

首届中国（乳山）牡蛎国际高峰论坛

会议安排及报告简介

二〇一八年四月二十一日

中国 · 乳山

会议主题：

牡蛎产业可持续性与食用安全保障

会议主席：

张国范 研究员 中国科学院海洋研究所

郭希明 教授 Rutgers University, USA

首届中国（乳山）牡蛎国际高峰论坛

会议日程

会议时间：2018 年 4 月 21 日报到；22 日-23 日会议

会议地点：乳山市华玺大酒店

日 期	时间与地点	会议内容	主持人
4 月 22 日	08:30-09:40 3 楼国际 会议中心	开幕式	
	08:30-09:40	1、播放乳山市情宣传片（双语）； 2、请市委副书记、市长宫本杲同志致辞； 3、请国家贝类产业技术体系首席科学家张国范 致辞； 4、请威海市政府领导（待定）致辞； 5、请山东省海洋与渔业厅副厅长姜青春致辞； 6、请农业农村部渔业渔政管理局副局长李书民 同志致辞； 7、中科院海洋所与乳山市政府签订战略合作协 议（李超伦、宫本杲）； 8、请农业农村部渔业渔政管理局副局长李书民 同志和乳山市委书记周兵同志为“中国（乳山） 牡蛎国际高峰论坛”永久会址揭牌； 9、请中科院海洋研究所副所长李超伦同志和乳 山市委副书记、市长宫本杲同志为“中国（乳山） 牡蛎产业研究院”揭牌；	孔祥雷
	09:40-15:30 3 楼国际 会议中心	大会报告	
	09:40-10:10	美国牡蛎养殖产业介绍 Maria Haws, Ximing Guo（美国）	郭希明

	10:10-10:40	法国的牡蛎养殖 Aude Jouaux（法国）	
4 月 22 日	10:40-11:10	英国牡蛎养殖产业历史、现状及发展方向 Janet Brown（英国）	郭希明
	11:10-11:40	澳大利亚牡蛎养殖的历史、现状和未来 Michael Dove（澳大利亚）	
	11:40-12:10	韩国的牡蛎（ <i>Crassostrea gigas</i> ）养殖产业现状 Kwang-Sik Choi（韩国）	
	12:10-13:30 1 楼瑞尚阁 自助餐厅	自助午餐	
	13:30-13:50	中国牡蛎产业现状及发展态势 张国范	王晓通
	13:50-14:10	牡蛎产业进入提质增效新时期 崔 和	
	14:10-14:30	如何助力把中国牡蛎打造成高端农业品牌 杨维龙	
	14:30-14:50	牡蛎产品质量安全现状与工作思路 翟毓秀	
	14:50-15:10	中国牡蛎的主要消费形式和未来发展趋势 秦小明	
	15:10-15:30	牡蛎设施养殖工程的研究与应用进展 刘 鹰	
	15:30-15:50	会间休息	
	15:50-18:00	分论坛报告	
	15:50-18:00 3 楼国际会议中心	分论坛 I: 牡蛎产业自由讨论会	崔 和
	15:50-18:00 2 楼国宴厅	分论坛 II：分组洽谈交流	
	15:50-18:00 3 楼国宾厅	分论坛 III：遗传与育种专题讨论	
	15:50-16:05	法国长牡蛎大规模死亡原因及通过选育和产业实践缓解大规模死亡的介绍 Pierre Boudry（法国）	
	16:05-16:30	牡蛎的表观遗传变异及其对水产养殖的启示 Steven Robert（美国）	

	16:30-16:45	Oyster whole-genome resequencing aiming to GWAS of nutritional contents and breeding 李 莉	
4 月 22 日	16:45-17:00	香港牡蛎的遗传与育种 喻子牛	Ximing Guo, Michael Dove
	17:00-17:15	福建牡蛎的遗传与育种 柯才焕，曾志南	
	17:15-17:30	全球气候变化下牡蛎幼虫的适应性 Rajan（香港）	
	17:30-17:45	190K 牡蛎 SNP 芯片的设计与应用 亓海刚，呼锐	
	17:45-18:00	关于牡蛎基因组、遗传与育种的讨论 Ximing Guo, Michael Dove（美国）	
	18:30-3 楼华玺宴会厅	晚 餐	
4 月 23 日	09:00-12:00	乳山牡蛎产业现场考察、商业讨论及商业活动、牡蛎品鉴	
	12:00-13:30 3 楼华玺宴会厅	午 餐	
	13:30-17:00 3 楼国际会议中心	分论坛 IV：乳山牡蛎产业发展专题论坛 大会闭幕	王晓通
	18:00-20:00 1 楼瑞尚阁自助餐厅	自助餐	

China International Oyster Forum

Forum Manual

Organized by

Modern Agro-industry Technology Research System (CARS-49)

China (Rushan) Insititute of Oyster Technology

Co-organized by

Institute of Oceanology, Chinese Academy of Sciences

China Shellfish Association, CAPPMA

Supported by

ZHONGJINGGUOTAI Holding Group Co. Ltd

Qingdao Frontier Ocean Seed Company Ltd.

Oyster Association of Rushan

April 21-23, 2018

Rushan

Global oyster farming and trade have grown significantly in recent years. The growth is fueled by strong consumer demand and innovations in aquaculture production systems. Consumption of raw oysters are rising in many countries including China. However, climate change and environmental degradation are threatening the sustainability of oyster farming and the safety of human consumption. Managing farming sustainability and food safety require global dialogue as increasing amounts of oysters are traded internationally. China with an annual production of 4.6 million tons leads the world in oyster production and still, oysters imported from France, Australia, and US dominate raw oyster market in China. Rushan is one of the most important oyster production areas in China, and the Rushan International Oyster Forum hopes to bring leaders in oyster research, aquaculture and management from all major production countries to the home of Chinese oysters for an engaging exchange on issues facing the global oyster industry. The forum will focus on farming sustainability and food safety with topics covering status of oyster aquaculture, production systems, breeding technologies, environmental monitoring, harvest, processing, marketing and food safety issues.

Forum Chairs

Prof. Guofan Zhang (Co-Chair), Chinese Academy of Sciences, China

Prof. Ximing Guo (Co-Chair), Rutgers University, USA

Theme

Farming Sustainability and Food Safety

Time

April 21-23, 2018

Place:

Huaxi Hotel, Rushan, Shandong, China

28 Shengli Street, Rushan, Shandong, China

Participants

350 representatives from government, research institutes, universities and oyster seed production, aquaculture, processing and trade enterprises.

Invited speakers

1	Dr. Pierre Boudry Professor, Head of Research Unit Ifremer RBE-PFOM, Associate Director UMR 6539 LEMAR
2	Dr. Janet Brown Professor, Editor, The Grower Newsletter of the Association of Scottish Shellfish Growers
3	Dr. Kwang Sik Choi, Professor, School of Marine Biomedical Science, Jeju National University
4	Dr. Michael Dove Senior Scientist, NSW Department of Primary Industries Fisheries NSW Port Stephens Fisheries Institute
5	Dr. Ximing Guo Professor of Marine and Coastal Sciences, HSRL, Rutgers University
6	Dr. Maria Haws Director, Pacific Aquaculture and Coastal Resources Center (PACRC) Associate Professor of Aquaculture, University of Hawaii Hilo
7	Dr. Aude Jouaux, Chargée de mission aquaculture, Direction de l'Agriculture et des Ressources Marines, Région Basse-Normandie

8	Dr. Steven Roberts, Kenneth K. Chew Professor of Aquaculture, School of Aquatic and Fishery Science, University of Washington, US
9	Dr. Vengatesen Thiyagarajan Associate professor, Swire Institute of Marine Sciences and School of Biological Sciences, University of Hong Kong
10	Dr. Guofan Zhang Senior Scientist / Professor, Institute of Oceanology, Chinese Academy of Sciences
11	Dr. He Cui President, China Aquatic Products Processing and Marketing Alliance
12	Dr. Yuxiu Zhai Senior Scientist / Professor, The Yellow Sea Institute of fisheries, China Academy of Aquatic Sciences
13	Mr. Weilong Yang Former President, Yangcheng Lake hairy crab Association
14	Dr. Xiaoming Qin Professor, Guangdong Ocean University
15	Dr. Ying Liu Professor, Dalian Ocean University

Forum Schedule

Rushan Forum Program: Apr. 22nd (08:30-15:30, International Conference Hall, 3rd Floor)		
08:30-09:40	Speaker	Open Ceremony
09:40-10:10	Maria Haws, Ximing Guo	Oyster aquaculture in the US
10:10-10:40	Aude Jouaux	Oyster aquaculture in France
10:40-11:10	Janet Brown	Oyster aquaculture in UK, its history, current situation and future directions
11:10-11:40	Michael Dove	Oyster aquaculture and breeding in Australia
11:40-12:10	Kwang-Sik Choi	Oyster aquaculture in Korea
12:10-13:30	Lunch (Resun Court Café, 1 st Floor)	
13:30-13:50	Guofan Zhang	Oyster aquaculture in China
13:50-14:10	He Cui	Current status and prospectives of oyster trade in China and worldwide
14:10-14:30	Weilong Yang	How to help Chinese oyster to become a high-end agricultural brand?
14:30-14:50	Yuxiu Zhai	Quality and safety of oyster product and future directions
14:50-15:10	Xiaoming Qin	Main consumption patterns and future development trends of oyster in China
15:10-15:30	Ying Liu	Oyster Facility Aquaculture System: Current application and prospects
15:30-15:50	Coffee Break	
15:50-18:00	Workshop I	Free discussion on oyster farming industry (International Conference Hall, 3rd Floor)
	Hosts	He Cui (CAPPMA), Guofan Zhang (IOCAS)

	Guests	Speakers: Janet Brown, Maria Haws, Aude Jouaux
		Speakers: Weilong Yang, Yuxiu Zhai, Xiaoming Qin, Ying Liu
15:50-18:00	Workshop II	Commercial Workshop (Guoyan Hall, 2nd Floor)
15:50-18:00	Workshop III	Workshop on Genetics and Breeding (Guobin Room, 3rd Floor)
	Hosts	Ximing Guo and Michael Dove
15:50-16:05	Pierre Boudry	Oyster genetics and breeding in France
16:05-16:30	Steven Robert	Epigenetic variation in oysters and implications for aquaculture
16:30-16:45	Li Li	Oyster whole-genome resequencing aiming to GWAS of nutritional contents and breeding
16:45-17:00	Ziniu Yu	Genetics and breeding of Hong Kong oyster
17:00-17:15	Caihua Ke, Zhinan Zeng	Genetics and breeding of Fujian oyster
17:15-17:30	Vengatesen Rajan	Oyster larval adaptation to global climate change in China
17:30-17:45	Haigang Qi, Rui Hu	The oyster 190K SNP array: Design and application
17:45-18:00	Ximing Guo, Michael Dove	Discussions on oyster genomics, genetics and breeding
18:30-20:00	Oyster feast（Huaxi Hall, 3 rd Floor）	
Rushan Forum Program: Apr 23rd		
08:30-12:00	Field Trip and Oyster Tasting	
12:00-13:30	Lunch（Huaxi Hall, 3 rd Floor）	
13:30-18:00	Special session for local oyster industry and ceremony of International Oyster Town（International Conference Hall,3rd Floor） Close Ceremony	

特邀报告专家介绍

Introductions of the Invited Speakers

Pierre Boudry 教授，1994 年开始从事牡蛎相关研究，现为法国海洋开发研究院海洋鱼类及贝类生理学研究组负责人。他同时还是法国 LEMAR 实验室的副主任。LEMAR 实验室是由法国国家科学院、布雷斯特大学、法国发展研究院和法国海洋开发研究院四方共建的联合实验室，目前拥有超过 120 名固定职员，致力于海洋环境科学研究。他现任《水生生物资源》期刊的主编，同时还是《水产养殖》和《中国海洋湖沼学报》期刊编委会的成员。1998 年至今，他在国际海洋考察理事会下属渔业和海水养殖遗传应用工作组任法方代表。布德利博士的研究多集中在牡蛎养殖领域，已发表论文 140 余篇，是国际牡蛎研究领域成果最多的科学家（据近期的一项文献统计分析）。



摘要：

法国长牡蛎大规模死亡原因及通过选育和产业实践缓解大规模死亡的介绍

Pierre Boudry

法国海洋开发研究院，邮箱：pboudry@ifremer.fr

法国的牡蛎产业一直饱受牡蛎疾病困扰，持续的疾病造成了本地的欧洲平牡蛎（*Ostrea edulis*）大幅减产，也迫使人们引进长牡蛎来代替原来的葡萄牙牡蛎。2008 年以来，牡蛎疱疹病毒的变种“ μ var”开始大规模感染法国的长牡蛎幼虫，导致长牡蛎患上“长牡蛎死亡综合症”，并引起了长牡蛎的大规模死亡。“长牡蛎死亡综合症”传播极快且已波及全法牡蛎养殖区。雪上加霜的是，2011 年以来，受弧菌影响，成体长牡蛎的死亡率也开始增加。而不同种弧菌在致病力方面差异很大，这也给弧菌防控工作带来了严峻的挑战。

在此背景下，法国海洋开发研究院启动了多项研究项目，旨在找到引起牡蛎大规模死亡的生物和非生物因子。我们业已开发出能够追溯病原体、分析其遗传多样性和致病力分子基础的分子诊断工具。为了搞清楚环境因子（如温度、酸碱

度和盐度)对牡蛎大规模死亡的影响,我们采取了多种研究方法,包括:(1)受严密控制的病原体感染操作流程;(2)基于未染病和染病牡蛎的共栖息关系的生态学手段;(3)对“长牡蛎死亡综合症”重灾区的水域监控。目前,我们已在牡蛎稚贝中,找出了病原体感染和宿主免疫响应的时间动态变化规律。我们发现,牡蛎疱疹病毒会迅速影响牡蛎淋巴细胞的活力,而受影响的淋巴细胞难以再抵御细菌感染,导致稚贝极易染病死亡。值得注意的是,可以通过注射核苷酸激发牡蛎的免疫反应,而免疫反应的激发能使牡蛎更好地抵御病毒感染。

我们还通过病原体刺激实验,评估不同年龄牡蛎病原体抵抗力的遗传力,此举可为选择育种潜在收益评估工作提供必要信息。我们的评估结果已用于商业级别的选择育种。在传统育种之外,借助新型基因组技术进行标记辅助选择育种很有前景,不过该方法的有效收益尚需验证。此外,SNP 芯片技术在近年来的进步极大地促进了高通量基因分型技术的发展,因此表型鉴定技术的升级也是亟待解决的问题。

Biography: Prof. Pierre Boudry

Pierre Boudry has been involved in research on oysters since 1994 and is currently the head of a research group at Ifremer dedicated to the physiology of marine fish and shellfish. He is also Associate Director of LEMAR, a large (>120 permanent staff) joint laboratory, associating CNRS, Brest University, IRD and Ifremer, devoted to marine environmental sciences. He is currently editor-in-chief of the journal Aquatic Living Resources and on the editorial boards of Aquaculture and Chinese Journal of Oceanology and Limnology. He has represented France in the working group of the International Council for the Exploration of the Sea dedicated to the application of genetics to fisheries and mariculture since 1998. Most of his research is closely connected with oyster aquaculture and has led to more than 140 publications, resulting in his designation as the most productive author in a recent bibliometric analysis of oyster research worldwide.

Abstract:

Recent research on biotic and abiotic factors associated with Pacific oyster mortality syndrome in France and mitigation approaches using selective breeding and aquaculture practices.

Pierre Boudry

Ifremer, UMR 6539 LEMAR (UBO-CNRS-IRD-Ifremer), Centre Bretagne, 29280

Plouzané, France. Email: pboudry@ifremer.fr

The French oyster industry has been historically impacted by successive epizooties, leading to the introduction of *Crassostrea gigas* as a substitute for *Crassostrea angulata*, and the drastic reduction of production of the native *Ostrea edulis*. Since 2008, *C. gigas* production has also faced a type of mortality known as Pacific oyster Mortality Syndrome (POMS), associated with the detection of a specific genotype of the virus OsHV-1 named “μvar” and mainly affecting juveniles. POMS spread very fast and now affects all production areas. Additionally, since 2011, mortality of adults has increased locally, often associated with vibrios. Pathogenicity has been shown to be highly variable among vibrio species, which makes their monitoring challenging.

In this context, Ifremer has developed a variety of research programs aiming to characterize the biotic and abiotic factors associated with mortalities. Molecular diagnostic tools have been developed to trace pathogens and to characterize their genetic diversity and the molecular bases of their virulence. Different approaches have been used to better understand the impact of environmental factors, such as temperature, pH and salinity: (1) controlled infection protocols with specific pathogens, (2) more ecologically relevant approaches based on cohabitation between naive and infected oysters, and (2) field monitoring in zones known to be affected by POMS. Temporal dynamics of infection by pathogens and the immune response of the host have been characterized in juvenile oysters, showing that haemocytes are very rapidly affected by OsHV-1, resulting in secondary bacterial infections leading to death. Interestingly, the immune response of oysters can be triggered by injection of nucleic acids, which protect them against subsequent viral infection.

Disease challenges have also been used to estimate heritability of resistance to pathogens at different ages, which is essential information for estimating potential gains through selective breeding. Encouraging results have led to the development of commercial scale selective breeding. In addition to classical breeding approaches, the use of novel genomic tools to implement marker assisted selection is promising, but their effective gains remain to be demonstrated. Improvement of phenotyping methods is now clearly needed as high-throughput genotyping has already been greatly facilitated by the recent development of SNP arrays.

Janet H Brown 博士来自苏格兰牡蛎养殖协会，从事贝类方面研究近 40 年。从圣安德鲁斯大学获得博士学位，博士期间主要从事欧洲龙虾养殖技术研究。在印尼从事 4 年贝类方面的客座研究后，1984-2011 年 Brown 博士主要在斯特林大学从事水产养殖学学术研究，期间构建了热带甲壳类、贝类的养殖技术体系。自 2011 年 Brown 博士主要从事海洋贝类养殖以及种群恢复工作，从学术研究到产业化均有显著性成果产出。近几年来主要从事苏格兰牡蛎养殖协会方面的工作，是欧洲牡蛎种群恢复联盟创始人之一。



报告题目：

英国牡蛎养殖产业历史、现状及发展方向

Biography: Janet H Brown

Janet Brown has worked with shellfish all her adult life in one form or another. Her initial interest was in crustaceans with her PhD from St Andrews University on the European Lobster which led on to work with aquaculture of marine shrimp and freshwater prawns. After working 4 years on a University development project in Indonesia she became an academic at the Institute of Aquaculture, University of Stirling (1984-2011) where she established work on tropical commercial crustaceans, but this gradually expanded to also take in the aquaculture of molluscs. She was in charge of the Shellfish Unit until she left in 2011. Since then she has concentrated more on shellfish aquaculture and restoration. She is very much involved with the Scottish shellfish industry having been Editor of The Grower (the newsletter of the Association of Scottish Shellfish Growers) since 2004. This publication has increased in size and distribution very considerably since she left academic life. She is also very much involved with work to restore the European flat oyster and is a founder member of the newly established NORA (Native Oyster Restoration Alliance).

Speech Title:

Oyster aquaculture in UK: its history, current situation and future directions

崔光植，韩国济州岛国立大学海洋生物医学学院终身教授，主要研究领域为海洋生态学，贝类繁殖生物学，海洋贝类病害学以及海洋环境生物学，韩国海洋学会副会长，韩国贝类学会会长，国际水产养殖学会、美国贝类学会、亚洲渔业协会以及韩国水产学会委员。作为韩国海洋生物领域重要学术带头人，成功组织一系列国际学术会议及产业峰会。近 5 年来发表学术论文 45 篇。



报告题目：

韩国的牡蛎（*Crassostrea gigas*）养殖产业现状

Biography: Dr. Kwang-Sik Cho

Name: Choi, Kwang-Sik (Albert)

Degree hold: Ph.D. (Dept. Oceanography, Texas A&M University, College Station, USA)

Current Title:

Professor, School of Marine Biomedical Science, Jeju National University, 102 Jejudaehakno, Jeju, 63243, Korea

Contact:

E-mail: skchoi@jejunu.ac.kr; Tel: 82-64-754-3422; Fax: 82-64-756-3493;

Mobile Phone: 010-3699-9000

Research Areas:

Marine Ecology, Shellfish Reproductive Biology, Pathology of Marine Mollusks,
Marine Environmental Ecology

Professional Membership and Career

- 2008 Program Committee Chair for World Aquaculture Society Annual Meeting, Busan Korea
- 2009; Organizing Committee Chair, International Congress of Medical and Applied Malacology (ICMAM), 9th Conference in BUSAN,
- 2009; Organizing chair of Korea-Thailand Joint symposium on "Trend of Research on Marine Environment, Fisheries and Aquaculture" (held in Jeju)
- 2012-2013 President of the Korean Malacological Society

- 2014-2015 President of Aquaculture Chapter, Korean Society of Fisheries and Aquatic Science
- 2015 World Aquaculture Society Annual Meeting co-chair of the Steering Committee, Jeju Korea
- 2015 International Abalone Symposium, Yeosu Korea, co-chair of the Steering Committee
- 2016 – 2018, Vice President, The Korea Society of Oceanography
- Member of World Aquaculture Society, since 1992
- Member of National Shellfish Association, since 1987
- Member of Asian Fisheries Society, since 2001
- Member of Korean Aquaculture Society, since 1995

Speech Title:

Current Status of Pacific Oyster (*Crassostrea gigas*) Aquaculture in Korea

Michael Dove 博士是澳大利亚新南威尔士州初级产业部（DPI）的高级研究科学家，从事贝类相关研究已经超过 20 年。Dove 博士管理包括悉尼岩牡蛎育种计划等多个 DPI 的贝类研究计划。他曾参与多项国家和国际项目，以提高商业牡蛎的质量和数量，以及双壳贝类育苗场的生产技术。Dove 博士的研究重心是选择性育种，抗病性，以及其他重要经济性状的研究等。



摘要：

澳大利亚牡蛎养殖的历史、现状和未来

MICHAEL DOVE^{*1} AND WAYNE O'CONNOR¹

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牡蛎养殖是澳大利亚历史最悠久的水产养殖业之一，已有 140 多年的历史。在此之前，生活在沿海地区的土著居民收集当地牡蛎作为食物。两个最重要的商业品种是引进的长牡蛎（*Crassostrea gigas*）以及当地的悉尼岩牡蛎（*Saccostrea glomerata*）。长牡蛎主要在澳大利亚塔斯马尼亚州，南澳大利亚州和新南威尔士州（NSW）养殖，而悉尼岩牡蛎主要在新南威尔士州和昆士兰州养殖。2017 年，长牡蛎和悉尼岩牡蛎的产值分别为 4400 万美元和 3100 万美元。长牡蛎生产几乎完全依赖育苗场的苗种，而悉尼岩牡蛎的苗种既有野生的，也有来自育苗场的。在澳大利亚，牡蛎产业的最大威胁是病害。长牡蛎养殖产业受到牡蛎疱疹病毒（OsHV-1 μ Var）的影响。这种疾病 2010 年首次在新南威尔士州发现，导致该州长牡蛎产量从 2010 年的 377 吨下降到 2017 年的 175 吨。该病现已蔓延至澳大利亚的两个长牡蛎主产区，2016 年确认在塔斯马尼亚州爆发，2018 年在南澳大利亚州爆发。截止目前，病毒尚未蔓延至塔斯马尼亚州的所有养殖区，只在南澳大利亚州的野生长牡蛎中检测到。悉尼岩牡蛎产业主要受两种疾病的影响：由原生动物寄生虫 *Marteilia sydneyi* 引起的昆士兰未知（QX）疾病和冬季死亡疾病，对这些疾病，尚无有效药物。遗传选择育种已用于增强长牡蛎和悉尼岩牡蛎的抗病能力，使得长牡蛎对牡蛎疱疹病毒的抗性以及悉尼岩牡蛎对 QX 疾病的抗性得到显著提升。疾病的出现也促使人们对澳大利亚南部地区的扁牡蛎（*Ostrea angasi*）和热带地区的黑唇牡蛎（*Striostrea mytiloides*）等替代品种的养殖兴趣增加。此次报告将介绍澳大利亚牡蛎养

殖的概况，包括其历史，现状和生产方法，以及以牡蛎遗传和抗性改良为中心的当前和未来牡蛎研究概况。

关键词：长牡蛎 *Crassostrea gigas*，悉尼岩牡蛎 *Saccostrea glomerata*，抗病性，选择育种

Biography: Dr. Michael Dove

Dr. Michael Dove is a Senior Research Scientist with NSW Department of Primary Industries (DPI) and has been involved in mollusc research for over 20 years. Dr. Dove manages DPI's Mollusc Research Program including the Sydney rock oyster breeding program. He has worked on both national and international programs to improve quality and quantity of commercial oysters and bivalve hatchery production techniques. Dr. Dove's research is focussed on selective breeding and development of disease resistance alongside other commercially important traits.

Abstract:

HISTORY, STATUS AND FUTURE OF OYSTER CULTURE IN AUSTRALIA

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Oyster farming is one of the oldest aquaculture industries in Australia and has been practiced for over 140 years. Before this time, native oysters were collected by Aboriginals living in coastal areas for food. The two most important commercial species are the introduced Pacific oyster (*Crassostrea gigas*), cultured in Tasmania, South Australia and New South Wales (NSW) and the native Sydney rock oyster (*Saccostrea glomerata*), cultured predominately in NSW and also in Queensland. Pacific oyster and Sydney rock oyster production was valued at US\$44 and US\$31 million, respectively in 2017. Pacific oyster production is almost exclusively reliant on hatchery produced seed whereas Sydney rock oyster production relies on a mixture of wild and hatchery seed. The greatest threat to oyster production in Australia is disease. The Pacific oyster industry is affected by ostreid herpesvirus microvariant 1 (OsHV-1 μ Var). This disease was first detected in NSW in 2010 and caused Pacific oyster production in this state to fall from 377 tonnes in 2010 to 175

tonnes in 2017. The disease has now spread to the two main Pacific oyster producing states of Australia with outbreaks confirmed in Tasmania in 2016 and South Australia in 2018. To date, the virus has not spread to all growing regions in Tasmania and has only been detected in wild Pacific oysters in South Australia. The Sydney rock oyster industry is impacted by two diseases: Queensland unknown (QX) disease caused by the protozoan parasite *Marteilia sydneyi* and winter mortality disease, where the exact agent or agents have not been identified. Pedigree-based selective breeding programs are used to assist the Pacific oyster and Sydney rock oyster industries combat these diseases. Substantial progress has been made increasing the resistance of Pacific oysters to ostreid herpesvirus and Sydney rock oysters to QX disease. The emergence of disease has prompted increased interest in culturing alternative native species including the flat oyster (*Ostrea angasi*) in southern regions of Australia and black-lip oysters (*Striostrea mytiloides*) in tropical regions. This presentation will provide an overview of oyster aquaculture in Australia including its history, status and production methods as well as outline current and future oyster research that is centered on improvement of oyster genetics and disease resistance.

KEY WORDS: Pacific oyster, *Crassostrea gigas*, Sydney rock oyster, *Saccostrea glomerata*, disease resistance, selective breeding

郭希明教授本科毕业于山东海洋学院（现中国海洋大学），美国西雅图华盛顿大学理学博士，现任美国罗格斯大学海洋和海岸科学系终身教授。郭教授从事贝类遗传育种研究 30 余年，发表论文 150 余篇。郭教授是四倍体贝类及生产技术发明人，他发明的四倍体牡蛎，在多个国家成功应用于三倍体牡蛎商业化生产，对世界牡蛎养殖业影响巨大。郭教授是“国际牡蛎基因组计划”的协同主持人，该计划成功完成牡蛎全基因组测序，为牡蛎分子育种打下基础。郭教授及其团队培育出 NEX 美洲牡蛎抗病品系并应用于养殖生产。郭教授是 *Journal of World Aquaculture Society* 副主编，任 *Aquaculture*, *Marine Biotechnology*, *Aquaculture Research* 和 *Journal of Shellfish Research* 等多个国际期刊杂志担任编委。郭教授曾获美国罗格斯大学优秀学术奖、法国卡恩大学优秀讲席教授、山东省泰山学者海外特聘教授、新泽西发明名人堂年度发明人奖。



摘要：

美国美洲牡蛎的养殖与育种

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牡蛎养殖是美国重要的水产养殖产业之一。2016 年，美国牡蛎养殖总产量 141272 吨，产值约 1.91 亿美元，比 2006 年增加 113%。美国的牡蛎养殖主要有两种：集中于太平洋沿岸的长牡蛎（*Crassostrea gigas*，产值约 5600 万美元）和集中于大西洋和墨西哥湾沿岸的美洲牡蛎（*Crassostrea virginica*，产值约 1.27 亿美元）。近年来美国牡蛎养殖产量的增长主要来自于美洲牡蛎。

历史上，美洲牡蛎在美国有丰富的野生资源，过度采捕、栖息地破坏和疾病频发使野生资源急剧下降。为了发展美洲牡蛎的养殖，许多沿海州做了大量的工作。目前，美洲牡蛎的养殖苗种主要来源于工厂化育苗，有超过 30 家育苗厂培育该牡蛎苗种。人工培育的苗种大多数是单体苗种，养殖方式主要有水底、离底或悬挂笼式养殖，部分附壳苗用于底播养殖。在新泽西州和康涅狄格州等部分地区，一种新型的种苗收集、养殖模式被采用，养殖者用牡蛎壳收集苗种，然后转移到其他地区进行水底养殖。大多数牡蛎被生鲜销售，少数剥肉销售。

得益于市场需求、疾病防控和三倍体技术的发展，近年来美洲牡蛎的养殖规模得以快速扩大。在大西洋中部和东北部，美洲牡蛎的养殖主要受到三种疾病的威胁：由原生动物引起的 MSX 和 Dermo，以及由细菌引起的 JOD（主要使稚贝患病）。这三种疾病对牡蛎养殖的威胁非常大，每一种疾病都会在易感群体中引发超过 90% 的死亡率。长期的选择育种已经培育出抗病的美洲牡蛎，且被广泛的推广到养殖中。抗病品系的四倍体美洲牡蛎也已培育成功，并用于三倍体的生产。三倍体美洲牡蛎生长速度显著快于二倍体，产量约占该牡蛎总产量的 50%。

Biography: Professor Ximing Guo

Professor Ximing Guo received his bachelor's degree from Shandong College of Oceanography (now Ocean University of China, Qingdao) and his Ph.D. from University of Washington, Seattle, USA. He is currently a Professor of Marine and Coastal Sciences at Rutgers University, USA. Professor Guo has been studying genetics and breeding economically important molluscs for over 30 years. He has published over 150 peer-reviewed articles. Professor Guo is the primary inventor of tetraploid oysters that have been commercialized for triploid production in many countries and contributed significantly to oyster farming worldwide. Professor Guo is co-director of the international Oyster Genome Project that sequenced the genome of the Pacific oyster and provided a foundation for genetic analysis of oysters. Professor Guo and his team have developed disease-resistant eastern oysters for aquaculture production. Professor Guo is an Associate Editor of *Journal of the World Aquaculture Society* and serves on the editorial boards of several scientific journals including *Aquaculture Research*, *Marine Biotechnology*, *Journal of Shellfish Research*, *Acta Oceanologica Sinica* and *Oceanologia et Limnologia Sinica*. Professor Guo is the recipient of "Board of Trustees Award for Scholarly Excellence" from Rutgers, "Chair of Excellence" award at University of Caen of France, "Taishan Oversea Scholar" award from China and "Inventor of the Year" award from New Jersey.

Abstract:

Oyster Aquaculture in the United States: Eastern Oyster and Breeding

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Oyster farming is one of the most important aquaculture industries in the US. The US

produced 141,272 metric tons of oysters from aquaculture in 2016, with an estimated value of \$191 million, representing a 113% increase over that in 2006. Oyster production in the US comes mainly from two species: Pacific oyster (*Crassostrea gigas*, about \$56 million) from the Pacific coast and the eastern oyster (*Crassostrea virginica*, \$127 million) from the Atlantic and Gulf coasts. The eastern oyster is responsible for most of the recent increases in US oyster aquaculture production.

The eastern oyster historically supports major wild fisheries in the US. Over-fishing, habitat destruction and diseases have caused great declines in oyster populations in Chesapeake and Delaware Bays. Major efforts have been spent on developing eastern oyster aquaculture in many coastal states. Most of the eastern oyster aquaculture are based on hatchery produced seed. There are over 30 hatcheries producing eastern oyster seed for aquaculture. Most of the hatchery-produced seed are cultchless and used for on-bottom, off-bottom or suspended cage farming, and some are spat-on-shells for bottom planting. A form of extensive oyster farming is practiced in some states such as New Jersey and Connecticut, where oyster shells are planted on for seed collection and then transplanted to other areas for on-bottom culture. Most of the oysters are sold and consumed live or raw, with a small fraction are shucked for meats.

Eastern oyster farming has been expanding rapidly in recent years partly due to strong demand and the development of disease-resistant and triploid (with three sets of the chromosomes) oysters. Eastern oysters in much of the mid-Atlantic and NE regions are seriously affected by three major diseases: MSX (multinucleated sphere X, caused by the protozoan *Haplosporidium nelsoni*), Dermo (caused by the protozoan *Perkinsus marinus*) and JOD (juvenile oyster disease, caused by the bacterium *Roseovarius crassostreae*). These diseases present a major threat to oyster aquaculture, as each of the three diseases can cause up to 90% mortality in susceptible stocks. Long-term selective breeding has produced disease-resistant eastern oysters, which are widely used for aquaculture production. Tetraploid eastern oysters were developed from disease-resistant strains and used for triploid production. Triploid eastern oysters grow significantly faster than diploids and now account for about 50% of the eastern oyster production.

Maria C. Haws, 水产养殖专业副教授, 兼夏威夷希洛大学太平洋水产养殖与海岸带资源中心 (PACRC) 主任。她于 1984 年在里德学院获得生物学学士学位, 并于 1993 年获得德克萨斯州农工大学野生动物和渔业科学博士学位。Haws 博士目前的关注点是无脊椎动物, 重点是双壳贝类的生理学和养殖。在担任 PACRC 主任期间, 她关注于海洋观赏鱼的人工繁殖、鱼类和双壳贝类孵化场、海藻养殖和鱼菜共生等相关项目。在过去的 25 年里, Haws 博士为国际和美国的水产养殖的发展做出了巨大的贡献: 主要包括黑珍珠、砗磲、海绵和珊瑚的养殖。她在与社区和政府合作方面拥有长达二十三年的经验, 涉及渔业和水产养殖的沿海管理和适应气候变化方面。她也具有在坦桑尼亚、桑吉巴、墨西哥、洪都拉斯、尼加拉瓜、厄瓜多尔、马绍尔群岛共和国、密克罗尼西亚联邦、帕劳和库克群岛等地工作的国际经验。



摘要:

美国牡蛎的养殖: 西海岸和夏威夷产业介绍

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牡蛎养殖是美国水产养殖业的最重要的组成部分之一。2016 年美国牡蛎养殖产量是 141272 吨, 预计产值约 1.91 亿美元。美国牡蛎的生产主要来自于两个物种: 西海岸的长牡蛎(*Crassostrea gigas*)和 大西洋及墨西哥湾沿岸的美洲牡蛎(*Crassostrea virginica*)。由于过度捕捞和栖息地退化, 个体较小型本地牡蛎 (*Ostrea lurida* 和 *O. conchaphila*) 其种群大量消失, 长牡蛎在 20 世纪初引入, 并成为西海岸的牡蛎产业的主要养殖品种。太平洋西北部和夏威夷原住民有长期使用贝类的传统, 现在正从事于贝类养殖业。

过去 15 年来, 人工苗种成为主要苗种来源, 部分原因是由于海洋酸化 (OA) 导致自然栖息地减少。2008 年以来, 西北地区育苗场的生产也受到海洋酸化的严重影响。西海岸牡蛎养殖主要依靠夏威夷的 5 个育苗场, 大多数西海岸育苗场都使用俄勒冈州立

大学的贝类种质项目提供的种质，该项目已经进行了 26 年的太平洋牡蛎品系改良，该计划主要涉及二倍体牡蛎。最近开始使用三倍体和四倍体进行育种，并且出现了一些新的“私人定制”育种工作。

由于目前发生加利福尼亚托马斯湾和邻近地区的牡蛎疱疹病毒（OsHV-1）传播，人们越来越担心其可能在西海岸爆发，但西海岸受牡蛎疾病的影响小于东部和墨西哥湾沿岸地区。美国的牡蛎养殖也面临着监管问题，限制了养殖者的扩张并增加了巨大的成本；另一个威胁是由幽灵虾造成的牡蛎养成场的破坏以及妨碍解决这一严重威胁的监管问题。牡蛎养殖产业同时也利于贝类环境修复工作，如在美国沿海大部分地区使用贝类养殖来改善水质。

Biography: Maria C. Haws, Ph.D.

Maria C. Haws is an Associate Professor of Aquaculture and serves as the Director of the Pacific Aquaculture and Coastal Resources Center (PACRC) of the University of Hawaii Hilo. She received her doctorate in Wildlife and Fisheries Sciences from Texas A&M in 1993 and a B.A. in Biology from Reed College in 1984. Her current research interests include physiology and culture of invertebrates with an emphasis on bivalves. In her capacity as the PACRC Director, she also oversees programs related to captive breeding of marine ornamental fish, fish and bivalve hatcheries, seaweed culture and aquaponics. Dr. Haws has also worked in extension to support aquaculture development internationally and in the U.S. for over twenty-five years; these efforts have included culture of black pearls, giant clams, sponges and corals with community-based groups and women's groups. She also has twenty-three years of experience working with communities and governments on coastal management and climate change adaptation for fisheries and aquaculture. Her international experience includes work in Tanzania, Zanzibar, Mexico, Honduras, Nicaragua, Ecuador, Republic of the Marshall Islands, Federated States of Micronesia, Palau and the Cook Islands.

Abstract:

Oyster Aquaculture in the United States: West Coast and Hawaii

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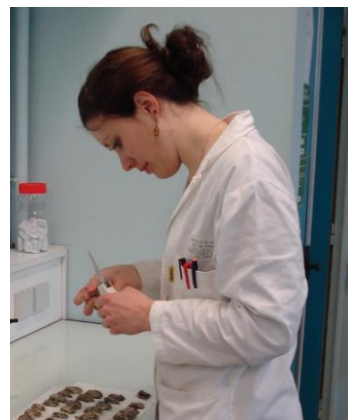
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Oyster farming is one of the most important aquaculture industries in the U.S. The US produced 141,272 metric tons of oysters from aquaculture in 2016, with an estimated value of \$191 million. Oyster production in the US comes mainly from two species: Pacific oyster (*Crassostrea gigas*) from the West Coast and the Eastern oyster (*Crassostrea virginica*) from the Atlantic and Gulf coasts. The West Coast oyster industry is largely based on the use of Pacific oysters, which were introduced in the early 20th century as populations of the small, native oysters (*Ostrea lurida* and *O. conchaphila*) were decimated by over-fishing and habitat degradation. The Indigenous peoples of the Pacific northwest and Hawai'i have long traditions of shellfish use and are now engaging in shellfish culture.

Over the last 15 years, hatchery production has become the primary seed source, in part due to diminished natural set as a result of ocean acidification (OA). Northwest hatchery production was also severely impacted by OA, beginning around 2008. The West Coast is heavily dependent on the five hatcheries based in Hawai'i. Most West Coast hatcheries use broodstock supplied by the Molluscan Broodstock Program at Oregon State University, which has been breeding for improved strains of Pacific oysters for 26 years. This program has dealt mainly with diploid oysters. Recently work has begun with breeding using triploids and tetraploids, and several new private breeding efforts have arisen.

The West Coast is less affected by oyster disease than the East and Gulf Coasts, although there is growing concern about the possible spread of the Ostreid Herpesvirus (OsHV-1) from its present occurrence in Tomales Bay, CA and adjacent areas. Oyster farming in the US also faces issues with regulation, which limits expansion and imposes significant costs on farmers. Another threat is the destruction of oyster growing grounds by ghost shrimp and regulatory issues that prevent addressing this serious threat. The oyster industry is also linked to and supports shellfish restoration efforts and the use of cultivated shellfish for water quality improvement along much of the U.S. coastlines.

Aude Jouaux 博士于法国卡昂大学获博士学位。Jouaux 博士在诺曼底地区工作，是拥有丰富经验的法国水产养殖行业专家。Jouaux 博士的主要研究领域为牡蛎生物学、遗传学、病害学以及水产养殖学。她是研究三倍体牡蛎生物学和遗传学的领军科学家。作为卡昂大学牡蛎会议中心的负责人，Jouaux 博士和同事们一起广泛开展了牡蛎对疱疹病毒免疫响应的研究工作，鉴定出了多个对抗病毒品系育种有指导意义的候选基因，为牡蛎 I 型疱疹病毒的防治工作做出了重要贡献。



摘要：

法国的牡蛎养殖

Aude Jouaux，水产养殖专家/行业主管，法国诺曼底，邮箱：audejouaux@hotmail.fr

提到法国，人们首先想到的必然是恢弘壮阔的历史、自由浪漫的生活和华美细腻的美食，而不是牡蛎。虽然法国牡蛎产量只占世界总产量的 1%，但却占据了欧洲产量的 90%。法国牡蛎还是高品质的代表，深受法国乃至全世界消费者的喜爱。那么，法国的牡蛎有什么特点？法国又是如何“生产”牡蛎的呢？本次报告中，我将带您回顾法国牡蛎产业的历史，为您介绍和分析法国牡蛎产业的现状。我会向您介绍牡蛎主产区是如何“生产”牡蛎，又是如何打造牡蛎品牌的。我还将展示我们所使用的多项生产和繁育技术，以及利用这些技术所获得的多种牡蛎产品。我希望通过本次报告，向听众展示在不同地理区域下、针对不同产品以及不同市场群体所采用的差异化生产模式，同时就法国牡蛎养殖产业所面临的挑战和潜在破局之道与大家展开讨论。

Biography : Aude Jouaux

Dr. Aude Jouaux received her Ph.D. from University of Caen in France. She is an expert in aquaculture working in Normandy. Dr. Jouaux's research has been on oyster biology, genetics, diseases and aquaculture. She has many years of experience working with the aquaculture industry in France. Dr. Jouaux is a leading expert on the biology and genetics of triploid oysters. She managed the Oyster Reference Center at University of Caen, which contributed to the control of OsHV-1 infections. Dr. Jouaux and her colleagues conducted extensive research on oyster's immune response to OsHV-1 and identified candidate genes for the breeding of OsHV-1 resistance.

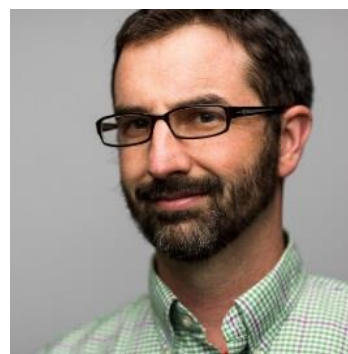
Abstract :**Oyster aquaculture in France**

Aude Jouaux, Aquaculture Specialist, Normandy, France. audejouaux@hotmail.fr

France is not known first of all for its oysters but for its history, its way of life and its gastronomy. Although only accounting for 1% of the world production, French oysters which represent 90% of the European production are recognized as a product of high quality. They are highly appreciated by consumers in France and around the world. What are the characteristics of these exceptional oysters and how are they produced? In this presentation, I will review the history and status of oyster production in France. I will introduce how oysters are produced and branded in major production areas. I will present various production and breeding techniques used and the different products obtained. This presentation intends to illustrate the different modes of production in different geographic area, different products and their marketing. Challenges facing the French oyster aquaculture industry and possible solutions will also be discussed.

Steven Roberts 是华盛顿大学水产科学学院的教授。

Roberts 博士于 2002 年在圣母大学（南本德，印第安娜州，美国）获得生物学博士学位。主要研究领域是水生生物对环境变化的生理反应，特别是环境表观遗传学、生殖生物学和水产养殖，包括对牡蛎、象拔蚌蛤和珊瑚等甲基化功能的研究，以及对大型基因组数据集的分析。在这方面，



他们实行开放式笔记本科学的管理方式，努力使所有的数据分析容易重现，并在线开放实验室会议。

摘要：

牡蛎的表观遗传变异及其对水产养殖的启示

牡蛎和其他海洋无脊椎动物的基因组中具有令人惊讶的多样性，包括基因家族的扩张、高突变率和大量的移动元件。对于生活在波动环境中的排放型产卵者来说，这无疑是有意义的。最近研究 DNA 甲基化的工作正在揭示一些在表观遗传水平上有类似多样性的新见解。在一些物种如双壳类中，发生在基因 DNA 中的甲基化数量有限，功能也不完全了解。一个新的可能的解释是，基因体 DNA 甲基化的作用依赖于基因功能，这是一种由作用于谱系特异性生活史性状的选择压力导致的潜在现象。对一些重要经济性状而言，我们知道在其他类群中，表观遗传标记与表型相关，与遗传变异无关，环境可以影响 DNA 甲基化，表观遗传标记能够被遗传。在贝类中，我们仍旧在研究表观遗传过程的作用，例如 DNA 甲基化对表型组的影响。尽管如此，在未来尤其是在变化的环境中推动水产养殖发展，需要考虑表观遗传过程的作用。

Biography: Steven B. Roberts

Steven Roberts is the Kenneth K. Chew Endowed Professor in the School of Aquatic and Fishery Sciences at the University of Washington (Seattle, Washington, United States). Dr. Roberts received his Ph.D. in Biology at the University of Notre Dame (South Bend, Indiana, United States) in 2002. His main research interest is the physiological response of aquatic species to environmental change with a particular focus on environmental epigenetics, reproductive biology, and aquaculture. This includes examining functional aspects of DNA methylation in oysters, geoduck clams, and corals.

A large part of his lab's research activity includes analysis of large genomic datasets. In doing this, they practice open notebook science, strive to make all data analysis easily reproducible, and hold open online lab meetings.

Contact

Kenneth K. Chew Professor of Aquaculture, School of Aquatic and Fishery Sciences, Box 355020, Seattle WA 98195;

phone: 206-866-5141 - email: sr320@uw.edu - website: robertslab.info

Professional Preparation

PhD, University of Notre Dame, 2002, Biological Sciences

BSc, North Carolina State University, 1997, Natural Resources

Appointments

2013-present Associate Professor - University of Washington

2006-2013 Assistant Professor - University of Washington

2003-2006 Assistant Research Scientist - Marine Biological Laboratory, MA

2002-2003 Post-doctoral scholar – USDA NRI Fellowship

Research Interests

Physiological response of aquatic species to environmental change with a particular focus on the relationship of transcriptomics, genetics, and epigenetic modifications. Current research efforts include characterizing the reproductive development in bivalves and the functional role of DNA methylation in aquacultured shellfish.

Abstract:

Epigenetic variation in oysters and implications for aquaculture

There is an amazing amount of diversity incorporated into the genome of oysters and other marine invertebrates including vastly expanded gene families, high mutation rates, and numerous mobile elements. These are certainly a benefit to broadcast spawners living in fluctuating environments. Recent work examining DNA methylation is revealing new insight into similar diversity at the epigenetic level. The function of DNA methylation in species such as bivalves where the limited amount of DNA methylation is predominantly found in gene bodies is not completely understood. One emerging possible explanation is that the role of gene body DNA methylation is dependent on gene function, a potential phenomenon that

has arisen from selective pressure on lineage-specific life history traits. With respect to commercially important traits, we know that in other taxa epigenetic marks are associated with phenotypes independent of genetic variation, the environment can influence DNA methylation, and epigenetic marks can be inherited. In shellfish, we are still learning about role of epigenetic processes such as DNA methylation in controlling the phenome. However it does appear that epigenetic processes will be important to consider in future efforts to advance aquaculture, particularly in changing environments.

Rajan 博士，香港太古海洋科学研究所和香港大学生物科学学院海洋生物学副教授，香港海洋污染重点实验室学术委员，香港蛋白质组学学会委员会委员和 ISOACC 组织（海洋酸化和气候变化跨学科研讨会）协调人。Rajan 博士发表有关海洋生物幼虫生物学领域学术论文 100 余篇，尤其在海洋生物幼虫应对海洋酸化、暖化以及淡水等胁迫的适应机制研究方面做出重要贡献。最近由 Rajan 博士领导了一个在牡蛎应对环境胁迫适应机制的国际多学科合作计划，并希望通过多代际遗传与表观遗传方面探讨牡蛎适应环境胁迫机制。自 2008 年起 Rajan 博士作为 PI 获得多项竞争性科研项目支持，经费总额超过 1000 万港元，并全部圆满完成。



报告题目：

全球气候变化下中国牡蛎幼虫的适应性

Biography: Dr. Vengatesen Thiyagarajan (Rajan)

- Rajan is an associate professor of larval biology at the Swire Institute of Marine Sciences and School of Biological Sciences in the University of Hong Kong;
- He is an “academic member” of a State Key Laboratory for Marine Pollution, a “council member” of the Hong Kong Proteomics Society and the organizer of the ISOACC symposium series (Interdisciplinary Symposium on Ocean Acidification (OA) and Climate Change);
- He has published >100 research articles in the field of larval biology using multi-faceted approaches (from classical through to modern molecular techniques) and contributed significantly to understand larval stress adaptation mechanisms to climate change associated multiple stressors including coastal acidification, warming and freshening;
- Recently, his group has developed an international multidisciplinary collaboration involving molecular ecology, biology, crystallography, mechanical engineering to systematically study mechanisms of oyster plasticity and tolerance to OA and multiple climate change drivers;

- As Principle investigator of ten highly competitive and successful research grant applications (have received >10 million HK dollars) with a 100% success rate for grant applications since 2008 (with one exception in 2016).
- Dr. Rajan and his group likes to work in the area of larval adaptation to multiple stressors through transgenerational inheritance and epigenetic mark in economically important oysters species along the Chinese coastal area.

Speech Title:

Oyster larval adaptation to global climate change in China

崔和博士自 2007 年起就职于中国水产流通与加工协会，现任协会会长。在他的带领下，协会以一种高度的责任感服务于行业与会员，对我国水产品加工技术水平和管理水平的提高，规范和繁荣水产品市场，提高水产品加工流通行业的经济、生态和社会效益起到积极的作用。任职期间，他以全球的视野，放眼产业链各环节的良好衔接与协调发展，关注鱼、虾、贝等主要贸易品种国内外的市场变化，了解并掌握变化的趋势和运行的规律，用于指导产业的健康发展。



崔和博士具有 30 多年的水产工作经验，先后就职于中国水产学会，中国水产杂志社，农业部渔业局，全国水产技术推广总站，中国渔业协会。在国内外发表论文 60 余篇，参与了多项重要国际课题。

报告题目：

牡蛎产业进入提质增效新时期

Biography: Cui He

Dr. Cui He has been working at China Aquatic Products Processing and Marketing Alliance (CAPPMA) since 2007, currently holds the position of President. Under his leadership, CAPPMA insists on serving the industry and members with high sense of responsibility, plays a positive role in promoting the improvement of processing technology and management of aquatic products in China, standardizing and prospering the aquatic products market, improving the economic, ecological and social benefits of aquatic products processing and marketing industry. During the tenure, Dr. Cui takes a broad view of good convergence and coordinated development of every link in the industrial chain, focus on market changes of fish, shrimp, shellfish and other major trading varieties at domestic and overseas market, understands the trend and operation rules, and guides the healthy development of the industry.

With over 30 years relevant working experience, Dr. Cui worked in China Society of Fisheries, China Fisheries magazine, Bureau of Fisheries and Fishery Law-enforcement Ministry of Agriculture, National Fisheries Technology Extension Center and China Fisheries Association. Dr. Cui published over 60 academic papers in both domestic and overseas and participated in many important international academic issues.

Speech Title:

Oyster industry entering a new era of pursuing high quality and efficiency in China

刘鹰，大连海洋大学科技处处长/海洋科技与环境学院院长、教授、博士生导师，曾任 Aquacultural Engineering Society（AES，国际水产工程学会，2014-2016）主席/荣誉主席；兼任国务院学位委员会水产学科评议组成员、中国农业工程学会特种水产工程分会主任委员、中国工业化水产养殖与装备产业技术创新战略联盟理事长、中国水产学会工业化养殖研究会副主任委员、全国水标委渔业机械仪器分委委员等。主要研究领域为水产集约化养殖系统生物与环境互作机理、水产高效养殖设施装备研发与创制、蓝色农业精准生产与福利养殖等，发表文章 160 余篇，出版专著 2 部，授权发明专利 30 余项，获得省部级奖励 8 项。2012 年入选中国科学院“海洋农业工业化生产体系交叉与合作科技创新团队”，2014 年入选“青岛市创新领军人才”，2015 年入选“国家农业科研杰出人才及其创新团队”，2016 年当选为中国科协“全国首席科学传播专家”。



报告题目：

牡蛎设施养殖工程的研究与应用进展

Biography: Ying Liu

Name: Ying Liu

Title: Professor

Research Field: Aquacultural Engineering, Recirculating Aquaculture System, Fish Welfare, Aquacultural Ecology and Bio-Environmental Control

Tel: 0086-411-84762010/0086; 13504115327

E-mail: yingliu@dlou.edu.cn

Resume:

Dr. Ying Liu is currently the Professor of the Dalian Ocean University(DLOU) and the director of Science & Technology Department of DLOU. He has also served as the Director of Branch Society of Aquacultural Engineering, Chinese Society of Agricultural Engineering (CSAE).

Dr. Liu has been involved in aquacultural engineering research and education since

1994. Dr. Liu received a B.S. in Agricultural Architecture and Bio-environmental Engineering from North-west A&F University (China), a M.S. and Ph.D. in Biosystem Engineering from Zhejiang University (ZJU). Being the Professor of DLOU, his research mainly focuses on Aquacultural Engineering, Recirculating Aquaculture System, Fish Welfare, Aquacultural Ecology and Bio-Environmental Control. Especially in recirculating aquaculture system post, he is one of the main scholar practitioner and responsible for design and use of recirculating aquaculture systems in China and application in industrial farming. He has published over 160 papers and 2 books, and authorized 37 invention patents. He also has been in charge for 30 research projects, such as National Key R&D Program of China projects, the National Natural Science Foundation of China and Sino-France Advanced Sciences and Technology International Cooperation Project.

Abstract:

Oyster Facility Aquaculture System - Current application and prospects

Liu Ying, Li Mingzhi, Zhang Junxin, Zhang Guangfa

Dalian Ocean University, Dalian, 116023, China Tel: 86-411-84762010,

E-mail: yingliu@dlou.edu.cn

Aquaculture is now fully comparable to capture fisheries when measured by volume of output on global scale. The contribution from aquaculture to the world total fish production of capture and aquaculture in 2016 reached 45% nearly, up from 25.7% in 2000. Aquaculture has seen a worldwide expansion over the past 20 years and already is the fastest growing sector in world production of animal-derived food with an average worldwide growth rate of 6-8% a year. Developing high-efficient facility aquaculture is the necessary way to make this industry healthy and continual development. This report summarize the new development for oyster facility aquaculture systems in domestic and oversea, and aspects of the production techniques and problems. Suggestions are made as to how the production of oyster maybe improved and optimized.

秦小明，男，1964年10月出生。食品科技学院教授、博士生导师、食品科学与工程一级学科博士点学科方向带头人。广东省高等学校千百十工程（省级）培养对象、国家现代农业产业技术体系贝类产品加工岗位科学家。兼任中国水产学会水产品加工与综合利用专业委员会委员、中国农业工程学会农产品贮藏与加工分会理事。



主要研究领域：水产品保活运输和精深加工技术、海洋生物资源加工综合利用技术以及功能性食品开发等研究。

近年来，主持和参与了国家科技支撑计划项目、星火计划项目、农业部“948”专项、国家现代农业产业技术体系（贝类）、农业科技成果转化基金以及省级以上重大科技项目等科研课题 19 项；在国内外权威学术期刊上发表学术论文 172 篇；出版专著和教材 5 部；荣获市厅级以上科技成果奖励 9 项；获得国家发明专利 12 项；5 项科技成果实现产业化，取得了良好的经济效益和社会效益。

通讯地址：广东省湛江市麻章区海大路 1 号 广东海洋大学食品科技学院

电子信箱：qinxm@gdou.edu.cn

摘要：

中国牡蛎的主要消费形式和未来发展形势

广东海洋大学 秦小明

近十年来，世界牡蛎的产量一直处于增长状态，从 2000 年前后的 380 万吨增长到了 2014 年的 530 万吨，目前全球牡蛎产值超 40 亿美元，其中 97.5%都来自人工养殖。我国的牡蛎资源分布很广，北起鸭绿江，南至海南岛，沿海皆可产牡蛎。目前，中国牡蛎的养殖总产量超过世界牡蛎总产量的 89%，位居世界第一。牡蛎产量在中国海洋贝类中排名第一，在法国、澳大利亚牡蛎等外国品牌引导下，国内的乳山牡蛎、钦州大蚝、程村蚝、沙井蚝、福建牡蛎等区域品牌正在崛起，预测今后，牡蛎养殖规模和产量将会持续扩大和提高。2016 年牡蛎销售价格与 2015 年同期相比，带壳牡蛎的售价升高了 20-30%；牡蛎肉的售价升高了 30-40%；牡蛎市场规模逐年增大，发展潜力很大。但是，中国牡蛎存在缺少品牌意识，消

费形式单一，缺乏深加工流通技术，加工比例低和副产物利用严重不充分等产业瓶颈问题。

2016 年中国生蚝的总产量约 457 万吨，出口量约 1 万吨，进口量约 3 万吨，从法国、美国、英国、澳大利亚等国家进口的生蚝约为 1.03 万吨，因此，我国养殖的牡蛎全部依靠内销。中国牡蛎的消费形式主要有烧烤蚝、冷冻牡蛎、蚝油、蚝豉等传统加工品以及牡蛎保健食品。其中，烧烤蚝是牡蛎消费的最主要形式，占到 60-70%；15-20%用于家庭菜肴烹调；用于加工的牡蛎原料约为 12-14%，用于加工成蚝油、蚝豉这些低端产品；精深加工产品占比低于 5%，高端产品尚未形成大规模的产业。未来几年，烧烤蚝仍然是中国牡蛎消费的最大宗形式。

中国牡蛎消费形式的未来发展趋势主要体现在如下几个方面：

1. 牡蛎的消费符合中国新时代大背景下食品消费的大趋势；牡蛎消费要紧跟新潮流，改善产品结构，加快更新换代，要上档次，上水平，满足不同人群的消费需求。

2. 中国牡蛎品牌创立与维护：国产牡蛎要做自己的品牌，在多元化的良性市场竞争过程中树立品牌，赢得消费者，乃是长久之计。

3. 我国具有一定的生食牡蛎高端产品市场潜力，国内生蚝多在二类海域养殖，如要生食，必须选择外海优质海域且经过净化，国产刺身牡蛎尚无法形成规模，大蚝主题餐饮名店连锁+预制调理菜肴食品将是主流发展方向。

4. 未来几年，烧烤蚝仍然是中国牡蛎消费最大宗的形式，但这种主要消费形式存在较大的食品安全风险。随着各生蚝主产区品牌的树立和精深加工产品增加，烧烤蚝的市场规模可能略有缩减。

5. 牡蛎休闲食品和即食食品、营养食品和保健食品会成为新的牡蛎消费趋势。

Biography: Prof. Xiaoming Qin

Name: Xiaoming Qin

Sex: Male

Date of birth: October 25, 1964

Nationality: China

Employer: Guangdong Ocean University

Academic Group Position:

1. Post Scientist of Shellfish Processing of National Modern Agriculture Industry Technology System
2. Committee member of aquatic product processing and comprehensive utilization, China Society of Fisheries

Education

1984. 9–1988. 7 Department of Food Processing, Zhanjiang Fisheries College. Awarded the degree of BSE (Bachelor of Science in Engineering).
1997. 4–1999. 3 The Graduate School of Agriculture, Gifu University. Awarded the degree of MSA (Master of Science in Agriculture) in Food Science and Technology for a thesis entitled “Studies on polysaccharide Isolated from the Fruit of *Lycium chinense* Mill”, supervised by Prof. Koji Kato.
1999. 4–2002. 3 The Graduate School of Agriculture, Gifu University. Awarded the degree of DSA (Doctor of Science in Agriculture) in Food Science and Technology for a thesis entitled “Isolation and Characterization of Arabinogalactan-protein from the Fruit of *Lycium chinense* Mill”, supervised by Prof. Koji Kato.

Research and professional experience

1988. 7–1993. 12 Assistant Professor at the Department of Agricultural Products Processing, Faculty of Horticulture, Guangxi Agricultural University
1994. 1–1996. 10 Lecture at the Department of Agricultural Products Processing, Faculty of Horticulture, Guangxi Agricultural University
2002. 4–2004. 5 Associate Professor, Supervisor of postgraduate at the Department of Food Engineering, Faculty of Light Industry and Food

Engineering, Guangxi University

2004. 6–2005.12 Associate Professor, Supervisor of postgraduate at the Department of Food Engineering, Faculty of Food Science and Technology, Zhanjiang Ocean University

2006.01–2011.10 Professor, Supervisor of postgraduate at the Department of Food Engineering, Faculty of Food Science and Technology

2011. 11–Recent Professor, Doctoral Supervisor at the Department of Food Engineering, Faculty of Food Science and Technology, Guangdong Ocean University

Major Research Direction

Comprehensive utilization technology of Marine biological resources, Health food development

Achievements and Awards

I. Original papers and reviews: 172

II. Books: 5

III. Invention Patent: 12

IV. Science and Technology Achievement Award: 9

Abstract:

The main consumption patterns and future development trends of oyster in China

Prof. Qin Xiaoming, Guangdong Ocean University, Post Scientist of Shellfish Product Processing, National Shellfish Industrial Technology System

Over the past decade, the output of oyster in the world has continued to grow, which increased from 3.8 million tons around 2000 to 5.3 million tons in 2014. Currently, the output value of oyster is over 4 billion US dollars, and 97.5% of them are farmed fish. Oyster resources are widely distributed in China, it can be produced from the coast of Yalu River in the north to the Hainan Island in the south. At present, the total output of oyster in China is 89% of it in the world, and is the largest in the world, as well as among marine shellfishes in China. Guided by foreign brands such as French and Australian oysters, the regional brands of Rushan oyster, Qinzhou

oyster, Chengcun oyster, Shajing oyster and Fujian oyster are on the rise. It is predicted that the culture scale and output of oyster will continue to expand and increase in the future. In China, the sale prices of oyster with shell and oyster meat in 2016 increased by 20-30% and 30-40%, respectively, compared with the same period in 2015. The market size of oyster increased year by year, and the development potential is great. However, there are many bottlenecks in oyster industry, such as lack of brand consciousness, single consumption pattern, lack of advanced processing and circulation technology, low processing ratio, insufficient use of by-products and so on.

In 2016, the total output of oyster in China was about 4.57 million tons, the export oyster was about 10 thousand tons, and the import was about 30 thousand tons. The oysters imported from France, the United States, the United Kingdom, Australia and other countries were about 10.3 thousand tons. Therefore, nearly all the oyster in China depends on the domestic market. The main consumption patterns of oyster in China are barbecued oysters, frozen oysters, oyster sauce, dried oyster, other traditional processed products, and oyster health food. Among them, barbecued oyster is the main one, accounting for 60-70% of oyster consumption. Beyond that, 15-20% of oyster is used for cooking in family dishes and 12-14% is used for primary processing as raw material, to process oyster sauce and dried oyster sauce. However, the ratio of advanced processing products is less than 5%, and the high-end products have not yet formed a large scale industry. Therefore, in the coming years, barbecued oyster is still the main pattern of oyster consumption in China.

The future development trend of the consumption pattern of oyster in China is mainly reflected in the following aspects:

1. Oyster consumption fits the main trend of food consumption in China's new era, the oyster consumption should keep up with the new trend, improve the product structure, speed up the product renewal, and meet the consumption needs of different people.
2. Creation and maintenance of Chinese-oyster's brands. Creation and establish domestic oyster brands is the long-term plan to win the consumer in a diversified competitive market competition.
3. The Chinese market has a certain potential for the high-end products of raw oyster diets. For most of domestic oysters are cultured in class II sea area, we have to harvest oyster from the high quality sea area and then subject it to depuration to diet as raw,

which lead to the domestic sashimi oyster is still unable to form the scale. The famous restaurant chain of oyster and prefabricated and treated food are the main trend of development.

4. Though barbecued oyster is still the main consumption pattern of oyster in the next few years, this consumption pattern has high risk of food safety. Market size of barbecued oyster may be slightly reduced in the future, as the establishing of oyster brands in main producing areas of oyster and the increasing of oyster products by advanced processing.

5. Snake food, ready-to-eat food, nutritious food and health food of oyster will become the new consumption trend of oyster.

杨维龙，江苏省苏州市人，1954 年生，高级水产工程师。2002 年因行业发展需要，在苏州成立阳澄湖大闸蟹行业协会，在组建过程中被全体会员一致推选为首任会长，并在 2008 年换届后再次连任。2003 年被江苏省渔业协会推选为首任省河蟹分会会长，2013 年被中国渔业协会河蟹分会推选为副会长，2017 年被中国水产流通与加工协会和渔业协会商贸分会等单位聘请为专家和品牌营销高级顾问。



在行业管理中较早提出创新农业品牌运作方式，在注重品质保护的基础上，率先通过地理标志产品保护、产品专卖等多项措施，对阳澄湖大闸蟹这一历史品牌进行了有效的保护，2001 年以来，依靠当地政府的大力支持和广大从业人员的积极参与，把一个曾经环境脏乱差，蟹农普遍处于亏损状态的阳澄湖，治理成如今环境优美，整个产业健康发展的生态湖，并影响和带动了全国蟹业的发展。

为此，杨维龙在 2003 年被上海新民晚报描述为“一个能从水中找出钻石的人”，2013 年被扬子晚报描述为“一个架设阳澄湖大闸蟹产业桥梁的人”，2006 年在农业部组织的一次有众多在京媒体参加的评议活动中，被评为“全国首届渔业十大新闻人物”，2008 年再次被水产前沿等全国性媒体评为“全国十大水产人物”，2014 年被中国渔业协会河蟹分会表彰为“阳澄湖大闸蟹旗手”。2014 年以来，为吉林舒兰大米等多家农业品牌做推广宣传。

报告题目：

如何助力把中国牡蛎打造成高端农业品牌

Biography: Yang Weilong

Born in 1954 in Suzhou, Jiangsu, the senior aquatic engineer. In 2002, he was selected as the first president for Suzhou Yangcheng Lake crab association by all members and was reelected in 2008. In 2003, he was selected as the president for River crab chapter of Jiangsu Fisheries association. In 2013, he was elected as the vice president for crab chapter of China Fisheries association. In 2017, he was invited to be the expert and senior consultant of brand marketing by China Aquatic Products Processing and Marketing Association and Business chapter of China Fisheries

Association. In the process of industry development, he put forward the operation mode for the agriculture innovative brand. Based on paying attention to quality, the historical brand of Yangcheng Lake crabs is effectively protected by the protection of geographical indications and product monopoly. Since 2001, relying on the support of the local government and the active participation of the employees, Yangcheng Lake, which has been poor in environment and is generally in a loss state, has been treated as an ecological lake with a beautiful environment and a healthy development of the whole industry. This has influenced and brought the development of the national crab industry in China.

Because of his outstanding contribution to the development of crab industry, Yang Weilong was described as "a person who can find diamonds from water" by Shanghai Xinmin Evening News in 2003. He was also described as "a man who builds bridges of Yangcheng crab industry" by Yangzi Evening Newspaper in 2013. In 2006 and 2008, he was named the "top ten news people in fishery industry" and "the ten largest aquaculture figures in China". In 2014, he was honored as "the flagman of Yangcheng crab" by crab chapter of China Fisheries Association. Since 2014, he promoted publicity for many agricultural brands such as the rice of Jilin, Shulan *et al.*

Speech Title:

How to help Chinese oyster to become a high-end agricultural brand?

翟毓秀，男，1962 年 10 月出生，研究员，硕士生导师，1984 年毕业于厦门大学化学系分析化学专业。现为中国水产科学研究院黄海水产研究所水产品质量与安全研究室主任、国家水产品质量监督检验中心常务副主任，农业部水产品质量安全监测与评价重点实验室、农业部水产品质量安全风险评估实验室（青岛）主任。兼任中国水产科学研究院水产品质量安全学科主任委员、领域首席科学家，国家农产品质量安全风险评估委员会委员、全国水准委和全国食标委水产品加工分委委员，农业部农产品质量安全专家组、全国水产品质量安全专家组成员以及国家现代农业产业技术体系农产品质量安全横向创新团队执行专家组成员等。



长期从事水产品安全与质量控制、标准化、质量检测等方面的工作，现为国家贝类产业技术体系质量安全与营养品质评价岗位科学家。先后主持承担国家重点研发计划、国家自然科学基金、国家科技支撑计划、国家科技基础性工作专项、国家重大科学仪器设备重大开发专项、农业部行业专项等为代表的研究项目、课题十多项，标准制修订项目近十项，在水产品安全与质量控制、风险评估、标准化、风险监测以及应急处置等方面做出贡献。先后获得农业部、国家海洋局、山东省、中国水产科学研究院、青岛市等各级奖励 10 项，2008 年获农业部“助奥行动”先进个人称号，2010 年以来发表论文 100 多篇、参编专著 7 部。

摘要：

牡蛎产品质量安全现状与工作思路

牡蛎是我国重要的贝类产业组成部分，是我国国民重要蛋白来源和出口创汇产品。然而，作为一种海水双壳贝类，牡蛎极易受到水体中污染物影响从而产生质量安全问题，如病原性微生物、生物毒素、持久性有机污染物和有害重金属元素等，对国内消费意愿及国际贸易均产生一定的不利影响，成为牡蛎产业发展亟需解决的关键问题。除此之外，由于缺乏对牡蛎营养品质情况的系统了解，并缺乏必需的评价标准，也进一步影响了消费者对其的消费动力。因此，本报告基于我国牡蛎质量安全现状和产业发展需求分析，提出了未来工作的重点思路，即质量与安全并重，在进一步提升牡蛎产品安全水平基础上，同时要重视牡蛎产品的

营养成分评价工作，同步促进我国牡蛎产业的升级转型，确保该产业健康可持续发展。

Biography: Zhai Yuxiu

Professor Zhai Yuxiu was born in Oct 1962 and Graduated from Xiamen University, then worked in Yellow Sea Fishery Research Institute(YSFRI), Chinese Academy of Fishery Sciences(CAFS) until to now. Prof. Zhai now is the deputy director of National Center for Quality Supervision and Test of Aquatic Products (NCQSTAP), also is the director of other several key laboratories, covering the Aquatic Products Quality and Safety Laboratory (APQSL) of YSFRI, Key Laboratory of Testing and Evaluation for Aquatic Product Safety and Quality MA, as well as the Laboratory of Quality & Safety Risk Assessment for Aquatic Products(Qingdao) MA. As one famous expert in China, Zhai services as the director and chief scientist of subject of food safety in CAFS, also is the key member of several top expert groups on food safety in China, such as the National Agricultural Products Quality and Safety Risk Assessment Committee, Agricultural Products Quality and Safety Expert Group of the Ministry of Agriculture, National Fisheries Quality and Safety Experts Group, etc.

Prof. Zhai focus on the detection, supervision and standardization of aquatic products safety for 30 years, and emphasis on the assessment of safety and nutrient of bivalves product recent years. By the support of tens of national funding, such as National Key R & D Program of China, National Natural Science Foundation of China, National Science and Technology support Program, National Science and Technology Basic Work Project, etc., Zhai has made huge progress and got excellent results on detection method, assessment technology, risk assessment, market supervision, as well as emergency disposal. Under the leading of Prof, Zhai, NCQSTAP almost established 30% standards of aquatic product safety in China. By himself, Prof. Zhai not only published over 100 papers, also have done excellent works to provide professional suggestion, support other major events or meeting, such as Olympic Games 2008, and he has been honored for tens of times by Chinese government.

Abstract:**Quality and safety of Oyster Product and future work emphasis**

As one important part of China's shellfish industry, oyster has provided high-quality protein for domestic consumers, also is an export-generating product. However, oyster is vulnerable to be polluted by contaminants existing in seawater, such as pathogenic microorganisms, biological toxins, persistent organic pollutants and harmful heavy metal elements, etc.. The contamination will bring adverse effects on safety level of oyster products, which maybe threaten the health of consumer. Therefore, the lower safety will further reduce consumer willingness of common consumers, as well as the international market competitiveness of oyster products. In addition, the lack of a systematic understanding of the nutritional quality of oysters and the lack of necessary evaluation criteria have further affected consumers' consumption dynamics. Based on the analysis of China's oyster quality and safety status and industrial development needs, the speaker puts forward the key ideas for future work, that is, equal emphasis on quality and safety. On the basis of further improving the safety of oyster products, we must also pay attention on the evaluation of nutritional composition of oyster products. It will simultaneously promote the upgrading and transformation of China's oyster industry, then ensure the healthy and sustainable development of the industry.

张国范研究员，中国科学院海洋研究所理学博士（1992 年），现任中国科学院海洋研究所研究员、中国科学院大学教授、国家贝类产业技术体系首席科学家。从事贝类遗传育种与养殖技术研究近 40 年，作为主要负责人领导并成功完成“国际牡蛎基因组计划”，该研究突破贝类逆境适应的既往认知，发表我国水产领域首篇 Nature 论文，SCI 引用逾 900 次，使我国贝类学科跻身国际前列。张国范研究员是我国最早开展贝类遗传改良研究并取得产业化应用的学者之一，育成我国首个海水养殖贝类新品种，近年来通过基因组手段开展牡蛎的高营养品质的遗传选育并取得显著进展。张国范研究员主持多项国家大型科研项目并取得突出成果，科研项目包括我国海水贝类唯一一个 973 项目等，相关成果获国家科技进步二等奖 3 项。张国范研究员是中国动物学会贝类学分会主任委员，中国海洋与湖沼学会、中国动物学常务理事、海洋生态养殖技术国家地方联合工程实验室主任，曾任国家水产原良种审定委员会成员、APEC 扇贝贸易质量控制与溯源标准项目专家（2008 年）。张国范研究员在牡蛎遗传与养殖领域，已发表论文 116 篇，是国际牡蛎研究领域成果最突出的科学家之一。



报告题目：

中国牡蛎产业现状及发展态势

Biography: Guofan Zhang

Dr. Guofan Zhang received his Ph.D. from Institute of Oceanology, Chinese Academy of Sciences (IOCAS) in 1992. He is currently a Senior Scientist at IOCAS, a Professor of Marine Biology at University of Chinese Academy of Sciences, and the Director and Chief Scientist of the National Shellfish Industrial Technology Center, China Agriculture Research System (CARS). Prof. Zhang has been studying genetics and breeding economically important molluscs for over 40 years. Prof. Zhang is chief scientist of the international Oyster Genome Project and accomplished sequencing the genome of Pacific oyster. The results of the project reveals the molecular adaptation of oyster to environmental stress and was published on the famous journal of

NATURE, which citation is about 900 (SCI) and this is the first NATURE publication of Chinese scientists working in fisheries and aquaculture. Prof. Zhang is one of the Chinese scientists initiating genetic improvement program to breeding economically molluscs since 1980s and his team developed the first certificated "new varieties" in farmed molluscs by Chinese Ministry of Agriculture in 2005. Recently, they have developed high glycogen content Pacific oyster strains utilizing GWAS methods for aquaculture production. He is the chief scientist for a series of molluscs projects in China including the National Basic Research Program of China (973 Program) specified in marine molluscan area. The related achievements by Prof. Zhang and his team have won three national prizes of Scientific and Technological Progress Award in China. Prof. Zhang is the President of Chinese Society of Malacology, the committee member of Chinese Society of Oceanology and Limnology and China Society of Zoology, the Director and Principal Scientist of the National and Local Joint Engineering Laboratory of Ecological Mariculture, and served as the Member of National Certification Committee for the Genetic Resources of Aquaculture and the Council Member of APEC Scallop Trade Quality Control and Traceability Standard Project. Prof. Zhang has 116 peer-reviewed publications closely connected with oyster genetics and aquaculture and listed as one of the most productive author in a recent bibliometric analysis of oyster research worldwide.

Speech Title:

Oyster farming industry in China: current status and future directions