4-2012

Electrochemical Characterization of the Shell of the Eastern Oyster, Crassostrea Virginica

Yuhchae Yoon
Andrew S. Mount
Karolyn Hansen
University of Dayton, khansen1@udayton.edu
Douglas C. Hansen

Follow this and additional works at: https://ecommons.udayton.edu/bio_fac_pub
Part of the Biology Commons

eCommons Citation
Yoon, Yuhchae; Mount, Andrew S.; Hansen, Karolyn; and Hansen, Douglas C., "Electrochemical Characterization of the Shell of the Eastern Oyster, Crassostrea Virginica" (2012). Biology Faculty Publications. 25.
https://ecommons.udayton.edu/bio_fac_pub/25

This Conference Paper is brought to you for free and open access by the Department of Biology at eCommons. It has been accepted for inclusion in Biology Faculty Publications by an authorized administrator of eCommons. For more information, please contact frice1@udayton.edu, mschlangen1@udayton.edu.
Mead and is valuable for understanding mussel population dynamics and ecosystem impacts that is critical for enhancing resource management.

CHROMOSOMAL SET MANIPULATION OF THE CHINESE SHRIMP, *FENNEROPENAEUS CHINENSIS*.
Jianhai Xiang, Fuhua Li, Yusu Xie, Chensong Zhang, Shihao Li, Linghua Zhou.
Institute of Oceanology, Chinese Academy of Sciences, 7 Nanhai Road, Qingdao, Shandong, 266071, China.

Using temperature shock (hot or cold) and/or chemical shock (CB, or some new chemical with lower toxicity and high efficiency) to induce triploidy Chinese shrimp, *Fenneropenaeus chinensis*, which is an important commercial species in China, in some cases 100% triploidy could be obtained. We discovered the female/male ratio was 4:1 in the triploidy population instead of the ratio 1:1 in normal population. Also, comparative studies on meiosis behavior of spermatocytes between diploid and triploid males were carried out by synaptonemal complex (SC) analysis. To identify key molecular changes involved in ovary of triploid shrimp, two subtracted cDNA libraries between triploid and diploid shrimp were constructed using suppression subtractive hybridization (SSH) technique. To further dissect exact gene functions for gonad development of shrimp, three significantly differentially expressed genes between diploid and triploid ovary, PCNA (proliferating cell nuclear antigen), CAS/CSE1 (cellular apoptosis susceptibility protein/chromosome segregation and SSRF (spermatogonial stem-cell renewal factor) were characterized by full-length cloning, qRT-PCR, in situ hybridization or prokaryotic expression.

IDENTIFICATION OF A NOVEL METAL BINDING PROTEIN IN OYSTER PLASMA.
Qinggang Xue1, Julie Gauthier2, Kevin Sehey3, Yanli Li1, Rosalie Anderson2, Jerome La Peyre1.
1 Louisiana State University Agricultural Center, Louisiana State University, Baton Rouge, LA, 70803, USA.
2 Loyola University, New Orleans, LA, 70118, USA.
3 Vanderbilt University, Nashville, TN, 37240, USA.

The second most abundant protein of eastern oyster plasma is conserved. Its function is currently being investigated.

THE QUANTIFICATION OF THE POTENTIAL SPAWNING CONTRIBUTION FROM THE RESTORED OYSTER (*CRASSOSTREA VIRGINICA*): A COMPARATIVE STUDY AMONG RESTORATION SITES AND SUBSTRATES IN COASTAL ALABAMA.
Nan Yao, William Walton.
Auburn University, 150 Agassiz St., Dauphin Island, Alabama, 36528, USA.

Numerous ecosystem services of oyster reef restoration have been documented. But the service that the oyster reef putting in an increasing larvae has not been previously quantified. In this study, we selected 4 restoration sites in coastal Alabama (Billy Gout Hole, Alabama Port, Coffee Island & Little River Bay areas) with 6 different substrates (Reef Balls, Reef Blocks, bagged oyster shell, loose oyster shell and 2 types of WADs). In 2011, we sampled the oysters monthly during the presumed reproductive season (June to November), dividing the oysters into 2 size classes, with up to 30 oysters collected per size class per sampling. Oysters were sexed by microscopic examination of the gonad, and the number of eggs per female was estimated using the method of Cox & Mann (1992). There were clear differences among the sites across the season. Differences among substrates are currently being analyzed and will be presented. The annual potential spawning contribution of each of the restoration sites will be estimated, compared and discussed.

ELECTROCHEMICAL CHARACTERIZATION OF THE SHELL OF THE EASTERN OYSTER, *CRASSOSTREA VIRGINICA*.
Yuhchae Yoon1, Andrew S. Mount2, Karolyn M. Hansen3, Douglas C. Hansen1.
1 University of Dayton Research Institute, Dayton, OH, 45469, USA.
2 Clemson University, Department of Biological Sciences, Clemson, SC, 29634, USA.
3 University of Dayton, Department of Biology, Dayton, OH, 45469, USA.

The valves of the eastern oyster (*Crassostrea virginica*) are composed of multiple mineralized layers. Valve closure forms an effective barrier to incursion by surrounding water. The material...
properties of shell were investigated to determine the effects of shell thickness, valve orientation, and shell layer composition on the electrochemical behavior using electrochemical impedance spectroscopy (EIS), potentiodynamic polarization, and scanning electron microscopy-energy dispersive spectroscopy (SEM-EDS). Microscopic analysis confirmed that the multilayered shell material is composed of calcium carbonate (CaCO₃) in all layers (prismatic, foliated, chalky) and that material density and elemental composition varied between foliated and chalky layers. EIS measurements in 3.5 wt% NaCl indicated that the impedance of the whole oyster shell in the low frequency region exhibited high impedance values (high resistance). Electrical current transit through the shell valve increased when the outer layers of the shell were sequentially removed by grinding (decreased shell thickness) while impedance (resistance) values were shown to decrease with decreasing shell thickness. These findings suggest that the presence of prismatic (outermost) shell layer in combination with the organic matrix between all shell layers may influence the electrochemical parameters and ionic conductivity through the oyster shell.

PERFORMANCE AND GENETIC VARIATIONS FOR BACKCROSS PROGENIES OF SMALL ABALONE.
Weiwei You, Caihuan Ke, Xuan Luo.
Xiamen University, Zengchengkui Building, Xiamen University, Xiamen, Fujian, 361005, China.

Haliotis diversicolor is a commercially important species cultured along the coast of southern China. “Dongyou No.1” small abalone, which was conferred for “new species certificate” by Ministry of Agriculture, has been proved for excellent disease-resistant ability and was large-scale produced in China. It was created by crossbreeding between Japan (as male) and Taiwan (as female) population of small abalone. In this research, “Dongyou No.1” was backcrossed with Japan and Taiwan population, respectively. But growth and survival for reciprocal backcross progenies were significantly different. Reciprocal backcrossing with Taiwan population, survival rate for the experimental groups were decreasing significantly, while production performance was improved when backcrossing with Japan population. Japan population was then selected as recurrent parents for grading cross with Taiwan population. Survival rate of F₃ (83.4%) progenies were higher than that of F₂ (77.6%) and F₁ (71.4%) at grow-out stage. Genetic variation for backcross progenies from different populations were also studied in this study by microsatellite markers.

ECODYNAMIC SOLUTIONS FOR THE PROTECTION OF INTERTIDAL HABITATS: THE USE OF OYSTER REEFS.
Tom Ysebaert¹, Brenda Wallès¹, Christian Dorsch¹, Jasper Dijkstra², Karin Troost¹, Nicolette Volp³, Bram Van Prooijen², Mindert De Vries², Peter Herman³, Anneke Hibma³.
¹ IMARES – Institute for Marine Resources & Ecosystem Studies, Korrinaweg 5, Yerseke, Zeeland, 4400 AC, The Netherlands.
² Deltares, P.O. Box 177, Delft, Zuid-Holland, 260 MH, The Netherlands.
³ Delft University of Technology, P.O. Box 5048, Delft, Zuid-Holland, 2600 GA, The Netherlands.
4 Royal Netherlands Institute for Sea Research, Korrinaweg 7, Yerseke, Zeeland, 4401 NT, The Netherlands.
5 Van Oord Dredging and Marine Contractors BV, P.O. Box 8574, Rotterdam, Zuid-Holland, 3009 AN, The Netherlands.

Ecosystem engineering processes are relevant to many environmental problems and management concerns. Within the program “Building with Nature” (www.ecoshape.nl) we investigate the use of bivalve reefs as ecodynamic measures to protect tidal flats against erosion, which poses a serious problem in the Oosterschelde estuary (Netherlands). Bivalve reefs are ecosystem engineers that influence tidal flow and wave action and therefore modify sediment transport patterns. The development of such infrastructural solutions that aim for an integration with the natural environment can only be achieved through experimentation and learning-by-doing. Artificial oyster reefs were constructed in different erosional intertidal environments in the Oosterschelde. Reefs consist of gabions filled with oyster shells (Crassostrea gigas), offering a stable substrate that allows for the settlement of oysters, while minimizing shell loss. Monitoring results indicate that artificial reefs can develop into self-maintaining, living oyster reefs which stabilize tidal flats. Site-specific effects in reef development (e.g. recruitment of oyster larvae) and in sediment dynamics were observed. Knowledge about local hydromorphological conditions and a thorough understanding of the ecosystem engineering properties and habitat requirements of C. gigas are needed to implement this concept in management practices. We present the concept, monitoring and modeling results and derive design rules from these.

TRANSCRIPTOMIC ANALYSIS OF CRASSOSTREA HONGKONGENSIS REVEALS MOLECULAR TOLERANCE MECHANISMS TO WIDE RANGE OF SALINITY FLUCTUATION.
Ziniu Yu, Yang Zhang, Ying Tong, Xiaoyu Kong.
South China Sea Institute of Oceanology, 164 W Xingang Rd., Guangzhou, Guangdong, 510301, China.

Crassostrea hongkongensis is an economically important aquaculture species inhabiting in estuary where salinity fluctuates significantly with tide cycle and variable freshwater input. Physiological tolerance to acute salinity variation guarantees the oyster’s