SESSION C – SOME INTERNATIONAL BIRD'S-EYE VIEWS

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OYSTERS IN CHESAPEAKE BAY: A THIRTY-YEAR RETROSPECTIVE ON THE PATH TO RECOVERY

Mark W. Luckenbach
Virginia Institute of Marine Science
College of William & Mary
Gloucester Point, VA 23062
luck@vims.edu

The decline of the oyster population and collapse of the fishery that it supported in Chesapeake Bay during the 20th Century are well documented and ascribed to overfishing, habitat degradation and disease. Over the past quarter century improvements in fisheries management, active oyster restoration and the emergence of oyster aquaculture have reversed this trend. Oyster landings from both the capture fishery and aquaculture are increasing, most prominently in high salinity disease-endemic areas. During this period, well over a hundred million U.S. dollars have been spent on a wide range of restoration and aquaculture development efforts. These efforts have included planting of shell and alternative substrates, transplanting of wild oysters, planting of hatchery-produced oysters on reefs, implementing more stringent harvest restrictions, establishing sanctuaries, breeding oysters for disease tolerance and fast growth, developing triploid technology, investigating the potential of introducing a non-native oyster species, revising leasing policies, and engaging a more diverse group of stakeholders in oyster restoration. Some of these efforts have proven fruitful; others have not. A review of these activities and their effectiveness provides context for moving forward with oyster restoration and fishery development in the Chesapeake Bay and beyond.

ADVANCES AND CHALLENGES FOR OYSTER CULTIVATION IN SWEDEN

Susanne Lindegarth*, Linnea Thorngren Matsson, Thomas Holthuis Dunér, Agnes Faxén, Mats Lindegarth, Alyssa Joyce and Åsa Strand

Address: Dept. of Biology and environmental Sceinces, University of Gothenburg, Sven Lovén Centre Tjärnö, S-452 96 Strömstad, Sweden.

*corresponding author: susanne.lindegarth@bioenv.gu.se

The native oyster *Ostrea edulis* occurs along the west coast of Sweden. Since 2006, the pacific oyster *Crassostrea gigas* has established wild populations and is widely distributed in shallow areas. There are small-scale fisheries by divers and about 60 tons of *O. edulis* and 20 tons of *C. gigas* were landed in 2014. The consumer demand far exceeds domestic production, and about 300 tons of oysters are imported to Sweden each year. As a result, there is a strong industrial interest to begin oyster farming. Many factors support development of shellfish aquaculture in Sweden including proximity to European markets, excellent physical and environmental characteristics, and nutrient-rich waters promoting high growth rates. Experimental work suggests that oysters may reach a marketable size within 18 months in some areas. Absence of *Bonamiosis* and *Marteiliosis* and generally pollution-free waters are also key production and marketing factors. Effective seafood safety monitoring programs are already in place and are currently used in quality assurance for blue mussels. Also, recent mapping of suitable locations indicates great opportunities for establishing farms. A major challenge however is to secure seed production for grow-out. A hatchery was established in 2006 but has had consistent problems with survival of larvae in *O. edulis*. Recent work using spat collectors in the field suggest that this method can be successfully used for spatfall of larvae of both oyster species and is a promising alternative to hatchery production. Farming of *C. gigas* is, however, currently not allowed as it is regarded as a non-native and invasive species for Sweden – further details are discussed in the paper.

DEVELOPMENT OF ALTERNATIVE OYSTER FARMING ZONES IN LOUISIANA

John Supan*
Louisiana Sea Grant College Program
Louisiana State University
Baton Rouge, LA 70803
jsupan@lsu.edu

Coastal land loss and sea level rise has greatly impacted oyster public and private oyster reefs and the environmental services they provide. This has resulted in a nearly 80% loss of oyster resources in Louisiana over the past 10 years. This has created severe hardship in coastal communities, since oyster production is a critical stimulus to state's coastal economy. There is a need to stabilize oyster production to provide more consistent business opportunity and ecosystem services

A well-planned and administered marine enterprise zone for oyster farming can circumvent user conflicts, navigation, security, and liability issues that may otherwise hinder the aquacultural use of coastal waters. Marine spatial planning can help identify ideal locations for such zones in cooperation with local and state government.

A plan to implement intensive (off-bottom) oyster culture was implemented in 2010 as the rationale of supporting hatchery-based oyster production. The 2012 Louisiana Legilsature passed Act 293, which authorized Alternative Oyster Culture (AOC) with the use of the water column and surface over existing oyster leases, including spatial planning to reduce user conflict. Act 583 authorized the Grand Isle Oyster Farming Zone, 10 hectares of public waters for expressed use of alternative oyster farming, where commercial harvest has begun using floating cage culture. The zone encourages entrepreneurship, foster new oyster farming businesses, and serves as an AOC demonstration site, under the authority of the Grand Isle Port Commission. These legislative acts serve as an impetus for commercialization of hatchery-based sustainable oyster farming in Louisiana.

FUTURE FOR OYSTER HATCHERIES IN CENTRAL-VIETNAM : EXPERIENCE FROM THE BELGIAN-VIETNAMESE VLIR-PROJECT

Nancy Nevejan[1*], Bay Phung[1,2], Quach Thi Khanh Ngoc[3], Peter Bossier[1]

[1]Laboratory of Aquaculture & Artemia Reference Center, Ghent University, Rozier 44, B-9000 Gent, Belgium (Nancy.Nevejan@Ugent.be)

[2]Research Institute for Aquaculture no.3, 33 Dangtat, Nhatrang, Vietnam

[3]Faculty of Economics, Nha Trang University, Vietnam

Oyster aquaculture has only recently emerged in Central Vietnam despite its potential. Although a minor activity in terms of production compared with shrimp and fish farming in the region, it contributes significantly to the food security and poverty alleviation of local coastal communities.

Four years ago, the Flemish Interuniversity Council (Vlir), Belgium, decided to support the Research Institute for Aquaculture No3 in Nha Trang, Vietnam in their endeavour to build a bivalve hatchery for production purposes and as a tool to further develop the academic skills of the staff of the Mollusk Research Division.

The major achievements of the project “Ensuring bivalve seed supply in Central Vietnam” (2011-2015) will be presented. The constraints for the development of bivalve aquaculture in Central Vietnam as identified during the project will be reviewed, using amongst others the highlights of a preliminary market study. Some strategies will be brought forward to ensure a continuous production of oyster and otterclam seed at RIA No3 beyond the project and to share the acquired know-how with farmers and other research institutes in Vietnam and abroad.

Title: Overcoming stagnation in EU aquaculture production; the challenge of getting tenure for oyster farmers in the UK.

Jonathan King

The European Union's strategy is to increase aquaculture production, reducing dependence on imports. This is reflected in the UK via its devolved governments' strategies. The reality of the situation is one of stagnation with production in the EU flat since 2000, compared with global growth of 7% per year. UK oyster production reflects this with just 120 tons of Pacific oysters (*Crassostrea gigas*) and 110 tons of flat oysters (*Ostrea edulis*) produced in 2012, a fraction of historic production levels. The difference between ambition and reality is largely because aquaculture must comply with EU regulations relating to integrated coastal zone management and sustainability. In England and Wales this has resulted in great difficulties approving new Fishery Orders, at present the application process can take many years and even renewal of existing Orders is challenging so the number is in fact decreasing. When assessing the potential environmental impact of a new oyster farm evidence gaps, particularly in the case of the non-native Pacific oyster, need to be filled to avoid the implementation of the precautionary principle and subsequent refusal of an application, and if the licencing time for Fishery Orders is to speed up to commercially realistic rates. In support of this the EU-funded SEAFARE project undertook research on the potential impacts of Pacific oyster farming, whilst separately evidence submitted to support an Appropriate Assessment for a Fishery Order application in North Wales examined the risks to a specific protected area and a management plan was developed.

PERSPECTIVES ON OYSTER AQUACULTURE IN JAPAN

Katsuyoshi Mori
The Foundation of Oyster Research Institute, Futaba Bldg.,31-5
Nakayama-minami, Sanezawa, Izumi-ku, Sendai, Miyagi 981-3217, Japan
office@worldoyster.org

The natural seed oysters (*Crassostrea gigas*) from Miyagi Pref., Japan were transplanted on a massive scale to USA from 1923 to 1978 (except 1941-1945) by ship and to France from 1965 to 1980 by airplane, because of their strong resistance to environmental changes, high fertility and high growth rate. Nowadays, ca. 55% of the oyster production in the world is a descendant of the Miyagi oyster species, meaning that it has come to be a “cosmopolitan oyster species” both nominally and actually.

Sendai Bay, Miyagi Pref., one of the most famous natural seed oyster collection area not only nationwide but also worldwide as well, consists of 3 bays, namely, Matsushima Bay, Ishinomaki Bay and Mangoku-Ura. Each bay has each different trophic level and water temperatures particularly from late spring to early autumn. Due to these different environmental conditions, soft-body growth and gonad formation in the oyster proceed much more rapidly in Matsushima Bay than in Mangoku-Ura. The process of these biological phenomena in Ishinomaki Bay mediates between the other 2 bays. These facts suggest that there are different types of natural oyster parent populations and then many chances of their natural genetic mixing, leading to the biologically important “species biodiversity” of the Miyagi oyster species. To sum up, the reasonable combination of different environmental characteristics of 3 bays has led to maintaining of genetic diversity and hence, the great success in natural seed oyster collection in Sendai Bay. That is why we do not need so-called hatchery system (or artificial land nursery system) that has been used in USA, France, Australia, etc. *“Nature is the best for maintaining both biodiversity and resilience of oyster species!”(K. Mori, WOS).*

Taking all of the perspectives on oyster aquaculture in Japan into consideration, there are several issues that should be faced up to. For example, 1) To maintain remarkable features of the Miyagi oyster, *C. gigas* ; 2) To protect the oyster industry in Japan from devastating mortality caused by oyster herpes, OsHV-1μVar, very specific for *C.gigas*.