Photo courtesy of M. Haws.

Improving Human Health and Nutrition through Shellfish Aquaculture

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Photo courtesy of AquaFish.

The AquaFish Innovation Lab and related programs have been promoting and developing aquaculture research throughout the world for almost 30 years. Shellfish species (molluscs and crustaceans) are an important and growing portion of the total global aquaculture production. Finding ways to improve shellfish product quality and safety will help create a source of nutritious food and sustainable income for vulnerable and impoverished communities.

Why Shellfish?

With over 850 million people undernourished throughout the world, shellfish consumption can enrich diets with animal protein, fatty acids, vitamins, and minerals that are lacking from many staple foods consumed in developing countries.

Photo courtesy of M. Haws.

Nutritional benefits:

- Many bivalve species provide almost all the dietary essential amino acids for maintenance and growth of the human body.
- Good source of omega-3 fatty acids.
- Excellent source of protein.
- Rich in iron.

Corn

Nutrition Facts

Serving Size kernels from 1 medium ear (90g)

Amount Per Serving

Calories 90	Calories from Fat 20
	% Daily Value*
Total Fat 2.5g	4%
Saturated Fat 0g	0%
Trans Fat 0g	0%
Cholesterol 0mg	0%
Sodium 0mg	0%
Total Carbohydrate 18g	6%
Dietary Fiber 2g	8%
Sugars 5g	
Protein 4g	
Vitamin A 2%	Vitamin C 10%
Calcium 0%	Iron 2%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories	2,000	2,500
Total Fat	Less Than	65g	80g
Saturated Fat	Less Than	20g	25g
Cholesterol	Less Than	300mg	300mg
Sodium	Less Than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram: Fat 9 Carbohydrate 4 Protein 4

Clam

Nutrition Facts

Serving Size 3 oz (85g) Clam, mixed species, cooked moist heat

Amount Per Serving

Calories 130	Calories from Fat 15
	% Daily Value*
Total Fat 1.5g	2%
Saturated Fat 0g	0%
Trans Fat 0g	
Cholesterol 55mg	18%
Sodium 95mg	4%
Total Carbohydrate 4g	1%
Dietary Fiber 0g	0%
Sugars 0g	
Protein 22g	
Vitamin A 10%	Vitamin C 30%
Calcium 8%	Iron 130%
Selenium 80%	

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

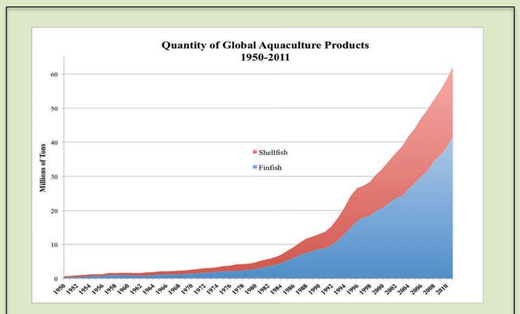
Calories per gram: Fat 9 • Carbohydrate 4 • Protein 4

Nutritional value for serving of corn (left) and clam (right). (Sources: www.defeatdiabetes.org (left) and www.seafoodhealthfacts.org (right).)

In addition to benefits to human health, many shellfish species also provide positive environmental impacts.

Environmental benefits:

- Reduce turbidity through filtration
- Carbon sequestration
- Habitat/shoreline stabilization
- Nutrient uptake



Global shellfish and finfish aquaculture production from 1950 to 2011. (Source: FAO.)

Photo courtesy of M. Haws.

Minimal capital costs and few inputs (i.e., feed, fertilizer, etc), combined with ecological and nutritional advantages, have contributed to the increase in shellfish aquaculture production over the last 60 years.

Food Security

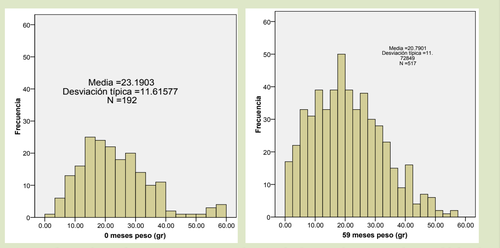
AquaFish promotes food security by fostering research and outreach that increase nutrient-rich food choices and provide sustainable income opportunities for those with limited resources.

The harvest of wild black cockles (*Anadara tuberculosa*) on the Pacific coast of Nicaragua provides much needed income and food for vulnerable, coastal communities. Villagers in Aserradores Estuary in Estero Padre Ramos National Reserve collaborated with researchers from Universidad Centroamericana (Central American University, UCA) and AquaFish to design a community management approach to help protect the viability of the cockle fishery and secure the livelihoods of cockle collectors in this area.

Photo courtesy of M. Haws.

Location of the community of Aserradores in the Department of Chinandega, Nicaragua. (Source:www.ineter.gob.ni.)

- Established 4 no take zones (i.e., no black cockle harvest allowed) which were sampled every six months.
- Significant increase in abundance and size for black cockles in no-take zones.



Size class distributions at months 0 (left) and 59 (right) of black cockles in the four designated no-take zones. (Source: Hernandez et al. AquaFish Final Investigation Report 09HHI01UH, Implementation Plan 2009-2011.)

After five years of community-based management and monitoring, the no-take zones have proved successful in increasing the number of cockles in the estuary. Due to this success, the Nicaraguan government is considering adopting this type of management system in the region.

Food Safety

Those with limited food choices need to be sure that the food they consume is safe to eat. Identifying hazards and developing strategies to eliminate them are cornerstones of AquaFish research.

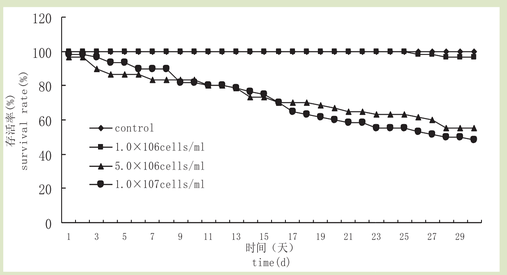
The red swamp crayfish (*Procambarus clarkii*) is a commercially important aquaculture species in Asia. Often, water quality in culture ponds is compromised by blooms of harmful *Mycrocystis* algae, known to be toxic to both humans and animals.

Photo courtesy of Duloup/Wikimedia Commons/Public Domain.

- Juvenile crayfish survival was significantly correlated with algae concentration.
- Adult growth was stunted when exposed to high algae concentrations.

This research can inform further studies to find ways to eliminate toxins in shellfish to safeguard people against food-borne illness and contamination.

AquaFish researchers at Shanghai Ocean University exposed crayfish to different concentrations of *Mycrocystis* algae to assess its impact on survival and growth of juvenile and adult crayfish.



Effect of different densities of *M. aeruginosa* algae on survival rates of *P. clarkii* larvae.(Source: Liping et al. AquaFish Final Investigation Report 09BMA05UM. Implementation Plan 2009-2011.)

Future Research

Research and trainings are planned to begin in 2014 in Tanzania on spat collection and nursery methods for shellfish culture. These studies and outreach activities will address obstacles that have hindered small-scale aquaculture development in this region, and potentially offering nutritious food options and income alternatives for poor communities.

Photo courtesy of M. Haws.

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