

Aquaculture's Prominent Role In Feeding a Growing Global Population

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Photo: Jeff Milisen, Kampachi Farms, LLC

Presented by:



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Introduction

The world's population is expected to increase substantially in the next 25 years to an estimated 9 billion people. Key questions arise from this growth. For instance, how will the seafood industry adapt to these changes? How can production be increased in a sustainable manner and what are the obstacles to sustainable growth? We ask these questions knowing that the global marine resources are finite, that predominant advice from leading health organizations around the world say that seafood is an essential part of a heart-healthy diet, and that some people, such as the average American consumer, are not eating enough seafood.

It is predicted that in 2015, worldwide consumption of farmed seafood products will outweigh consumption of wild catches. Considering this major growth, how might that ratio look in a quarter-century and will we actually be able to fulfill those needs? These are just some of the questions this whitepaper will consider.

Why eat seafood?

The sea and the life it contains have driven many aspects of human evolution. That's why omega-3 fatty acids are such a critical element to our overall health. Besides the obvious health benefits, there are many reasons to eat seafood. For instance, seafood is an efficient and more environmentally friendly food because it doesn't require energy for metabolism to heat itself or to stand. That means that it has relatively fewer environmental impacts than livestock.

Won't eating seafood harm the ocean?

The harvest and production of seafood and the effect on the ocean is a common environmental concern. Yet if it's done properly, aquaculture has fewer ocean impacts than other forms of agriculture. This has to do mainly with the fact that seafood lives in an environment that fully supports it. Fish and shellfish require fewer resources to grow than any of the terrestrial proteins.

Comparing the amounts of greenhouse gases for feed reveals just how small the impact on seafood is when compared to other proteins.

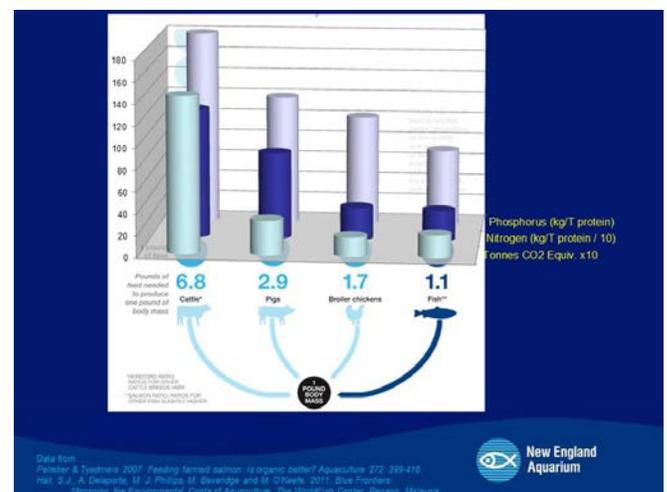


Figure 1

Global seafood consumption now and in the future

Today, it is estimated that about half of the seafood is farm raised and half is wild caught. In the future, this will likely shift quite dramatically. The Fish 2030 project estimates that by 2030, 62 percent of

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seafood will be farm raised and the remaining 38 will be wild caught.¹

How do we make more protein available?

As the global population increases, so too does the need for protein. To meet these needs we must create protein sustainability. Aquaculture plays a key role in overall global food security. But because wild-capture fisheries have plateaued, today more fish and aquatic protein comes from aquaculture than ever before.

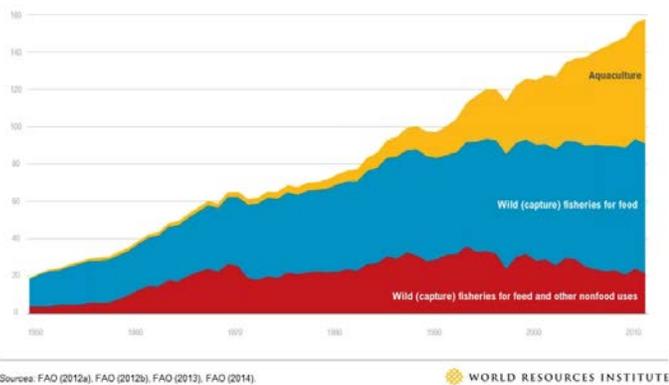


Figure 2

Modern aquaculture is a new food system whose growth allows more protein to be created globally. In the United States alone, approximately 57 percent of seafood consumed is farm raised. Shrimp and salmon are the top two species of fish consumed in the United States and both of these fish are primarily farmed species.

¹ FAO FIPS (2014) // Fish to 2030 (2013)

Aquaculture is critical to US seafood consumption...

| Rank | Species | Lbs Per Capita | Source |
|------------------|-----------|----------------|---------------|
| 1 st | Shrimp | 3.6 | ~90% farmed |
| 2 nd | Salmon | 2.7 | ~70% Farmed |
| 3 rd | Tuna | 2.3 | Wild-caught |
| 4 th | Tilapia | 1.4 | 100% Farmed |
| 5 th | Pollock | 1.2 | Wild-caught |
| 6 th | Pangasius | 0.8 | 100% Farmed |
| 7 th | Cod | 0.6 | Wild-caught |
| 8 th | Catfish | 0.6 | 99% Farmed |
| 9 th | Crab | 0.5 | Wild-caught |
| 10 th | Clams | 0.5 | Farmed & Wild |

Source: New England Aquarium

Figure 3

Rethink size, create more

Today, the seafood industry operates under a wild fisheries construct because consumers are used to eating large fish that only exist in the ocean. This is an important point since management of wild fisheries for large individuals keeps the stocks healthy and ensures that fish are staying in the ocean and reproducing.

In terms of aquaculture, there are many benefits to growing smaller fish. A 2011 comparison project looking at catfish, rainbow trout and sablefish revealed some interesting information. Researchers were specifically interested in what happens to production processes when the size of the fish is decreased. The study showed that aquaculture production was increased by 50 percent simply by shifting the size of fish being produced. This type of decreased fish size also saves on feed use. This production should become more common to match

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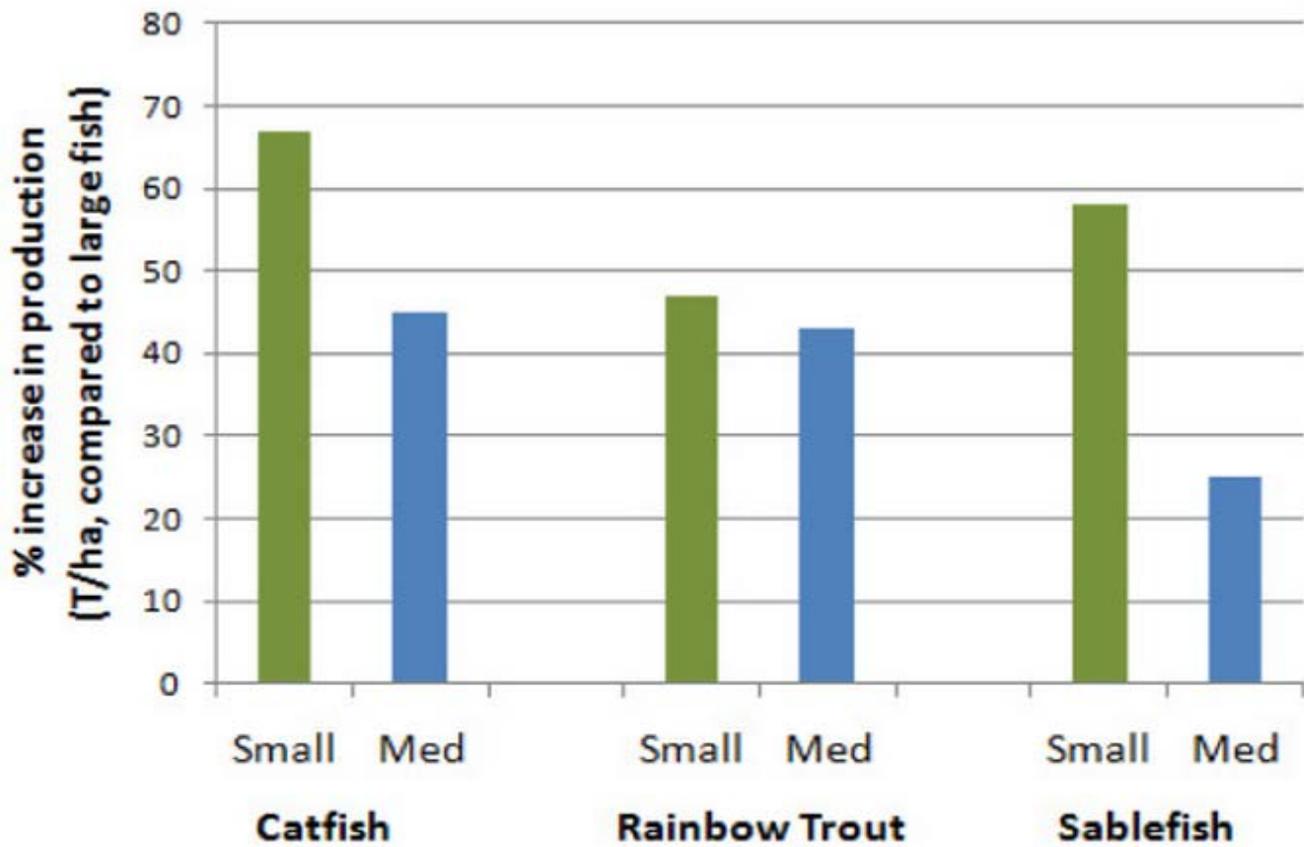


Figure 4

more sustainable production with sustainability goals.²

Waste less

In addition to creating more through aquaculture, we must also learn to waste less. A considerable effort is being made to characterize food losses globally with a number of national and

² *Thrusty MF, Hardy R, Cross SF. Limiting Size of Fish Fillets at the Center of the Plate Improves the sustainability of Aquaculture Production. Sustainability. 2011; 3(7):957-964*

international programs being put in place to address these losses.

In the seafood realm, waste varies based on whether a product is fresh or frozen. One study found that it took 2.4 times the amount of fresh fish to create a single unit of product. By comparison, it only took 1.3 times the amount of frozen fish to yield that same unit.^{3,4}

³ *Stoner, J. MS Thesis, Dalhousie University*

⁴ *Stoner & Tyedmers in review*

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Though fresh fish might seem more sustainable and healthy, the waste it produces compared to frozen is substantial. In terms of aquaculture, it is important to think about what we are creating, how we are creating it and how it's being marketed and distributed.

Do a better job

Most people know that aquaculture can be done in many different ways, with many different species. All of these are lumped together under the concept of aquaculture.



Figure 5

Highlighting production scenarios that are less environmentally impactful will help facilitate a healthy and balanced view of what aquaculture actually is, and how varied the particular practices really are.

Food production is perhaps the single-most impactful thing we as humans do to the environment. And while it is impossible to completely mitigate all environmental impacts, we

can alter food production practices to be less environmentally impactful.

The Conservative Alliance for Seafood Solutions created what is known as the Common Vision. The Vision calls for its major seafood buyers to take a series of steps to ensure more environmentally friendly practices within the seafood industry.

The Vision asks members to:

- Commit to developing and implementing a comprehensive, corporate policy on sustainable seafood.
- Assess and monitor the environmental sustainability of your seafood products.
- Support environmentally responsible seafood choices through purchasing decisions.
- Make information regarding your seafood products publicly available.
- Educate your customers, suppliers, employees and other key stakeholders about environmentally responsible seafood.
- Engage in and support policy and management reform that leads to positive environmental outcomes in fisheries and aquaculture management.⁵

Many stakeholders are going above and beyond these guidelines to further reduce impact on the environment. The following graph shows lower impacts on the right. While a few producers have low impacts and few have very high impacts, the majority fall somewhere in the middle. Therefore,

⁵ *Solutions for Seafood:*
<http://www.solutionsforseafood.org/projects/common-vision/>

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the question becomes: How do we take that entire curve and move it to the right?

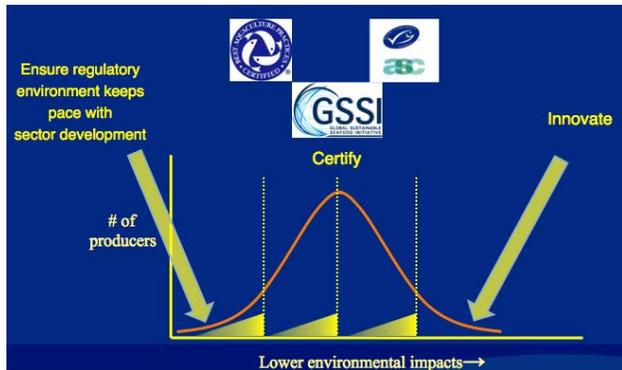


Figure 6

There are a number of mechanisms that allow this to happen. First, we must ensure that regulations around the environmental safeguards keep pace with sector development. Yet, innovation is also important. When it comes to regulation and innovation, the bulk of producers fall in the middle. The question then becomes: What do we do with those people? This is where environmental certification comes into play. The seafood industry must help guide the production processes move forward with less environmental impact.

Changing aquaculture's image

When considering impact comparisons between aquaculture and land-based livestock production, fish farming is the more environmentally responsible choice, yet there seems to be far more scrutiny over farming the seas than farming on soil. So why is there such a disconnect, and why aren't these facts about aquaculture more well known?

There are many reasons for this disconnect. The first likely has to do with the fact that terrestrial agriculture has been around for about 10,000 years

when it replaced traditional hunting practices. It is a familiar and stable practice in our world. The second reason for resistance is that aquaculture is usually using common property resources. This leads to displacement of people that are already using those resources. The third reason relates to how the development of aquaculture has happened at the moment in history when there is a lot more corporatization, commercialization and globalization. Despite the fact that modern agriculture is now a corporate business, many still cling to the myth that farming is a family business. And while this growth is critical to producing a healthy economy and providing the necessary food for the population, there is widespread resistance to this corporate culture. But having large corporations involved can be helpful in many other ways as well. For instance, these entities can invest more in the R&D and in certification programs.

The fourth reason why aquaculture struggles to gain a footing is that in many ways, the commercial fishing industry perceives aquaculture as competition. The need for more seafood is real, and pressing, and solely relying on wild catch cannot meet our growing demands. If 3 billion people move up into the middle class between now and 2050 and they are eating primarily beef and pork, the planet is going to be in a lot of trouble. The growing middle class should be eating seafood, rather than terrestrial animals. Aquaculture provides a clear way to scale and meet these growing demands.

Other reasons for pushback might relate to aquaculture being the "new-kid-on-the-block." We are naturally leery of the new. There have also been documented environmental impacts of aquaculture in its past that have been hard to shake loose for

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some. But aquaculture today is far different than it was 30 years ago because there is better rule setting and environmental monitoring.



Figure 7

Meeting growing seafood demand

Clearly, in order to feed future populations, aquaculture must increase. So what is the biggest obstacle in achieving that goal? Is it the capability of the natural environment to provide the necessary ingredients for that growth? Or is it our ability to manage industry operations and make efficient use of those ingredients, and other prevent major losses from disease?

There are two schools of thought within the seafood community. The first wants to move the planet forward on a more sustainable footing. The second wants to preserve the status quo, has less vision and cares less about the importance of sustainability. By relying primarily on land animal proteins, we will only further increase the environmental pressures on the planet. It is estimated that as much as 18 percent of greenhouse gas emissions come from terrestrial animal proteins. We must start to displace the future beef and protein production with aquaculture to reduce the tremendous impacts on global climate change.

Financial constraints also have an impact on the industry. To make money, production is often increased beyond what is sustainable for the local ecosystem. This is where cooperation across all sectors of the industry must occur to identify these big challenges.

In many cases, aquaculture involves farming species that haven't been domesticated. They are inextricably linked to their environment, which is why we must pay such close attention to that environment. Because when we start tipping that balance towards too much production, the farms will lose money because they will lose animals. This also leads to environmental impact.

The role of certification

Most people are familiar with the Marine Stewardship Council whose blue eco label is put on consumer packaging indicating environmental responsibility and sustainable practices. But sustainability certification has helped open up key markets for farmed seafood products as well, such as Best Aquaculture Practices by the Global

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Aquaculture Alliance, or the Aquaculture Stewardship Council. But only about 5 percent seafood products have earned such an eco label. So how does certification actually impact industry practices?

The main thing these labels have done is sparked conversation where there wasn't one previously. People are now working more collaboratively toward a common goal: reaching the other 95 percent of products that aren't certified.

There are different ways and different levels of impact with different species and production systems within aquaculture. Because of this, we can't have a single, low-bar eco-certification, sustainability definition that requires doing a minimum to get a label. By working towards differentiating programs that are a little lower bar, we will allow farms to start working at an entry level. Once this is achieved, we can move to an intermediate level and continue to increase.

Giving eco-labeling schemes enough time to become established will also reveal where incentives lie. This will ensure that others in the industry are then going to buy into the programs.

Even though it is early in the game, significant measures of success can already be seen. For example, about 70 percent of global salmon production follows the Global Salmon Initiative, moving towards ASC certification of farmed salmon.

Disease and feed

Arguably two of the most important issues when it comes to aquaculture are disease and sourcing feed. When disease rears its head it can cut into suppliers' profits, drive up prices and cast a

negative light on the industry as a whole. This often leads to media frenzy.

From infectious anemia in farmed salmon, to early mortality syndrome in farmed shrimp, these diseases pose a serious threat to the industry. But how can the industry prevent the spread of these diseases?

It starts with constant vigilance. If diseases are caught early, they can be controlled. If collective inaction occurs, the results can be catastrophic. These types of diseases often can't be avoided, but they can be managed. In any crop or any animal protein production system, there are diseases that farmers have learned to deal with. But somehow, in aquaculture the perception is that diseases are a symptom of the unsustainability of the production.



Photo: M Tlusty

Figure 8

Many diseases in the agricultural world such as swine flu, MERS or mad cow disease have the potential to affect human lives, yet there is not a demand to stop farming pigs, chickens or cattle.

Aquaculture is also often accused of feed inefficiencies. With finite resources of forage fisheries, can we reasonably expect to increase

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production of aquaculture products as needed? Aquaculture actually offers the most efficient use of the proteins and oils that can be directed into the feed industry.

When you create a protein, the food has to come from somewhere. In terms of global food security, this is a major point that needs to be addressed. Ideally, this food should not take from resources that can feed humans. Current innovation research is looking for ways around this, such as using bacteria or insect proteins as fishmeal. But human behavior also plays a part in this process. For instance, many people would simply refuse to eat fish grown on insect protein, even though in the wild, fish often feast on these types of food. This is part of the disconnect that occurs when people don't fully understand where their food comes from.

Tremendous strides have been made in developing alternative sources of proteins and oils for feed. In Kona, Hawaii, for the last eight years researchers have been looking at alternative diets for kampachi, a sashimi-grade fish. The goal of these studies is to serve as a type of litmus test to see if high product quality of sashimi-grade product can be maintained with alternative proteins. For several innovative feed formulations, there has been no discernible differences in product quality or growth parameters between fish fed the fishmeal-based diet, and those fed with soy-based diets. No discernible differences have been noted with the soy protein concentrate fed fish.



Figure 9

The goal is to translate these research advances into something that can be applied at a farm scale. To do that, the production systems for these oils and proteins need to be scaled up. There is, at present, no feed-grade production of soy protein concentrate established in the U.S. This makes it difficult to build an industry around this type of feed grade soy if there is no source of supply.

Moving forward, we should work to gain a better understanding of the physiology of the fish and as we get better with selective breeding to select strains of the species that are cultured that are more amenable to alternative proteins and oils. If you follow the trend in salmon over the last 30 years, there has been a major shift towards more agricultural proteins and oils, more inclusion of soy and other grains in the diet, with no real significant compromise in product quality. This serves as a good example of the potential of alternative feed.

Conclusion

Aquaculture is important and it's here to stay. It is a critical tool to create food globally and domestically. Aquaculture provides amazing growth benefits.

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Products like seaweed and shellfish are great examples of the benefits of aquaculture because they are easily produced and there are not a fed species, which means they have less environmental impact.

In order for aquaculture to be successful, we must rethink how products are being created. Some questions to consider are:

- What's the appropriate size?
- What's the appropriate species?
- How does all this compare to other proteins?

Ultimately, we need to be mindful of the waste we are creating. We can create the perfect seafood through aquaculture, but if we throw it away, it's worthless.

We need to do a better job farming the sea than we have done with the land. We have had huge environmental impacts, and we continue to have impacts through terrestrial agriculture. And we can actually learn from a lot of those impacts and figure out how to do aquaculture better.

Contributors

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Neil Sims is the cofounder of Kampachi Farms and Kona Blue Water Farms in Kailua-Kona, Hawaii. Neil is also the Founding President of the Ocean Stewards Institute - the open ocean aquaculture trade association.