



Lindgren-Pitman, Inc.

**Manufacturer of Monofilament and
Commercial Fishing Equipment**

- Primeline® Monofilament
- Duralume® Light Sticks
- Complete Longline Fishing Systems

2615 NE 5th Avenue, Pompano Beach, FL 33064

White Paper Submission for the Technology Innovation Program

Critical National Need:

OFFSHORE AQUACULTURE: A \$10 BILLION ECONOMIC OPPORTUNITY FOR THE U.S. HAS NOT CREATED \$1, NOW HAS FEDERAL GO-AHEAD, BUT ENGINEERING AND SCIENCE IS NOT COMPLETE.

Respectfully submitted by:

Peter Lindgren
President
Lindgren-Pitman, Inc.
(954) 943-4243
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Technology Innovation Program
National Institute of Standards and Technology
US Dept. Of Commerce
Via tipwhitepaper@nist.gov

Subject: TIP Critical National Needs Ideas

Dear White paper review members:

The U.S. imports \$9.6 billion in ocean seafood each year and this figure growing rapidly. Offshore Aquaculture is one of the fastest growing businesses in the world, except in the U.S.. Wild fish stocks are already strained and government forecasts indicate that only offshore aquaculture can fill the supply gap for the future.

The U.S. has the largest EEZ in the world at 3.4 million square miles and produces only \$1 billion in ocean aquaculture fish in state waters. In the 3.4 million square miles of federal waters, the U.S. has yet to farm a fish. A 1/10 square mile fish farm can grow \$8 million worth of fish at \$3 / lb per farm gate or about 2-3 times that retail value. This is not junk food; this is what doctors are recommending we incorporate into our diets. We now get most of this from imports. Again, we have 3.4 million square miles. The potential exists to eliminate the majority of imported fish and subsequent foreign trade offsets and possibly export seafood. Each \$10 billion of retail sales should create at least 20,000 jobs. No matter how conservative we calculate these numbers, the opportunities and benefits are undeniably huge and we have plenty of space to be environmentally sound.

The industry will need more science, improved efficiency, and public outreach to meet private and public goals. The infrastructure and access for this does not exist today.

Why has the U.S. not proceeded with aquaculture in federal waters? Here are just a few of the reasons:

1. No federal process exists to apply for permits.
2. No agreement exists on which agency would be in charge.
3. Environmental concerns.
4. High labor rates in the U.S.
5. Possibility of severe storms that can affect offshore sites.

September 3 and 4, 2009 has benchmarked the laying of the cornerstone for offshore aquaculture in the U.S. Federal waters. It has been determined that aquaculture is to be included under the Magnuson – Stevens Act and those departments within the DOC, NOAA, and NMFS will regulate ocean aquaculture. The Gulf of Mexico Council's proposed aquaculture plan has been accepted due to an intentional no comment 30 day clock out, making the proposal law by default. This was followed by an announcement to have a federal plan to be completed in months. This begins a new age with new problems and opportunities for fisheries and ocean management in the U.S..

However, there is still opposition from environmentalists and some of the fears are as follows:

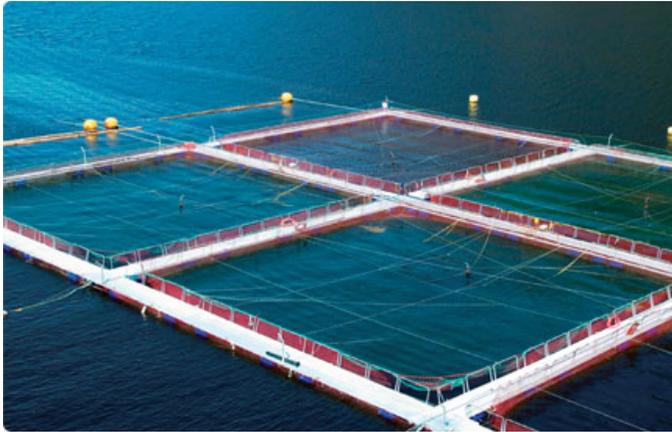
1. Fish meal supplies are unsustainable. Research indicates that this is not a near term problem, but it will certainly be a long term problem. We know that we can farm a fish with less fish than it takes to grow a wild fish. The correct balance of fish resources may create more table fish and more sport fish. Also, much is being done to feed fish from other sources. This is still an area that requires a lot of work.
2. Fish escapes will damage the environment. First, the fish has to get out of the cage and improved cage security is a worthy research topic. Indigenous fish are not a problem. Sterile fresh water fish have already been developed and this is a good hi-tech solution that needs further funding.
3. Disease in high density environment will spread to the wild and create problems. Another good area of study.
4. Environmentalists believe that by-products from hi-density cages will make a sewer of the ocean bottom. This has occurred before in areas with too much fish, too shallow water, too little current, and where overfeeding has occurred. Research needs to be done to document requirements for adequate sites and biodensity.
5. It's too rough in the Gulf of Mexico and hurricanes will destroy the cages and the fish will escape. Underwater cages have already survived hurricanes, but engineering is far from finished and these cages cannot be farmed efficiently. Better and more efficient infrastructure is needed in several areas. Automation, remote monitoring, reduced maintenance, and safety.
6. It is 10 – 70 miles offshore to the correct depths in the Gulf of Mexico and it's not efficient to farm there. More efficient systems need to be developed for this area.

Now that the federal government has promised a forth coming plan to permit aquaculture, there is a need to address the reality of having it in the U.S.. Aquaculture development in the U.S. more difficult than in other countries for several reasons, including lack of sheltered sites and rough open water, distance to ideal sites in the Gulf of Mexico, and high labor rates. There is a lot of work to be done in science and engineering.

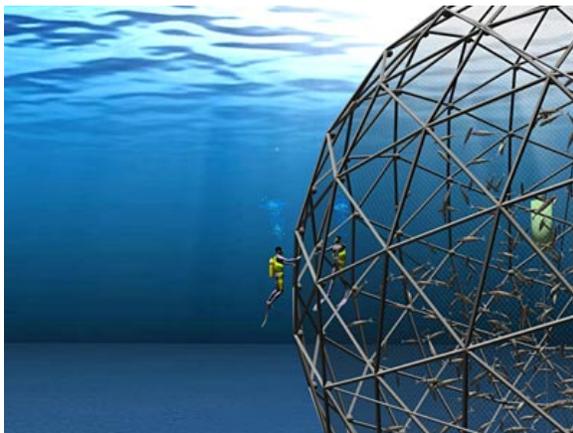
Equipment Concerns:

Ocean cages are generally of two types: floating and underwater. The most common are floating cages because they are low cost, however they use cheap netting with antifouling, and are not hurricane proof. They are designed for sheltered and near shore applications. Large floating cages are not likely to work in the Gulf of Mexico because of the risk of total loss from severe storms. Underwater cages are a relatively new development and are very durable, but more expensive.

Worldwide fish farms have been under development for a long time. Most of them consist of a floating arrangement in a rectangle of dock type segments or one or more large polyethylene pipes in a big circle with netting underneath. Improvements have been in lower cost and better durability, as farms are forced further offshore because of lack of sheltered sites. Shown next are floating cages suitable for sheltered and calm water. These cages are cost effective, but will not survive hurricanes.



The second type of ocean cages is the underwater cage. They can be surfaced if necessary, but industry developments are making this unnecessary. The company, ETI, in Washington State manufactures harvesting and feeding equipment for underwater cages. Offshore underwater cages are not at risk from large waves, storms, birds, and human predators. Both Ocean Spar in Washington State and Ocean Farm Technologies in Maine have developed cages that have survived hurricanes without loss. Underwater cages are likely to be used in the Gulf of Mexico and other parts of the U.S. because of the limited sheltered sites available and the public's resistance to having ocean farming visible in their back yard. The Gulf of Mexico is of course in the Hurricane Belt, as well as other U.S. territory sites. Another advantage of offshore cages is ocean currents help disperse fish waste and opportunities for reducing farm density with additional space has environmental advantages for fish waste products and disease control. The U.S. has one significant advantage: 3.4 million square miles of space to choose from.



Aqua Pod Cage



Small Ocean Spar Cage

Notice the small Ocean Spar Cage underwater cage has growth on the netting. This greatly increases the risk of disease, inhibits water flow and fish growth, and increases anchoring stress. These cages are now cleaned by hand. This will not be efficient enough to be competitive with foreign producers. Automated cleaning must be developed. Also safer antimicrobial materials and easier cleaning structures and net or screen fish barriers.

The potential for offshore aquaculture in the U.S. is huge economically and socially. Today many imports of fish are labeled improperly and sold fraudulently as another species. We not only do not know what we are eating, but under what conditions it was raised. Imported fish are often grown under unknown and suspicious conditions. We can only control what we do in the U.S. and we have a huge enviable untapped offshore potential.

There are programs under the DOC such as NOAA, NMFS and Saltonstall – Kennedy and SBIR that have funded many projects. Development has been very good on a trivial scale. The potential is for healthier food, billions in economic development, tens of thousand of jobs, and billions in trade offset. The new jobs created will be numerous and highly varied. The development of offshore farming will require engineers, divers, maintenance workers, boats, captains, processors, salesman, managers, truck drivers and on. Current funding opportunities are only a few hundred thousand dollars a year because of other priorities. Can we really expect so much from so little? Offshore aquaculture has huge potential and some expensive problems that need to be taken care of now. Please assist to make this huge potential a reality by funding more science and engineering for offshore aquaculture more aggressively and ASAP.

Sincerely,

Peter Lindgren
Lindgren -Pitman, Inc.
2615 NE 5th Avenue
Pompano Beach, FL 33064
(954) 943-4243

References for this White Paper:

1. Offshore Aquaculture in the United States: Economic Considerations, Implications and Opportunities. July 2008. U.S. Department of Commerce
2. World Review of Fisheries and Aquaculture
3. Overcoming Technical Barriers to the Sustainable Development of Competitive Marine Aquaculture in the United States. October 2009. NOAA.