PICES/CLIVAR WG-40 Workshop

Programme

Hosted by: First Institute of Oceanography, Ministry of Natural Resources

June 20-22, 2019

Qingdao·China

Contents

1. Basic Information

1.1 Accommodation

Hundred Hotel (4 Star)

Address: No. 176 Haier Road, Laoshan District, Qingdao, China

1.2 Meeting Venue

The meeting room is on the 8th floor of Scientific Research Building at FIO campus.

Figure 1: The workshop venue at FIO

When you arrive at the Scientific Research Building, you need to take the elevator to the 7th floor and then go upstairs to the 8th floor.

1.3 Route from Hundred Hotel to FIO

On the morning of June 20, Ms. Yanfei Bi will show you the way from Hundred Hotel to FIO. All the participants should arrive at the lobby before 8:15, since at 8:15 all the participants will head to FIO together. Please do not be late!

Directions:

Start from Hundred Hotel, go along with Haier Road for about 10 minutes and then turn left at the second crossroads, go along with Xian-xia-ling Road for about 2 minutes and then you will find FIO is on your left.

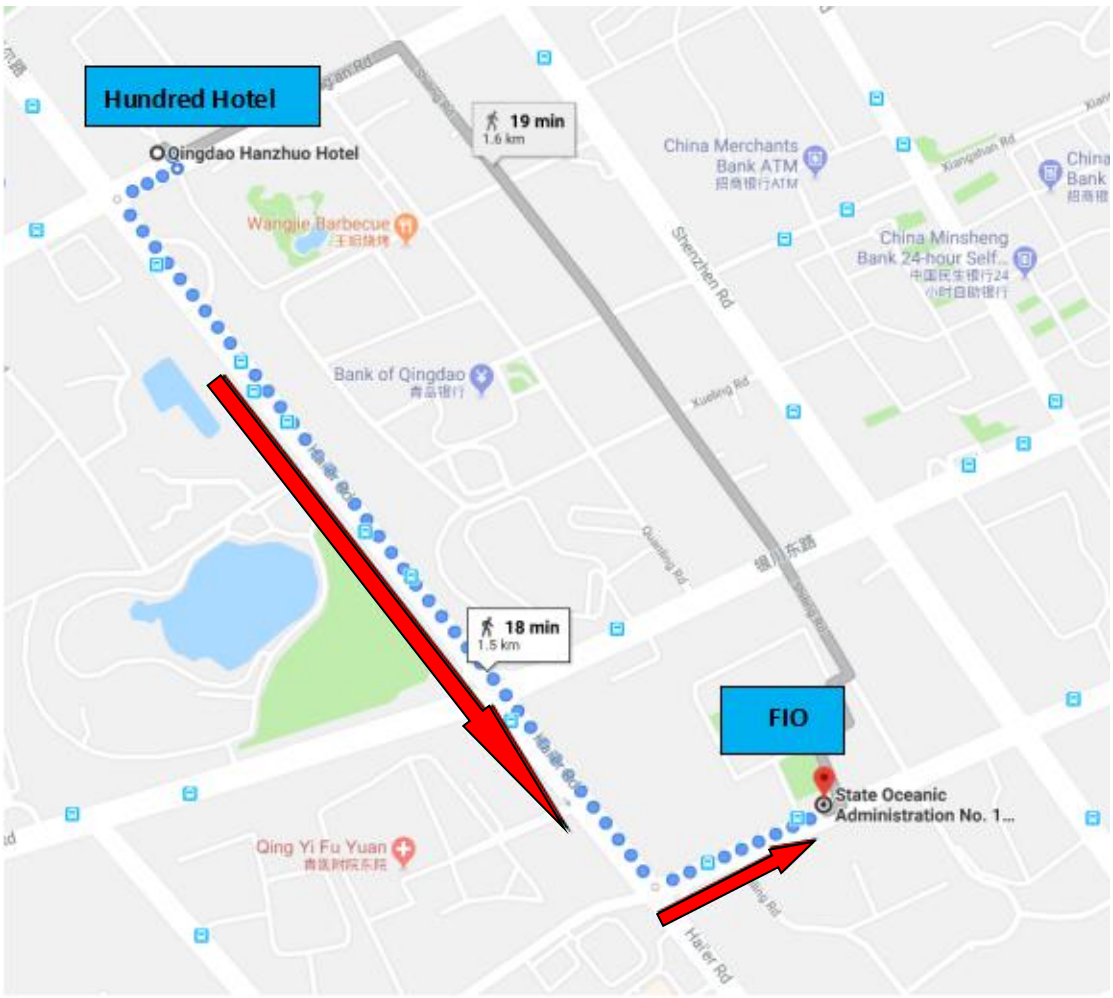

Figure 2: Road map from the Hundred Hotel to FIO

1.4 Weather

June is the beginning of summer in Qingdao and it is a mild month. You could wear a T-shirt during the day. But the weather is a little cool in the early morning and evening. It is better to bring a thin coat with you, especially when you go to the seaside or outside. The weather and temperature are listed in the following table for your reference. More information could also be found on the internet and you are encouraged to check it before your coming.

Date	June 20	June 21	June 22
Weather	Cloudy	Cloudy	Sunny
Temperature	18-27℃	18-28℃	18-27℃

1.5 A map around FIO

A map around the First Institute of Oceanography (FIO), Ministry of Natural Resources (MNR), China, is provided in Appendix. And information of some surrounding restaurants, shopping malls and hotels can also be found in Appendixes.

2. Agenda

Agenda for
PICES/CLIVAR WG-40 workshop on "Towards an integrated approach to understanding ecosystem predictability in the North Pacific"

Chaired by Ryan Rykaczewski, Antonietta Capotondi, Masami Nonaka and Fangli Qiao

Aim of the workshop: *The aim of this workshop is to deepen the understanding of the climate processes that generate predictability and to assess the range of forecasting methods applied throughout the North Pacific. We intend to review the current efforts and state of ocean and climate regional forecasting in target marine, assess the mechanisms responsible for predictability in the different areas and their relationships, and discuss the steps and action required to develop a common framework for forecasting activities.*

Thursday, June 20

08:45-09:00 Registration

Chaired by Antonietta Capotondi

09:00-09:10 Welcome remarks from (1) Co-Chair Ryan Rykaczewski; (2) CLIVAR office; and (3) Fangli Qiao as local host, each within 3 minutes.

09:10-09:22 Overview of the objectives of PICES and the FUTURE Science Plan
WG-40 Co-chairs (Ryan Rykaczewski)

09:25-09:40 Review of the WG-40 Terms of Reference and Workshop Objectives (Ryan Rykaczewski)

09:40-09:55 Discuss objectives of this particular workshop and the development of a special issue on Ecological Forecasting in the North Pacific

09:55-10:15 Brief introduction of participants

10:15-10:30 Overview of sources of marine ecosystem predictability (Shoshiro Minobe)

10:30-10:45 Coffee Break

10:45-11:05 Predicting interannual anomalies in biogeochemical conditions in the Northeastern Pacific (Ryan Rykaczewski)

11:05-11:35 Predicting physical ecosystem drivers of North Pacific marine ecosystems using a Linear Inverse Modeling approach (Antonietta Capotondi)

11:35-11:55 Statistical and Dynamical Downscaling climate projections for the California Current Upwelling System (Mercedes Pozo-Buil)

11:55-13:30 Lunch (cafeteria provided by FIO)

Chaired by Fangli Qiao

13:30-13:50 Forecasting responses of fish community to climatic and oceanographic changes (Caihong Fu)

13:50-14:10 BGC-Argo Observations and Ecosystem Forecasting for the Western Pacific Ocean (Fei Chai)

14:10-14:30 Discussion of some common issues in the Northeastern Pacific; mechanisms of drivers of predictability (or lack thereof)

14:30-14:50 Basin-scale Relations Between Marine Ecosystem Indices and Physical Environments in North Pacific (Shoshiro Minobe)

14:50-15:10 Western Pacific forecasting effort (Masami Nonaka)

15:10-15:25 Coffee Break

15:25-15:45 Long-term variabilities in ecosystem structures of northwestern North Pacific and the possible mechanisms (Yongjun Tian)

15:45-16:05 Toward an operational forecasting system of green tide in the Yellow Sea (Zengrui Rong)

16:05-17:00 Discussion of some common issues in the Northwestern Pacific; mechanisms of drivers of predictability (or lack thereof)

17:30-20:00 Welcome banquet hosted by First Institute of Oceanography, MNR, China

Friday, June 21

Chaired by Fei Chai

09:00-09:15 Review of the Workshop Objectives and summary of Thursday's discussion

09:15-09:35 The key role of surface waves in seasonal prediction of North Pacific (Fangli Qiao)

09:35-09:55 Applications of a systematic coastal ecology-sediment-environment coupled numerical model (Xuehai Liu)

09:55-10:15 Physical factors influencing the recapture rate and yield of the releasing edible jellyfish in the Liaodong Bay, China (Liping Yin)

10:15-10:30 Coffee Break

10:30-11:30 Discussion of some common issues in the Northwestern Pacific and comparison with those of the Northeastern Pacific

11:30-13:30 Lunch (cafeteria provided by FIO)

Chaired by Ryan Rykaczewski

13:30-15:00 Open discussion

Discussion of some common issues in the Northwestern Pacific and comparison with those of the Northeastern Pacific

15:00-15:30 Discussion of potential elements to include in manuscripts for the Special Issue

- Motivations for forecast development
- Forecast type and model details
- Forecast lead time
- Key mechanisms of predictability
- Skill assessment and sources of uncertainty
- End users of ecosystem predictions

15:30-15:45 Coffee Break

15:45-16:15 Discussion of socioeconomic motivations for improved ecosystem forecasts in the North Pacific

16:15-16:45 Discussion of key mechanisms facilitating predictability in the North Pacific

16:45-17:15 Discussion of skill metrics and uncertainty

Saturday, June 22

Visit to oceanographic resources around Qingdao (e.g., institute, research vessel, national lab)

3. Abstracts

(1)

Overview of sources of marine ecosystem predictability

Shoshiro Minobe (Hokkaido University, Sapporo Japan)

In this short presentation, I would like discuss potential processes that contribute the marine ecosystem predictability over the North Pacific. The processes treated are mainly physical processes, including El Niños and their teleconnections, propagations of ocean Rossby waves, due to the limitation of the author's expertise, but it is desirable to cover the biological processes through the discussion with audience.

(2)

Predicting interannual anomalies in biogeochemical conditions in the northeastern Pacific

Ryan R. Rykaczewski
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School of the Earth, Ocean, and Environment
University of South Carolina

The ecosystems of the California Current and Gulf of Alaska in the northeast Pacific are home to valuable fisheries that support commercial and recreational activities. However, the health and productivity of the marine populations of the region are sensitive to climate variability at a range of scales. At interannual to decadal timescales, severe anomalies in the oxygen and nitrogen concentrations in the system has been linked to unusual mortality events of higher predators, increased distribution of harmful algal blooms, and changes in fisheries productivity. The occurrences of these events are hypothesized to be the result of both local (stratification, winds, runoff, and respiration) and remote (source-water ventilation, contributions, and sources; and atmospheric teleconnections) factors. Here, I describe evidence for the influence of basin-scale processes on the biogeochemical conditions in the northeast Pacific and speculate on our ability to predict these anomalies in the future using a combination of observations and data-assimilative models.

(3)

Predicting Physical Drivers of North Pacific Marine Ecosystems Using a Linear Inverse Modeling Approach

Antonietta Capotondi, Prashant D. Sardeshmukh

University of Colorado/CIRES, Boulder, CO
NOAA/Earth System Research Laboratory, Physical Sciences Division, Boulder, CO

A Linear Inverse Model (LIM) is a stochastically forced damped linear dynamical model whose dynamical evolution operator and stochastic forcing amplitudes are estimated using the observed lag-covariances of the system state vector. We construct a LIM over a spatial domain extending from 30^{o}S to 70^{o}N and from 100^{o}E to 70^{o}W, including the entire tropical and North Pacific.

Our system is described by monthly averages of sea surface temperature (SST) and sea surface height (SSH), two quantities that play a key role in ecosystem dynamics. In particular, SSH is dynamically linked to thermocline depth, and provides information on upper-ocean heat content and thermocline displacements related to upwelling. Such LIMs have been shown to have comparable prediction skill to that of state-of-the-art comprehensive nonlinear forecast models in the tropical Pacific, but their application outside tropical areas has remained largely unexplored.

In this study, we use the LIM approach to understand the predictability of the extreme and persistent warming that occurred in the northeast Pacific from the Winter of 2013/14 to the Winter on 2015/17. Such extreme conditions were poorly captured by operational forecast systems. Our LIM results confirm that the sequence of events during 2014-16 in the northeast Pacific was indeed “unusual” and hard to predict, but the presence of an El Niño event toward the end of 2015 improved significantly the LIM skill. Future work includes a more direct comparison of the LIM performance with other forecast systems, as well as the use of the uncertainty estimate available from the LIM methodology to assess the degree of “uniqueness” of the northeast Pacific conditions during 2014-15. In future applications, the LIM will also be used to explore the predictability of SST and SSH variations along the western Pacific rim.

(4)

A Statistical and Dynamical Downscaled Framework for Climate and Ecological Predictions in the California Current System

Mercedes Pozo Buil[1,2], Michael G. Jacox[1,2]

1Institute of Marine Science, University of California Santa Cruz, Santa Cruz, CA
2Environmental Research Division, NOAA Southwest Fisheries Science Center, Monterey, CA

Global Climate Models (GCMs) have been used to make forecasts on

seasonal and decadal timescales, with demonstrated forecast skill for a range of physical ocean properties. However, these global forecast systems have large spatial biases in Eastern Boundary Upwelling Systems like the California Current System, where fine-scale dynamics play an important role. As a result, bias correction and/or downscaling of the GCM output is a critical step for their application to local scales. Dynamical downscaling of global climate output using a regional ocean model is a common method of improving resolution in regional applications; however, if global forcing fields are not corrected first, the regional model inherits biases through the forcing. Here, we use output from the CanCM4 model, a contributor to the North American Multi-Model Ensemble (NMME), and apply a combined statistical and dynamical downscaling method to reduce biases in regional predictions of the CCS. First, the CanCM4 forcing is corrected based on comparison with historical atmosphere and ocean reanalyses with either (i) a simple spatially-dependent bias correction or (ii) multiple linear regression of EOFs to related the coarse-scale CanCM4 fields to fine-scale reanalysis fields. Then, the Regional Ocean Modeling System (ROMS) is used to dynamically downscale the corrected CanCM4 output. Preliminary results show that the initial step of statistically correcting global forcing fields leads to improved representation of relevant ecosystem variables like Sea Surface Temperature. Finally, we explore the importance of including multiple forecast ensemble members and evaluate how much of the predictability in higher trophic level properties (i.e., species distribution) is consistent with predictable components of the physical parameters.

(6)

BGC-Argo Observations and Ecosystem Forecasting for the Western Pacific Ocean

Fei Chai[1,2]
[1]State Key Laboratory of Satellite Ocean Environment Dynamics, Second Institute of Oceanography, China
[2]School of Marine Sciences, University of Maine, USA

The Biogeochemical-Argo (BGC-Argo) Program aims at operating a network of profiling floats equipped with sensors of key biogeochemical variables for supporting research activities that address impacts of changing climate on ocean biogeochemical cycles and ecosystems. In the Northwestern Pacific, there are several BGC-Argo floats deployed during the last several years. In this talk, we will show examples of using BGC-Argo floats and coupled physical-biogeochemical models to investigate how ocean circulation affect on biogeochemical processes and distributions in the water column.

To investigate how marine ecosystem responses to both natural climate variability and anthropogenic forcing, we also developed a series of high-resolution coupled physical-biogeochemical models to investigate interaction and exchange processes between Northwest Pacific and China Seas (East China Sea and South China Sea). We will present some our model results related to nutrient sources and transports and how these processes may affect phytoplankton productivity and carbon cycle in Northwest Pacific and China Seas. Combining physical-biogeochemical models and multiple observations including remote sensing and BGC-Argo data, we have started to produce short-term forecasts of nutrients, oxygen and carbon cycle for the Northwest Pacific and China Seas.

(7)

Basin-scale Relations between Marine Ecosystem Indices and Physical Environments in North Pacific

Shoshiro Minobe1, 2, Emiyati1,6, Nathan Mantua3, Shin-ichi Ito4, Emanuele Di Lorenzo5

1 Department of Natural History Sciences, Graduate School of Science, Hokkaido University.

2 Department of Earth and Planetary Sciences, Faculty of Science, Hokkaido University.

3 Southwest Fisheries Science Center, National Marine Fisheries Service, National Oceanographic and Atmospheric Administration, California 95060, USA.

4 Atmosphere and Ocean Research Institute, University of Tokyo.

5 School of Earth and Atmospheric Sciences, Georgia Institute of Technology, Atlanta, Georgia, USA.

6 Remote Sensing Application Center, Indonesian National Institute of Aeronautics and Space.

To understand how marine ecosystem varies and how marine ecosystem is related to climate, it is useful to conduct a multi-variate analysis using large number (several tens) of marine ecosystem indices. Such analyses for the eastern North Pacific have been conducted by previous studies, but not for the western North Pacific as well as the whole North Pacific. We report for the first time large-number multi-index analyses for the whole and western North Pacific. The main analysis method is Empirical Orthogonal Function. The results indicate that the main features are common among regions for the first EOF mode over different regions, but the second mode has substantial differences across regions. It appears that the first mode is related to the overall warming over the North Pacific, but the second mode is closely related to decadal climate modes.

(8)

Climate and ocean predictability studies in the western North Pacific

Masami Nonaka and Takeshi Doi (JAMSTEC)

To explore potential of ecosystem prediction in the western North Pacific region, we introduce our predictability studies of climate and ocean physical variables on seasonal and interannual time scales. We have been conducting seasonal climate prediction every month. While its prediction skills in the western North Pacific is still limited, especially for the sea surface height, improved skill is suggested for yeas with ENSO events, probably relating to its good prediction skill of ENSO. On interannual time scale, we have investigated potential predictability of mesoscale eddy activities in the Kuroshio Extension region. In its downstream region, eddy activities correlate with current speed that is affected by signals propagating from the central North Pacific with lags of several years.

(9)

Long-term variabilities in ecosystem structures of northwestern North Pacific and the possible mechanisms

Yongjun Tian
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E-mail: yjtian@ouc.edu.cn

Under the multiple pressures of climate change and overfishing, a lot of fishery resources are seriously declining with changes in stock structure, and the sustainable utilization of marine fishery resources is facing serious challenges. As marginal sea of the northwestern North Pacific, the Japan Sea, the Yellow Sea (YS) and East China Sea (ECS) marine ecosystems are largely influenced by the Kuroshio Current and its branches and have experienced decadal shifts in marine environment. Additionally, intensive fishing efforts have also generated considerable impacts on the northwestern North Pacific at both species- and community-levels, including over-exploitation of commercial species and changes in species composition and trophic structure. Using long-term time series in fisheries, climate and oceanography, here we examined the variation patterns in small pelagic species and fish community structures in three current systems around Japan and in China Seas. Evident decadal variabilities were detected in the fish community in the northwestern North Pacific and showed good correspondence with climate change. Our results provided strong evidence of the impacts of basin-scale climate change on small pelagic species and regional ecosystem, and have important implications for ecosystem-based fisheries management.

(10)

Toward an operational forecasting system of green tide in the Yellow sea

Zengrui Rong, Lianbo Hu and Xiaodan Li
Ocean University of China

Among the many manifestations of harmful alglal blooms (HABs) worldwide, the green tide affects Qingdao and the Shandong Province in China is the largest and the most spectacular. These outbreaks start inconspicuously as contaminant growth of the seaweed alga Ulva prolifera on rafts or frames of the mariculture species Porphyra yezoensis. This occurs at a massive Porphyra aquaculture zone near Subei Shoal in Jiangsu Province, 200 km to the south. The Ulva is discarded during harvesting, and as it floats away, it grows and aggregates, forming large patches that are easily visible from space. With growth fueled by nutrient-enriched waters on the Yellow Sea shelf, the green tide is advected north by winds and currents and ultimately impacts the coast near Qingdao with floating accumulations and beach deposits of millions of tons of biomass. Societal and economic impacts are severe and recurrent – the green tide has occurred in Shandong Province every year since 2007, with individual events costing US$130M and more.

A monitoring and forecasting system for green tide has been developed. A remote sensing algorithm has been conducted to detect the green tide patches and to digitize those images to create a particle field that can be incorporated into a particle transport module. Bloom transport and landfall are then being predicted by a regional hydrodynamic forecast model that in turn is coupled to a weather model. The capability of the foresting system in predicting the distribution and trajectory of green tide is evaluated. It performs well over a time scale of about 10 days, with the coverage area error of about 30%.

(11)

The key role of surface waves in seasonal prediction of North Pacific

Fangli Qiao, Zhao Yiding, Yin Xunqiang and Song Yajuan
First Institute of Oceanography, Ministry of Natural Resources, Qingdao 266061, China Email: qiaofl@fio.org.cn

Abstract: Seasonal prediction of the ecosystem system in the North Pacific relies on our ability to develop robust climate prediction systems. Recent advances in the First Institute of Oceanography Earth System Model (FIO-ESM) have significantly reduced the seasonal prediction error of sea surface temperature anomaly (SSTA) in the high-latitudes. These improvements are examined and attributed to the vertical mixing induced by surface waves, which dominates the thermal structure of the upper ocean, and

influences the atmosphere-ocean coupling system through air-sea exchanges. The climate model can now predict the meridional distribution of SSTA, especially the characteristics of rapid decline in the North Pacific Transition Zone 25°N-45°N, which is a key region for marine ecosystem dynamics. These advances in seasonal predictions are the foundations of the FUTURE science program, and a robust base towards establishing operational ocean and ecosystem predictions under PICES framework.

(12)

Applications of a systematic coastal ecology-sediment-environment coupled numerical model

Xuehai Liu[1], Jing Lu[1]

1 First Institute of Oceanography, Ministry of Natural Resources of China, Qingdao 266061, China

Abstract: To meet the demand of research and assessment on sediment, ecology, environment, and mankind productive activities (such as aquaculture) in the coastal areas, an systematic ecology-sediment-environment coupled numerical model, which includes the ecological, sediment transport, water quality, aquaculture, diffusion and particle tracking, assessment evaluation modals, was established. All modules are effectively coupled together, and the hydrodynamic effects of deposition and breeding, the effects of sediment concentrations on phytoplankton, and the processes of deposition and resuspension of organic particles on seabed are all considered in the model. Here we addressed some implications of the model in the South Yellow sea and some aquaculture bays, such as evaluations of the phytoplankton growth affected by sediment in the coastal area, the carrying capability of mariculture, and the environmental restoration in eutrophic waters by phytoremediaton.

Key Words: ecosystem model, sediment, mariculture, environmental restoration.

(13)

Physical factors influencing the recapture rate and yield of the edible jellyfish in the Liaodong Bay, China

Liping Yin1, Chang Zhao1, Guansuo Wang1, Fangli Qiao1

1 The First Institute of Oceanography, State Oceanic Administration, Qingdao, China

A coupled individual based model for jellyfish Rhopilema esculentum was developed to research the physical factors that influence the yield and recapture rate of the jellyfish in Liaodong Bay, China. Within the coupled model,

virtual particles representing the jellyfish were capable of growth, mortality, diel-vertical migration and were passively moved by the marine physical processes such as advection and diffusion. The study uses the archived ocean physical data from an operational ocean circulation-surface wave coupled forecasting system for the seas off China and adjacent areas (OFS-C). Comparing the model result with the reported jellyfish yield information in years 2008 to 2010, it is shown that the yield of the jellyfish is controlled by the recapture rate and the mean individual quality. The pattern of current influences the jellyfish distribution during the fishing season, which further impacted the recapture rate. In addition, the recapture rate is also influenced by the temperature at releasing time as well as the natural mortality. The individual quality of the jellyfish is affected by the growth time, the ambient temperature of the jellyfish and the salinity. Overall, a relative growth time, higher temperature and lower salinity can improve the individual jellyfish quality. With all the physical factors taken together, this study show that the top of the bay is better than the eastern and western coasts as the fishing ground and site at the east coast is not an advisable location for jellyfish release.

Appendix I: A map around FIO

Appendix II: Restaurants

1. Lanzhou Hand-Pulled Noodles (HALAL) (兰州拉面)

Address: Second floor, No. 1-12 Xianxialing Road.
This HALAL restaurant offers hand-pulled noodles and rice.
The distance from FIO: about 80 m.

2. Feng Tian Rice with Spare Ribs (奉天排骨米饭老店)

Address: No. 1-10, Xianxialing Road.
This authentic restaurant provides rice with spare ribs.
The distance from FIO: about 90 m.

3. Tong Xiao Niu Hotpot (彤小牛筋头巴脑香锅米饭)

Address: Second floor, No. 1-7 Xianxialing Road.
This restaurant serves hotpot especially with beef.
The distance from FIO: about 120 m.

4. Yu Pin Beef Soup Restaurant (御品正宗牛肉汤)

Address: Second floor, No. 1 Xianxialing Road.
This restaurant serves beef soup with rice.

The distance from FIO: about 90 m.

5. Yi Sheng Pin Seafood Restaurant (一圣品海鲜舫)

Address: No. 16-7 Xianxialing Road.
This restaurant serves fresh seafood.
The distance from FIO: about 950 m.

6. Dongjia-Korea Charcoal Barbecue (东家韩国炭烤肉)

Address：Building 1, No. 16-17 Xianxialing Road.
This restaurant provides Korea traditional charcoal barbecue, as well as chicken and beer.
The distance from FIO: about 800 m.

7. Three Dishes (三条鱼崂山渔家菜)

Address: Building 2, No. 33 Yinchuan East Road.
This restaurant offers typical local cuisines, especially the fresh seafood.
The distance from FIO: about 900 m.

8. Lao Ma Tou Hotpot (老码头火锅)

Address: Building 2, No.16-23 Xianxialing Road.
This restaurant services spicy Sichuan Hotpot.
The distance from FIO: about 800 m.

9. Liu Hao Men Fish Restaurant (六号门沸腾鱼)

Address：at the corner of Yinchuan East Road and Qinling Road.
This restaurant provides spicy Sichuan cuisine.
The distance from FIO: about 800 m.

10. Kong Tao Casiu (港岛记)

Address: Building 1, No. 61 Hai'er Road.
This restaurant is famous for its HongKong food, such as roast pork and HongKong classic milktea.
The distance from FIO: about 550 m.

11. Blue Aegean Sea Western-style Restaurant (蓝海爱琴海西餐厅)

Address: Building 3, No. 9-2 Miaoling Road.
This cafeteria contains beef steak, salmon, Chinese food and other delicious food.
The distance from FIO: about 1400 m.

12. GREATHai (味泰)

Address: First Floor of Lion Mall, No. 195 Xianggang East Road.
This restaurant offers Thailand-style dishes.
The distance from FIO: about 1400m.

13. Hitide International Hotal (海泰万丰国际酒店)

Address: No. 68 Shandong Tou Road.
The hotel also services buffet during the lunch and dinner time.
The distance from FIO: about 1600m.

Appendix III: Coffee

14. SPROfessional Coffee (泛亚旗舰店)

Address：at the corner of Xianxialing Road and Hai'er Road.
The distance from FIO: about 350 m.

15. GeekMall Coffee (创客咖啡)

Address: No. 63, Hai'er Road.
This coffee bar also provides great dessert.
The distance from FIO: about 700 m.

Appendix IV: Shopping Malls

16. Youke Convenient Store (友客便利店)

Address: No. 1-8 Xianxialing Road.
This store keeps open for all day (24 hours) and provides necessities of life.
The distance from FIO: about 100 m.

17. Leader Plaza (丽达购物中心)

Address: No. 18 Qinling Road.
There are some restaurants in the second floor and the supermarket is on the basement of the plaza.
The distance from FIO: about 950 m.

18. Lion Mall (金狮广场)

Address: No. 195 Hong Kong East Road.
There are more than 60 restaurants in the Lion Mall, including worldwide delicious food.

The distance from FIO: about 1000 m.

19. Liqun/Jinding Plaza (利群/金鼎广场)

Address: No. 83 Haier Road
There are more than 30 restaurants on the sixth floor, such as Taipei cuisine, Japan cuisine, and typical Qingdao seafood and so on. And the supermarket is on the basement of the plaza.
The distance from FIO: about 1200 m.

Appendix V: Hotels

20. Qingdao Blue Horizon Hotel (蓝海大饭店)

Tel: +86-532-88996666
Addr: No.9-2 Miaoling Road, Laoshan District, Qingdao (青岛市崂山区苗岭路 9-2 号)
The distance from FIO: about 1400m.

21. Hitide International Hotel (海泰万丰酒店)

Tel: +86-532-88956666
Addr: No.68 Shandong Tou Road, Laoshan District, Qingdao (青岛市崂山区山东头路 68 号(近青医附院东院)
The distance from FIO: about 1600m.

22. Home Inn Hotel (如家海尔路会展中心海水浴场店)

Tel: +86-532-88990000
Addr: No.61 Haier Road, Laoshan District, Qingdao (崂山区海尔路 61 号(天宝国际楼下))
The distance from FIO: about 350m.

23. Hanting Hotel (汉庭海尔路会展中心店)

Tel: +86-532-55761111
Addr: No. 63 Haier Road, Laoshan District, Qingdao (崂山区海尔路 63 号 (青岛数码科技中心一楼))
The distance from FIO: about 350m.

Note: The numbers 1-15 display the location of some restaurants and cafe. And the numbers 16-19 show the places that you can go shopping. The numbers 20-23 represent the hotels.