Summary Report

9th China-U.S. Living Marine Resources Panel
Joint Coordination Meeting

Oct. 19-23, 2012

The 9th China-U.S. Living Marine Resources Panel Meeting was convened in Shanghai, People's Republic of China on October 19-20. Related discussions and site visits were held from October 21-23 in Shanghai and in Shandong Province. Prof. Qing Liu and Dr. Ned Cyr, Co-Chairs of the Panel, opened the meeting and complimented the participants on the progress that has been made following the previous meeting held in Silver Spring, Maryland in June 2011.

This report includes: a) a summary of presentations and discussions, b) a list of action items (Appendix 1), c) a copy of the meeting agenda (Appendix 2), d) a list of meeting participants (Appendix 3), and e) a list of acronyms (Appendix 4).

Opening Presentation: Overview of the U.S.-China LMR Panel and Collaborative Research Activities in 2012 (Keith Chanon, NOAA and Li Jilong, CAFS)

Mr. Keith Chanon and Prof. Jilong Li jointly summarized the projects of the China-U.S. LMR Panel since it last met in June 2011. Topics of mutual interest identified by the Panel members in 2011 included aquaculture, climate and ocean acidification, harmful algal blooms, sea ranching, endangered species and habitat monitoring, assessment and restoration.

On November 1-3, 2011, a workshop on "Habitat Monitoring, Assessment and Restoration of Reef Systems" was convened in Honolulu, HI. The goal of the workshop was to exchange information and experience associated with monitoring, assessment, and restoration of reef systems and to identify opportunities for collaboration. Agreement was reached for NOAA's Pacific Islands Fisheries Science Center (PIFSC) to host two CAFS scientists (from the South China Sea Fishery Research Institute (SCSFRI)); one to work on Autonomous Reef Monitoring Structures (ARMS) and the other to work on stock assessment methodologies. The one-month visits occurred in August-September 2012.

On April 1, 2012, Dr. Christopher Brown attended a CAFS' seminar on shellfish cultivation, classification, and pollutant monitoring in Beijing.

On April 12, 2012, the China-U.S. Sea Turtle Workshop was held in Shanghai at the East China Sea Fisheries Research Institute (ECSFRI). The workshop facilitated the exchange of information and highlighted research priorities and potential joint projects.

The U.S. and China continue to work together to better understand the biology and ecology of western gray whales. Drs. Dave Weller and Robert Brownell from NOAA's Southwest Fisheries Science Center are working with Dr. Qian Zhu from the State Oceanic Administration's Institute of Oceanography to collect information on the

occurrence and distribution of the whales and develop community outreach materials to support conservation efforts.

For the future, the U.S. plans to organize a workshop in the summer-fall of 2013 on the influence of oil spills on fisheries and their ecosystems. Scientist exchanges will be planned between the Yellow Sea Fishery Research Institute (YSFRI) and Mote Marine Laboratories to study fishery resource enhancement methods. NOAA will identify expertise to assist CAFS in utilizing remote sensing technologies to assess the impact of human development activities on coastal habitats and fisheries. ECSFRI will apply for funding from the Chinese Nature Science Foundation to support a joint study on the abundance dynamics of *Euphausia pacifica* in the East China Sea and to trace the reasons for low abundance and conduct a comparative study in the North Pacific.

The presenters identified some challenges facing the LMR Panel:

1. Lack of dedicated funds to support projects
2. Need for raising the priority of joint activities within the government structures of each country
3. Need for increased coordination on a routine basis.

The Panel meeting was organized into the following four themes:

Theme 1: 2012 Collaborative Research Projects and Activities Pursuant to the Framework of the LMR Panel

Theme 2: Assessment of the Efficacy of Reef Systems

Theme 3: Marine Aquaculture, including the Use of Aquaculture to Support Fisheries (i.e. Sea Ranching and Stock Enhancement)

Theme 4: Next Steps for the Living Marine Resources Panel

Theme 1: 2012 Collaborative Research Projects and Activities Pursuant to the Framework of the LMR Panel (Leaders: Keith Chanon, Jilong Li)

Presentation 1.1: Dramatic Declines in *Euphausia pacifica* Abundance in the East China Sea: Response to Global Warming (Dong Zhang, ECSFRI)

Prof. Dong Zhang gave a presentation on the change of abundance for the *Euphausia pacifica* (krill) in the East China Sea. As with other marine ecosystems, water temperature has been anomalously warm in recent years in the East China Sea. However, the effects of the climate warming on this ecosystem are largely unknown. The historical data were analyzed to explore the effects of climatic change on the abundance and distribution changes of *Euphausia pacifica* in the East China Sea (the Changjiang River estuary and its adjacent areas). In 1959, the highest abundance occurred in the spring and autumn; however, abundance was significantly reduced in the spring of 2002. The greatest abundance of *E. pacifica* in the East China Sea occurred at regions with temperatures around 18 °C. Both inter-annual (between November 1959 and 2002) and inter-monthly (between May and June 1959) comparisons suggest that *E. pacifica* has

had a temperature-driven northward shift in distribution since 1959. *Euphausia pacifica* was the numerically dominant *euphausiid* in the East China Sea in 1959. Its mean abundance was up to 1.64 ind/m^3 in 1959; however, this figure decreased to 0.36 ind/m^3 in 2002, and krill have been hard to find in the East China Sea since 2003. The decline of *E. pacifica* abundance may be in response to global warming as surface water temperature has steadily increased since 1959. However, water temperature, alone, may not solely account for the decline of *E. pacifica* as temperatures in the spring and fall in recent years (2003-2007) were still in the range enabling the distribution of *E. pacifica.*

In conclusion, there has been a dramatic reduction in the abundance of krill since 2002 which is likely due to the change of temperature. Further research is needed to verify the correlation between temperature and the abundance of krill, as well as to correlate krill abundance with changes in the abundance of other fish. This could be a good opportunity for the use of Geographic Information System (GIS) applications.

CAFS will apply for funding in 2013 to support joint surveys and related fieldwork and will consider sending a student to the U.S. on a scientist exchange.

Presentation 1.2: A Western North Pacific Gray Whale Bycaught in Fujian Province, China (Xianyan Wang, SOA)

Dr. Xianyan Wang reported a dead gray whale (*Eschrichtius robustus*) entangled in a set gillnet on November 5, 2011, at Pingtan, Fujian Province, China. Notably, this is the first recorded incidental catch of a gray whale in Fujian Province, as well as the first record in Chinese waters in the 21st century. He described the external morphological characteristics and skeleton measurements of this whale. The whale was a female; its body length and weight are 13m and 21t respectively, which is thought to be the largest whale stranded/bycaught in Chinese waters. The cranium of this gray whale is 281cm in length, 128cm in width, and 250kg in weight. Specifically, the vertebra, phalanx, rib and V-bone of this gray whale are different from those reported previously. Besides, the gray whale has 14 pairs of ribs and 10 V-bones. These findings indicate that the skeletal anatomy of gray whales may vary across individuals. Dr. Wang also reviewed the main threats to the western North Pacific gray whale.

SOA and NOAA will conduct joint research to establish the existence of western gray whales with initial funding from the International Whaling Commission.

Presentation 1.3: China-US Sea Turtle Workshop (April 12, 2012)-Status of Collaborative Activities (Keith Chanon, NOAA)

Mr. Keith Chanon presented on the joint collaboration on Sea Turtles. He provided background including the interest from both countries to focus on green sea turtles, loggerheads, and leatherbacks, as identified at the 8th LMR Panel Meeting held June 2011. Sea turtle scientists and managers from both countries held a workshop on April 10, 2012 in Shanghai at the ECSFRI. Two priority research activities were identified at the workshop:

1. Biology and ecology: develop proposal on a specific area/region to assess foraging ecology; and
2. Distribution: analyze tagging data mapped to oceanographic parameters.

In addition to these priorities, nine additional projects of mutual interest were identified, including sea turtle health assessment and necropsy techniques.

Participants at the April workshop also established a joint Sea Turtle Working Group to be led by Honghui Huang (SCSFRI), Feiyan Zhang (Gangkou Sea Turtle Reserve), George Balazs (PIFSC) and Jeff Seminoff (SWFSC).

Following the workshop, NOAA supported an exchange with Feiyan Zhang, enabling her to visit the PIFSC for 10 days in September 2012 where she participated in sea turtle necropsies, capture activities, and visited foraging areas. This visit enabled Mrs. Zhang and the U.S. team to further refine priorities for collaborative research.

Mr. Chanon identified the following action items:

1. The Joint Sea Turtle Working Group will submit a work plan that advances joint activities related to the top two priorities (within the general areas of foraging ecology and population distribution),
2. The Working Group should consider organizing a scientific staff exchange with U.S. scientists timed with the Guangdong Reserve annual release of sea turtles.

Presentation 1.4: Manifestation of Seasonal Dynamics and Yearly Changes in Lakes and Coastal Wetlands Using Remote Sensing, Geographic Information Systems (GIS) and Spatial-Temporal Modeling Across these Fishery Habitats (Lin Wang, CAFS)

Dr. Lin Wang introduced the following mission of the Fishery Remote Sensing and GIS Application Initiative that is underway at CAFS.

1. To create and effectively disseminate fundamental knowledge about fishery resources, interactions, and the environment;
2. To monitor and predict the response of fishery resources and ecological environment to natural environmental and human-caused changes at the local, regional and global levels;
3. To train students, future leaders, and educate the broader public in fishery sciences for remote sensing and GIS technology application;
4. To integrate, synthesize, and apply scientific knowledge to societal problems, such as the sustainable development of fishery resources, water and other related resources, the identification and mitigation of risks posed by natural hazards, and the consequences of human activities on the environment.

The short-term goals of her research focus on:

- Interactions between fishery resources, ecological and environmental change, and human activities;
- Multi-scale observation and data assimilation;
- Spatial-temporal modeling of fishery ecological environmental changes based on remote sensing, GIS and high performance computing;

- Fishery ecological disaster monitoring and impact assessment.

A few case studies conducted by Dr. Wang and her team include:

- Change detection of major coastal wetland cover through the reclamation construction period using time-series remote sensing data over north of Bohai Bay, China;
- Automatic detection of shoreline changes with respect to comparing the impacts between fisheries and sea reclamation;
- Landscape analysis of coastal ecosystem supply and demand for: the effects of reclamation, land cover change, and classification methods;
- Discriminating the aquatic phytoplankton functional types using remote sensing data, time-series classification with several statistical machine-learning classifiers, and GIS spatial analysis methods;
- Coastal and lake topography and fishery resources detection using sonar eco-sounder and spatial distribution mapping using GIS analysis.

Below are Dr. Wang's continuing efforts on fishery habitat remote sensing mapping and GIS analyses:

- Construction of the nationwide fishery resource habitat classification system (includes the entire coastal and inland area).
- Mapping fishery resource habitats according to the classification system using above 30-meter resolution remote sensing data and the Object-based classification method.
- Probing a new set of software tools for large area mapping.
- Mapping of 2010, 2000 and 1990 data.
- Acquiring an evolving set of nationwide fishery resource habitat validation samples over 5000 locations.
- Acquiring an evolving set of training samples of over 12000 locations.
- Establishing a new strategy of classifying the nationwide fishery habitat.

Dr. Wang proposed that NOAA and CAFS organize a workshop that focuses on the following areas:

1. Manifestation of landscape-level variation and transitions of costal and lake-wetland ecosystems caused by disturbance, climate change and human activities.
2. Manifestation of landscape ecosystem services and functions for fisheries at different scales.
3. Understanding the associations among fishery diversity, abundance of endangered species and characteristics of seasonal habitat in a large conservation hotspot and resources rebuilding area.

Theme 2: Assessment of Efficacy of Artificial Reef Systems (Leaders: Gerard Dinardo, Ping Zhuang)

Presentation 2.1: New-style Artificial Reefs and Facilities for Culture and Stock Enhancement of *Apostichopus japonicas* (Hongsheng Yang, CAS)

Apostichopus japonicus (Selenka), a species of sea cucumber, belongs to Echinodermata and Holothuroidea. It is a typical temperate species which distributes from 35°N to 44°N throughout the Northwest Pacific. Adults inhabit rocky and sand pelitic submarine areas, those especially with seaweed cover. The economic value of *A. japonicus* is the highest of all mariculture species in China. Pool and cofferdam aquaculture are traditional methods of *A. japonicus* aquaculture. People commonly use basic supplies (bricks, stones, nets, cages, etc.) to improve the sediments to build suitable habitat for *A. japonicus*.

A variety of new artificial reefs and facilities are designed for the purpose of improving water body utilization rates and harvest of *A. japonicus*. Research indicates that habitat modifications, including the use of multi-layer and plate-type artificial reefs that enable the co-culture of sea grass, shellfish, and macroalgae increase the production of *A. japonicas.*

The Chinese Academy of Sciences (CAS) expressed interest to strengthen academic exchanges between China and US scholars and to jointly conduct cooperative research on habitat and resource restoration techniques for the successful production of sea cucumbers. It was noted that an exchange of information regarding new techniques such as autonomous underwater vehicles (AUVs), acoustic sensors and cameras can be useful for assessing artificial reefs.

Presentation 2.2: Contribution of Artificial Reefs Along the Shandong Coast of China to Carbon Sinks (Changtao Guan, YSFRI)

Artificial reefs and marine ranching have become important components of a low-carbon economy along the coast of Shandong Province. Since 2000, the total investment in the construction of artificial reefs and marine ranching in the province has reached over 123 million USD. More than 8 million m^3 of artificial reefs have been constructed forming 155 artificial reef districts totaling 14,500 hm^2. The construction of artificial reefs can create new "little ecosystems" where primary production of marine organisms increase and accelerate the carbon cycle in the large marine ecosystem.

In order to better quantify the capacity for artificial reefs to absorb carbon, new calculation methods must be developed. Following the publication of the YSFRI research, NOAA will consider how it can contribute to the Chinese research program.

Presentation 2.3: Stock Assessment Methodologies of Reef Systems and Joint Analyses (Gerard Dinardo, NOAA)

Dr. Gerard DiNardo discussed the goals and activities of the recent scientist exchange between Dr. Chuanxin Qin of SCSFRI and PIFSC, as well as ideas for advancing stock assessment methodologies that incorporate enhancement (stock and habitat) activities. The first half of Dr. Qin's visit involved: 1) data screening and mining activities; 2) plotting and mapping of survey data; and 3) exploratory analyses. The latter half of his visit involved the development of an analytical framework for assessing the utility of stock and habitat enhancements and preliminary analyses. Data requirements for advancing assessments were also discussed, including catch monitoring, catch-per-unit-

effort (CPUE) time series, size (length or weight) structure, movement (connectivity) and stock enhancement statistics. The potential application of size-based approaches to assess fish stocks associated with artificial reefs in the Guangdong Province was discussed as an appropriate methodology in data limited situations.

The SCSFRI and PIFSC will continue to exchange data and stock assessment methodologies and will prepare articles for publication.

Presentation 2.4: Stock Assessment Methodologies of Reef Systems: A Case Study Using Yangmeikeng Artificial Reef (Chuanxin Qin, SCSFRI)

Dr. Chuanxin Qin discussed the use of stock assessment for artificial reefs. According to his research, artificial reef construction is a useful way to restore coastal fishery resources. In recent years, there has been a rapid increase of artificial reefs in Guangdong province. Through 2010, more than 180 km^2 of artificial reefs were constructed along Guangdong Province's coast. However, compared with the construction of artificial reefs, the research on stock assessment for these reefs has been minimal. Located in a typical subtropical gulf environment, Yangmeikeng artificial reef was selected to evaluate the restoration of fishery resources. A conventional biomass method and regression tree with R software were used to analyze the artificial reef fishery resource data. The results showed a significant increase in fish biomass.

CAFS and NOAA will continue joint efforts to exchange and improve methods for assessing artificial reefs.

Presentation 2.5: NOAA & CAFS Scientific Exchange on Autonomous Reef Monitoring Systems (ARMS) (Zhenzhao Tang SCSFRI)

Dr. Zhenzhao Tang provided a report on the exchange program between the U.S. and China on habitat monitoring, assessment and restoration of reef systems. The exchange focused on the following goals:

1. Learn to deploy, recover, and conduct real-time processing on ARMS units;
2. Learn current procedures in post-processing of motile organisms from preserved bulk specimens obtained from ARMS units recovered in the U.S. Pacific Islands;
3. Learn to obtain percent cover information from plate analysis on sessile communities;
4. Learn to process associated metadata;
5. Be exposed to the database system used to record and document all aspects of ARMS activities.

As the visiting scientist, Dr. Tang worked with the PIFSC, focusing on:

- Sorting samples obtained from ARMS units recovered in the U.S. Pacific Islands;
- Assembling ARMS and monitoring acidification using calcification accretion units (CAUs);
- Deploying and recovering ARMS.

A plan has been proposed to apply ARMS in South China. The use of ARMS in the South China Sea will help evaluate diversity between natural and artificial reefs, however, it is limited to invertebrates. Consideration should also be given to techniques for the evaluation of abundance and diversity of finfish. NOAA will provide technical guidance to assist CAFS in modifying the ARMS design. CAFS will:

1. Submit a proposal on ARMS to the Ministry of Agriculture;
2. Reach an initial agreement on ARMS with the Fishery Bureau of Shenzhen;
3. Conduct experimental deployment of ARMS in coral reef sites and artificial reef sites in the northern South China Sea. Optional sites include Zhujiang Kou, Beibu Bay, Yue Xi, Yue Dong and Sanya.

Theme 3: Marine Aquaculture, Including Use of Aquaculture to Support Fisheries (i.e. sea ranching and stock enhancement) (Leaders: David O'Brien, Hongsheng Yang)

Presentation 3.1: Science and Policy Initiatives for Sustainable Aquaculture in the U.S. (David O'Brien, NOAA)

David O'Brien gave an overview of the U.S. science and policy on aquaculture. Aquaculture production in the United States has grown little in the past 20 years due to competition for coastal land, a long and difficult permitting process, and opposition from some environmental groups. The U.S. now imports 86% of its seafood, despite having the largest EEZ in the world. In 2011, NOAA released a new Aquaculture Policy that focuses on developing sustainable marine aquaculture to create jobs and protect the environment. The NOAA Fisheries Office of Aquaculture is working in several areas to implement this policy, including developing a more efficient permitting process and conducting research in key areas such as: modeling environmental impacts of aquaculture, shellfish disease research, and developing new aquaculture feeds for finfish. NOAA is working with international collaborators on these research initiatives and is interested in developing collaborations with Chinese researchers.

NOAA will facilitate the participation of Chinese scientists in meetings of the World Aquaculture Society, the American Chapter of the World Aquaculture Society, and the American Fisheries Society.

Presentation 3.2: Study and Integration of Technology of Modern Marine Ranching: Effect and Experiences of Construction in Zhangzidao Island Sea Area (Tao Tian, DOU)

Marine ranching has become an effective means to address depleted stocks in China. Modern marine ranching integrates the construction of artificial habitat, release of seeds, taming of fish behavior, environmental monitoring, and management technologies. Prof. Tian Tao and his team have constructed ecological marine ranching in the Zhangzidao Island sea area. In the past ten years, 100 thousand hollow cubes were used to construct artificial reefs to help restore the seabed ecosystem. Combined with the release of seeds, the stock was effectively restored. This success set an example for marine ranching in other coastal areas.

Chinese and U.S. scientists will consider working together to model the shape and design of artificial reefs and assess the effectiveness of sea ranching.

Presentation 3.3: Alternative Feeds Research at NOAA (Ron Johnson, NOAA)

Dr. Ron Johnson presented NOAA's research on alternative feeds in aquaculture. Aquaculture is the fastest growing food-producing sector in the world today, and demand for feed ingredients, especially fishmeal and oil, has increased dramatically. In global terms, more than 3.7 million tons of fishmeal and 0.7 million tons of fish oil, representing 61% and 74% of total production, respectively, were used for aquaculture in 2008. Stocks of feed-grade pelagic species are currently managed at near-maximum levels of harvest, and supplies cannot increase in the future. Thus, alternative protein and oil sources are needed to supplement or replace fishmeal and oil in aquafeeds if further development of the aquaculture industry is to be sustained. Nutrient-dense diets containing high levels of marine-derived meals and oils approximate the ideal protein and lipid profiles for farmed fish and are efficiently metabolized for energy and growth. Simultaneous replacement of both fishmeal and fish oil by terrestrial alternatives is problematic and total replacement of both has not yet been successful with marine finfish. Nutritionists in the NOAA and the United States Department of Agriculture (USDA) recently sponsored the NOAA-USDA Alternative Feeds Initiative in the United States to systematically investigate the potential of various alternative feed ingredients for fish feeds. This initiative takes a triple bottom line approach to evaluating alternative feed ingredients which takes into account the economic, environmental, and human health consequences of using an ingredient. The four most promising types of alternative feed ingredients will be discussed. These include plant protein meals, by-product meals from ethanol production, animal processing by-product meals, and fish processing by-product meals.

Chinese scientists from ECSFRI hope to visit the NWFSC lab and participate in a nutrition study including the joint publication of results (fall 2013). Mengqing Liang (YSFRI) and Ron Johnson intend to collaborate on an alternative feeds study with sablefish.

Presentation 3.4: Stock Enhancement - Joint China-US Activities: YSFRI & Mote Marine Laboratory Collaborative Fisheries Enhancement Initiatives (Ken Leber, Mote Laboratory)

Dr. Ken Leber, an Associate Vice President at Mote Marine Laboratory (MML) in Mote's Directorate of Fisheries and Aquaculture, gave a presentation to the Panel on the science underlying some new stock-enhancement related collaborations the YSFRI and MML have planned together. After a brief discussion of definitions of the various kinds of stocking to enhance fisheries, Dr. Leber announced a new LMR collaboration involving CAFS and US scientists that has resulted in planning for scientific exchanges between YSFRI and MML, including exchanges of students or Post Docs between the two institutions and a joint YSFRI-MML project proposal, submitted in 2011 and recently funded by the China Ministry of Science and Technology. The project aims to research key technologies needed for rebuilding declining fisheries stocks and their habitat, and improve the assessment system needed to measure, control and ensure success of enhancement effects on declining fishery stocks in China. He also explained that the project is based around "A Responsible Approach to Marine Stock

Enhancement," a prescription for a more careful approach to designing and conducting fisheries enhancement programs, first published by Lee Blankenship and Ken Leber in 1995 and recently updated with co-author Kai Lorenzen and published in *Reviews in Fisheries Science* in 2010. Dr. Leber described the basic approach and quantitative measures needed, and emphasized the basic need for enhancement efforts to be well integrated with other forms of fisheries management, with close involvement of stakeholders in the planning and execution of enhancements, and with attention to the institutional framework needed to manage and conduct enhancements.

Beyond the project planning already underway, next steps include:

1) Secure funding to support scientist and student exchanges (~$15,000 each), and increase LMR member attendance at scientific symposiums on marine fisheries enhancements (e.g. such as the special sessions on stock enhancement at World Aquaculture Society conferences);
2) Conducting a workshop (preliminarily planned for summer 2013) in China on marine fisheries enhancement to introduce the "Responsible Approach to Marine Stock Enhancement" project participants and stakeholders and provide training in the use of various tag technologies for quantifying the effectiveness of stocking;
3) Scientist exchanges on genetic characteristics and habitat carrying capacity within stock enhancement programs.

Theme 4: Next Steps for the Living marine Resources Panel (Leaders: Ned Cyr, Qing Liu)

Presentation 4.1: US-China Science Symposium and Staff Exchanges (Gerard DiNardo, NOAA)

Dr. Gerard DiNardo discussed the history, structure and goals of the Scientific Exchange Program (SEP), as well as recent activities and future plans. Initially established in 2009 between NOAA Fisheries, PIFSC and SHOU, the objective of the SEP is to foster scholarly exchange and training in the fishery and ecological disciplines, as well as promoting scientific collaborations. Two activities comprise the SEP, a Visiting Scientist and Visiting Student Program and a Scientific Seminar Series. The Visiting Scientist and Visiting Student Program is intended to support international exchanges by providing a mechanism to promote scientific training, while cultivating scientific collaborations among U.S. and Chinese scientists. Scientific priorities will be discussed and adopted during regular meetings of the LMR Panel, or at alternative venues as necessary. A three-year operating plan is recommended, and exchanges would last from one month for visiting students, to as much as one year for visiting scientists. The proposed seminar series provides a unique opportunity to address exciting new interdisciplinary areas of research and development. Seminars would convene every two years, thus providing adequate planning horizons for participants. Seminar topics would be discussed and adopted two years prior to the scheduled seminar during regular meetings of the LMR Panel, or at alternative venues as necessary. Presentations would include all scientific research conducted under the US-China Marine & Fisheries Science & Technology Protocol, and other research deemed pertinent. Two seminars have been convened, April 2009 and April 2012, covering a variety of topics including fishery bycatch, turtle

biology, Highly Migratory Species stock assessment and socioeconomic modeling, and fish biology and ecology. Activities of the Visiting Scientist and Visiting Student Program were discussed, including the visits of two scientists from the South China Sea Fisheries Research Institute to the NOAA Fisheries PIFSC in August 2012.

Future plans of the SEP were presented including a scientific seminar in 2014 and scientist exchanges in 2013. It was recommended that all scientist exchanges within the LMR Panel fall under the umbrella of the SEP.

Closing Remarks

- The LMR Panel Co-Chairs encouraged the lead investigators of each joint project to develop a data sharing agreement.
- The Co-Chairs thanked everyone for their participation at the meeting. Prof. Qing Liu indicated that Prof. Guohui Cui, Vice President of CAFS, will replace her as the Chinese Co-Chair as she will have new responsibilities.
- Dr. Ned Cyr indicated that the U.S. will plan to host the next Panel meeting in February 2014 in conjunction with the meeting of the American Chapter of the World Aquaculture Society in Seattle, Washington.

Site visits

CAFS organized site visits for the U.S. delegation. This included a tour of the ECSFRI, followed by a visit to Xunshang Corporation and its aquaculture and seafood processing facilities at Weihai, Shandong Province, and tours of the YSFRI and the CAS Institute of Oceanology at Qingdao, Shandong Province. These tours provided opportunities for further discussion and exchange of information to strengthen collaboration and facilitate the progress on joint projects.

Qing Liu, Professor	Ned Cyr, Ph.D
Chinese Chair	U.S. Chair
Vice President of Chinese Academy of Fishery Sciences	Director, Office of Science and Technology NOAA/National Marine Fisheries Service

Appendix 1

Action Items for Collaboration

1. Krill
    a. CAFS to submit a project proposal next year for surveys & related fieldwork (collect data on environmental and biological factors) (CAFS: Dong Zhang)
    b. Explore a scientist exchange (CAFS to send student to U.S. – 2013) (NOAA: Bill Peterson)

2. Western Gray Whale
   Following are the phases of the joint project between SOA and NOAA (SOA: Qian Zhu and Dong Zhang; NOAA: David Weller and Robert Brownell)
    a. Phase 1: Conduct local knowledge surveys with fisherman to determine if, when, and where gray whales are encountered.
        i. U.S. scientists to visit China in 2013 to develop surveys. Surveys should be compatible with other efforts outside of China
        ii. Explore opportunities for Chinese scientists to visit the U.S. to join surveys and exchange information on survey methodologies (eastern gray whale)
    b. Possible Phase 2: Conduct field studies (photographing and biopsy sampling)
    c. Consider partnership with Mote Marine Lab for tissue analysis (John Reynolds and Dana Wetzel)

3. Sea Turtles
    a. Request a work plan from the Joint Sea Turtle Working Group that identifies the top 2 priorities (within the general areas of foraging ecology and population distribution) (December 15, 2012 deadline) (Gangkou Sea Turtle Reserve: Feiyan Zhang and CAFS: Honghui Huang; NOAA: George Balazs and Jeffrey Seminoff)
    b. Consider scientific staff exchange with U.S. scientists in conducting research timed with the Guangdong Reserve annual release of sea turtles (Joint Sea Turtle Working Group)

4. Remote Sensing
    a. U.S. to identify experts that can collaborate with CAFS and explore opportunities for CAFS scientists to visit NOAA to exchange information regarding habitat mapping and remote sensing applications (and other technologies). (CAFS: Lin Wang; NOAA: Ned Cyr)

   b. CAFS to invite US experts to participate in a seminar (April/May 2013) addressing functional diversity system mapping (CAFS: Lin Wang)
   c. Explore opportunity for CAFS to present at the International Fishery Stock Assessment GIS Symposium (NOAA: Gerard DiNardo)

5. Sea Cucumbers & Artificial Reefs
   a. Explore scientific staff exchanges to share new technologies with China for assessing the usefulness of artificial reefs for sea cucumber production (CAS: Hongsheng Yang; NOAA: Ron Johnson to follow-up with Dr. Scott Smiley in Alaska)
   b. Potential for CAFS to join March, April, or September cruise in U.S. (Hawaii) on the use of camera systems on advanced technologies (AUVs) for general stock assessment (NOAA: Gerard DiNardo)

6. Artificial Reefs & Carbon Sinks
   a. NOAA to consider how to contribute to Chinese efforts following the publication of research by the YSFRI and potential collaboration with the U.S. Blue Carbon Program. (CAFS: Changtao Guan; NOAA: Roger Griffis)

7. Assessment of Artificial Reefs
   a. SCSFRI and PIFSC to publish two joint papers (description of artificial reef management in the S. China Sea and publication of data) (CAFS: Chuanxin Qin; NOAA: Gerard DiNardo)
   b. SCSFRI and PIFSC to exchange data, information on stock assessment methodologies and jointly develop an experimental design (summer/fall 2013) (CAFS: Chuanxin Qin; NOAA: Gerard DiNardo)
   c. MML offered to provide information on tagging for assessment purposes (Ken Leber)

8. Autonomous Reef Monitoring Systems
   a. SCSFRI submitted a proposal to the MOA. If it is successful, it would provide funding to support involvement from the PIFSC (NOAA: Rusty Brainard; CAFS: Pimao Chen and Zhenzhao Tang)
   b. SCSFRI to obtain agreement from PIFSC on the modification of ARMS for use in China (NOAA: Rusty Brainard; CAFS: Pimao Chen and Zhenzhao Tang)
   c. SCSFRI to prepare a plan for the deployment of 6 or more ARMS (NOAA: Rusty Brainard; CAFS: Pimao Chen and Zhenzhao Tang)

9. Aquaculture - General
    a. Facilitate the participation of Chinese scientists in meetings of the World Aquaculture Society, the American Chapter of the World Aquaculture Society, and the American Fisheries Society. (CAFS: Jilong Li; NOAA: David O'Brien, Ron Johnson, and Ken Leber (MML))

10. Aquaculture - Modeling
    a. SCSFRI and NOAA to consider working together to model the shape and design of artificial reefs and assess the effectiveness of sea ranching, seed releasing and acoustic taming. (CAFS: Honghui Huang; NOAA: James Morris)

11. Aquaculture - Alternative Feeds Research
    a. Chinese scientist from ECSFRI (contingent on the availability of funds) to visit the NWFSC lab and participate in a 12-week nutrition study (fall 2013), including the joint publication of results. (CAFS: Jilong Li; NOAA: Ron Johnson)
    b. Mengqing Liang (YSFRI) and Ron Johnson (NOAA) hope to collaborate on an alternative feeds study involving sablefish towards the end of 2013 at the NOAA NWFSC lab.

12. Aquaculture - Stock Enhancement and Sea Ranching
    a. Finalize the joint project between the YSFRI and MML (YSFRI: Yingyin Wang; MML: Ken Leber)
    b. Arrange scientist staff exchange(YSFRI: Yingyin Wang; MML: Ken Leber)
        i. Dr. Qian Ma to spend 3 to 6 months in 2013 working with the Stock Enhancement Program at MML;
        ii. Dr. Shouyu Zhang to coordinate exchange on carrying capacity assessment research (YSFRI: Shouyu Zhang; MML: Ken Leber)
    c. Chinese participation in PACOM (2nd week of December 2012)

13. Oil Spill Recovery
    a. NOAA to convene a joint workshop for spring/summer 2013 (Seattle) to address ecotoxicology and environmental assessment related to oil spill effects on LMRs (CAFS: Jilong Li; NOAA: Nathaniel Scholz and Gina Ylitalo)
    b. NOAA to share a list of questions with CAFS to define specific issues and interests for the workshop (NOAA: Keith Chanon)

14. Science Symposium and Scientific Staff Exchange
    a. Establish a 3-year work plan for staff exchanges and seek funding (CAFS: Jilong Li; NOAA: Gerard DiNardo, Keith Chanon, Jihong Dai)
    b. 2014 Seminar: Identify topics and venue for seminar and all collaborating sponsors (SOA-National Bureau of Marine Affairs, CAS, CAFS, NMFS, Mote…) (CAFS: Jilong Li; SHOU: Xiaojie Dai; NOAA: Gerard DiNardo, Keith Chanon)
    c. Establish funding mechanism and explore options to support scientist exchanges (e.g., US National Research Council for Postdoc exchanges, NSF, US Department of State, Chinese MOA, SOA, MST) (CAFS: Jilong Li; NOAA: Keith Chanon and Jihong Dai)

15. Consider joint activities on Chinese Mitten Crabs (YSFRI: Zhimeng Zhang; NOAA: David O'Brien)

Appendix 2

Agenda of 9th China-U.S. LMR Panel Joint Coordination Meeting

Meeting Objectives:

- *Exchange knowledge between the Chinese and U.S. scientists for supporting the management of living marine resources*
- *Review the status and progress of joint activities*
- *Identify joint priorities and specific areas for collaboration (short and longer-term activities) and identify mechanisms and resources to sustain cooperation and joint activities over the next five years*

Friday Oct. 19 (Changjiang Conference Hall, Third floor)

8:50 Opening Statements

-Prof. Qing Liu, Chinese Chair

-Dr. Ned Cyr, U.S. Chair

-Prof. Ping Zhuang

9:10 Self-introductions by participants

9:25 Adoption of the Agenda & Assignment of Rapporteurs

-Prof. Qing Liu

-Dr. Ned Cyr

Rapporteurs: -Keith Chanon and Dr. Jihong Dai

-Dr. Hao Yue and Xiaojun Jing

9:35 Overview of the U.S.–China LMR Panel and Collaborative Research Activities in 2012

-Prof. Jilong Li

-Keith Chanon

Theme 1: Collaborative Research Projects and Activities Pursuant to the Framework of the LMR Panel Meeting

(Leaders: Prof. Jilong Li and Keith Chanon)

9:55 Presentations:

1. Dramatic Declines in *Euphausia Pacifica* Abundance in the East China Sea: Response to Global Warming *(Prof. Dong Zhang, East China Sea Fishery Research Institute)*
2. A Gray Whale Bycaught in Fujian Province, China (*Dr. Xianyan Wang, State Oceanic Administration)*

10:35 Tea break

10:50 presentations:

3. China-U.S. April 12, 20012 Sea Turtle Workshop - Status of Collaborative Activities *(Keith Chanon, NOAA)*

4. Manifestation of seasonal dynamics and yearly changes of lake and costal wetland using remote sensing, GIS and spatio-temporal modeling across this fishery habitats. *(Dr. Lin Wang, CAFS)*

11:20 Open Discssion–Collaborative Research Projects and Activities Pursuant to the Framework of the LMR Panel Meeting

12:00: Lunch (Canteen at Second floor)

Theme 2: Assessment of Efficacy of Reef Systems

(Leaders: Gerard DiNardo, Prof. Ping Zhuang)

14:00 Presentations:

1. New-style Artificial Reefs and Facilities for Culture and Stock Enhancement of *Apostichopus japonicas*(*Prof. Hongsheng Yang, Chinese Academy of Sciences*)
2. Contribution of the Construction of Artificial Reefs along the Shandong Coast of China to the Fisheries Carbon Sinks (*Prof. Changtao Guan, Yellow Sea Fisheries Research Institute*)
3. Stock Assessment Methodologies of Reef Systems and Joint Analyses (*Gerard DiNardo, NOAA*)
4. Stock Assessment Methodologies of Reef Systems: A Case study Using Yangmeikeng Artificial Reef (*Dr. Chuanxin Qin, South China Sea Fishery Research Institute*)

15:20 Tea break

15:35 Presentations：

5. Autonomous Reef Monitoring Systems (ARMS) (*Gerard DiNardo, NOAA)*
6. NOAA & CAFS Scientific Exchange on Autonomous Reef Monitoring Systems (ARMS) (*Dr. Zhenzhao Tang, South China Sea Fishery Research Institute)*

16:15 Open Discussion – Assessment of Efficacy of Reef Systems and Next Steps for Collaboration

16:50 Tea break

Theme 3: Marine Aquaculture, Including Use of Aquaculture to Support Fisheries (i.e., sea ranching, stock enhancement)

(*Leaders: David O'Brien, Prof. Hongsheng Yang***)**

17:00 Presentations:

1. Science and Policy Initiatives for Sustainable Aquaculture in the U.S. (*David O'Brien, NOAA*)
2. Study and Integration of Technology of Modern Marine Ranching: Effect and Experiences of Construction in Zhangzidao Island Sea Area (*Prof. Tao Tao, Dalian Ocean University*)

17:40 Adjourn for the Day

Saturday, Oct. 20 (Changjiang Conference Hall, Third floor)

Theme 3 (continued): Marine Aquaculture, Including Use of Aquaculture to Support Fisheries (i.e., sea ranching, stock enhancement)

(*Leaders: David O'Brien, Prof. Hongsheng Yang***)**

9:00 Presentations:

3. Alternative Feeds Research at NOAA (*Ron Johnson, NOAA*)
4. Stock Enhancement – Joint China-US Activities: Yellow Sea Fisheries Research Institute & Mote Marine Laboratory Collaborative Fisheries Enhancement Initiatives) (*Ken Leber, NOAA*)

9:40 Open Discussion –Marine Aquaculture, Including Use of Aquaculture to Support Fisheries (i.e., sea ranching, stock enhancement) and Next Steps for Collaboration

10:10 Tea break

Theme 4: Next Steps for the Living Marine Resources Panel Meeting

(Leaders: Prof. Qing Liu, Dr. Ned Cyr)

10:25 US-China Science Symposium and Staff Exchanges (Gerard DiNardo)

10:45 Discussion of Potential Activities and Scope for the Short and Long-Term Joint Program

11:15 Identification of Joint Research Projects and Activities

11:35 Discussion of the Next Panel Meeting (location, timing, other issues)

11:50 Closing: Remarks by the Chinese Chair and U.S. Chair

Sunday, Oct. 21

U. S. delegation departs to Qingdao city and Sangou Bay

Monday, Oct.22

Study tour in Sangou Bay and back to Qingdao city

Tuesday, Oct. 23

Morning: Visit the Institute of Oceanology

Afternoon: Visit the Yellow Sea Fisheries Research Institute

Appendix 3

Meeting Participants

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Appendix 4

Acronyms

CAFS: Chinese Academy of Fishery Sciences

CAS: Chinese Academy of Sciences

CAUS: calcification accretion units (CAUs)

CPUE: catch per unit effort

CRED: Coral Reef Ecosystem Division

DOU: Dalian Ocean University

ECSFRI: East China Sea Fishery Research Institute

EEZ: exclusive economic zone

GIS: geographic information system

LMR: Living Marine Resources

MML: Mote Marine Laboratory

MOA: Ministry of Agriculture

MST: Ministry of Science and Technology

NOAA : National Oceanographic Administration, USA

NSF: National Science Foundation, USA

PIFSC: Pacific Island Fishery Science Center

SCSFRI: South China Sea Fishery Research Institute

SHOU: Shanghai Ocean University

SOA: State Oceanic Administration, China

YSFRI: Yellow Sea Fishery Research Institute