

**CENTER
FOR
TROPICAL
AND
SUBTROPICAL
AQUACULTURE**

2014 Aquaculture Status Update

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2. State of Hawaii
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4. Marine Shrimp
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1. Palau

By: **Thomas Taro**
Palau Community College
Koror, Palau

1. Giant clam

Existing Farms or Business Operations	The Palau Mariculture Demonstration Center (PMDC) has been successfully producing the Palauan endemic species of giant clams namely <i>Tridacna derasa</i> , <i>T. maxima</i> , <i>T. squamosal</i> , <i>T. crocea</i> and <i>Hippopus hippopus</i> in the hatchery for over two decades and so far the only source of seedstock for small scale and semi-commercial production basis. As of 2013, about 25 to 30 farms were established and received giant clam seedlings from PMDC.
Status in Terms of Production	Small scale and semi-commercial farming for local market and export as an aquarium species.
Important Problems/Challenges the are facing	CITES listing of giant clam is constraining the trade Manpower shortage for sustained research and extension service
New Aquaculture Activities	The members of Palau Aquaculture Cooperative Association (PACA) has encouraged PMDC to produce more seedlings in order to sustain their production.

New Government Activities that will affect the aquaculture	Government, through the Bureau of Marine Resources ‘(BMR), Palau Mariculture Development Centre (PMDC) has continued to provide material and technical advice to farmers.
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2. Milkfish

Existing Farms or Business Operations	A state government (Ngatpang) and three commercial enterprise in Koror, Airai and Melekeok States have expanded their production for milkfish as food and bait for long line tuna fishing into commercial scale . Milkfish grown to marketable size as food fish were cultured in floating cages while those for the tuna baits were cultured in the earthen ponds.
Status in Terms of Production	Medium scale commercial farming for local consumption.
Important Problems/Challenges the are facing	Expansion of farming to other states is constrained by lack of local expertise. Local source of milkfish fry and feeds is limited, therefore, commercial farms import milkfish fry and feeds from neighboring countries like Philippines and Taiwan. Banning of Industrial Tuna Fishing in Palau may result to the reduction in tuna bait production.
New Aquaculture Activities	To establish local milkfish fry production, the existing milkfish farms and Palau Community College have collaborated to develop the broodstock and monitor the natural spawning.
New Government Activities that will affect the aquaculture	The move to completely eliminate industrial tuna fishing on Palau waters may have negative impact to milkfish farming industry in Palau.

3. Rabbitfish

Existing Farms or Business Operations	Only one private owned fish farm is growing rabbitfish on a floating cage.
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Status in Terms of Production	<p>Interest rabbitfish farming declined after the researcher working on rabbitfish left the country in 2011 to 2012.</p> <p>Seed production technique has been revived after the researcher was reinstated in 2013 and larval rearing trials have been conducted to improve survival rate.</p> <p>Nursery and grow-out trials are being conducted in tanks and cages.</p>
Important Problems/Challenges the are facing	<p>Appropriate feeds to improve growth rate needs to be established.</p> <p>Interest in rabbitfish needs to be revived by sustaining availability of seedstock and demonstration on grow-out for marketable size.</p> <p>Existing law for the closed season in fishing of rabbitfish</p>
New Aquaculture Activities	<p>A project on seed production, nursery and grow-out of the rabbitfish <i>Siganus lineatus</i> under CTSA funding has been implemented at PCC hatchery since October 2012.</p> <p>Interest on rabbitfish farming is being revived by conducting series of larval rearing, nursery and grow-out trials at PCC hatchery.</p>
New Government Activities that will affect the Aquaculture	<p>The banning of industrial tuna fishing in Palau waters may encourage existing milkfish farms to consider rabbitfish as alternative species to grow in ponds and floating cages.</p>

4. Grouper

Existing Farms or Business Operations	None
Status in Terms of Production	None
Important Problems/Challenges the are facing	<p>Unavailability of hatchery produced fingerlings.</p> <p>Most fish farmers have concentrated on milkfish farming with less interest on other aquaculture commodities.</p> <p>Limited supply of trashfish for feeds.</p> <p>Government regulation on the export of groupers and closed season in grouper fishery</p>

New Aquaculture Activities	The Bureau of Marine Resources in collaboration with Taiwan Technical Mission continued to work on the seed production of rabbitfish, however, fingerling production was limited. As of now the only species that was produced was only the <i>Epinephelus polyphekadion</i> .
New Government Activities that will affect the aquaculture	

5. Mangrove crab

Existing Farms or Business Operations	There were two farmers who cultured mangrove crab (<i>Scylla serrata</i>) in earthen ponds, one farmer using a pen inside a mangrove and 6 farmers grow crabs in steel meshed cages. Hatchery produced crablets were sourced out from PCC hatchery.
Status in Terms of Production	Small scale
Important Problems/Challenges the are facing	High local demand but supply of wild caught crabs is very limited. Limited supply of trashfish for feeds. Government started to allow importation of live crabs from Philippines.
New Aquaculture Activities	The project on seed production of mangrove crabs at PCC hatchery that funded by CTSA has been successful and crablets produced were distributed to crab farmers for grow-out trials. Hundreds of thousand excess newly transformed crablets were released to mangrove conservation areas.
New Government Activities that will affect the aquaculture	Government has ammended the existing law on mangrove crab fishery which allowed the crab farmers to keep mangrove crabs with carapace length of less than 5 inches provided that the crabs were produced from the hatchery.

2. Hawaii

By: Ron Weidenbach

Hawaii Fish Company
Waialua, HI

The most recent aquaculture statistics for the Hawaii region were for the year 2012, published in the August/September 2013 issue of *Hawaii Farm Facts* by the USDA National Agriculture Statistics Service in cooperation with the Hawaii Department of Agriculture (Figure 1.). The full report can be viewed at: http://www.nass.usda.gov/Statistics_by_State/Hawaii/Publications/Miscellaneous/facts.pdf. Unfortunately, this was the last issue of this report due to Agency reorganization.

The number of aquafarms reported to have been operating in Hawaii in 2012 (all counties) was 70, remaining constant from 2011. This may be an underreported number not reflecting the actual number of small aquaculture and aquaponic operations now present in the State which appear to be increasing annually.

Total Hawaii aquaculture value in 2012 was reported to have been \$57.7 million, up significantly from the \$40 million reported in 2011 and the \$30 million reported in 2010. Algae sales still continue to account for the majority of industry value at \$28.4 million (51 percent of the value) with shellfish, finfish, and other items accounting for \$27.3 million (49 percent of the value). However, this represents a significant adjustment from 2011 where algae production accounted for 63% of total value. Unfortunately, further details of the industry breakdown are no longer provided.

Aquaculture: Value at Record High \$55.7 Million for 2012

Hawaii aquaculture increased for the second year reaching a record high \$55.7 million in 2012, compared to 40.0 million during the previous year. Algae sales accounted for \$28.4 million and almost half of the value. The ‘other’ category included the remaining sales. ■

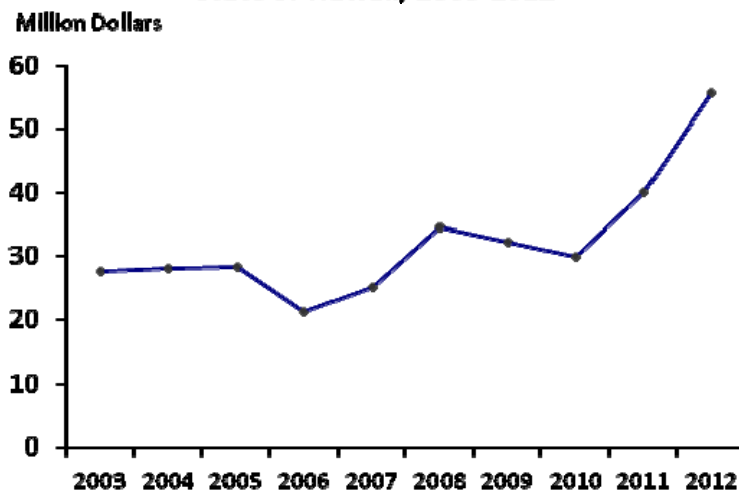


AQUACULTURE: Number of Operations, Production, and Value, State of Hawaii, 2008 - 2012

Year	Operations	Production		Value					
		Shellfish	Finfish	Shellfish	Finfish	Algae	Ornamental	Other ¹	Total
	<i>Number</i>	<i>----- 1,000 Pounds -----</i>		<i>----- 1,000 Dollars -----</i>					
2008	70	32	1,311	261	7,022	15,740	3,346	8,281	34,650
2009	70	56	821	420	4,447	16,995	2,671	7,797	32,330
2010	75	76	211	575	1,012	16,725	1,837	9,821	29,970
2011	70	55	315	413	1,493	25,230	2,514	10,320	39,970
2012	70	²	²	²	²	28,420	²	27,320	55,740

¹ Items not sold by weight which includes number count for example seed stock, brood stock, fingerlings, and disclosures for 2008-2011. ² Disclosure. Values for “Shellfish”, “Finfish”, and “Ornamental” are combined with “Other” for 2012.

Hawaii Aquaculture: Value, State of Hawaii, 2003-2012



3. Kauai

By: **Bernard Tsao**

Kauai Community College
Lihue, HI

Existing Farms or Business Operations:

Large Scale Commercial:

White Shrimp culture, Moi & Clams
Sunrise Capital Inc., Kekaha, Kaua`i
Manager: Jim Sweeney
Production Consultant: Mike Turner

Small Scale Commercial:

Chinese Catfish culture
Moloa`a Aquatics, Moloa`a, Kaua`i
Owners: Brandon Miranda
Rudy Miranda
Jesse Rabot

Blue Tilapia culture
Owner: Don Heacock, Lihu`e, Kaua`i

Ornamental Koi Carp culture
Kaua`i Koi Guys, Wailua Homesteads, Kaua`i
Owner: Geis

AYS Aquaponics Hybridized Tilapia culture / Aquaponics
Owner: Caroline Myers, Lihu`e, Kaua`i

Demonstration, Research & Training:

Tilapia culture / Aquaponics
UH Kauai Community College, Aquaponics project
Principal Investigator: Bernie Tsao, Lihu`e, Kaua`i

Bioenergy:

Microalgae culture
Hawaii Bioenergy (HBE) Kaua`i Algae Farm, Kapaia, Kaua`i
Department of Defense, Defense Advanced Research Project Agency (DARPA)

Note: There exist several casual backyard / hobby scale Tilapia ponds and extensive production systems around the island.

Status in terms of Production and Species:

Sunrise Capital's shrimp (*Penaeus vannamei*) production at Kekaha is now considered the largest aquaculture operation in the State. Their broodstock operation, Kona Bay Marine is now among the world leaders in providing broodstock *Vannamei* shrimp to hatcheries in China, Vietnam, Malaysia and India. They'd received the Dept of Health Certification to grow and sell shellfish. They are currently

selling clams (*Mercinaria mercinaria*) to local retailers and restaurants on Kauai. They are currently processing 10,000lbs. of meat shrimp and 150lbs of clams per week. 30 gram size shrimp are being sold fresh by same day airfreight and the rest frozen to local and west coast markets. There exist a huge demand in clams and expect to increase production to three to five hundred pounds/week by next year. They had invested in a blast freezing system that takes 2000lb shrimp to -25 FH in about 1.5 hours. Most of their ponds are now into recirculation Biofloc technology to reduce the need to discharge water. This coupled with more clam and oyster growing will further filtration methods to reach their goal of zero water exchange. Other than daily operational challenges, they are not facing any significant problems. They are continually enforcing bio security at the hatchery and farm to prevent any kind of cross contamination.

The Chinese Catfish (*Clarias fuscus*) farm at **Moloa'a Aquatics** has been in operation since 2010. This is a flow through system whereby aquaculture wastewater is used to irrigate fruit orchards, ie. Banana and Longan trees. There is a noticeable difference in trees and fruits watered with the fish water. The fruit is bigger and trees healthier using less fertilizer. Currently have approximately 3,5000 Chinese catfish. They have not sold any fish for they are beyond optimum sale size. But will try to market the next batch. There was a recent outbreak in disease but have since recovered and restocked. Their greatest challenges are time management, maintaining water filtration and water quality, high cost of feed, electricity and water. Considering photovoltaic applications.

Don Heacock's Blue Tilapia (*Oreochromis aureus*) production is a flow through integrated farm system where he utilize the surface water from nearby irrigation ditch and drains the effluent directly into his Taro beds. No new development that I know of.

Kaua'i Koi Guys are raising ornamental Koi Carp (*Cyprinus carpio*) on a small commercial scale at a private residential backyard. Their primary markets are hobbyists and resorts.

The Aquaponics system at the **UH Kauai Community College** is in full production and is being sustained as a training and demonstration project for continuing education and workshops. Recent inspections by the UH-IACUC Institutional Animal Care & Use Committee generated positive results and gained approval for continued operation. System was restocked with new hybridized Tilapia (*Oreochromis sp.*) (Pink/White) fingerlings from Big Island during mid-August, 2013 @ 77 fish/cu meter (185 fish/tank x 4 tanks). Towards the end of 2013, two part-time workers were hired, a production manager and aquaponics technician. Since then, the system has been operating at 100% with continuous and consistent production primarily of salad greens. The bulk of it being lettuces (Green Butterhead, Green Oakleaf, Red Leaf Vulcan, Red Summercrisp, Red Butterhead, etc.) as well as Asian Greens such as Tatsoi, Mizuna and Watercress. Smaller items were Arugula, Mint, Beet Green and Beets, Spring Onions, Cilantro. An average of 188 units are being packaged and sold at the local farmers market per week. The operational part of project is now financially self-sustaining. The fish are not being harvested at the moment. The greatest challenges are with common pests, in-house fiscal/administrative bureaucracies and the bi-annual dealings with the UH-IACUC and the Office of Laboratory Animal Welfare (OLAW).

AYS Aquaponics in Lihue is a relatively new small-scale commercial aquaponics venture launched during August 2013. This system was designed with plants as priority and therefore low-density fish stocking. System is performing successfully thus far and is producing varieties of lettuces, Chard, Basil, Watercress, Kale, Parsley, Chives, Green Onion, Strawberries, Tomatoes, Eggplant, Thyme, Cilantro and Mint. Products are being sold commercially through a handful of local organic produce

vendors and farmers markets. Production is not consistent due to inconsistent management. Major challenges are common pests, personal time management and high cost of electricity @ an extra \$100/month.

The Kauai Algae Farm was established next to the Kauai Island Utility Cooperative's Kapaia Power Station in 2006. The objective is to develop a cost-effective photosynthetic open pond system to produce algal oil. The project will also demonstrate preprocessing technologies that reduce energy use and the overall cost of extracting lipids and producing fuel intermediates. Hawaii BioEnergy has recently reactivated the site and began operations. The farm received \$5 million from the US Department of Energy during August 2013 (still pending), and an \$8.7 M 2-phase contract from Defense Advanced Research Project Agency (DARPA) that kicked off in February 2014. The overall objective is to leverage previous DARPA Algal Derived JP-8 project to retire remaining major risks and explore follow-on private investment in commercialization of algae production. First phase is to complete all system retrofits and shakedown tests in the first phase, and if that looks good, we get funded for second phase (13 months) to test, produce, and evaluate biomass & oil; and build techno-economic & business models for commercialization. The go/no-go decision for phase 2 is scheduled for 28 July. This contract is primed by Texas A&M, with team members including Global Algae Innovations (us) and Hawaii BioEnergy. The 33-acre Kauai Algae Farm currently has several species of algae growing, with most high-volume production from Chlorella. They recycle growth media in their system, and are carbonating media with flue gas from the adjacent KIUC exhaust.

Important Problems/Challenges:

Lack of a reliable 'on island' local source for Tilapia & Catfish fingerling stockers.

Access to high quality commercial aquaculture feed & farm equipment suppliers.

Challenges are operating costs. Labor, feed, shipping, and energy.

There is a great need to investigate and diversify the potential culture of other warm freshwater fish and aquatic species in Hawaii.

A first small-scale Tilapia hatchery by **Village Green LLC**. was established and completed in October 2012. The goal is to provide high health disease free tilapia fingerling as stock to the growing aquaponics industry on Kauai and Hawaii in general. The hatchery initially went through some technical problems with unsuccessfully spawning of Tilapia broodstock in a laboratory controlled environment. Since then adjustments have been made and there were several successful spawns. Sadly, the operation had been terminated last month due to the high cost of operational expenses.

New aquaculture activities:

Aquaponics is the most promising sustainable solution for our island's food production industry. There are ongoing interests and growing activities in small-scale resident and commercial aquaponics development within the island community as a whole. There are currently over 174 graduates through aquaponics training workshops offered through the Kaua'i Community College. However workshop enrollment seemed to have declined this year.

Numerous residential scale systems have been installed this year along with an additional small-scale commercial operation, '**Kaua'i Roots Farm Aquaponics**' scheduled to be in production by September.

4. Marine Shrimp

By: **David Kawahigashi**

Vannamei 101

Honolulu, HI

1) Existing farms or businesses:

- Kona Bay (Kauai) – shrimp production for local market and broodstock export to Asia
- Kualoa Ranch – shrimp production for local market
- Romy (Kahuku) – shrimp production for shrimp restaurant
- Shrimp Improvement Systems (Kona) – Broodstock export to Asia

2) Status in terms of production and species

- Kona Bay – *P. vannamei* culture; second largest supplier of SPF certified broodstock to Asia
- Shrimp Improvement Systems – largest supplier of SPF *vannamei* broodstock to Asia

3) Any important problems or challenges

- Broodstock business is a lucrative niche market for SIS and Kona Bay.
- Challenges to new shrimp farm development is both in the market (for live shrimp) and cost of production (Hawaii is expensive!)

4) New Aquaculture activities

- None that I know of...

5) New government policies

- None that I know of....

5. Marine Food Fish

By: **Jennica Lowell**

Research and Fish Health Manager
Kampachi Farms
Kailua-Kona, HI

a) Existing farms or business operations/ b) Their status in terms of production and species

Blue Ocean Mariculture- Ongoing production of Kampachi and Moi. Applied to DLNR OCCL for expansion in production capacity

Kampachi Farms- Kampachi and grouper research

Installed a research scale cage in federal waters off of Big Island (fish recently harvested). Still working to build large scale production in Mexico

c) Any important problems/challenges they are facing

Time for permit renewal/ granting.
External parasites are still having to be managed

d) New aquaculture activities

Mamala Bay applied for a CDUP for a site off of the Honolulu airport. Moi production in net pens

e) New government policies that will affect aquaculture in your region or area of expertise.

Magnusson-Stevenson Act re-authorization

6. Industry Development

By: **John Corbin**

Aquaculture Planning and Advocacy
Kaneohe, HI

Status of the Hawaii Industry

In 2012 the industry continued to rebound from the recession to hit a new high in sales of \$56 million based on about 70 surveyed farms. Growth in value has been dramatic in recent years; from \$30 million in 2010, to \$40 million in 2011, to the most recent 2012 value (see attachment). Highlights include:

- Continued growth in algae production led by Cyanotech at NELHA. The Company is the world leader in growing and processing nutraceuticals from algae.
- Continued growth of the Other Category , mainly global sales of SPF shrimp broodstock. Hawaii SPF shrimp companies are the cornerstone for the U.S., Asian and South American aquaculture of *L. vannamei*.

The challenges to starting and operating an aquaculture business in Hawaii continue, e.g., access to water and land, access to capital and lengthy and expensive permitting processes. That said, aquaculture is widely supported as a part of the State food security strategy and has demonstrated success for producing products for local consumption and export. Positive trends include: the eat-locally-produced-food movement and the strong desire for the food service industry to use locally produced products.

How Does Hawaii and Aquaculture Stack Up

The 2012 Census of U.S. Agriculture provides some interesting conclusions.

Hawaii Aquaculture 2012- Hawaii is a leader in U.S. aquaculture

- Market value for production = \$56,450,000
- Rank in U.S. states = 10th
- Rank in Hawaii Ag production = 6th
- Per cent of total Ag sales = 8.5%
- Market value of Hawaii County = \$46,783,000.
- Rank with all U.S. Counties = 4th

Highlights of Hawaii Agriculture

- Number of operations = 7000
 - Total area operated = 1,120,000 acres
 - Average farm size = 160 acres
 - Average market value of sales per farm = \$94,478
 - Farm size distribution
 - 63 % are between 1 and 9 acres
 - 25 % are between 10 and 49 acres
- 88 % are between 1 and 49 acres
- Legal status distribution = 81.2 % are family or individual ownership
 - Tenure of principal owner
 - 66.2 % or 4636 are full owners
 - 9.8% or 686 are part owners

Number of operators per farm

- 54.8% have one operator
- 45% more than one operator

Age of farm operator

- Under 25 – 1
- 25-34 – 107
- 35-44 – 255
- 45-54 – 613
- 55-64 – 1221
- 65 and over – 1445

Farm operators with other occupations = 3358 or 48% of 7000 farms