Fishery Management Report No. 16-23

2015 Annual Aquatic Farm Status Report

by

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and

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June 2016

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$log_{2,}$ etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

FISHERY MANAGEMENT REPORT NO. 16-23

2015 ANNUAL AQUATIC FARM STATUS REPORT

by

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ABSTRACT

With the enactment of the Aquatic Farm Act in 1988, the Alaska Department of Fish and Game implemented regulations for aquatic farming of shellfish and aquatic plants and established the aquatic farm program. This program oversees the permitting of aquatic farm, hatchery, and nursery operations; stock transport and acquisitions; seed source health examinations and approvals; and collection of annual operation activity data including production and sales data. Statutes, regulations, and polices for aquatic farm and hatchery activities provide for industry development while still protecting established fishery uses and the state's fish and wildlife resources and their habitat. Permitted operations must use managed cultivation practices that are technically and operationally feasible and they must demonstrate that they are contributing to the economy and well-being of the state. During 2015, the overall sales of shellfish and aquatic plants for all permitted operations including seed suppliers totaled $1.13 million. Aquatic farm operations sold over 1.17 million Pacific oysters and 16,713 lb of blue mussels and seaweed combined with a total farm gate value of $867,785. Regionally, Southern Southeast operations had over 44% of all sales statewide, followed by Kachemak Bay (38%), Prince William Sound (14%), and Northern Southeast (4%). Seed suppliers produced approximately 9.5 million juvenile Pacific oysters, a 42% increase from the previous year. Seed sales increased by 4% and totaled $266,669. Seed suppliers reported an increase in the number of workers (6%) and days worked (34%) whereas aquatic farms reported a decrease in number of workers (–25%) and days worked (–15%). Pacific oyster inventory at aquatic farms being cultured for sale increased by 5% and totaled 15.2 million. Pacific oyster seedstock inventory for seed suppliers reached the highest ever recorded at 10.3 million, an increase of 138%—a good indicator of potential growth in the aquatic farming industry.

Key words: Aquatic farming, hatchery, nursery, mariculture, managed cultivation, culture, seedstock, Pacific oyster, Crassostrea gigas, Pacific geoduck, Panopea generosa, Pacific littleneck clam, Protothaca staminea, blue mussel, Mytilus trossolus, bivalves, aquatic plants, kelp, farm gate value, Aquatic Farm Act

INTRODUCTION

The Aquatic Farm Act[1] became law on June 9, 1988, allowing farming of shellfish and aquatic plants in Alaska. The intent of the legislation was to create an aquatic farming industry in the state that would contribute to Alaska's economy by providing jobs and business opportunities, strengthen the competitiveness of Alaska seafood in the world marketplace, broaden the diversity of products, and provide year-round supplies of premium quality seafood. The Act supported responsible growth of the aquatic farm industry, while considering established uses and ongoing activities in areas of proposed aquatic farm operations. This legislation did not support finfish farming and added a moratorium for this type of activity. In 1990, a law passed and codified as Alaska Statute (AS) 16.40.210 prohibited finfish farming in Alaska.[2]

Statutory authority passed that allowed the Alaska Department of Fish and Game (ADF&G) commissioner to permit and regulate aquatic farming in a manner that protects the state's fish and game resources and improves the state's economy (AS 16.05.050). Other changes added provisions to (1) construct and operate an aquatic farm or a hatchery,[3] (2) acquire and transport stock to supply an aquatic farm or hatchery and/or for propagation purposes, (3) put restrictions on importing stock, (4) establish disease control protocols, (5) require inspections and reporting, and (6) establish penalties (AS 16.40.100–199). Similar authorizations were added to existing statutes used by the Department of Natural Resources (DNR) to permit and regulate use of state tideland and submerged waters for aquatic farming. The Department of Environmental

[1] Section 19, Chapter 145, Session Laws of Alaska (SLA), 1988; HCS CSSB 514.
[2] Section 2, Chapter 91, SLA 1990.
[3] As defined in AS 16.40.198, means a facility for the artificial propagation of stock, including rearing of juvenile aquatic plants or shellfish.

Conservation had existing authorizations to oversee food safety of shellfish for human consumption.

To implement the statutes, ADF&G developed regulations (5 AAC 41.100–199) to administer the aquatic farm and hatchery permitting. These became effective on April 10, 1988, and were further refined on several occasions, with the last revision occurring on January 26, 2012. The regulations require a person to obtain applicable permits to (1) construct and operate an aquatic farm or a hatchery; or (2) acquire, purchase, offer to purchase, transfer, possess, sell, and offer to sell stock and aquatic farm products that are grown or reared at the hatchery or aquatic farm. Other provisions allowed by statutory authorizations were reflected in the regulations to manage aquatic farming in the state to ensure protection of state's natural stocks, existing fishery uses, and fish and game resources and their habitats.

ALLOWANCE FOR PACIFIC OYSTER IMPORTATION

The statutes, AS 16.40.199(8), defined "shellfish" as a species of crustacean, mollusk, or other invertebrate, in any stage of its life cycle, that is indigenous to state water, or that is authorized to be imported in the state under a permit issued by the commissioner. Although the state prohibits the transport of nonnative species into the state, an exception was made by the Board of Fisheries that allowed live commercially cultured Pacific oysters to be imported for aquaculture purposes (5 AAC 41.070) to provide needed seedstock to aquatic farm operations in the state. Transport conditions for juvenile Pacific oysters into Alaska specify that only oyster broodstock cultured for 3 or more generations on the Pacific Coast of North America be used to produce progeny (or spat) for import. In addition, importing Pacific oyster spat requires that there be an "acceptable disease history," meaning that there has been no incidence of diseases exotic to the state or considered a risk to local stocks in terms of oyster health or marketability.

To ensure that imported Pacific oysters had no pathogens of transport concern, ADF&G developed shellfish health and disease control policies to certify Pacific oyster from out-of-state seed sources (Meyers 2014). Only juvenile Pacific oysters (≤ 20 mm shell height), may be imported into the state. This reduces the risk of the pathogen, *Mytilicola* sp., which is in most Pacific Northwest stocks. Additional approval requirements for instate shellfish hatchery and seed distribution facilities that transport live oysters and other indigenous species within Alaska were also established, to further prevent disease introductions (Meyers 2014). These control policies have been essential to preventing the introduction and spread of diseases into Alaska.

ON-BOTTOM CULTURE OF INDIGENOUS SPECIES

In the spring of 1999, the state began open enrollment for on-bottom aquatic farm site proposals for culturing Pacific littleneck clam and Pacific geoduck, both indigenous to Alaska. Controversy over on-bottom culture proposals began to emerge—primarily focusing on the extent to which shellfish farmers could sell common property shellfish from an aquatic farm site and interpretation of what would be allowable under the state's legal provisions.

Site surveys revealed some proposed farm sites had sufficient densities of geoduck wild stock to support a limited-entry commercial fishery. ADF&G denied those permit applications. In February of 2000, an applicant filed a lawsuit[4] against ADF&G's decision.

[4] Alaska Trademark Shellfish, LLC v. State, 172 P3d 764 (Alaska 2007).

The Alaska Supreme Court ruled in 2004 that the constitution prohibited permitting aquatic farm operations culturing geoduck in a site where *significant* populations of wild stock—in this case, Pacific geoduck—were present. The court defined a significant population as one that would "attract and support a commercial fishery."

With support from ADF&G, aquatic farm operators, and commercial geoduck fishery divers, the Alaska legislators passed legislation[5] in 2005 that codified the ruling of the Supreme Court. This legislation added the court's definition for an insignificant population with authority for the commissioner to determine the threshold. Now, new proposed aquatic farm sites can only have an insignificant population of Pacific geoducks. Once permitted, permit holders can remove these naturally occurring Pacific geoduck clams inside the aquatic farm site boundary as part of their operations; however, they must notify ADF&G and report their harvest of wild stock landings on fish tickets.

For existing permitted operation sites that held a significant amount of Pacific geoduck, provisions allowed the right to harvest with the constraint that permit holders pay reasonable compensation back to the state for wild stock sold that exceeded an insignificant population. Further modifications in regulations allowed operators to request a determination to change the status of the remaining Pacific geoducks on the site from wild stock to aquatic farm product after they meet specific criteria (i.e., harvesting wild stock and reseeding) at the permitted site. These provisions help maintain important safeguards for conserving Pacific geoduck resources while being consistent with previous court decisions and the state's objective to expand the industry.

PROCESS FOR OBTAINING AN AQUATIC FARM OR HATCHERY OPERATION PERMIT

Any person that wants to construct and operate an aquatic farm or a hatchery (a hatchery supplies aquatic plants or shellfish to an aquatic farm) has to have a valid operation permit from the commissioner. An aquatic farm, as defined in AS 16.40.199(1), is a facility that grows, farms, or cultivates aquatic farm products in captivity or under positive control. A hatchery, as defined in AS 16.40.199(5), is a facility for the artificial propagation of stock, including rearing of juvenile aquatic plants or shellfish. Nursery operations, like hatcheries, rear and supply stock for use by aquatic farms, but do not artificially propagate stock. Nursery activities are included in the hatchery definition and can be further delineated as a *remote setting nursery*, which is a facility that rears eyed larvae, or an *in-water nursery*, which is a facility that rears juvenile seedstock in a FLoating UPweller SYstem (FLUPSY).

Applicants can apply to construct and operate an aquatic farm, hatchery, or nursey by submitting a multi-agency application during the open filing period. Reviews of permit applications begin after the January 1 and April 30 openings each year. Most of the lands, including tidelands or submerged lands, are state owned and to utilize these lands requires a state lease. DNR is the lead agency for aquatic farm land use authorization and coordinates the review of proposed aquatic farm and hatchery applications. Applications are distributed by DNR to various agencies, including ADF&G and the Department of Environmental Conservation. The public, and local, state, and federal agencies have an opportunity to comment as part of the public review process before any determinations are finalized. DNR administers public notices on project proposals and distributes public comments to appropriate parties and concerned agencies. DNR determines

[5] Section 1–3, Chapter 13 SLA 2005 (HB 198).

whether a lease for the proposed aquatic farming project on state lands is in the best interest of the state. Typically, decisions by ADF&G to issue operation permits follow DNR issuing an aquatic farm lease. Each agency makes a determination based on provisions in their applicable regulations.

Prior to an aquatic farm, nursery, or hatchery operation being permitted by ADF&G, program staff, along with other department biologists, geneticists, and pathologists, review applications and make recommendations to the commissioner to ensure that proposed operations won't significantly alter existing uses of fish and wildlife resources, or pose significant adverse effects on fish, wildlife, or their habitat. Applicants often choose to participate in pre-application meetings with ADF&G staff to identify potential locations away from existing uses or sensitive habitats—such as anadromous fish streams, eelgrass and kelp beds, herring spawning areas, marine mammal haulouts and rookeries, and seabird colonies. Reviews of the site location, operation's development plan, and cultivation techniques are also conducted to determine site suitability, and whether the proposed plan is technically and operationally feasible and will improve the productivity of the culture species above what would occur naturally at the site. Once an operation is up and running, all operation activities must be conducted in accordance with the permit conditions and the development plan.

AQUATIC FARM PROGRAM

PROGRAM ACTIVITIES

The ADF&G Division of Commercial Fisheries aquatic farm program is responsible for regulating and permitting aquatic farming industry activities within the state, and providing regulatory, technical, and planning services to people interested in aquatic farming. Specific authority includes issuing aquatic farm and hatchery operation permits, shellfish/aquatic plant acquisition and stock transport permits, seed source approval (instate) and certification (out-of-state), and geoduck status determinations. Aquatic farm and hatchery site inspections are conducted jointly with DNR.

Operation Permits

During 2015, the program administered permit oversight of 65 aquatic farms, 7 shellfish nurseries, and 2 shellfish hatcheries (Table 1; Figure 1). Of all permitted operations, 89% had some form of activity during that year (including seed acquisition, inventory, or sales) based on annual reports submitted by permit holders. Only 8 permitted operations reported no activity. Staff issued 3 permit renewals, 5 transfers to a new operator, and closed 9 aquatic farm operation permits.

Broodstock Acquisition Permits and Stock Transport Permits

The program issues broodstock acquisition permits for hatcheries, and stock transport permits for approved culture species to, from, and between aquatic farms, nurseries, and hatcheries. Reviews ensure activities are conducted in a manner that protects the health and genetic integrity of Alaska shellfish and aquatic plant stocks. To facilitate review and permit issuance, seed sources are *approved* for instate distribution, or *certified* for out-of-state hatcheries and nurseries for import into Alaska. Disease histories based on pathology examinations of organisms are established for each location and each species. Acceptable annual shellfish health reports are

required for all out-of-state stocks, and the facility must be recertified each year. Instate seed sources also need to establish a disease history and have acceptable pathology examinations.

For 2015, program staff issued 3 broodstock acquisition and transport permits to allow shellfish hatchery operations to acquire and transport broodstock for propagative purposes and produce seedstock for aquatic farms and nurseries.

Staff issued approvals for 90 stock transport permits to allow permit holders to transport stock from approved seed supply locations to their permitted operations. This was a decrease of 21% from the previous year. Of the stock transport permits issued, 90% were for Pacific oyster seedstock and the remainder were for Pacific geoduck. One transport permit request for import from a noncertified out-of-state seed sources was denied. There were 2 noncompliance events where stock transports took place without a valid permit.

Seed Source Approvals (instate) and Certifications (out-of-state)

Instate hatchery or nursery operations that plan to sell and transport seed are approved as seed distribution facilities once an acceptable disease history is established. Shellfish specimens cultured in the seed source facility are sent to the ADF&G state pathology lab to verify there are no pathogens of concern present. The duration of the approval varies by facility and is dependent upon the disease history.

Instate seed source approval for seed source distribution was issued for OceansAlaska Hatchery in Ketchikan. Other facilities with multiyear approvals issued in previous years were Eagle Shellfish Farm in Simpson Bay near Cordova, Alutiiq Pride Shellfish Hatchery in Seward, Kachemak Shellfish Growers' Association Nursery in Halibut Cove, and Naukati Bay, Inc. Shellfish Nursery in Naukati Bay. A list of approved instate shellfish seed providers in 2015 is in Table 2.

Out-of-state hatchery and nursery operations may request certification to import Pacific oysters into Alaska. Pacific oysters are the only nonindigenous species allowed to be imported. In order to prevent exotic pathogens from entering the state, certification to import out-of-state Pacific oyster seedstock is more stringent than the approval process for instate facilities. Propagation of Pacific oyster does not currently occur in Alaska hatcheries so instate seed sources are dependent on getting smaller Pacific oyster eyed larvae and juvenile seed from Pacific Northwest shellfish hatcheries that are certified out-of-state seed sources. Some aquatic farm operators purchased seed directly from these seed sources as well.

Staff issued annual certifications to 3 out-of-state hatcheries and associated nurseries during the year; this allowed importation of Pacific oyster eyed larvae or juvenile seed into Alaska to supply permitted operations. Out-of-state seed sources in 2015 included Hilton's Coast Seafood Quilcene Hatchery and Nursery (Quilcene, Washington), Hawaiian Shellfish LLC Hatchery and Nursery (Kea'au, Hawaii), Hawaiian Shellfish LLC Goosepoint Nursery (Willapa Bay, Washington), and Whiskey Creek Shellfish Hatchery (Netarts Bay, Oregon). A list of certified out-of-state shellfish seed providers is in Table 3.

Geoduck Status Determination

ADF&G requires operators of subtidal aquatic farms to track wild stock geoduck harvest at their sites by using fish tickets. Based on provisions in 5 AAC 41.258, a determination can be made, at the request of the permit holder, as to whether the permit holder has met certain aquatic farm

development criteria to change the status of geoduck remaining on a subtidal aquatic farm from wild stock to aquatic farm product. After this determination, if the geoduck are determined to be aquatic farm product, the permit holder is no longer required to report the landing and submit a fish ticket for Pacific geoduck harvested from an aquatic farm site. Permit holders still must record harvest number and sales information at the end of the calendar year on an aquatic farm annual report submitted to the ADF&G.

In 2015, staff received 3 requests from permit holders for a determination to change the status of remaining geoduck on their sites and all 3 were granted. Between 2012 and 2015, 11 geoduck status determinations were made by the ADF&G commissioner for on-bottom, subtidal aquatic farm sites with operation permits approved for the culture of Pacific geoduck. Only 2 on-bottom, subtidal aquatic farm sites remain that have not had a determination; 1 is eligible and another requires additional seed to be outplanted to be eligible.

Inspections

Operations may be inspected to insure they are adhering to their permit conditions and applicable regulatory requirements. The inspections also give ADF&G staff an opportunity to see operators' shellfish or aquatic plant products, answer technical or regulatory questions, or address issues operators may be having meeting their business goals or operation and development plans. Inspections check whether approved species are being cultured; culture organisms are being managed according to the operation plans; in-water structures have been maintained, adequately secured, and anchored to prevent grounding; and that no exotic organisms are present that may pose a threat to fish and wildlife and their habitat.

In 2015, ADF&G staff conducted onsite inspections at 53% of the 49 permitted operations located in Southeast Alaska. Most operators met staff at their sites and showed them their aquatic farm product. Aerial inspections over 3 permitted and 4 closed aquatic farm operations were also completed. No onsite underwater inspections took place at the 13 subtidal aquatic farm site operations this year due to the cost of diving on the sites. Previous underwater compliance inspections on subtidal aquatic farm sites by ADF&G divers occurred in 2006 (15 sites inspected) and later in 2011 (1 site inspected).

STATUS OF THE AQUATIC FARM INDUSTRY

All aquatic farm, nursery, and hatchery operation permit holders are required to provide an annual report to ADF&G and DNR summarizing their activities for the calendar year (5 AAC 41.270). The annual report provides information for both agencies and details operation sales, production, seed transport and acquisitions, estimated mortality, and inventory. The report also provides details on development activities of the aquatic farm, nursery, or hatchery operations; installation of new culture gear, equipment, and support facilities; and a summary of conditions that may affect the operation production. The 2 main agencies (DNR and ADF&G) use the information in the annual report to carry out their agency responsibilities and keep track of the operations.

In 2015, 63 annual reports were received for 54 aquatic farms, 7 shellfish nurseries, and 2 shellfish hatcheries. A summary of the annual report data and changes from the previous year follows below.[6]

SALES VALUE AND PRODUCTION

In 2015, the overall contribution in sales from all permitted operations (aquatic farms, hatcheries, and nurseries) reached the second highest level recorded with a total of $1,134,454 based on farm gate value[7] (Table 4; Figure 2). The highest sales reported, $1,174,801, occurred in 2014.

Overall production[8] included 10.6 million Pacific oyster, 16,688 lb of blue mussels, and 25 lb of seaweed.[9] Production for all operations from 2014 to 2015 increased by 29% for numbers, and by 67% for pounds. Of all permitted operations, 26 (40%) reported sales in 2015.

Aquatic Farm Sales Value and Production

Total aquatic farm gate value totaled $867,785 in 2015, the second highest recorded for all years (Table 4; Figure 3). Aquatic farm sales in Alaska using farm gate value were distributed by area as follows: 44% for Southern Southeast,[10] 4% for Northern Southeast,[11] 14% for Prince William Sound, and 38% for Kachemak Bay. Sales decreased slightly (0.3%) from the previous year. The principle aquatic farm product cultured in the state continues to be Pacific oysters, with 92% of the sales statewide and a farm gate value of $796,945. The remainder of the sales included blue mussels and a small amount of seaweed. The highest total sales occurred in 2014 for Pacific oyster and in 2015 for blue mussels. Aquatic farm operations reported sales year round, with a peak from May to September (Figure 4). The highest number of operations with sales occurred from June to August.

Pacific oyster sales occurred at 21 aquatic farm operations in 2015 compared to 26 the previous year. Of those, 6 aquatic farm operations made annual oyster sales ranging from $50,000 to $200,000 and contributed to 76% of the total oyster sales and 77% of the total production in that year (Table 5). The aquatic farm operations in this sales range showed an increase of 16% in their oyster sales contribution from the previous year. Sales for this category of operations averaged 10 months of sales compared to an average of 6 months for other operations having fewer sales. The operations in the largest sales range category were also the largest aquatic farms, averaging 12 acres and making up 30% of all permitted farms (Table 5; Figure 5).

The average price for Pacific oyster was $9.84 per dozen, up $0.24 (2.5%) from 2014.

The average age for Pacific oysters at the time of was 3.4 years for Southeast aquatic farm operations, and approximately 3.8 years for Southcentral operations.

Pacific oyster production for aquatic farm operations totaled 1.17 million oysters sold (Table 4; Figures 3 and 6) which was 3% lower than the previous year's production. Pacific oyster

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[6] Data obtained from Aquatic Farm, Nursery, and Hatchery Operator Annual Reports, ADF&G mariculture program confidential files.

[7] The farm gate value can be defined as the unprocessed value, excluding the costs of packaging or transport of the product to its first point of sale.

[8] Not including 5,000 juvenile Pacific geoducks that were produced without any actual sales.

[9] *Palmaria mollis* (red ribbon kelp), permission granted to release confidential data.

[10] Southern Southeast includes aquatic farms from South of Port Alexander.

[11] Northern Southeast includes aquatic farms from Yakutat to Port Alexander.

production in 2015 was the third highest recorded since 2008. Peak production for Pacific oysters was in 2005 (Figure 3).

Blue mussel production showed a substantial increase (74%) in 2015 with 16,688 lb produced (Figure 7), but did not surpass the highest production reported (1991; Figure 3). Blue mussel sales also increased substantially (64%) from 2014, with a value of $70,800 (Table 4; Figures 3 and 7). Blue mussel average age at the time of sale was 1.6 years, showing a faster turnaround time to market. The average price for blue mussels was $5.27 per lb, down $0.47 (8.2%) from 2014.

Hatchery and Nursery Sales Value and Production

Overall shellfish seedstock sales for hatchery and nursery operations totaled $266,669 (Table 4; Figure 8). The highest sales for all years occurred in 2015 for Pacific oyster seedstock and 2014 for Pacific geoduck seedstock. Hatchery and nursery operations made sales between March and December with peak sales from June to November (Figure 9). The average statewide sale price for Pacific oyster seedstock from hatchery operations was $11.82 per thousand, an increase of $0.74 per thousand from 2014. The average statewide sale price for Pacific oyster seedstock from nursery operations was $31.94 per thousand, a decrease of $10.26 per thousand from 2014.

In 2015, instate hatcheries, remote setting facilities, and inwater nursery operations combined produced approximately 9.5 million Pacific oyster eyed larvae and juvenile seedstock, a 42% increase in seedstock available compared to 2014 (Figure 10). Hatchery operations also produced 50,000 Pacific geoduck seedstock, but no sales were reported. Hatchery and nursery operations production combined was highest in 2015 for Pacific oysters and highest in 2001 for clams (Figure 10).[12]

NEW SEED ACQUISITIONS

New seed acquisition was reported for 25 out of 63 permitted operations submitting annual reports, and 46 transport shipments of seedstock occurred for all operations—down 22% from 59 in 2014.

No seedstock was generated from propagation of Pacific oysters in Alaska hatcheries in 2015; all acquisitions of Pacific oyster seedstock (eyed larvae or smaller juvenile seed) came from certified Pacific Northwest and Hawaiian shellfish hatcheries. All indigenous species of seedstock originated from instate hatchery operations.

Hatchery and Nursery Seed Acquisitions

During 2015, 6 instate hatchery and nursery operations acquired approximately 104 million Pacific oyster eyed larvae and approximately 8.9 million juveniles (Figure 11). This is the highest number of Pacific oysters acquired to date, with the majority of the increase in eyed larvae acquisitions. Between 2014 and 2015, seedstock acquisitions increased 987% for hatcheries and 13% for nurseries. Pacific oyster seedstock acquired by hatchery and nursery operations occurred from February through October (Figure 12).

[12] Clams refer to littleneck clams in this year.

Aquatic Farm Seed Acquisitions: Pacific Oysters

New Pacific oyster seed from approved seed suppliers acquired for aquatic farm operations totaled 6.5 million in 2015, a decrease of 410,329 oysters (6%) from the previous year (Figure 13). The proportion of new seed acquired made up 43% of the inventory compared to 48% of the inventory in 2014. Historically, peak acquisitions of new Pacific oyster seedstock occurred in 1998 (Figure 13).

For aquatic farm operations, acquisitions took place between March and December with the highest number of operations acquiring Pacific oyster seedstock in August (Figure 14). The number of aquatic farms acquiring Pacific oysters in 2015 has remained relatively stable over the last 2 years (23 in 2015 and 27 in 2014). Six aquatic farm operations acquired seed directly from hatchery and remote setting nursery operations, and the remaining 17 aquatic farm operations acquired seed from inwater nursery operations. Two aquatic farms acquired seed from out-of-state certified seed sources.

Aquatic Farm Seed Acquisitions: Other Species

Four aquatic farms acquired 20 million blue mussels from onsite natural sets that settled on culture gear, an increase of 7 million blue mussels (54%) from 2014. A small number of Pacific geoduck were acquired during September 2015 without any sales (Figure 15). Peak acquisitions of Pacific geoduck seedstock occurred in 2007. Acquisitions of green sea urchin, giant kelp, sugar kelp, and bull kelp from onsite natural sets on culture gear were acquired by a few aquatic farm operations, but the acquisition figures are confidential as the number of operators reporting was less than 3.

Seed Availability

Overall mean percent of seedstock acquired[13] for all species and all operation types was 59% of that requested, 3% higher than in 2014. Hatcheries acquired 96% of the Pacific oyster eyed larvae requested, up from 20% in 2014. Nurseries acquired 50% of the Pacific oyster eyed larvae requested and 71% of the Pacific oyster juvenile seed requested.

Aquatic farm operations acquired an average of 61% of Pacific oysters requested, which was comparable to 2014. Although demand was very high for Pacific geoduck in 2015, very little seedstock was available and none was purchased by aquatic farm operators in that year.

Seed shortages have been problematic since aquatic farming began in Alaska, although there were no reports of seed quantity and quality issues in 2015 except for Pacific geoduck. The timing of when seedstock is available for sale may be an obstacle for some operators, as shown by the frequency of seed acquisitions for different types of operations along the supply chain in Figure 16. Hatcheries and remote setting facilities began acquiring seed primarily in March and April and then later from July through October. Hatcheries and remote setting facilities reported no acquisitions in the months of January, February, May, June, November, and December. Inwater nurseries acquired seed in February, May through July, and October with a peak in May. Aquatic farms began acquiring seed in March and continued through to December with highest number of acquisitions in August.

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[13] Mean percent acquired was determined by comparing the maximum numbers of seedstock an operator requested from an approved or certified seed source on their approved stock transport permit and the actual number acquired by an operator from that source.

INVENTORY

At the end of 2015, 52 out of 63 operations (83%) submitting annual reports to the department indicated that they had aquatic farm product or seedstock inventory for their operations.

Aquatic Farm Inventory

Aquatic farm operations inventory included approximately 15.2 million Pacific oysters, 8 million blue mussels, 910,926 geoducks, and 64,500 other species[14] (Figure 17). The highest inventory numbers for all species for aquatic farms occurred in 2000 with the majority of the inventory consisting of blue mussel in that year (80%; 23 million).

Pacific oyster inventory for aquatic farm operations increased by approximately 716,463 (5%) from the previous year and totaled 15.2 million (Figure 18). Oysters made up 63% of the aquatic farm total inventory. The highest oyster inventory reported occurred in 2001 and totaled 16.6 million. Pacific oyster in-water inventory using 2015 unit sales price had an estimated value at marketable size of approximately $12.5 million.

Blue mussels made up the second largest portion of the aquatic farm inventory, increasing by 7.6 million (1,789%) from 2014.

Reported inventory for Pacific geoduck decreased by approximately 57,600 (6%) compared to 2014 (Figure 19). Geoduck inventory for aquatic farms peaked in 2014.

Hatchery and Nursery Inventory

Pacific oyster seed inventory at hatchery and nursery operations increased by 6.0 million (138%; Figure 20) compared to the previous year. In 2015, inventory for Pacific oysters was the highest ever recorded for these operations at 10.3 million.

Pacific geoduck inventory decreased to zero in that year; peak inventory for this species was in 2001 (Figure 21).

WORKDAYS AND EMPLOYMENT

Direct employment at aquatic farm operations included owners, partners, employees, interns, and family. Positions included paid, unpaid, part time, full time, seasonal, and year round. For most operations, it was common to have volunteers, family members, or interns working for the aquatic farm operator to help keep labor costs down. Hatchery and nursery operations had more paid full-time and seasonal employees.

Aquatic Farm Operations

Aquatic farm operation positions and number of days worked have steadily increased over the years as more operations are started and a larger work force is needed. In 2015, this trend reversed and the number of total positions working at aquatic farms decreased 25%, from 185 in 2014 to 138 in 2015 (Figure 22). Although the number of workers decreased, the number of workers categorized as laborers (not owners or permit holders) increased by 2.5% in 2015. Laborers made up 66% of all reported positions. Paid positions, including laborers, owners, and

[14] Other category includes green sea urchins and sugar kelp; combined to maintain confidentiality.

permit holders, decreased 31%, from 80 in 2014 to 55 in 2015. Paid positions made up 40% of all workers.[15] The highest number of positions working at aquatic farms occurred in 2014.

The total number of reported days worked on aquatic farms decreased by 15%, from 11,345 workdays in 2014 to 9,664 workdays in 2015. The number of days paid employees worked on aquatic farms decreased 20%, from 4,449 in 2014 to 3,546 in 2015 as well. Historically, the highest number of days worked at aquatic farms occurred in 2003.

Hatchery and Nursery Operations

Hatchery and nursery operations have reported a steady increase of worker positions and days worked over the years, as demand increases and ability to produce seedstock improves. Between 2014 and 2015, hatchery and nursery positions combined increased by 6% to 36 (Figure 23), making it the second highest year on record. The highest recorded number of workers occurred in 2013 for these operations.

The number of days worked at hatchery and nursery operations in 2015 was the highest recorded of all years, and increased by 34% from the previous year to 3,420. Of all the hatchery and nursery positions, 11 positions worked more than 150 days, an 83% increase from the previous year. Approximately 92% of the total hatchery and nursery positions reported were laborers.[16] Paid positions in shellfish hatchery and nursery operations increased by 9% to 24 positions in 2015. The number of days paid employees worked at these operations increased 66% between 2014 and 2015 to 2,946 days worked.

PACIFIC GEODUCK WILD STOCK HARVEST LANDINGS

An interim use permit issued from the Commercial Fisheries Entry Commission is required in order to harvest wild stock Pacific geoducks from an aquatic farm. During 2015, the Commercial Fisheries Entry Commission issued 1 interim use permit.[17] However, according to fish ticket records, no wild stock Pacific geoduck harvest occurred at subtidal aquatic farms. From 2006 to 2015, the cumulative harvest of wild stock Pacific geoduck on 15 permitted subtidal aquatic farms totaled 90,170 lb, equivalent to 40,056 individual Pacific geoducks (Table 7).[18]

INDUSTRY TRENDS AND ISSUES

2015 HIGHLIGHTS

- Sales contribution from all permitted operations (aquatic farms, hatcheries, and nurseries) using farm gate value reached the second highest level recorded with a total of $1.13 million.
- Overall pacific oyster production and sales for all permitted operations (aquatic farms, hatcheries, and nurseries) increased to 10.6 million, a 29% increase from 2014.

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[15] Worker category is all persons working at the operations including owners or operation permit holders.

[16] Laborer category does not include owners or operation permit holders.

[17] Data from Commercial Fisheries Entry Commission Public Search Application web page at http://www.cfec.state.ak.us/plook/#permits

[18] Data from ADF&G OceanAK database (accessed June 2016). URL not publically available as some information is confidential.

- Aquatic farm blue mussel production increased 74% from 2014, totaling 16,688 lb produced and sold (the second highest number recorded).
- The average statewide price for Pacific oyster produced from aquatic farms was $9.84 per dozen, up $0.24 from the previous year's calculated price, an increase of 2.5%.
- Six aquatic farm operations had annual oyster sales ranging from $50,000 to $200,000, contributing 76% of the total oyster sales, an increased contribution of 16% for this sales range from the previous year.
- Sales of aquatic farm product occurred year round, with the highest number of operation's sales from June to August.
- Statewide contributions in aquatic farm sales, distributed from high to low total sales, were as follows: 44% for Southern Southeast,[19] 38% for Kachemak Bay, 14% for Prince William Sound, and 4% for Northern Southeast.[20]
- Aquatic farm operations inwater inventory estimates included approximately 15.2 million Pacific oysters, 8 million blue mussels, 910,926 geoducks, and 64,500 other species.[21]
- Pacific oyster seed inventory for hatchery and nursery operations reached the highest ever recorded at 10.3 million, an increase of 138% from 2014.
- Employment opportunities increased at seed supply operations, with a 6% increase in reported worker positions and 34% increase in days these positions worked compared to 2014 reported totals. Paid positions also increased by 9% for these operations, and the number of days paid employees worked increased by 66%.

DIVERSIFICATION OF SPECIES

Mussels

Mussel production on Alaskan aquatic farms continues to grow, with this year's harvest reaching the second highest level recorded. Kachemak Bay in the Southcentral region remains the production hub with a handful of mature operations, but there is a growing interest in crop diversification from aquatic farmers throughout the state and mussels are a logical choice. With healthy natural sets occurring at most farm sites, the free seed requires less handling than Pacific oysters and usually reaches market size in 2 years or less. As the market for mussels grows, aquatic farmers may find them an attractive source of year-round income. The industry has received substantial support in the past, including a legislative grant to explore large-scale mussel farming as well as frequent workshops to facilitate technology transfer from more developed sectors in Maine and New Zealand. Knowledgeable presenters have accepted invitations to annual meetings of the Alaska Shellfish Grower's Association for the past several years, providing information on blue mussel culture. In 2015, the University of Alaska Southeast included mussel aquaculture in their curriculum for the Fisheries Technology program. Mussels will likely remain a fixture in the landscape of Alaskan aquatic farming for years to come.

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[19] Southern Southeast includes aquatic farms from South of Port Alexander.
[20] Northern Southeast includes aquatic farms from Yakutat to Port Alexander.
[21] Other category includes green sea urchins and sugar kelp; combined to maintain confidentiality.

Seaweed

Seaweed is becoming more attractive as another viable aquatic farm product—as many species can be cultivated within a short growing season and harvested in between shellfish crops. Partnerships began to take shape between entrepreneurs, educators, potential seed producers, and aquatic farmers to develop necessary algae seedstock to supply operations. This year, Premium Oceanic, LLC, a California company, submitted an application for a hatchery operation at the University of Alaska to produce macroalgae seedstock on seeded spools intended for use on aquatic farms to grow out on submerged longline gear. In the fall of 2015, during the Alaska Shellfish Growers Association in Ketchikan, kelp growers from Maine provided presentations and hands-on demonstrations to help transfer knowledge and recruit growers interested in learning more about kelp hatchery protocols and longline culture techniques. OceansAlaska and 10 aquatic farm operators volunteered to take part in the kelp grow-out projects that are due to start in 2016.

National Sea Grant Award: Mariculture Diversification, Innovation, and Technology Transfer

In addition to the development of a kelp hatchery and demonstration farms using longlines to grow out kelp, a 2-year project (Mariculture Diversification, Innovation, and Technology Transfer) funded by a National Oceanic and Atmospheric Administration National Sea Grant will also focus on alternate gear technology for rearing oysters—baskets and floating mesh bag arrays suspended on longlines (Newell et al. 2015). Aquatic farm participants in the kelp and oyster pilot projects will collect data for the study (including growth rates, yield, and environmental parameters). This data will provide a template for use by the industry regarding site suitability conditions by species for each gear type. The project will help further define husbandry practices that make for economically viable businesses, and provide business plan templates with technology cost/benefit analysis. Other elements of the study will focus on technology transfer of farming and processing machinery and development of a seaweed farming work group. Outcomes of the funded project listed in the grant include cooperation amongst growers, diversification of products cultivated on farms for year round sales, and technology transfer of seaweed growth and yield.

Alaska Mariculture Initiative

In 2014, the Alaska Fisheries Development Foundation established the Alaska Mariculture Initiative with the intent to broaden support for and development of the mariculture aquatic farming industry, and include restoration and enhancement of invertebrate wild fisheries. Other objectives of the initiative include convening a conference of stakeholders to build partnerships and create strategic plans to optimize economic benefits of shellfish resources for coastal communities, restore and enhance shellfish fisheries that are threatened or affected, and grow shellfish farming businesses. The initiative hopes to increase the industry to $1 billion in 30 years.

Initial funding from National Oceanic and Atmospheric Administration Soltenstall-Kennedy Grant enabled the Alaska Fisheries Development Foundation to pursue the first phase of the initiative. Phase I involved the development of an economic analysis report highlighting 9 mariculture industry case studies for salmon, crab, geoduck, mussels, clam, and seaweed that have been successful across the globe (Northern Economics Inc. 2015). Each case study provided key elements in mariculture development and growth. Key elements for development

mentioned in the report included favorable growing areas, development plan with coordinated research and development, successful business plan and culture technology, workforce development, fishing and processing infrastructure, and public acceptance and support. Future phases of work will build on the information provided in Phase I to focus on an economic analysis of the Alaska mariculture industry (Phase II) and provide for a cost/benefit analysis and the potential economic impact of this industry to the state (Phase III). Phase II and III have been funded by the U.S. Economic Development Administration.

REFERENCES CITED

Newell, C., B. Hudson, and G. Frietag. 2015. Alaskan mariculture diversification, innovation, and technology transfer. Presentation at the Alaska Shellfish Grower's Association annual conference held in Ketchikan on November 19, 2015. Available from https://seagrant.uaf.edu/map/aquaculture/shellfish/techtraining/2015/akmaric-diversification.pdf (accessed June 20, 2016).

Walker, B., C. Hladick, and M. Catterson. 2015. Alaska shellfish farm size feasibility study. Division of Commerce, Community, and Economic Development. Available from http://www.afdf.org/wp-content/uploads/2b-Alaska-Shellfish-Farm-Size-Feasibiliy-Study.pdf (accessed June 20, 2016).

Meyers, T. 2014. Policies and guidelines for Alaska fish and shellfish health and disease control. Alaska Department of Fish and Game, Division of commercial Fisheries, Regional Information Report 5J14-04, Anchorage.

Northern Economics Inc. 2015. Economic analysis to inform the Alaska mariculture initiative: Phase 1 case studies. Prepared for Alaska Fisheries Development Foundation with funds from Award No. NA14NMF4270058. http://www.afdf.org/wp-content/uploads/1c-Economic-Analysis-to-Inform-AMI-Phase-I-Case-Studies.pdf (accessed June 20, 2016).

TABLES AND FIGURES

Table 1.−List of permit holders with operation permits in 2015.

Site type	Permit number[a]	Site name	Last name	First name	Business name
Aquatic Farm	1996-18-AF-SC	Simpson Bay	Aguiar	James	Eagle Shellfish Farm
Nursery	1996-18-NU-SC	Simpson Bay	Aguiar	James	Eagle Shellfish Farm
Aquatic Farm	1993-12A-AF-SE	Unnamed Bay/Cap-Tuxekan Islands	Ausec	Gary	Harmony Seafoods
Aquatic Farm	1993-12B-AF-SE	Cap/Tuxekan Islands	Ausec	Gary	Harmony Seafoods
Aquatic Farm	1991-101-AF-SC	Peterson Bay	Bader	Ronald	Moss Island Oyster Farm
Aquatic Farm	2002-02B-AF-SE	Slate Island	Bakker	Cornelis	Cornelis Bakker Inc.
Aquatic Farm	2007-04-AF-SE	Black Island	Bakker	Cornelis	Cornelis Bakker Inc.
Aquatic Farm	2000-09-AF-SC[C]	Halibut Cove	Bates	Weatherly and Greg	Alaska Shellfish Farms LLC
Aquatic Farm	2009-101-AF-SC	Halibut Cove (oysters)	Bates	Weatherly and Greg	Alaska Shellfish Farms LLC
Aquatic Farm	2012-103-AF-SC[C]	Halibut Cove (mussels)	Bates	Weatherly and Greg	Alaska Shellfish Farms LLC
Aquatic Farm	2010-101-AF-SE	Kootznahoo Inlet	Booth III	William (Jay)	Boo Koo Oysters
Nursery	1996-14-NU-SC	Halibut Cove KSGC Nursery	Crosby	Sean	Kachemak Shellfish Mariculture Association
Nursery	2012-101-NU-SC	KSMA Remote Setting Nursery	Crosby	Sean	Kachemak Shellfish Mariculture Association
Aquatic Farm	2011-113-AF-SE	Steamboat Bay	Cunningham	Brian	Steamboat Bay Alaska Seafoods
Aquatic Farm	1991-104-AF-SC	Halibut Cove	Dale	Brenda	Snug Harbor Seafoods Inc
Aquatic Farm	1991-109-AF-SC	Little Jakolof Bay	Fell	Donald	Oyster Cove Seafarms
Aquatic Farm	2011-107-AF-SE	South portion of San Island in El Capitan Passage	Fitzgerald	Mike and Corinne	New Tokeen Oysters
Aquatic Farm	2002-03D-AF-SE	Point Alava Extension	Fuhs	Paul	Alaska Longneck Farms LLC
Aquatic Farm	2007-02-AF-SE	Jinhi Bay	Gladsjo	Ernie and Carol	Jinhi Bay Oysters
Aquatic Farm	2009-104-AF-SE	Shikat Bay	Greeley	James	Tomaso Shellfish Farms
Aquatic Farm	2009-112-AF-SE	Gonakadetseat Bay	Harris	Tom	Yak-Tat Kwaan Inc.
Aquatic Farm	1990-04-AF-SE	Big John Bay and Stedman Cove	Henderson	Tom	Pearl of Alaska
Hatchery	1992-01-HA-SC	Alutiiq Pride Shellfish Hatchery	Hetrick	Jeff	Alutiiq Pride Shellfish Hatchery
Aquatic Farm	2014-101-AF-SE	Port Frederick	Hillman	John	Port Frederick Oysters
Nursery	2003-03-NU-SE	Tuxekan Narrows	Hills	Joshua	Naukati Bay, Inc.
Aquatic Farm	2013-103-AF-SC	East Squaw Bay	Irving	Mike	Alaska's Best Shellfish
Aquatic Farm	1990-03-AF-SE	Unnamed Bay/Mosman Island	Kiser	John	Rocky Bay Oysters LLC
Aquatic Farm	2002-03A-AF-SE[T]	Coho Cove	LaCroix	Stephen	Sea Farms Alaska
Aquatic Farm	2002-03B-AF-SE[T]	West Gravina	LaCroix	Stephen	Sea Farms Alaska
Aquatic Farm	2002-03C-AF-SE[T]	Point Alava	LaCroix	Stephen	Sea Farms Alaska
Aquatic Farm	2002-03D-AF-SE[T]	Point Alava Extension	LaCroix	Stephen	Sea Farms Alaska
Aquatic Farm	2002-03E-AF-SE[T]	Black Island	LaCroix	Stephen	Sea Farms Alaska
Aquatic Farm	1996-15-AF-SC	Bear Cove	Lambe	Sarah	Old Gregg Oyster Co.
Aquatic Farm	2011-103-AF-SE	Fred Point/Burnt Point/North Bight	Lindoff	Anthony	Kushtaka Farms LLC
Aquatic Farm	1991-113-AF-SC	Peterson Bay	Loflin	Cameron	Otter Rock Oyster Company
Aquatic Farm	2001-25A-AF-SE	Krestof Sound	Manning	Thomas	Krestof Clam Company

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Table 1.−Page 2 of 3.

Site type	Permit number[a]	Site name	Last name	First name	Business name
Aquatic Farm	2001-25B-AF-SE	Bridget Cove	Manning	Thomas	Krestof Clam Company
Nursery	2011-105-NU-SE	Siginaka Islands	Manning	Thomas	Krestof Clam Company
Hatchery	2011-110-HA-SE	OceansAlaska	Marsh	Tomi	OceansAlaska
Aquatic Farm	2005-04-AF-SE	Peratrovitch Island	McMillan	Greg	Keta Seafoods
Aquatic Farm	2000-18A-AF-SE	Ape Point	Morin	Kurt	Alaska Shellfish
Aquatic Farm	2000-18B-AF-SE	Pt Alava	Morin	Kurt	Alaska Shellfish
Aquatic Farm	2000-18C-AF-SE	Coho Cove	Morin	Kurt	Alaska Shellfish
Aquatic Farm	2006-01-AF-SE	Point Sykes	Morin	Kurt	Alaska Shellfish
Nursery	2006-02-NU-SE	Alaska Shellfish Nursery	Morin	Kurt	Alaska Shellfish Nursery
Aquatic Farm	2004-04-AF-SE	Boca de Quadra	Nelson	Brad	Seaproducks Inc.
Aquatic Farm	1990-11-AF-SE	Canoe Lagoon/Fools Bay	Nicholson	Sharon Gray and Don	Canoe Lagoon Oyster Co.
Aquatic Farm	1991-21A-AF-SC	Jakolof Bay	Olsen	Eric	Sunset Cove Oyster Farm
Aquatic Farm	2009-107-AF-SE	Shikat Bay	Parsley	Gregg	Shikat Bay Osyters Inc.
Aquatic Farm	2000-08-AF-SC	Halibut Cove	Pierce	Rick and Therese	K-Bay Oyster Company
Aquatic Farm	2011-101-AF-SE	Sunrise Site/Hobart Bay	Pierre	Mchugh	Goldbelt, Incorporated
Aquatic Farm	2011-102-AF-SE[C]	Sand Spit/Hobart Bay	Pierre	Mchugh	Goldbelt, Incorporated
Aquatic Farm	1991-22A-AF-SC	Jakolof Bay	Reveil	Margo	Jakolof Bay Oyster Company
Aquatic Farm	1990-21A-AF-SE	Kahli Cove	Ryggs	Jerry Larry and Linn	Oysters LLC
Aquatic Farm	1990-21B-AF-SE	Kahli Cove	Ryggs	Jerry Larry and Linn	Oysters LLC
Aquatic Farm	2000-10-AF-SC	Bear Cove	Rykaczewski	Steven	Early Tide Seafarms
Aquatic Farm	2011-106-AF-SE	Clover Passage	Sande	Trevor	DBA Marble Seafoods
Aquatic Farm	2014-102-AF-SE[C]	Zimovia Islets	Sawyer	Timothy	Heaven's Bay Zimovia Shellfish
Aquatic Farm	1991-08A-AF-SC	SW Eaglek Bay	Sczawinski	Dave	Pristine Products
Aquatic Farm	1991-116-AF-SC	Peterson Bay	Seims	Gary	Seims Sea Farms
Aquatic Farm	2009-109-AF-SE	Heceta Island	Sheets Jr	Michael	Alaskan Half Shell Oysters LLC
Aquatic Farm	1991-117-AF-SC	Halibut Cove	Sidelinger	Kevin	Sea Farms of Alaska
Aquatic Farm	1991-26A-AF-SC	South Bay/Perry Island	Van Hyning	Jon	Aquabionics Inc.
Aquatic Farm	2009-113-AF-SE	Steamer Bay Intertidal Site	Weltzin	Jeff	Alaska Wilderness Gourmet
Aquatic Farm	1992-24-AF-SC	Jakolof Bay	Wheeler	James	Clam Gulch Seafoods LLC
Aquatic Farm	2011-104-AF-SE	Hamilton Bay	Williams	Gary	Organized Village of Kake
Aquatic Farm	2003-01-AF-SE	Tokeen Bay	Wyatt	Eric	Blue Starr Oyster Co
Nursery	2003-01-NU-SE	Tokeen Bay	Wyatt	Eric	Blue Starr Oyster Co
Aquatic Farm	2002-01A-AF-SE	South Sykes	Zaugg	Gary	Pac Alaska LLC
Aquatic Farm	2002-01B-AF-SE	West Gravina	Zaugg	Gary	Pac Alaska LLC
Aquatic Farm	2002-03A-AF-SE	Coho Cove	Zaugg	Gary	Pac Alaska LLC
Aquatic Farm	2002-03B-AF-SE	West Gravina	Zaugg	Gary	Pac Alaska LLC

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Table 1.−Page 3 of 3.

Site type	Permit number[a]	Site name	Last name	First name	Business name
Aquatic Farm	2002-03C-AF-SE	Point Alava	Zaugg	Gary	Pac Alaska LLC
Aquatic Farm	2002-03E-AF-SE	Black Island	Zaugg	Gary	Pac Alaska LLC

[a] Permit Number – superscript C indicates a permit that was closed during the year; superscript T indicates a permit that was transferred during the year

Table 2.−List of approved instate shellfish seed providers in 2015.

Business name (waterbody location)	Contact information	Available seed	Scientific name	Broodstock origin	Exp. date
Alutiiq Pride Shellfish Hatchery (Land-based—Seward)	Jeff Hetrick P.O. Box 369 Seward, AK 99664 jjeffhetrick@gmail.com 907.224.5181 (phone) 907.224.5282 (fax)	Pacific Oyster	*Crassostrea gigas*	Mixed West Coast	2/29/2016
		Geoduck Clam	*Panopea generosa*	Betton Island, Alaska	2/29/2017
Blue Starr Oyster Co. Nursery (Tokeen Bay) [a]	Eric Wyatt Blue Starr Oyster Co P.O. Box 369 Craig, AK 99921 alaskan@bluestarroysters.com 406.235.6059 (phone) 907.401.1372 (cell)	Pacific Oyster	*Crassostrea gigas*	Mixed West Coast	2/28/2017
Eagle Shellfish Farm (Simpson Bay)	James Aguiar P.O. Box 2211 Cordova, AK 99574 jaguiar@yahoo.com 907.253.3481 (phone)	Pacific Oyster	*Crassostrea gigas*	Mixed West Coast	2/29/2016
Kachemak Growers Shellfish Cooperative Nursery (Halibut Cove)	Sean Crosby/Suzanne Torian Kachemak Shellfish Mariculture Association P.O. Box 416 Homer, AK 99603 Info@alaskaoyster.com 907.399.1595 (phone) 907.299.1932 (cell)	Pacific oyster	*Crassostrea gigas*	Mixed West Coast	2/29/2016
Naukati Bay, Inc. Shellfish Nursery (Naukati Bay)	Mike Smith (Operator) Naukati Bay, Inc. – NKI Box 1 Naukati, AK 99950 naukati@alaskaoyster.com 907.629.4146 (phone)	Pacific Oyster	*Crassostrea gigas*	Mixed West Coast	2/28/2016
OceansAlaska Hatchery and Remote Setting Nursery (Georges Inlet)	Ron Zebal and Conor Eckholm P.O. Box 6383 Ketchikan, AK 99901 rzebal@gmail.com conoreckholm@yahoo.com 907.225.7900 (phone)	Pacific Oyster	*Crassostrea gigas*	Mixed West Coast	12/31/2015

[a] Nursery FLUPSY owned by Sealaska Corporation subsidiary, Haa Aani, LLC.

Table 3.−List of certified out-of-state shellfish seed providers in 2015.

Business name (waterbody location)	Contact information	Available seed	Scientific name	Broodstock origin	Expiration date
Coast Seafoods Company (Land-based facility, Quilcene, WA)	Sherry Kilmer, Site Manager Quilcene Office P.O. Box 327 Quilcene, WA 98376-0327 jedwards@coastseafoods.com 800.423.2303 (toll-free) 360.765.3345 (phone) 360.765.3045 (fax)	Pacific Oyster (eyed larvae only)	*Crassostrea gigas*	Quilcene Bay, Washington	2/29/2016
		Pacific Oyster (seed < 20 mm only)	*Crassostrea gigas*	Quilcene Bay, Washington	2/29/2016
		Pacific Oyster (seed < 20 mm only)	*Crassostrea gigas*	Tillamook Bay, Oregon	2/29/2016
Whiskey Creek Shellfish Hatchery (Land-based facility, OR)	Sue Cudd Owner/Manager 2975 Netarts Bay Road W. Tillamook, OR 97141 whiskeycreek1@mac.com 503.815.8323 (phone) 503.842.6426 (cell)	Pacific Oyster (eyed larvae only)	*Crassostrea gigas*	Netarts Bay, Oregon	2/29/2016
Hawaiian Shellfish, LLC	Provan Crump Hatchery and Seed Production Manager P.O. Box 492391 Kea'au HI 96749-2391 provan@goosepoint.com 360.581.3083 (phone)	Pacific Oyster (seed < 20 mm only)	*Crassostrea gigas*	Willapa Bay, Washington	2/29/2016

Table 4.–Alaska shellfish production and farm gate value in 2015.

Statewide

Aquatic farms				Hatcheries and nurseries		
Species	Numbers	Pounds	Sales	Species	Larvae and seed numbers	Sales
Oysters	1,165,518	0	$796,945.15	Oysters	112,907,115	$266,669.00
Clams	0	0	$0.00	Clams	55,000	$0.00
Mussels	0	16,688	$70,800.30	Mussels	0	$0.00
Other[a]	0	25	$40.00	Other	0	$0.00
Total	1,165,518	16,713	$867,785.45	Total	112,962,115	$266,669.00

Southeast

Aquatic farms				Hatcheries and nurseries		
Species	Numbers	Pounds	Sales	Species	Larvae and seed numbers	Sales
Oysters	648,314	0	$420,529.50	Oysters	100,806,115	$215,389.00
Clams	0	0	$0.00	Clams	5,000	$0.00
Mussels	0	0	$0.00	Total	100,811,115	$215,389.00
Other	0	0	$0.00			
Total	648,314	0	$420,529.50			

Southcentral

Aquatic farms				Hatcheries and nurseries		
Species	Numbers	Pounds	Sales	Species	Larvae and seed numbers	Sales
Oysters	517,204	0	$361,415.65	Oysters	12,101,000	$51,280.00
Clams	0	0	$0.00	Clams	50,000	$0.00
Mussels	0	16,688	$70,800.30	Mussels	0	$0.00
Other*	0	25	$40.00	Other	0	$0.00
Total	517,204	16,713	$447,255.95	Total	12,151,000	$51,280.00

Source: 2015 Operator Annual Reports, ADF&G Mariculture Program

[a] Includes *Palmaria mollis* (red ribbon kelp); permission granted to release data.

Table 5.–Summary of Pacific oyster annual sales ranges for aquatic farms in 2015.

Annual sales range (Pacific oyster only)	Number of permits in range	Percent of total permits	Average acres of each permit	Total combined sales in each range	Percent of total sales	Average months sold	Total combined production in each range	Percent of total production
$50,000–$200,000	6	30%	12.08	$603,604	76%	10	893,812	77%
$25,000–$50,000	3	15%	5.94	$103,721	13%	7	146,082	12%
$10,000–$25,000	3	15%	1.70	$57,111	7%	6	78,173	7%
$5,000–$10,000	3	15%	2.50	$20,365	3%	7	32,673	3%
$1–$5,000	5	25%	1.62	$12,145	1%	4	14,778	1%
Grand Total	20	100.0%	4.77	$796,946	100.0%	6.80	1,165,518	100%

Table 6.–Summary of commercial harvest of wild stock geoducks from aquatic farms, 2006–2015.

Year	Operator	Site name	ADF&G AFOP No.[a]	Acres	No. clams	Landed pounds
2006-2015	Morin	Ape Point	00-18A-AF-SE	5	0	0
2006-2015	Morin	Point Alava	00-18B-AF-SE	6.45	0	0
2006-2015	Morin	Coho Cove	00-18C-AF-SE	3.5	323	806
2006-2015	Zaugg	South Sykes	02-01A-AF-SE	7.5	9,085	20,938
2006-2015	Zaugg	Gravina Island	02-01B-AF-SE	5.1	3,678	10,161
2006-2015	Bakker	Gravina Island	02-02A-AF-SE	1	0	0
2006-2015	Bakker	Slate Island	02-02B-AF-SE	8.6	7,370	17,121
2006-2015	LaCroix	Coho Cove	02-03A-AF-SE	6.48	2,353	5,101
2006-2015	LaCroix	Gravina Island	02-03B-AF-SE	5.42	4,580	11,574
2006-2015	LaCroix	Point Alava	02-03C-AF-SE	3.88	3,989	7,466
2006-2015	LaCroix	Point Alava Ext.	02-03D-AF-SE	4.71	2,943	5,447
2006-2015	LaCroix	Black Island	02-03E-AF-SE	4.93	4,076	8,438
2006-2015	Ethelbah	Cannery Pt	04-02-AF-SE	6.99	0	0
2006-2015	Lentz	Boca de Quadra	04-04-AF-SE	9.9	1,659	3,118
2006-2015	Bakker	Black Island	07-04-AF-SE	2.9	0	0
2006-2015	Marsh	West Pt Alava	07-06-AF-SE	9.89	0	0
Total					40,056	90,170

Note: ADF&G may release records regarding cumulative annual harvests of wild stocks at individual aquatic farm sites as per AS 16.40.155.
[a] ADF&G AFOP = Alaska Department of Fish and Game Aquatic Farm Operation Permit.

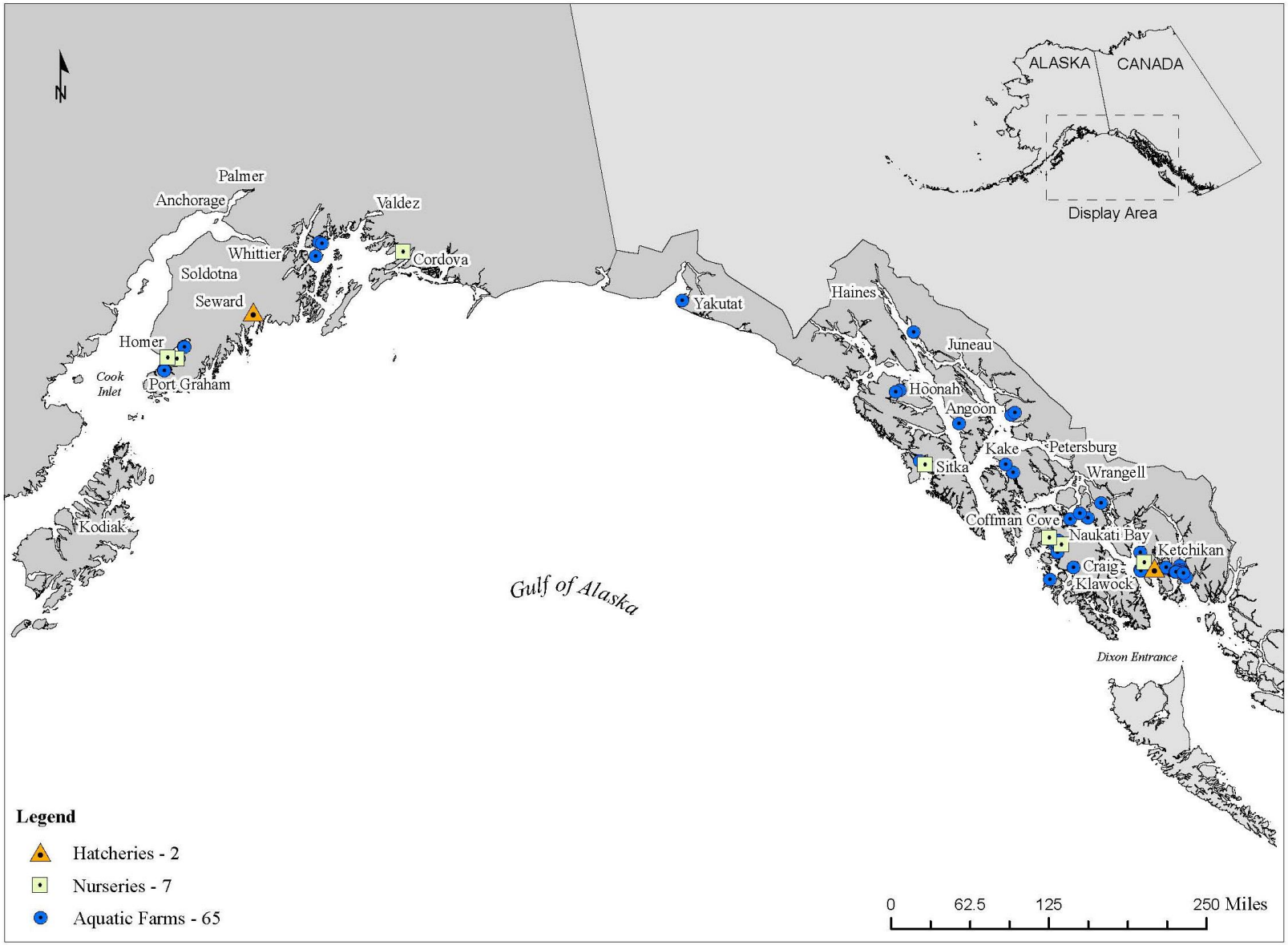

Figure 1.−Aquatic farm, nursery, and hatchery operations permitted to operate in Alaska in 2015.

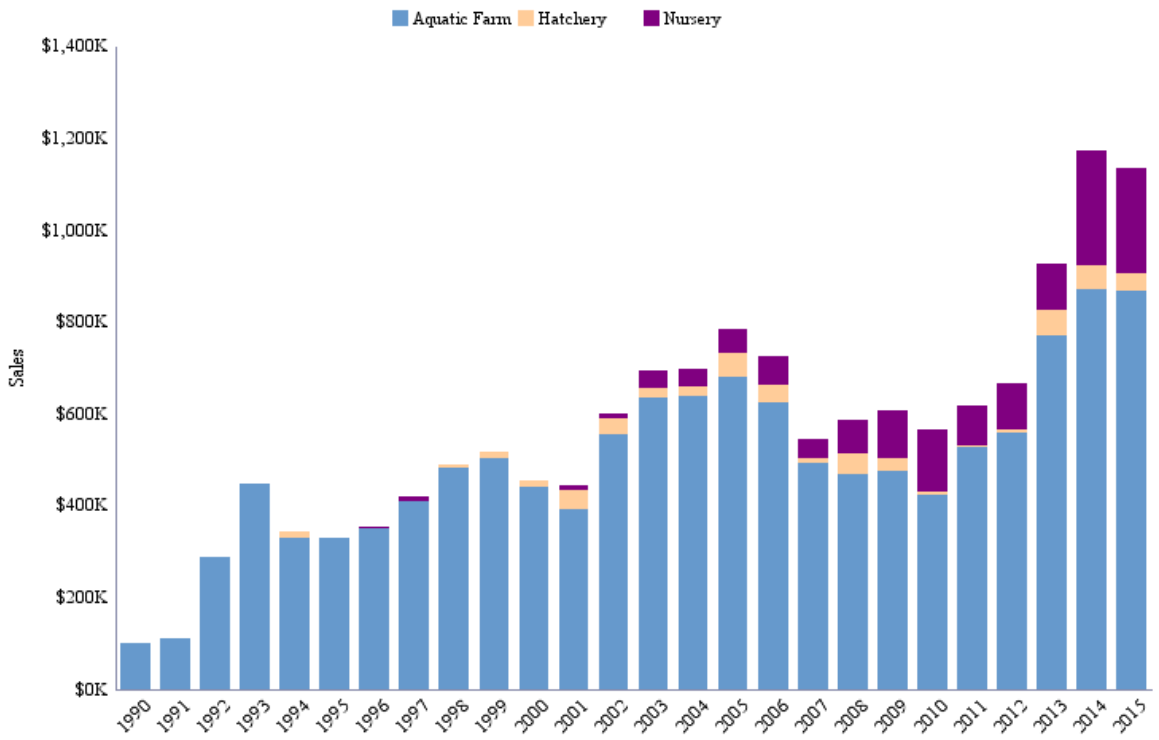

Figure 2.−Sales by operation type, 1990−2015.

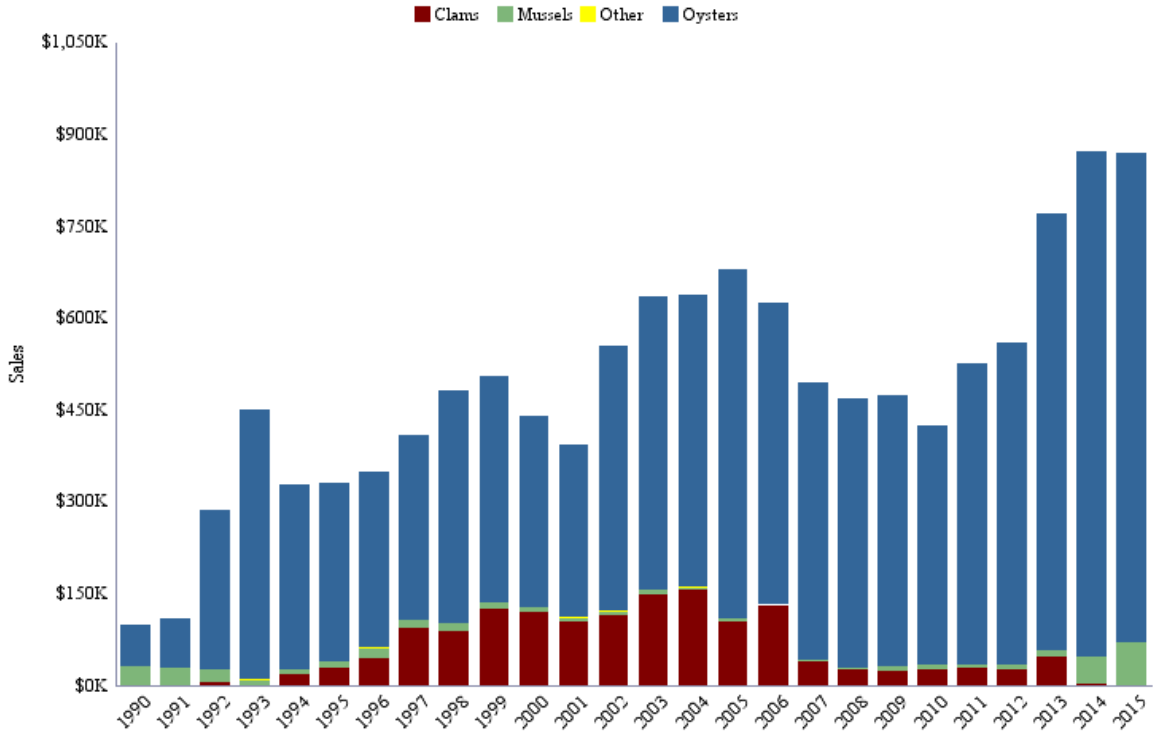

Figure 3.−Aquatic farm operation sales by species, 1990−2015.

Note: All clam sales through 2009 are for Pacific littleneck clams. Beginning in 2010, clam sales includes both Pacific littleneck clams and geoduck clams. Other sales include scallop, seaweed, and sea cucumber.

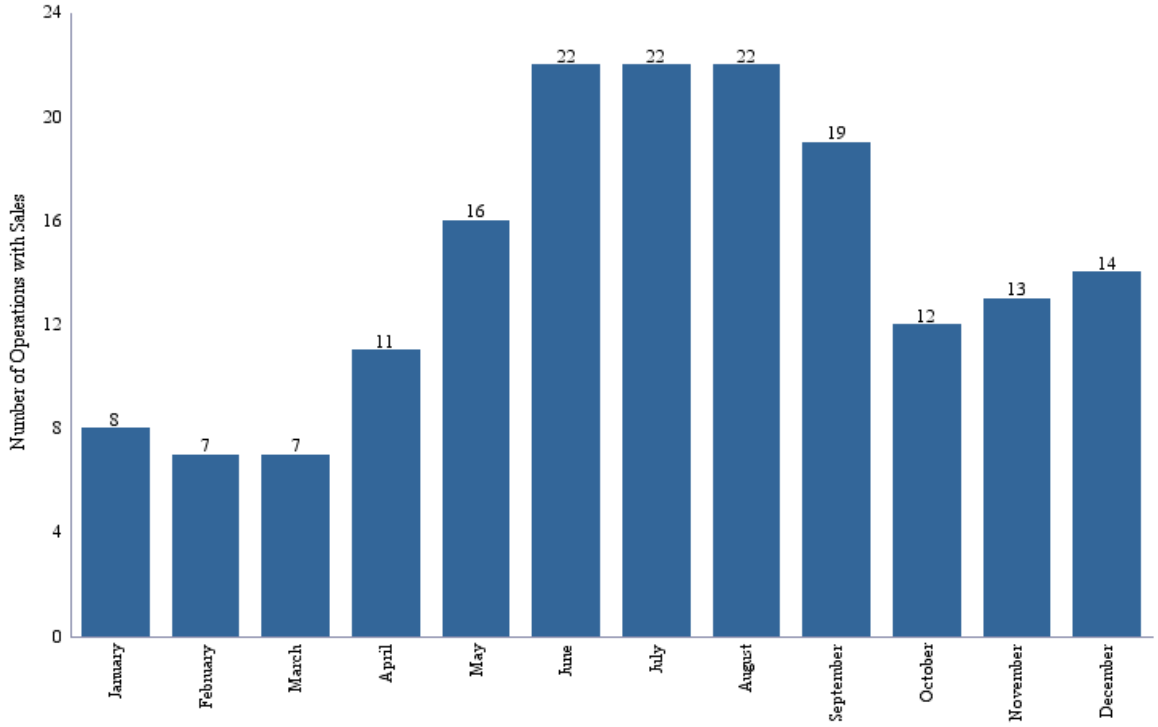

Figure 4.−Months aquatic farm products sold by aquatic farm operations in Alaska during 2015.

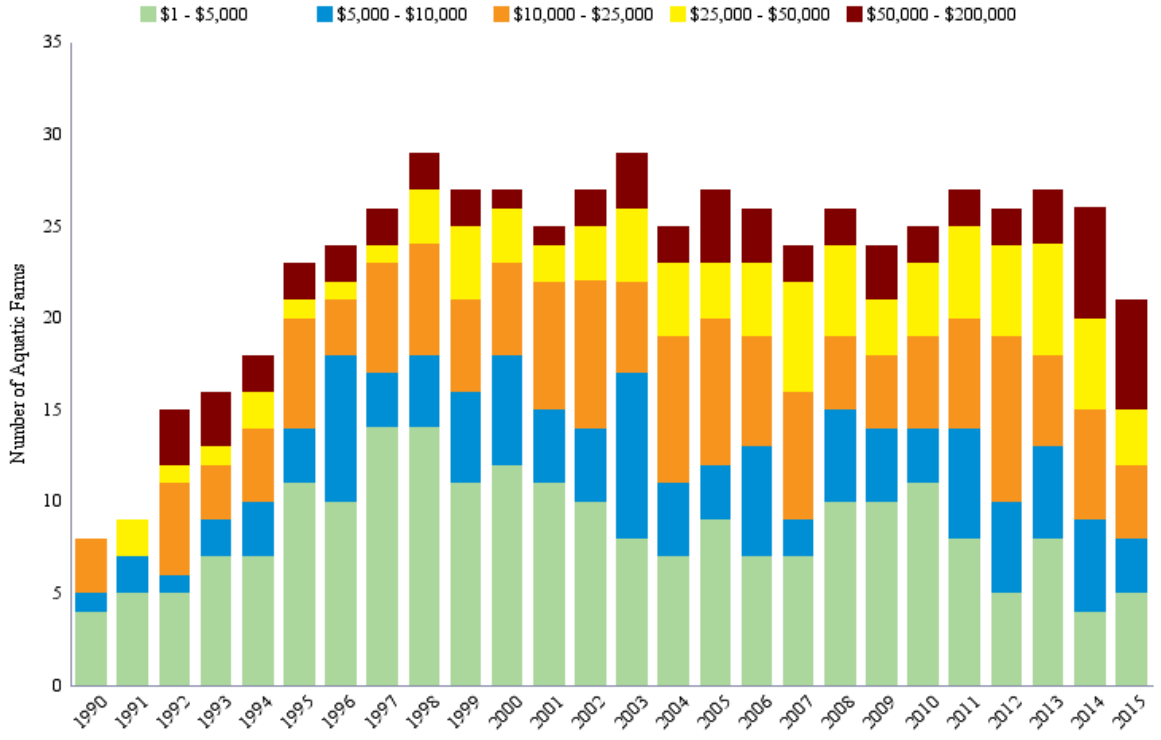

Figure 5.−Number of aquatic farm operations in each sales range, 1990−2015.

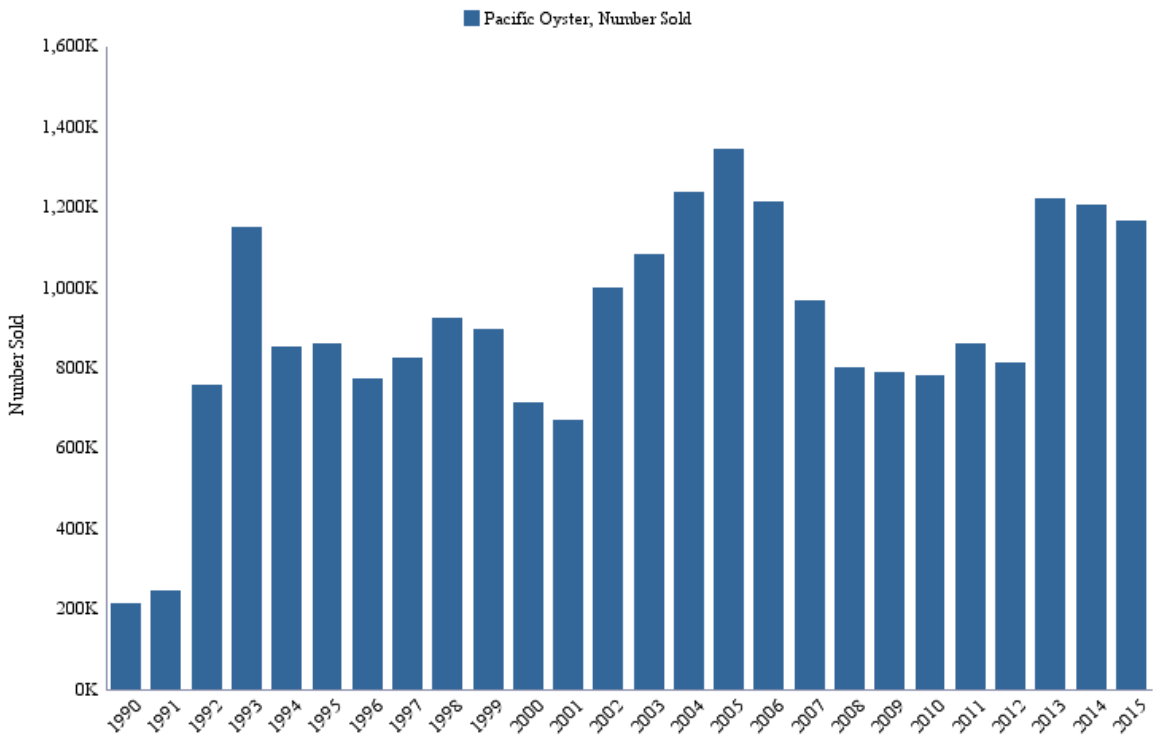

Figure 6.−Aquatic farm operations Pacific oyster production numbers sold, 1990−2015.

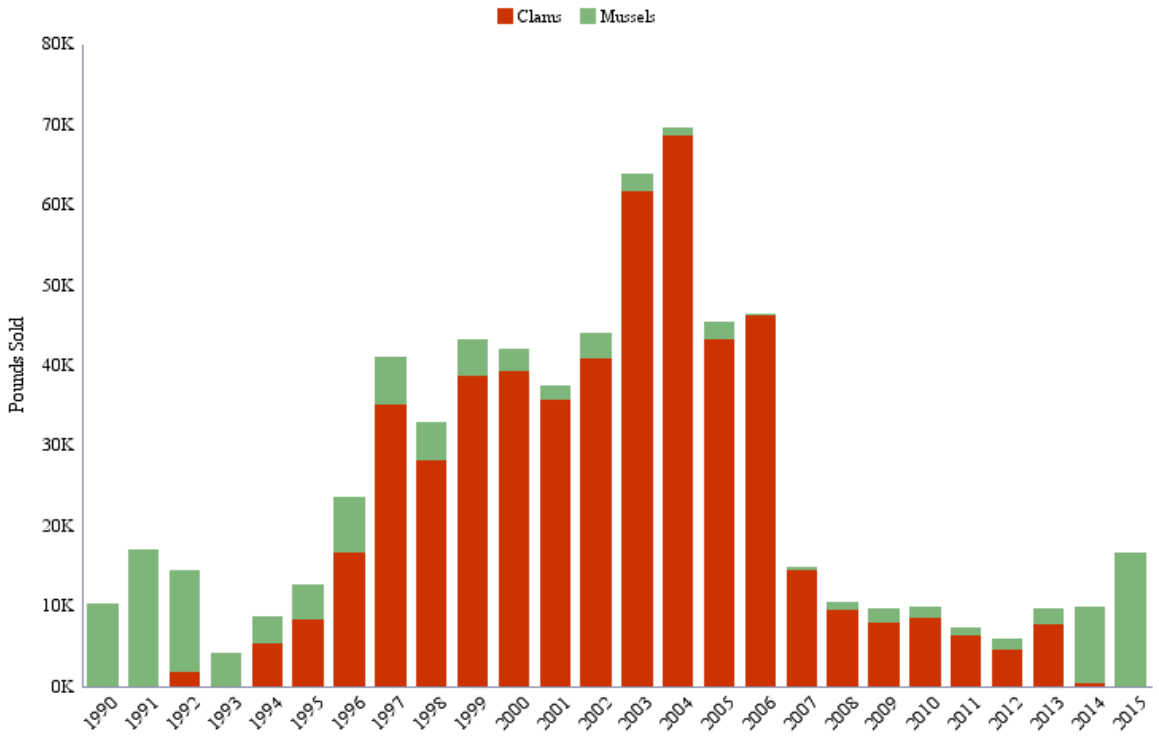

Figure 7.−Aquatic farm operations non-oyster production pounds sold by species, 1990−2015.

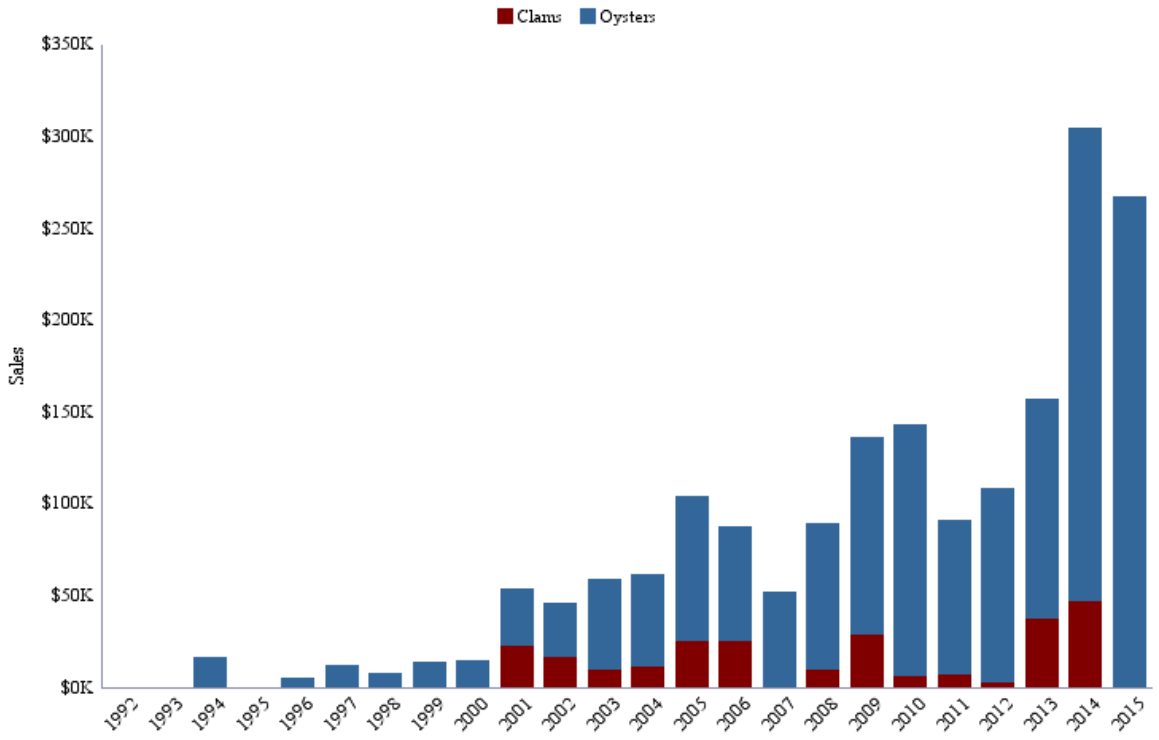

Figure 8.−Hatchery and nursery operation sales by species, 1992−2015.

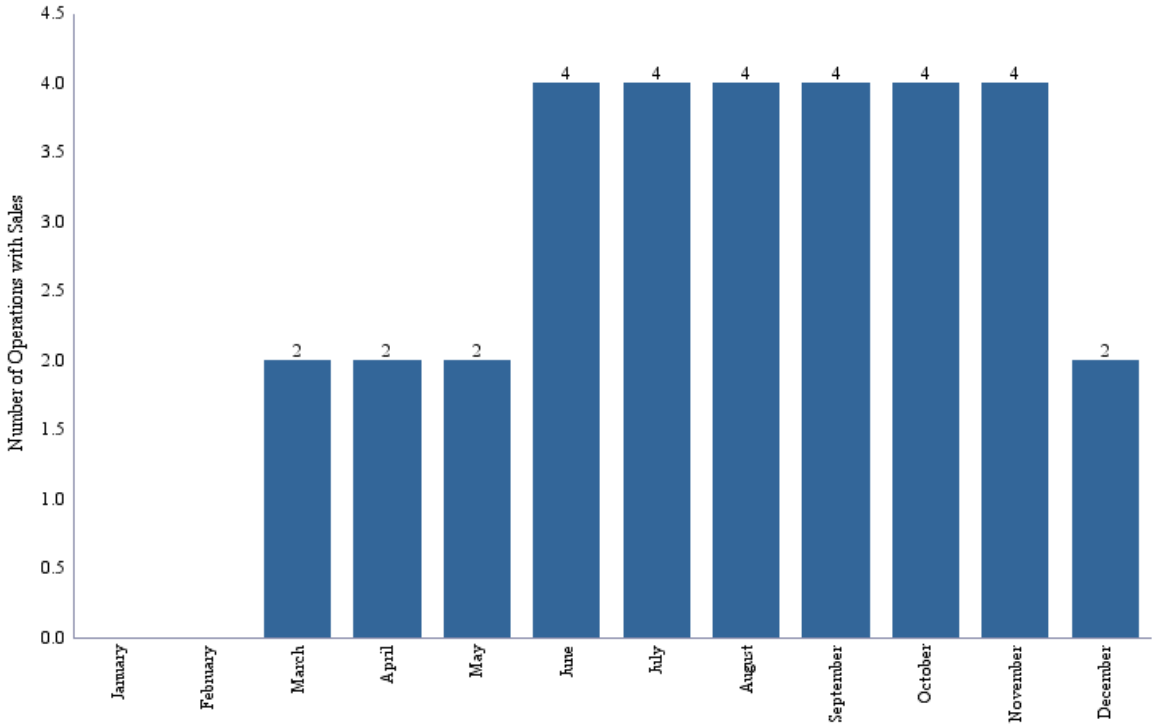

Figure 9.−Months seedstock sold by hatchery and nursery operations in Alaska during 2015.

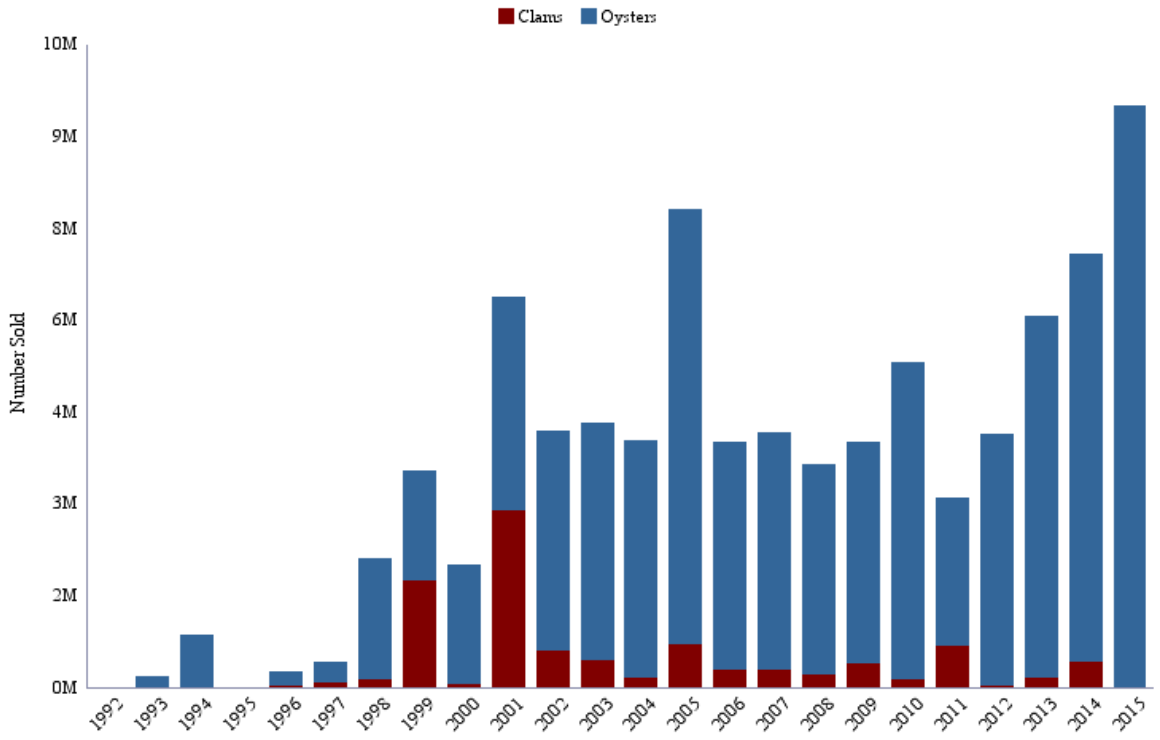

Figure 10.−Hatchery and nursery operations production number sold by species, 1992−2015.

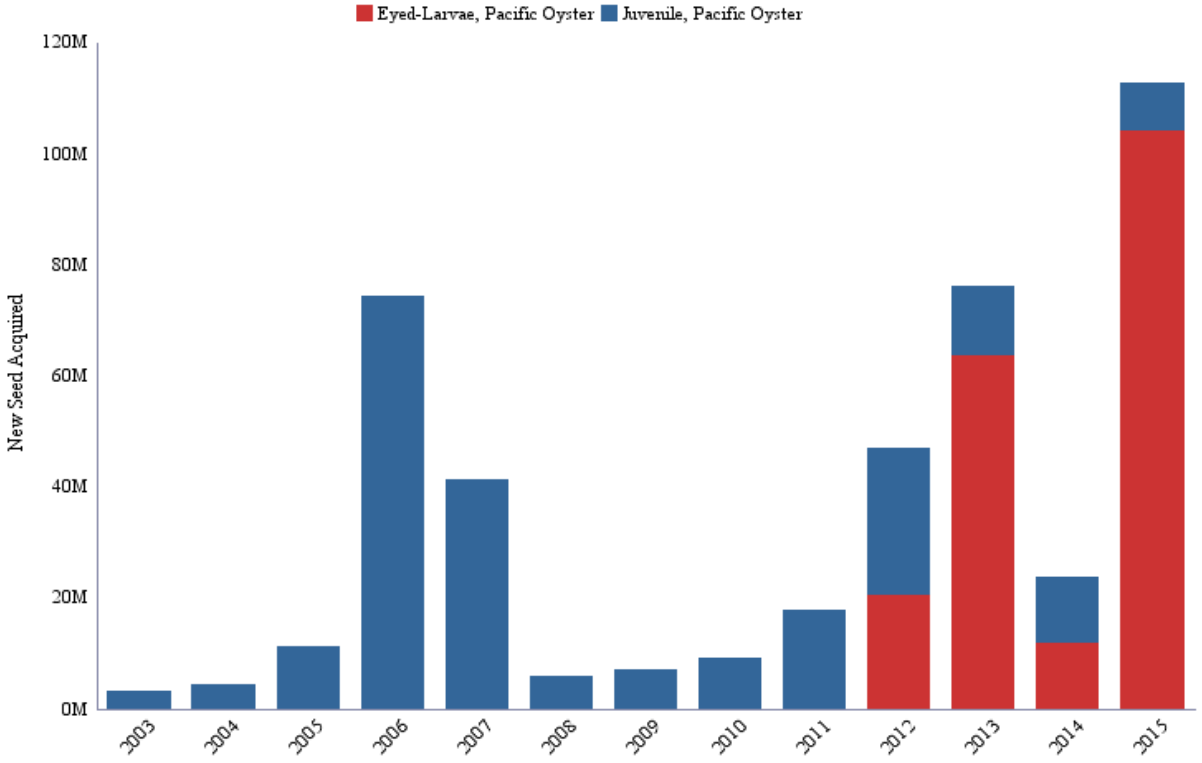

Figure 11.−New Pacific oyster acquisitions for hatchery and nursery operations from 2003 to 2015.

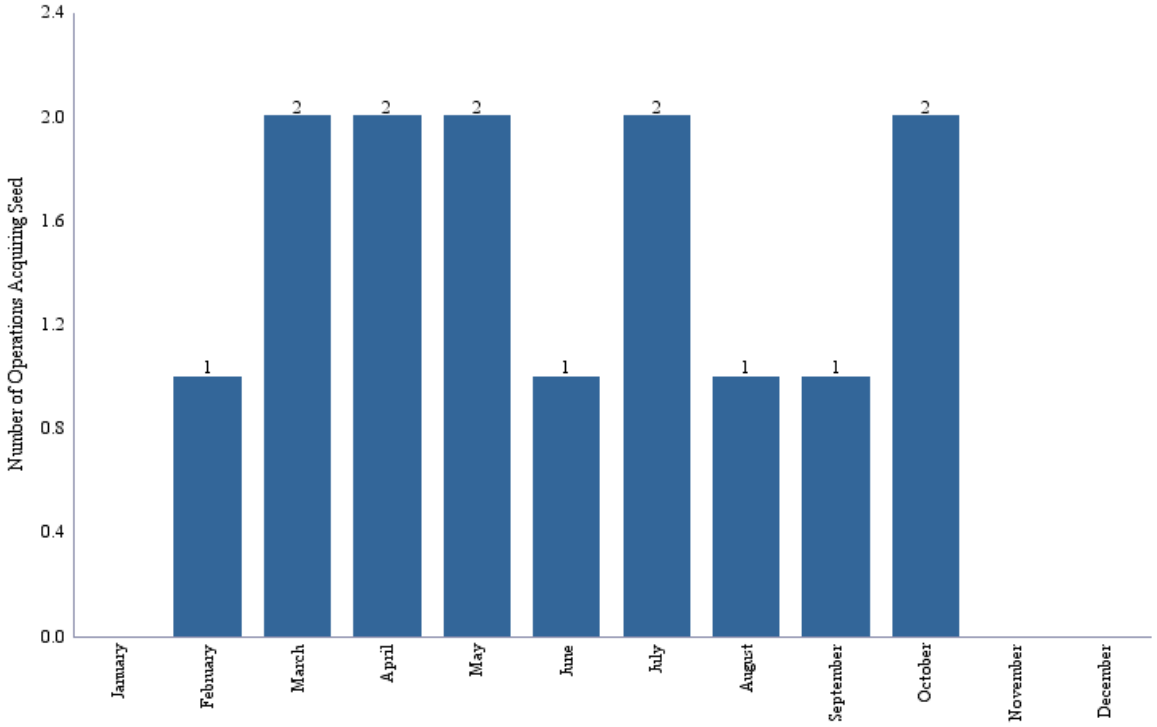

Figure 12.−New Pacific oyster eyed larvae and juvenile seed acquired by hatchery and nursery operations by month.

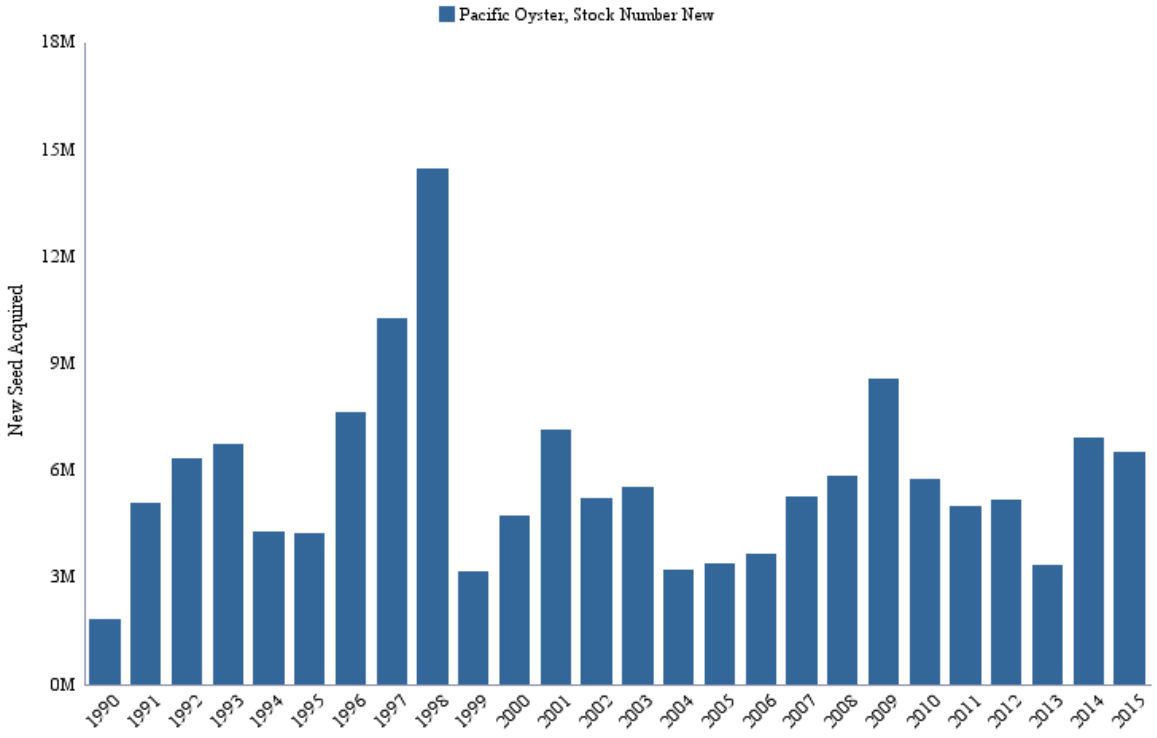

Figure 13.−New Pacific oyster seed acquired by aquatic farm operations, 1990−2015.

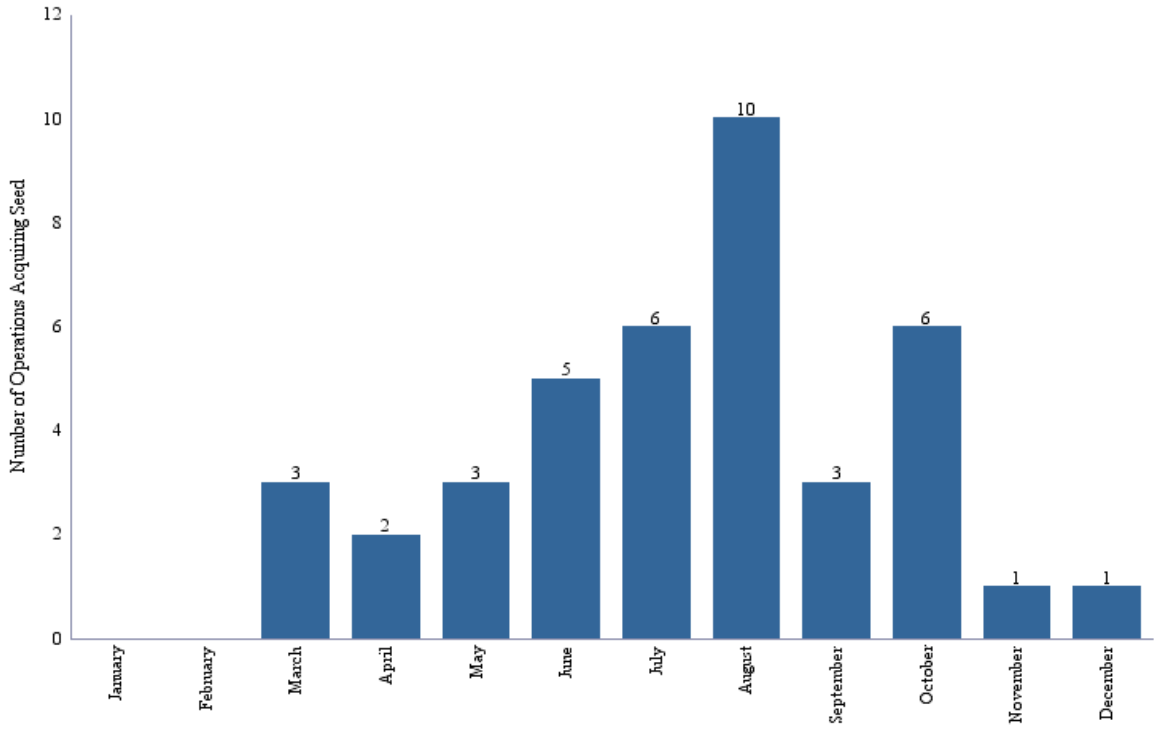

Figure 14.−New Pacific oyster eyed larvae and juvenile seed acquired by aquatic farm operations by month.

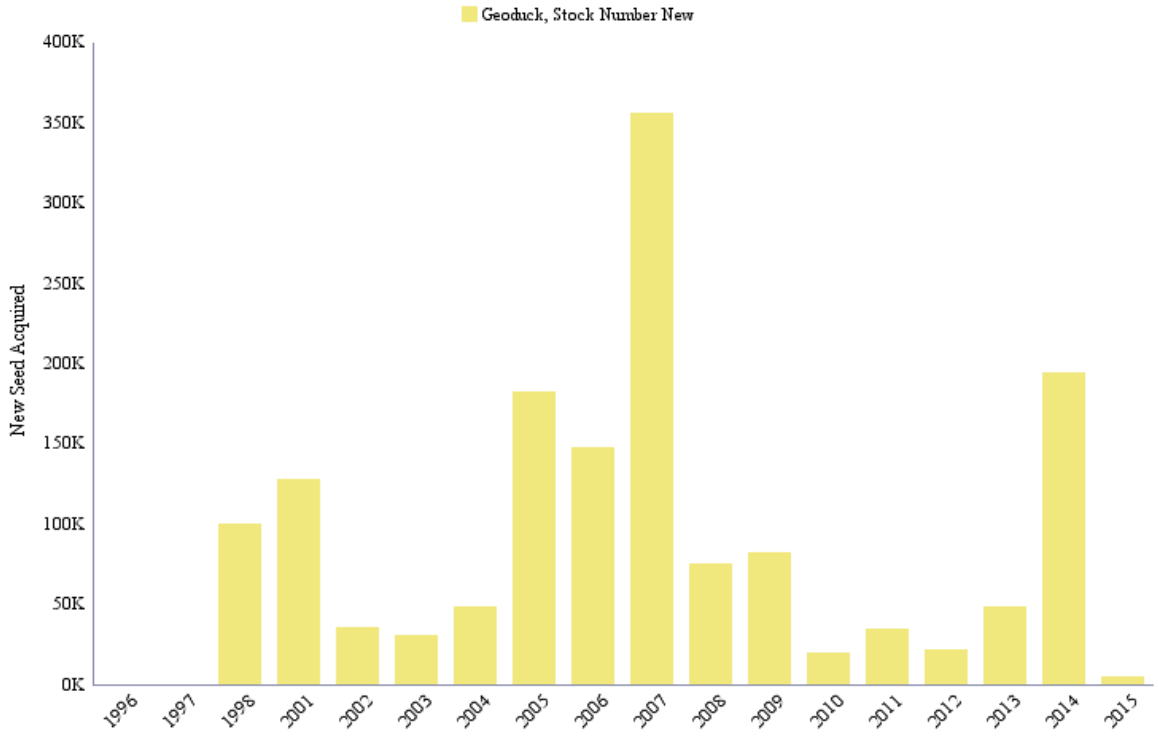

Figure 15.−Pacific geoduck seed acquired by aquatic farm operations, 1996−2015.

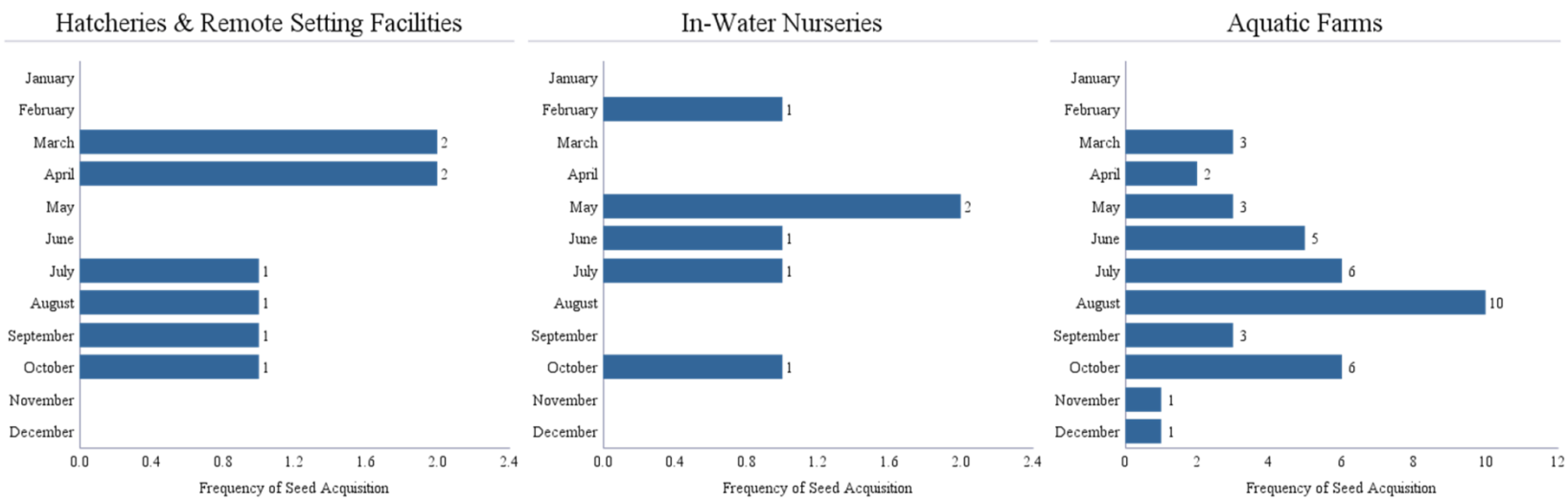

Figure 16.−Frequency of seed acquisitions by hatchery, and remote setting, in-water nursery, and aquatic farm operations in 2015.

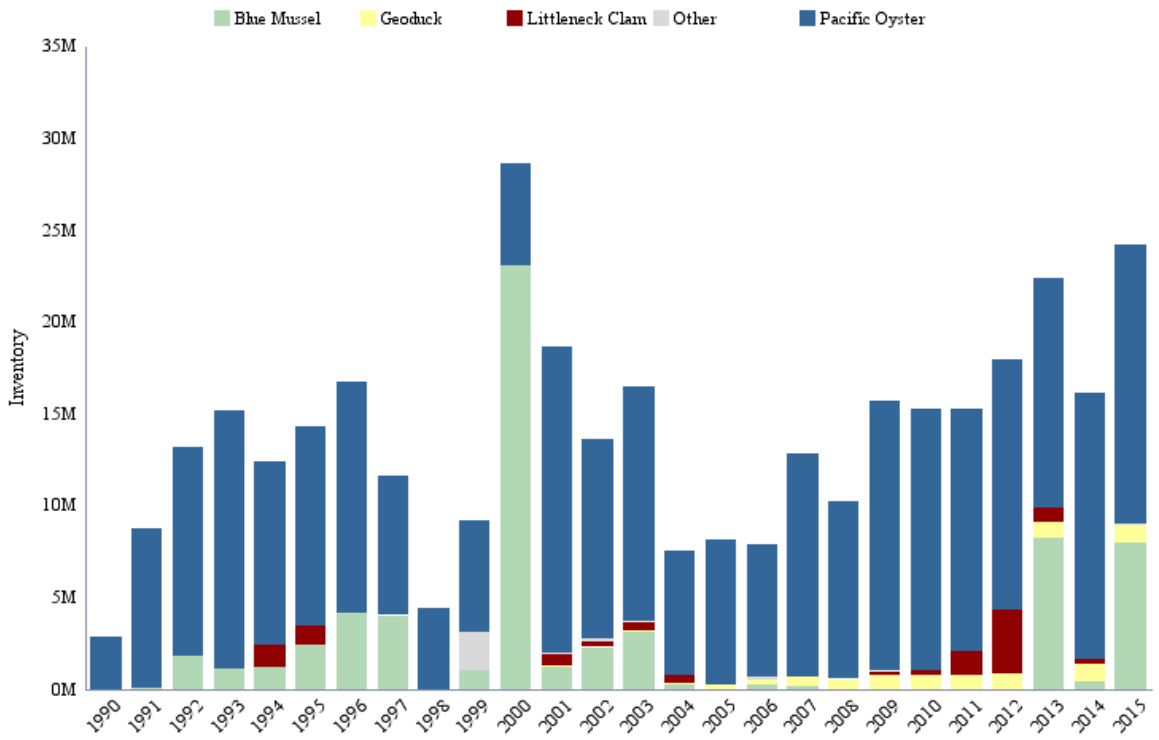

Figure 17.−Inventory of principle aquatic farm products at aquatic farm operations, 1990−2015.

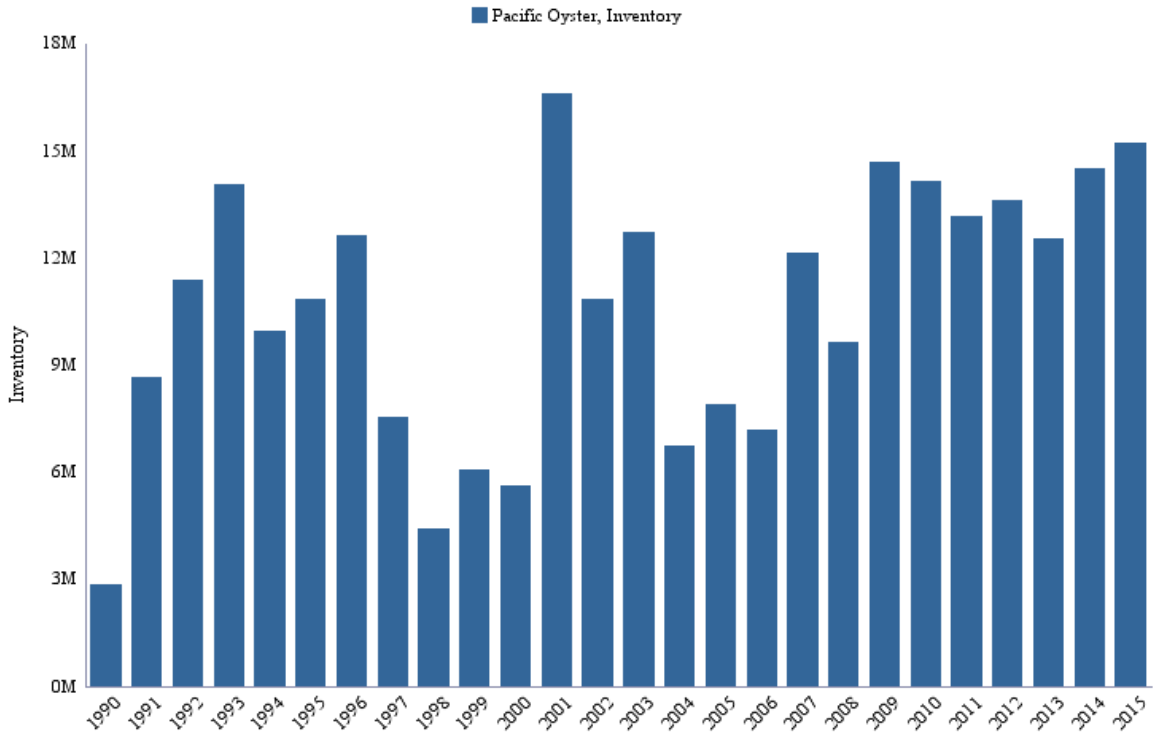

Figure 18.−Aquatic farm operations Pacific oyster inventory, 1990−2015.

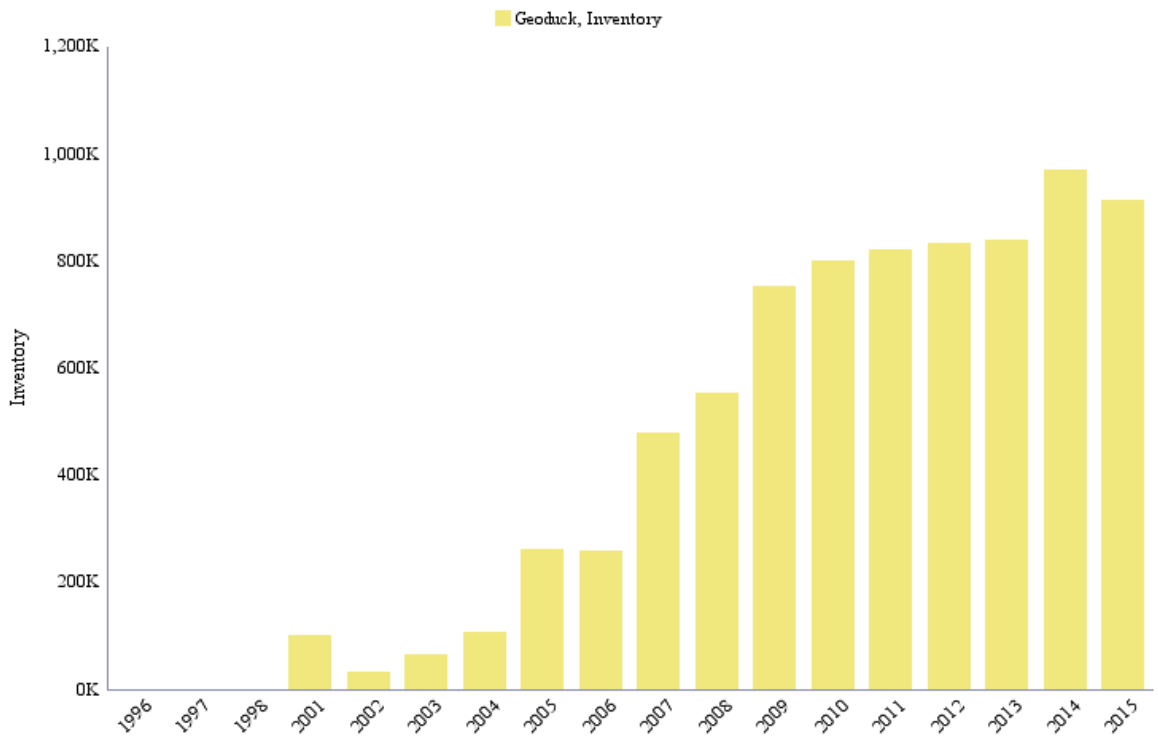

Figure 19.−Aquatic farm operations Pacific geoduck inventory, 1996−2015.

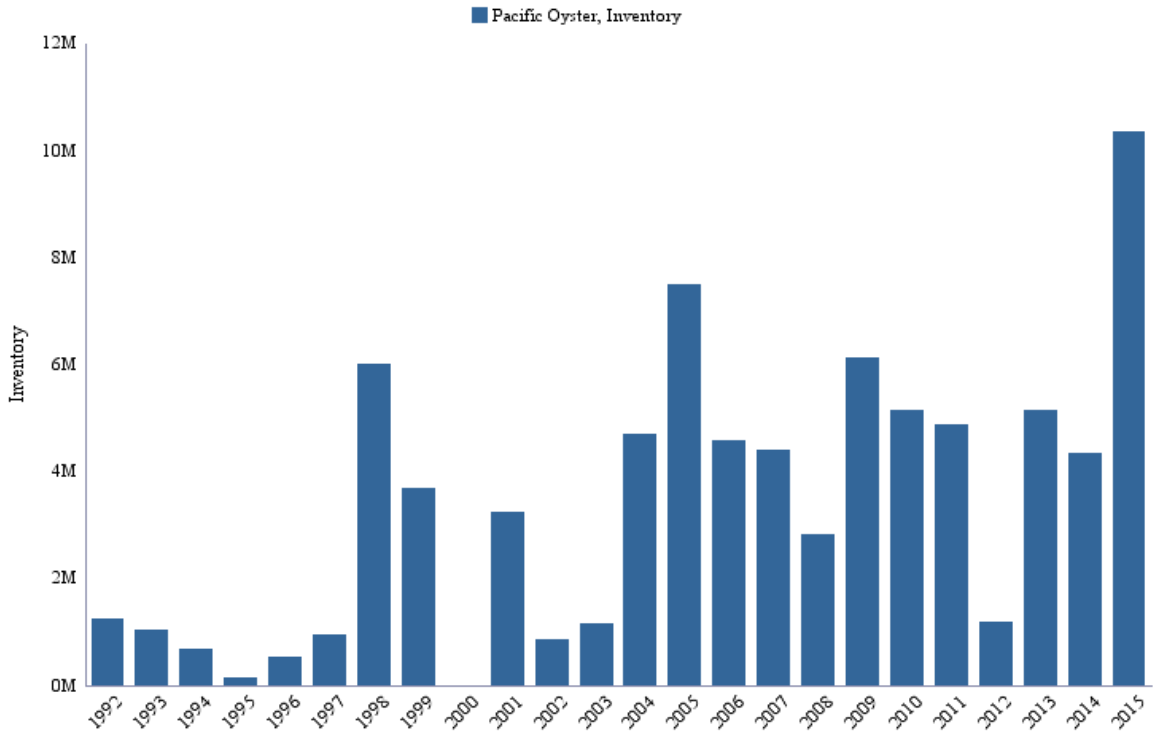

Figure 20.−Hatchery and nursery operations Pacific oyster inventory, 1992−2015.

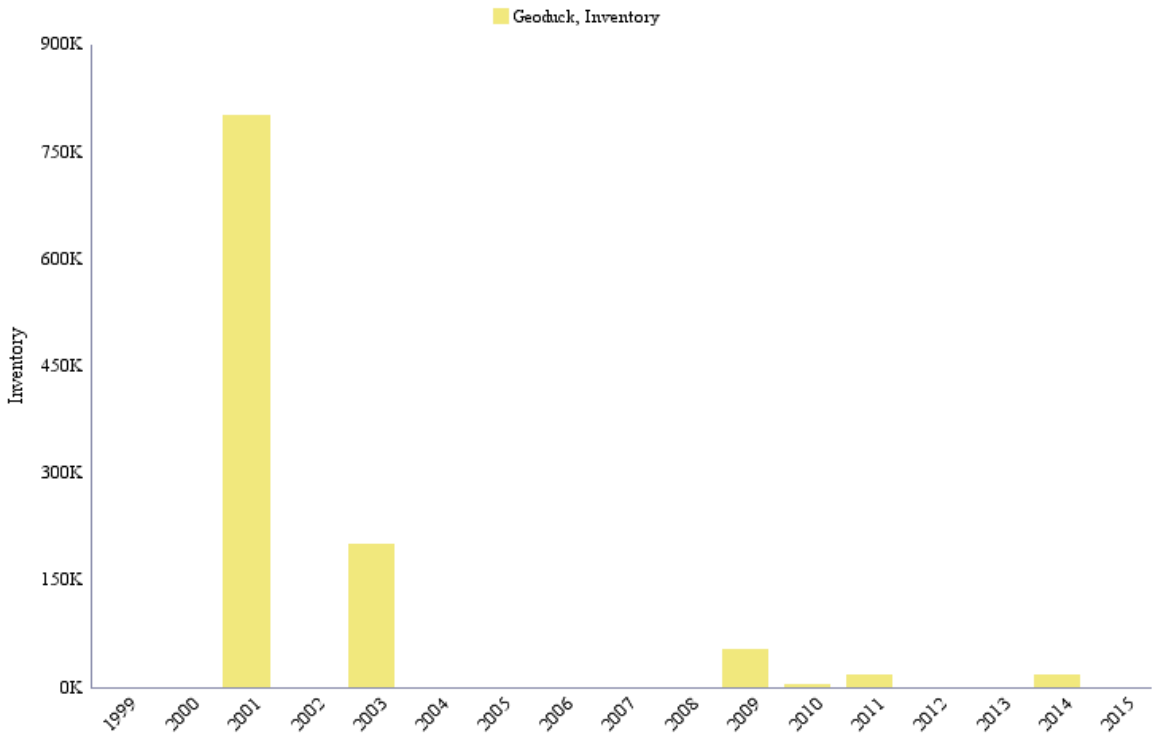

Figure 21.−Hatchery and nursery operations Pacific geoduck inventory, 1999−2015.

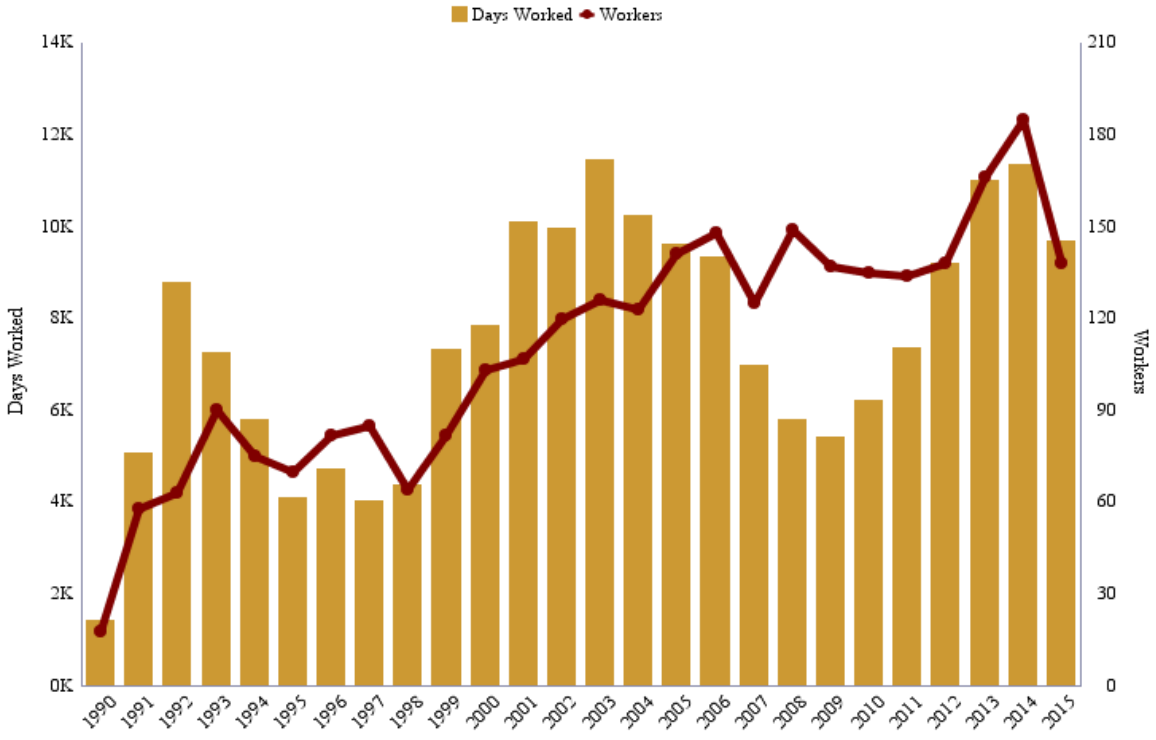

Figure 22.−Number of workers and days worked for aquatic farm operations, 1990−2015.

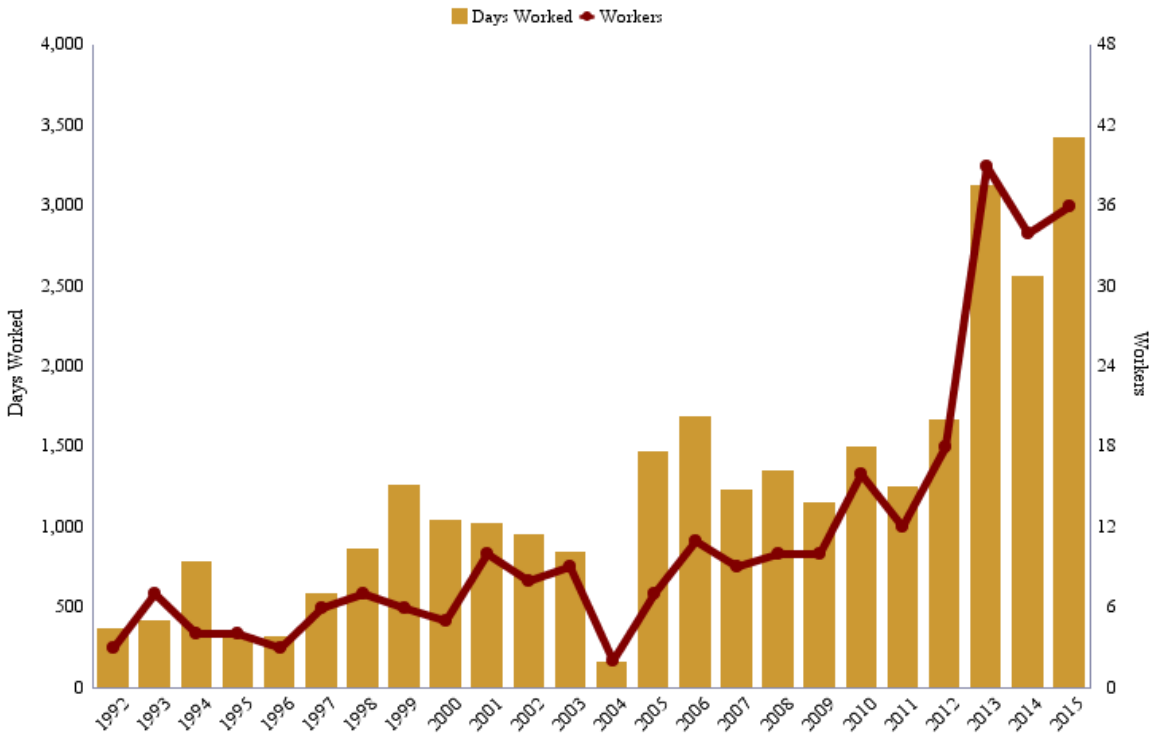

Figure 23.−Number of workers and days worked for hatchery and nursery operations, 1992−2015.