatment in publicly owned treatment works is amenable to the use of aquaculture systems funded, in part, by EPA's State Revolving Fund (SRF) Program. In conjunction with the U.S. Army Corps of Engineers, EPA also implements the Clean Water Act Section 404 Wetlands Protection Program aimed at protecting natural wetlands from the impacts of dredging and filling.

Chemicals and other materials to be used in aquaculture are subject to Pesticide Registration by EPA prior to marketing to the user.

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U.S. Army Corps of Engineers

The role of the U.S. Army Corps of Engineers (USACOE) is to strengthen our Nation's security by building and maintaining America's infrastructure and providing military facilities where service members train, work, and live. The USACOE maintains America's waterways to support the movement of critical commodities and providing recreational opportunities .Additionally, by devising hurricane and storm damage reduction infrastructure, they reduce the risks from disasters.

The Clean Water Act of 1977 requires the Corps to reissue nationwide permits (NWP) every five years. The primary goal of the NWPs is to authorize certain activities, including aquaculture, that have minimal adverse effects on the environment. The Corps reissued NWP 48 with some changes. NWP 48 has been modified to authorize expansion of existing commercial shellfish growing operations and new activities, with a 0.5 acre limit of disturbance to submerged aquatic vegetation beds. They have also removed the reporting requirement for certain on-going commercial shellfish aquaculture activities.

404 permitting: The USACOE Regulatory Program mission is the protection of the Nation's aquatic resources, while allowing reasonable development, including aquaculture, through fair, flexible, and balanced permit decisions. The Corps evaluates permit applications for essentially all construction activities that occur in the Nation's waters, including wetlands.

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U.S. Agency for International Development (USAID)

The U.S. Agency for International Development (USAID) supports aquaculture research and development projects in developing countries where significant opportunities exist to utilize this form of food production to meet nutritional needs and to increase incomes and employment opportunities. It supports applied research, usually involving U.S. scientists, primarily through the Bureau for Food Security (BFS).

The main mechanism through which USAID supports aquaculture research is through the AquaFish Innovation Lab which is managed by Oregon State University and involves more than a dozen other U.S. universities as well as research institutions in fifteen developing countries. BFS also supports aquaculture research and development activities undertaken by the WorldFish Center.

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NOAA Fisheries

NATIONAL AQUACULTURE ACT OF 1980

Act of September 26, 1980, Public Law 96-362, 94 Stat. 1198, 16 U.S.C. 2801, et seq.

To provide for the development of aquaculture in the United States, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Aquaculture Act of 1980".(1)

FINDINGS, PURPOSE, AND POLICY

SEC. 2. (a) FINDINGS.--Congress finds the following:

(1) The harvest of certain species of fish and shellfish exceeds levels of optimum sustainable yield, thereby making it more difficult to meet the increasing demand for aquatic food.

(2) To satisfy the domestic market for aquatic food, the United States imports more than 50 per centum of its fish and shellfish, but this dependence on imports adversely affects the national balance of payments and contributes to the uncertainty of supplies.

(3) Although aquaculture currently contributes approximately 13 percent of world seafood production, less than 6 percent of current United States seafood production results from aquaculture. Domestic aquaculture production, therefore, has the potential for significant growth.(2)

(4) Aquacultural production of aquatic plants can provide sources of food, industrial materials, pharmaceuticals, and energy, and can assist in the control and abatement of pollution.

(5) The rehabilitation and enhancement of fish and shellfish resources are desirable applications of aquacultural technology.

(6) The principal responsibility for the development of aquaculture in the United States must rest with the private sector.

(7) Despite its potential, the development of aquaculture in the United States has been inhibited by many scientific, economic, legal, and production factors, such as inadequate credit, diffused legal jurisdiction, the lack of management information, the lack of

supportive Government policies, and the lack of reliable supplies of seed stock.(3)

(8) Many areas of the United States are suitable for aquaculture, but are subject to land-use or water-use management policies that do not adequately consider the potential for aquaculture and may inhibit the development of aquaculture.

(b) PURPOSE.--It is the purpose of the Act to promote aquaculture in the United States by-

(1) declaring a national aquaculture policy;

(2) establishing and implementing a national aquaculture development plan;(4)

(3) establishing the Department of Agriculture as the lead Federal agency with respect to the coordination and dissemination of national aquaculture information by designating the Secretary of Agriculture as the permanent chairman of the coordinating group and by establishing a National Aquaculture Information Center within the Department of Agriculture; and

(4) encouraging aquaculture activities and programs in both the public and private sectors of the economy; that will result in increased aquacultural production, the coordination of domestic aquaculture efforts, the conservation and enhancement of aquatic resources, the creation of new industries and job opportunities, and other national benefits.

(c) POLICY.--Congress declares that aquaculture has the potential for reducing the United States trade deficit in fisheries products,(5) for augmenting existing commercial and recreational fisheries and for producing other renewable resources, thereby assisting the United States in meeting its future food needs and contributing to the solution of world resource problems. It is, therefore, in the national interest, and it is the national policy, to encourage the development of aquaculture in the United States.

DEFINITIONS

SEC. 3.(6) As used in this Act, unless the context otherwise requires--

(1) The term "aquaculture" means the propagation and rearing of aquatic species in controlled or selected environments, including, but not limited to, ocean ranching (except private ocean ranching of Pacific salmon for profit in those States where such ranching is prohibited by law).

(2) The term "aquaculture facility" means any land, structure, or other appurtenance that is used for aquaculture and is located in any State. Such term includes, but is not limited to, any laboratory, hatchery, rearing pond, raceway, pen, incubator, or other equipment used in aquaculture.

(3) The term "aquatic species" means any species of finfish, mollusk, crustacean, or other aquatic invertebrate, amphibian, reptile, or aquatic plant.

(4) The term "coordinating group" means the interagency aquaculture coordinating group established by section 6.

(5) The term "person" means any individual who is a citizen or national of the United States or of any State, any Indian tribe, any institution of higher education, and any corporation, partnership, association or other entity (including, but not limited to, any community development corporation, producer cooperative, or fishermen's cooperative) organized or existing under the laws of any State.

(6) The term "Plan" means the National Aquaculture Development Plan required to be established under section 4.

(7) The term "Secretaries" means the Secretary of Agriculture, the Secretary of Commerce, and the Secretary of the Interior.

(8) The term "Secretary" means the Secretary of Agriculture.[(7)]

(9) The term "State" means any of the several States, the District of Columbia, the Commonwealth of Puerto Rico, American Samoa, the Virgin Islands of the United States, Guam, the Commonwealth of the Northern Mariana Islands, and the Trust Territory of the Pacific Islands, or any other territory or possession of the United States.

NATIONAL AQUACULTURE DEVELOPMENT PLAN

SEC. 4.[(8)] (a) IN GENERAL.--(1) Within eighteen months after the date of the enactment of this Act, the Secretaries shall establish the National Aquaculture Development Plan.

(2) In developing the Plan, and revisions thereto under subsection (d), beginning not later than six months after the date of enactment of this Act, the Secretary[(9)] shall consult with the Secretary of Commerce and the Secretary of the Interior,[(10)] other appropriate Federal officers, States, regional fishery management councils established under section 302 of the Fishery Conservation and Management Act of 1976 (16 U.S.C. 1852), and representatives of the aquaculture industry. In addition, the Secretary shall give interested persons and organizations an opportunity to comment during the development of the Plan.[(11)]

(b) CONTENTS OF PLAN.--The plan shall--

(1) identify aquatic species that the Secretaries determine to[(12)] have significant potential for culturing on a commercial or other basis;

(2) recommend actions to be taken by the public and private sectors (which may include, but are not limited to, research and development, technical assistance, demonstration, extension education, and training activities) that are necessary to achieve such potential;

(3) address, after taking into account the status of aquaculture regarding the aquatic species concerned-

(A) aquaculture facility design and operation,

(B) water quality management,

(C) use of waste products (including thermal effluents),

(D) nutrition and the development of economical feeds, including natural food sources,

(E) life history, genetics, physiology, pathology, and disease control (including research regarding organisms that may not be harmful to fish and shellfish, but are injurious to humans),

(F) processing and market development,

(G) production management and quality control, and

(H) the development of adequate supplies of seed stock;

(4) include, where appropriate, research programs on the effect of aquaculture on estuarine and other water areas and on the management of such areas for aquaculture;

(5) include, where appropriate, programs to analyze, and formulate proposed resolutions of, the legal or regulatory constraints that may affect aquaculture; and

(6) include such other research and development, technical assistance, demonstration, extension education, and training programs as the Secretary deems(13) necessary or appropriate to carry out this Act.

In formulating the Plan, the Secretary(14) shall, to the extent practicable, take into account any significant action that (i) has been, or is proposed to be, undertaken by any other Federal department or agency, any State agency, or any person, and (ii) may affect the implementation of the Plan.

(c) ACTIONS AND IMPLEMENTATION.--The Plan shall specify--

(1) with respect to those actions that the Secretary determines(15) should be undertaken, the period of time within which each such action should be completed, in order to implement the Plan; and

(2) with respect to each such action which of the Secretaries, acting individually, jointly, or collectively, has the responsibility for implementing the action.

The specifications of Secretarial responsibilities under paragraph (2) for implementing actions shall be determined on the basis of--

(A) the responsibilities conferred on the respective Secretaries by law or by any executive action having the effect of law (including,

but not limited to, Reorganization Plan Numbered 4 of 1970);(16)

(B) the experience, expertise, and other appropriate resources that the department of each such Secretary may have with respect to the action required under the activity concerned; and(17)

(C) the concurrence of the Secretaries.(18)

(d) REVISION OF PLAN.--The Secretaries shall undertake periodic reviews of the operation and effectiveness of the Plan. If as a result of any such review, or the aquaculture assessment required under subsection (e), the Secretaries determine that-

(1) any aquatic species not currently identified in the Plan has significant potential for aquaculture;

(2) any action specified in the Plan is not being accomplished on a successful and timely basis; or

(3) any action specified in the Plan should be terminated because its objectives have been achieved or its projected benefits do not warrant further support; the Secretaries shall appropriately amend the Plan.

(e) CONTINUING AQUACULTURE ASSESSMENT.--The Secretaries, through the coordinating group, shall undertake a continuing assessment of aquaculture in the United States for the purpose of maintaining, on a continuing basis--

(1) a complete profile of the aquacultural industry with respect to the incidence, size, and status of commercial aquacultural enterprises;

(2) the identification of the private and public institutions and organizations involved in aquacultural research, extension, credit, and market development;

(3) the identification of the various aquatic species being cultured and a description of the status of commercial development of each of those species;

(4) to the extent practicable, the identification of aquacultural production regions, species, and markets that have significant potential for development;

(5) a catalog describing all Federal programs and activities that directly or indirectly encourage, support, or assist aquaculture; and

(6) the identification of the economic, physical, legal, institutional, and social constraints that inhibit the development of aquaculture in the United States.

FUNCTIONS AND POWERS OF SECRETARIES

SEC. 5.[(19)] (a) MANDATORY FUNCTIONS.--In implementing the Plan, the Secretaries shall--

(1) provide advisory, educational, and technical assistance (including training) with respect to aquaculture to interested persons, and in providing such assistance, shall, to the maximum extent practicable, avoid duplication of similar assistance provided by other Federal departments and agencies and by State agencies;

(2) consult and cooperate with interested persons, Federal departments and agencies, State agencies, and regional fishery management councils established under section 302 of the Fishery Conservation and Management Act of 1976 (16 U.S.C. 1852);

(3) encourage the implementation of aquacultural technology in the rehabilitation and enhancement of publicly owned fish and shellfish stocks (including rehabilitation and enhancement by private nonprofit enterprises), and in the development of private commercial aquacultural enterprises; and

(4) prescribe such regulations as may be necessary to carry out the Plan.

(b) DISCRETIONARY FUNCTIONS.--In implementing the Plan, the Secretaries may--

(1) for the purposes of assessing the biological, technical, and economic feasibility of any aquacultural system--

(A) conduct tests of the system, and, if necessary to demonstrate its feasibility, construct, operate, and maintain developmental aquaculture facilities for testing laboratory results, and

(B) conduct such other tests or analyses as may be necessary;

(2) develop methods to enhance seed stocks of aquatic species; and

(3) conduct such other tests or analyses or take such other actions as the Secretaries deem necessary or appropriate.

(c)[(20)] INFORMATION SERVICES.--(1) In addition to performing such other mandatory functions under this Act--

(A) the Secretaries shall collect and analyze scientific, technical, legal, and economic information relating to aquaculture, including acreages, water use, production, marketing, culture techniques, and other relevant matters;

(B) the Secretary shall--

(i) establish, within the Department of Agriculture, a National Aquaculture Information Center that shall serve as a repository for the information generated under subparagraph (A) and other provisions of this Act and shall, on a request basis, make that information available to the public,

(ii) arrange with foreign nations for the exchange of information relating to aquaculture and support a translation service,

and

(iii) conduct a study of the extent to which the United States aquaculture industry has access to relevant Federal programs which assist the agricultural sector and report to Congress on the findings of such study by December 31, 1986;

(C) the Secretary of Commerce shall conduct a study, and report to Congress thereon by December 31, 1987, to determine whether existing capture fisheries could be adversely affected by competition from products produced by commercial aquacultural enterprises and include in such study an assessment of any adverse effect, by species and by geographical region, on such fisheries and recommend measures to ameliorate any such effect; and

(D) the Secretary of the Interior, in consultation with the Secretary of Commerce, shall undertake a study, and report to Congress thereon by December 31, 1987, to identify exotic species introduced into the United States waters as a result of aquaculture activities, and to determine the potential benefits and impacts of the introduction of exotic species.

(2) Any production information submitted to the Secretaries under paragraph (1)(A) shall be confidential and may only be disclosed if required under court order. The Secretaries shall preserve such confidentiality. The Secretaries may release or make public any information in any aggregate or summary form that does not directly or indirectly disclose the identity, business transactions, or trade secrets of any person who submits such information.

(d) BIENNIAL REPORT.--The Secretary[(21)], through the coordinating group and in consultation with the Secretary of Commerce and the Secretary of the Interior,,[(22)] shall prepare on a biennial basis, and submit to Congress, a report on the status of aquaculture in the United States. Such[(23)] report shall contain a description and evaluation of the actions undertaken with respect to the Plan during the reporting period, an explanation of any revisions made to the Plan during the reporting period, and such other comments and recommendations as the Secretary deems appropriate. The report required by this subsection shall be submitted to the Congress not later than February 1, 1988.[(24)]

COORDINATION OF NATIONAL ACTIVITIES REGARDING AQUACULTURE

SEC. 6.[(25)] (a) ESTABLISHMENT.--There is established within the Office of Science and Technology Policy an interagency aquaculture coordinating group that shall, subject to subsection (f), operate as a Joint Subcommittee on Aquaculture of the Federal Coordinating Council on Science, Engineering, and Technology (hereinafter in this section referred to as the "Federal Council") established by Executive Order 12039, dated February 24, 1978. The coordinating group shall be composed of the following members or their designees:

(1)The Secretary of Agriculture, who shall be the permanent chairman of the coordinating group.[(26)]

(2)The Secretary of Commerce.

(3)The Secretary of the Interior.

(4)The Secretary of Energy.

(5)The Secretary of Health and Human Services.

(6)The Administrator of the Environmental Protection Agency.

(7)The Chief of Engineers.

(8)The Administrator of the Small Business Administration.

(9)The Administrator of the Agency for International Development.

(10) The Chairman of the Tennessee Valley Authority.

(11) The Director of the National Science Foundation.

(12) The Governor of the Farm Credit Administration.

(13) The heads of such other Federal agencies as are deemed appropriate by the Director of the Office of Science and Technology Policy (hereinafter in this section referred to as the "Director"), after consultation with the coordinating group.

(b) PURPOSE AND FUNCTIONS.--The purpose of the coordinating group is to increase the overall effectiveness and productivity of Federal aquaculture research, transfer, and assistance programs. In fulfilling this purpose the coordinating group shall--

(1) review the national needs for aquaculture research, transfer, and assistance;

(2) assess the effectiveness and adequacy of Federal efforts to meet those national needs;

(3) undertake planning, coordination, and communication among Federal agencies engaged in the science, engineering, and technology of aquaculture;

(4) collect, compile, and disseminate information on aquaculture;

(5) encourage joint programs among Federal agencies in areas of mutual interest; and

(6) recommend to the Federal Council specific actions on issues, problems, plans, and programs in aquaculture.

(c) REPORTS.--The coordinating group shall regularly report to the chairman of the Federal Coordinating Council on the coordinating group's activities and on recommendations concerning Federal policies and programs related to aquaculture.[(27)]

(d) FEDERAL CONSISTENCY.--Each Federal department and agency that has functions or responsibilities with respect to aquaculture or has jurisdiction over any activity that affects, or that may affect, the achievement of the purpose and policy of this Act, shall, in consultation with the coordinating group and to the maximum extent practicable, perform such function, responsibility, or activity in a manner that is consistent with the purpose and policy of this Act.

(e) FUNCTIONS IF FEDERAL COUNCIL TERMINATED.--If at any time after the date of the enactment of this Act, the functions of the Federal Council are by executive action terminated or transferred to an agency other than the Office of Science and Technology Policy, the coordinating group shall carry out its purpose under the direction of the Director. In that event, the recommendations of the coordinating group referred to in subsection (b)(6) and the reports required under subsection (c)[(28)] shall be made to the Director.

CONTRACTS AND GRANTS

SEC. 7.[(29)] (a) IN GENERAL.--The Secretaries may each carry out any action that such Secretary is responsible for implementing under the Plan through grants to, or contracts with, any person, any other Federal department or agency, any State agency, or any regional commission.

(b) TERMS AND CONDITIONS.--Any contract entered into, or any grant made, under subsection (a) shall contain such terms and conditions as the Secretary concerned shall by regulation prescribe as being necessary or appropriate to protect the interests of the United States. No contract may be entered into, and no grant may be made under subsection (a), for any purpose that is in violation of any applicable State or local law.

(c) LIMITATION.--The amount of any grant made under subsection (a) may not exceed an amount equal to one-half the estimated cost of the project for which the grant is made.

(d) AUDIT.--Each recipient of a grant or contract under this section shall make available to the Secretary concerned and to the Comptroller General of the United States, for purposes of audit and examination, any book, document, paper, or record that is pertinent to the funds received under such grant or contract.

CAPITAL REQUIREMENTS FOR AQUACULTURE

SEC. 8.[(30)] (a) CAPITAL REQUIREMENTS STUDY.--The Secretaries, through the coordinating group, shall conduct within twelve months after the date of enactment of this Act, a study of the capital requirements of the United States aquaculture industry. The study shall--

(1) document and analyze any capital constraints that affect the development of aquaculture in the United States; and

(2) evaluate the role that appropriate Federal financial assistance does or could play in filling gaps in the normal credit market with respect to aquaculture.

The study will identify the capital needs of the United States aquaculture industry, with emphasis on the needs that are not being filled either in normal credit channels or through government programs for direct loans, loan guarantees, disaster loans, and insurance. Upon its completion, the

Secretaries shall submit the results of the study to Congress.

(b) CAPITAL REQUIREMENTS PLAN.--Based on the results of the Capital Requirement Study conducted under subsection (a), and within six months of the completion of the study, the Secretaries shall formulate a plan for acting on the study's findings. The plan shall include: (1) those Federal actions, if any, found to be necessary to meet financial needs unmet through normal credit channels and existing Federal programs; and (2) recommendations, if any, for legislative actions. Upon completion, the plan shall be submitted to Congress.

REGULATORY CONSTRAINTS ON AQUACULTURE

SEC. 9.(31) (a) REGULATORY CONSTRAINTS STUDY.--The Secretaries, through the coordinating group, shall conduct, within twelve months after the date of enactment of this Act, a study of the State and Federal regulatory restrictions to aquaculture development in the United States. The study shall--

(1) include a literature review and a descriptive list identifying the parameters of the issue;

(2) identify and list relevant current and pending Federal regulations restricting the development of commercial aquaculture operations;

(3) identify and list relevant current State regulations restricting the development of commercial aquaculture operations in five States selected randomly in five separate geographic regions of the United States;

(4) conduct case studies of ten commercial aquaculture operations in the United States representing a wide range of marine and fresh water species to determine the practical effects of regulatory restrictions on aquaculture; and

(5) develop a flow-chart time line using the information obtained by means of paragraphs (1) through (4) to identify those regulations and restrictions that could have the most detrimental effect in establishing commercial aquaculture operations in the United States.

Upon completion of the study, the Secretaries shall submit its results to Congress.

(b) REGULATORY CONSTRAINTS PLAN.--Based on the results of the Regulatory Constraints Study conducted under subsection (a), and within six months of the study's completion, the Secretaries shall formulate a plan for acting on the study's findings. The plan will contain specific steps the Federal Government can take to remove unnecessarily burdensome regulatory barriers to the initiation and operation of commercial aquaculture ventures. Upon its completion, the Secretaries shall submit the plan to Congress.

AUTHORIZATIONS FOR APPROPRIATIONS

SEC. 10.(32) For purposes of carrying out the provisions of this Act, there are authorized to be appropriated(33)

(1) to the Department of Agriculture, $1,000,000 for each of fiscal years 1991 through 2002[(34)];

(2) to the Department of Commerce, $1,000,000 for each of fiscal years 1991 through 2002; and

(3) to the Department of[(35)] Interior, $1,000,000 for each of fiscal years 1991 through 2002.

Funds authorized by this section shall be in addition to, and not in lieu of, funds authorized by any other Act.

DISCLAIMER

SEC. 11.[(36)] Nothing in this Act shall be construed to amend, repeal, or otherwise modify the authority of any Federal officer, department, or agency to perform any function, responsibility, or activity authorized under any other provision of law.

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(1) See also the National Agricultural Research, Extension, and Teaching Policy Act of 1977, "Subtitle L- Aquaculture", added by the Agriculture and Food Act of 1981, Public Law 97-98, section 1440(a), 95 Stat. 1316.

(2) Section 2(a)(3) of the National Aquaculture Act of 1980, 16 U.S.C. 2801, was amended by the National Aquaculture Improvement Act of 1985, section 1732(1), Public Law 99-198, 99 Stat. 1641, by striking out "10 percentum" and inserting in lieu thereof "13 percent", and by striking out "3 per centum" and inserting in lieu thereof "6 percent".

(3) Section 2(a)(7) of the National Aquaculture Act of 1980, 16 U.S.C. 2801, was amended by the National Aquaculture Improvement Act of 1985, section 1732(2), Public Law 99-198, 99 Stat. 1641, by inserting "scientific," before "economic,", and by inserting "the lack of supportive Government policies," immediately after "management information,".

(4) Section 2(b)(2) of the National Aquaculture Act of 1980, 16 U.S.C. 2801, was amended by the National Aquaculture Improvement Act of 1985, section 1732(3), Public Law 99-198, 99 Stat. 1641, by striking "and" at the end of paragraph (2), by redesignating paragraph (3) as paragraph (4), and by inserting after paragraph (2) a new paragraph (3).

(5) Section 2(c) of the National Aquaculture Act of 1980, 16 U.S.C. 2801, was amended by the National Aquaculture Improvement Act of 1985, section 1732(3), Public Law 99-198, 99 Stat. 1641, by inserting "for reducing the United States trade deficit in fisheries products," immediately after "potential" in the first sentence.

(6) 16 U.S.C. 2802.

(7) Section 3 of the National Aquaculture Act of 1980, 16 U.S.C. 2802, was amended by the National Aquaculture Improvement Act of 1985, section 1733, Public Law 99-198, 99 Stat. 1641, by redesignating paragraph (8) as paragraph (9), and by inserting after paragraph (7) a new paragraph (8).

(8) 16 U.S.C. 2803.

(9) Amended by the National Aquaculture Improvement Act of 1985, section 1734, Public Law 99-198, 99 Stat. 1641, by striking out "Secretaries" each place it appears in paragraph (2) and inserting in lieu thereof "Secretary".

(10) Amended by the National Aquaculture Improvement Act of 1985, section 1734, Public Law 99-198, 99 Stat. 1641, by inserting "the Secretary of Commerce and the Secretary of the Interior," immediately after "shall consult with".

(11) Subsection (a)(3) which read: "If the Secretaries deem it to be appropriate, they may establish, and appoint the members of, an advisory committee to assist in the initial development of the Plan. Individuals appointed to the advisory committee shall be knowledgeable or experienced in the principles and practices of aquaculture. The members of the advisory committee (other than officers or employees of the Federal Government), while away from their homes or regular places of business in the performance of services for the advisory committee, shall be allowed travel expenses, including per diem in lieu of subsistance, in the same manner as persons employed intermittently in the Government service are allowed expenses under section 5703 of title 5 of the United States Code." was deleted by the National Aquaculture Improvement Act of 1985, section 1734, Public Law 99-198, 99 Stat. 1641.

(12) Amended by the National Aquaculture Improvement Act of 1985, section 1734, Public Law 99-198, 99 Stat. 1641, by inserting "to" immediately after "determine" in paragraph (1).

(13) Amended by the National Aquaculture Improvement Act of 1985, section 1734, Public Law 99-198, 99 Stat. 1642, by striking "Secretaries deem" and inserting "Secretary deems".

(14) Amended by the National Aquaculture Improvement Act of 1985, section 1734, Public Law 99-198, 99 Stat. 1642, by striking "Secretaries" in the matter following paragraph (6) and inserting "Secretary".

(15) Amended by the National Aquaculture Improvement Act of 1985, section 1734, Public Law 99-198, 99 Stat. 1642, by striking "Secretaries determine" in paragraph (1) and inserting "Secretary determines".

(16) Amended by the National Aquaculture Improvement Act of 1985, section 1734, Public Law 99-198, 99 Stat. 1642, by striking "and" at the end of paragraph (2)(A).

(17) Amended by the National Aquaculture Improvement Act of 1985, section 1734, Public Law 99-198, 99 Stat. 1642, by striking the period at the end of paragraph (2)(B) and inserting in lieu thereof "; and".

(18) Amended by the National Aquaculture Improvement Act of 1985, section 1734, Public Law 99-198, 99 Stat. 1642, by inserting after paragraph (2)(B) this new subparagraph (c).

(19) 16 U.S.C. 2804.

(20) Amended by the National Aquaculture Improvement Act of 1985, section 1735, Public Law 99-198, 99 Stat. 1642, by inserting a new

subsection (c).

(21) Amended by the National Aquaculture Improvement Act of 1985, section 1735, Public Law 99-198, 99 Stat. 1642, by striking "Secretaries" each place it appears and inserting "Secretary".

(22) Amended by the National Aquaculture Improvement Act of 1985, section 1735, Public Law 99-198, 99 Stat. 1642, by inserting "and in consultation with the Secretary of Commerce and the Secretary of the Interior,". Two commas appear in the Code at this point.

(23) Amended by the National Aquaculture Improvement Act of 1985, section 1735, Public Law 99-198, 99 Stat. 1642, by striking out "Each such" and inserting in lieu thereof "such"; by striking "under section 4(d)"; and by striking "deem" in the second sentence and inserting in lieu thereof "deems".

(24) Amended by the National Aquaculture Improvement Act of 1985, section 1735, Public Law 99-198, 99 Stat. 1642, by striking out the last sentence and inserting this new one.

(25) 16 U.S.C. 2805.

(26) Amended by the National Aquaculture Improvement Act of 1985, section 1736, Public Law 99-198, 99 Stat. 1643, by inserting ", who shall be the permanent chairman of the coordinating group" after "Agriculture".

(27) Amended by the National Aquaculture Improvement Act of 1985, section 1736, Public Law 99-198, 99 Stat. 1643, by repealing subsection (c) and changing subsections (d), (e), and (f) to subsections (c), (d), and (e) respectively.

(28) Amended by the National Aquaculture Improvement Act of 1985, section 1736, Public Law 99-198, 99 Stat. 1643, by striking out "subsection (d)" and inserting "subsection (c)".

(29) 16 U.S.C. 2806.

(30) 16 U.S.C. 2807.

(31) 16 U.S.C. 2808.

(32) 16 U.S.C. 2809.

(33) Amended by the Act of November 8, 1984, Public Law 98-623, Section 402 to provide authorizations for appropriations through 1985; and was further amended by the National Aquaculture Improvement Act of 1985, section 1737, Public Law 99-198, 99 Stat. 1643, by striking out "1985" in each of paragraphs (1), (2), and (3) and inserting in lieu thereof "1985, and $1,000,000 for each of fiscal years 1986, 1987, 1988"; and was further amended by the Food, Agriculture, Conservation, and Trade Act of 1990, Public Law 101-624, section 1614(c), 104 Stat. 3728 to extend the authorizations for the Departments of Agriculture, Commerce, and Interior through 1993.

(34) Amended by the Agricultural Research, Extension, and Education Reform Act of 1998, Public Law 105-185, June 23, 1998, section 301(i), by striking “the fiscal years 1991, 1992, and 1993" each place it appears and inserting “fiscal years 1991 through 2002".

(35) So in original. Probably should be "of the".

(36) 16 U.S.C. 2810.

(B) the establishment and extension of various methods of planting, cultivating, harvesting, and processing supplemental and alternative crops;

(C) the transfer of such applied research to on-farm practice as soon as practicable;

(D) the establishment through grants, cooperative agreements, or other means of such processing, storage, and transportation facilities for supplemental and alternative crops as the Secretary determines will facilitate the achievement of a successful program; and

(E) the application of such other resources and expertise as the Secretary considers appropriate to support the program.

(3) The program may include, but shall not be limited to, agreements, grants, and other arrangements—

(A) to conduct comprehensive resource and infrastructure assessments;

(B) to develop and introduce supplemental and alternative income-producing crops;

(C) to develop and expand domestic and export markets for such crops;

(D) to provide technical assistance to farm owners and operators, marketing cooperative, and others;

(E) to conduct fundamental and applied research related to the development of new commercial products derived from natural plant material for industrial, medical, and agricultural applications; and

(F) to participate with colleges and universities, other Federal agencies, and private sector entities in conducting research described in subparagraph (E).

(d) The Secretary shall use the expertise and resources of the Agricultural Research Service, the Cooperative State Research Service, the Extension Service, and the land-grant colleges and universities for the purpose of carrying out this section.

Subtitle L—Aquaculture

PURPOSE

SEC. 1474. [7 U.S.C. 3321] It is the purpose of this subtitle to promote research and extension activities of the institutions hereinafter referred to in section 1475(b), and to coordinate their efforts as an integral part in the implementation of the National Aquaculture Act of 1980 (16 U.S.C. 2801 et seq.) by encouraging landowners, individuals, and commercial institutions to develop aquaculture production and facilities and sound aquacultural practices that will, through research and technology transfer programs, provide for the increased production and marketing of aquacultural food products.

AQUACULTURE ASSISTANCE PROGRAMS

SEC. 1475. [7 U.S.C. 3322] (a) RESEARCH AND EXTENSION PROGRAM.—The Secretary may develop and implement a cooperative research and extension program to encourage the development, management, and production of important aquatic food species

within the several States and territories of the United States and to enhance further the safety of food products derived from the aquaculture industry, in accordance with the national aquaculture development plan, and revisions thereto, developed under the National Aquaculture Act of 1980.

(b) GRANTS.—The Secretary may make grants to—

(1) land-grant and seagrant colleges and universities;

(2) State agricultural experiment stations;

(3) colleges, universities, and Federal laboratories having a demonstrable capacity to conduct aquacultural research, as determined by the Secretary; and

(4) nonprofit private research institutions;

for research and extension to facilitate or expand promising advances in the production and marketing of aquacultural food species and products and to enhance further the safety and wholesomeness of those species and products, including the development of reliable supplies of seed stock and thereapeutic compounds. Except in the case of Federal laboratories, no grant may be made under this subsection unless the State in which the grant recipient is located makes a matching grant (of which amount an in-kind contribution may not exceed 50 percent) to such recipient equal to the amount of the grant to be made under this subsection, and unless the grant is in implementation of the national aquaculture development plan, and revisions thereto, developed under the National Aquaculture Act of 1980.

(c) AQUACULTURE DEVELOPMENT PLANS.—The Secretary may assist States to formulate aquaculture development plans for the enhancement of the production and marketing of aquacultural species and products from such States and may make grants to States on a matching basis, as determined by the Secretary. The aggregate amount of the grants made to any one State under this subsection may not exceed $50,000. The plans shall be consistent with the national aquaculture development plan, and revisions thereto, developed under the National Aquaculture Act of 1980.

(d) AQUACULTUREAL CENTERS.—To provide for aquacultural research, development, and demonstration projects having a national or regional application, the Secretary may establish in existing Federal facilities or in cooperation with any of the non-Federal entities specified in subsection (b) up to five aquacultural research, development, and demonstration centers in the United States for the performance of aquacultural research, extension work, and demonstration projects. Funds made available for the operation of such regional centers may be used for the rehabilitation of existing buildings or facilities to house such centers, but may not be used for the construction or acquisition of new buildings or facilities. To the extent practicable, the aquaculture research, development, and demonstration centers established under this subsection shall be geographically located so that they are representative of the regional aquaculture opportunities in the United States. To the extent practicable, the Secretary shall ensure that equitable efforts are made at these centers in addressing the research needs of those segments of the domestic aquaculture industry located within that region.

(e) LISTING OF LAWS ON AQUACULTURE.—The interagency aquaculture coordinating group established under section 6(a) of the National Aquaculture Act of 1980 (16 U.S.C. 2805(a)) shall, in consultation with appropriate Federal and State agencies, compile a listing of Federal and State laws, rules, and regulations materially affecting the production, processing, marketing, and transportation of aquaculturally produced commodities and the products thereof. The interagency aquaculture coordinating group shall make such listing available to the public not later than January 1, 1992, and shall update and revise such listing not later than January 1, 1996, to show such laws, rules, and regulations as in effect on that date.

(f) FISH DISEASE PROGRAM.—The Secretary shall implement, in consultation with the Joint Subcommittee on Aquaculture referred to in section 6 of the National Aquaculture Act of 1980 (16 U.S.C. 2805), a fish disease program to include the development of new diagnostic procedures for fish diseases, the determination of the effect of water environment on the development of the fish immune system, and the development of therapeutic, synthetic, or natural systems, for the control of fish diseases.

[Section 1476 repealed by section 302(a) of P.L. 105–185, 112 Stat. 563.]

AUTHORIZATION FOR APPROPRIATIONS

SEC. 1477. [7 U.S.C. 3324] There is authorized to be appropriated $7,500,000 for each of the fiscal years 1991 through 2007. Funds appropriated under this section or section 1476 may not be used to acquire or construct a building.

Subtitle M—Rangeland Research

PURPOSE

SEC. 1478. [7 U.S.C. 3331] It is the purpose of this subtitle to promote the general welfare through improved productivity of the Nation's rangelands, which comprise 60 per centum of the land area of the United States. Most of these rangelands are unsuited for cultivation, but produce a great volume of forage that is inedible by humans but readily converted, through an energy efficient process, to high quality food protein by grazing animals. These native grazing lands are located throughout the United States and are important resources for major segments of the Nation's livestock industry. In addition to the many livestock producers directly dependent on rangelands, other segments of agriculture are indirectly dependent on range-fed livestock and on range-produced forage that can be substituted for grain in times of grain scarcity. Recent resource assessments indicate that forage production of rangeland can be increased at least 100 per centum through development and application of improved range management practices while simultaneously enhancing wildlife, watershed, recreational, and aesthetic values and reducing hazards of erosion and flooding.

Alaska Fisheries Development Foundation
Matching Grant Funds - Documentation Form
Alaska Mariculture Task Force Meetings

Name	Signature	6/27/2017 Number of Hours
Paula Cullenberg		
Julie Decker		
Angel Drobnica		
Jeff Hetrick		
Chris Hladick		
Heather McCarty		
Sam Rabung		
Mike Stekoll		
Kate Sullivan		
Chris Whitehead		
Eric Wyatt		
Linda Mattson		
Micaela Fowler		

The above signatures certify that these members of the Mariculture Task Force spent the hours listed above in either meetings or preparation time for meetings of this group and that these salaries were paid by non-federal funds.

Julie Decker

From: Foundation for Food and Agriculture Research [moconnor@foundationfar.org]
Sent: Friday, June 09, 2017 5:01 AM
To: jdecker@afdf.org
Subject: PRESS RELEASE: Foundation for Food and Agriculture Research to Invest Up to $5 Million in Strengthening the American Aquaculture Economy

Categories: AFDF

PRESS CONTACT
Stephanie Miles
202.604.5756
smiles@foundationfar.org

FOR IMMEDIATE RELEASE

Foundation for Food and Agriculture Research to Invest Up to $5 Million in Strengthening the American Aquaculture Economy

WASHINGTON, June 9, 2017 - The Foundation for Food and Agriculture Research, a nonprofit organization established through bipartisan congressional support in the 2014 Farm Bill, today announced a competitive research program to stimulate innovative research on farmed production of fish and shellfish. The U.S. imports up to 90 percent of the seafood consumed domestically and approximately half is produced by aquaculture, often from countries that do not have strict environmental and product safety standards.

FFAR will invest up to $5 million for research that will improve economic opportunities for U.S. farmers and increase the supply of domestically-produced, nutritious foods. Doubling U.S. aquaculture would result in 50,000 domestic jobs and a billion dollars of new value, according to a National Oceanic Atmospheric Administration study.

Researchers will be invited to apply for the program on July 10, 2017 and be required to identify matching funds to be eligible for a grant. The Foundation's dollar-for-dollar matching model will ensure that research proposals come with funding partners who are invested in delivering value and seeing measurable outcomes. The FFAR investment of up to $5 million in aquaculture research will be at least doubled.

"The United States has the resources and innovation necessary to support a thriving aquaculture economy here at home," said Sally Rockey, Ph.D., executive director of FFAR. "The Foundation for Food and Agriculture Research is committed to addressing the global demand for nutritious,

sustainable protein sources, and this competitive grant program announced today will bolster that potential."

This Foundation for Food and Agriculture Research program will support the long-term success of farmed fish and shellfish products in the U.S. by accelerating solutions to industry challenges. Unmet research needs to be addressed through this program will focus on understanding biological and technological barriers to economic viability and the environmental impact of a diverse range of aquatic species. This is the second initiative within the FFAR Protein Challenge, a suite of research programs that supports producers' efforts to meet the growing global protein demand while conserving natural resources.

"We greatly appreciate the leadership and innovative grant program that FFAR is offering to resolve biological and economic sustainability challenges," said Jim Parsons, President, National Aquaculture Association. "We strongly believe this will assist in the production of even better US farm-raised fish and shellfish, increase on-farm productivity for U.S. aquaculturists, and strengthen rural and/or coastal economies."

The Foundation is committed to supporting research on the following topics:

Genomics and breeding of understudied shellfish species, including mussels, clams, scallops for improved performance parameters.

- Hatchery research, including best early stage life cycle production practices for commercial fish.
- Market-based analyses for new species and/or production regions.

Researchers will be invited to respond to a Request for Applications, to be available on the FFAR website on July 10, 2017.

More information: http://foundationfar.org/challenge/protein-challenge/aquaculture/ .

About the Foundation for Food and Agriculture Research

The Foundation for Food and Agriculture Research, a 501 (c) (3) nonprofit organization established by bipartisan congressional support in the 2014 Farm Bill, builds unique partnerships to support innovative and actionable science addressing today's food and agriculture challenges. FFAR leverages public and private resources to increase the scientific and technological research, innovation, and partnerships critical to enhancing sustainable production of nutritious food for a growing global population. The FFAR Board of Directors is chaired by Mississippi State University President Mark Keenum, Ph.D., and includes ex officio representation from the U.S. Department of Agriculture and National Science Foundation.

Learn more: www.foundationfar.org | Newsletter
Connect: @FoundationFAR | @RockTalking

Suite 630, WASHINGTON, DC 20004

Julie Decker

From: North Pacific Research Board [admin=nprb.org@mail154.atl221.rsgsv.net] on behalf of North Pacific Research Board [admin@nprb.org]
Sent: Monday, June 05, 2017 3:01 PM
To: jdecker@afdf.org
Subject: INVITATION: Submit research ideas to the North Pacific Research Board 2018 Request for Proposals

Categories: AFDF

Invitation to submit ideas for potential RFP research topics—by July 10th View this email in your browser

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Submit Your Research Ideas

Solicitation for NPRB's 2018 Request for Proposals—by July 10th

This email serves as a formal invitation to submit ideas for potential research topics to be included in the 2018 North Pacific Research Board (NPRB) Request for Proposals (RFP), scheduled to be released in October 2017.

We are in the process of developing research priorities to be reviewed by the board this fall. In this process, NPRB staff consult with the NPRB science panel, advisory panel, and board members, the North Pacific Fishery Management Council, and the broader research community. NPRB draws on research needs outlined in the **2005 Science Plan**, assessments of completed, ongoing and planned projects, new information presented in scientific conferences, and new findings published in scientific literature. NPRB also directly solicits research priorities from state and federal agencies, research institutions, and industry partners to jointly identify time-sensitive science, management, and monitoring needs and opportunities.

Submit Your Ideas

If you have suggestions for research topics to consider in the 2018 RFP, please complete the online RFP input form by Friday, **July 10, 2017** to ensure consideration. Please refer to the **RFP evolution** to view past research themes in the annual RFP since 2002.

Thank you for your interest, insight, and ideas.

Sincerely,

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