Asia-Pacific
Economic Cooperation

Marine Science, Technology and Innovation Towards Science-based Management and Sustainable Use of Oceans and Marine Resources

Tokyo, Japan
28-29 June 2017

APEC Ocean and Fisheries Working Group

February 2018

APEC Project: OFWG 03 2016

Produced by

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Table of contents

OFWG 03 2016 – APEC Workshop on Marine Science, Technology and Innovation towards Science Based Management and Sustainable Use of Oceans and Marine Resources

Executive Summary

Background

Many parts of the world's oceans have not yet been sufficiently observed. It is against this background that in 2016 Japan took the initiative as chair of G7 summit and ministerial meetings, in boosting global commitments to support scientific work to enhance global ocean observation and research with a view to introducing the evidence-based policy making (EBPM) in the field of oceans.

Evidences, obtained from marine observation are the crucial source of all kinds of ocean policy making, including fisheries. That is why we undertook this project, which aims at bridging science and policy making.

Aims

In boosting above global commitments to support scientific approaches in ocean policies, the project which has view toward introducing evidence-based policy making (EBPM) in ocean policy making aims to enhance the capability of EBPM among ocean policymakers to assist in achieving sustainable ocean governance in international society, particularly in the APEC region, through the following:

(1) Networking between ocean policy makers in the APEC region and other stakeholders related to realization of sustainable ocean management including leading experts in various ocean fields and in civil society, among others;

(2) Capacity development of participants through sharing good practices, knowledge of combination of the latest marine scientific research and observation and marine policy-making; and

(3) Formulation of policy recommendation to raise interest among stakeholders in EBPM in ocean policy making, and also reflect this interest in consideration of various APEC and non-APEC ocean-related meetings.

Acknowledgements

In the workshop, the participants unanimously confirmed the importance of the following:

- ✓ To recognize that global endeavours supported by evidence-based deliberations and international cooperation can help conserve oceans;
- ✓ To strengthen coherence between policy and marine science and technology through marine scientific research and observation and further regional and global; collaboration,
- ✓ To acknowledge that there is abundant potentials in oceans and evidence-based wise and sustainable use of oceans, and that will benefit from sustainable development;
- ✓ To promote capacity development, networking and sharing of best practices and knowledge including innovative approaches for sustainable use of oceans;
- ✓ To take into consideration not only scientific evidences but also traditional and social knowledge of local people and communities in making and implementing sustainable ocean policy,

- ✓ To acknowledge that a holistic approach is necessary for the implementation of SDG14, and such efforts will also contribute to the achievement of other SDG goals.

Workshop on Marine Observation and Research
Towards Evidence Based Sustainable Ocean Governance
(28th and 29th June, 2017, Tokyo, Japan)

27th June 2017, Arrival of Participants

28th June, Workshop

Venue: Tokyo Office of JAMSTEC (Japan Agency for Marine-Earth Science Technology)

0. Opening	
9:00-9:30	**Registration**
9:30-9:35	**Opening Remark** ➢ **Mr Masaaki KAI, Director General, National Ocean Policy Secretariat, Cabinet Office, Government of JAPAN**
9:35-9:40	**Photo session**
1. Combination of Marine Scientific Research and Evidenced Based Policy Making in Ocean Policy	
	Moderator: Dr Yoshihisa SHIRAYAMA, Executive Director, Japan Agency for Marine-Earth Science and Technology
9:40-10:20	**Keynote Speech:** **Science Policy Dialogue Necessary for Implementation of SDG14** ➢ **Dr Yoshihisa SHIRAYAMA, Executive Director, Japan Agency for Marine-Earth Science and Technology** **[Summary]** **Five threats that are major obstacles for implementation of SDG14 are recognized in marine environment. However, all of them are possible to be solved if policies work properly based on dialogue with science.**
10:20-11:00	**Presentation:** **Recent Cases of IUU Fishing in the Northwest(NW) Pacific Region, Possible Use of Satellite Remote Sensing Images** ➢ **Mr Masanori MIYAHARA, President, Japan Fisheries Research and Education Agency(FRA)** **[Summary]** **FRA started analysis of IUU fishing operations in NW Pacific region, based upon night-time light images from satellite, AIS and other information. IUU catch of mackerel was estimated as 150-250 thousand MT in 2016.**
11:00-11:40	**Presentation:** **Marine Scientific Research and Government Policy Initiatives － The Case of TORI in Chinese Taipei** ➢ **Dr Hui-Ling LIN, Director General, TORI, Chinese Taipei** **[Summary]** **The government and marine scientific research institutions should encourage**

	efficient communication channels to optimize their mutual goals of managing ocean affairs, defending maritime rights and protecting ocean resources. The best way to accomplish this is to promote face-to-face discussions through visits, symposiums and workshops designed to efficiently exchange the latest information in each area of concern.
11:40-12:00	**Q & A , Discussion**
12:00-13:30	**Lunch Break**
2. Sustainable Management of Biological Resources	
	Moderator: Mr Masanori MIYAHARA, President, Japan Fisheries Research and Education Agency(FRA)
13:30-13:50	**Presentation:** **<u>Sustainable Management of Coastal Fishery Resources in Japan</u>** ➢ **Dr Takashi YAMAKAWA, Associate Professor, Department of Aquatic Bioscience, Graduate School of Agricultural and Life Science, The University of Tokyo** **[Summary]** **Institutional background of Japanese coastal fisheries management is briefly addressed, and then, an example of a developing process of self-motivating management activities of spiny lobster fishery by fishermen in a fisheries cooperative association at Wagu area, Mie Prefecture, based on scientific advices is introduced.**
13:50-14:10	**Presentation:** **<u>Information Technologies for Sustainable Fishery</u>** ➢ **Dr Masaaki WADA, Professor, School of Systems Information Science, Future University Hakodate** **[Summary]** **For sustainable fishery it is important to understand and adapt to resource situations and environment conditions. In Japan, fishermen utilize IT for resource management, environment observation and knowledge sharing. Here, we introduce a couple of good examples of IT fishery.**
14:10-14:30	**Presentation:** **<u>Towards the Sustainable Development of Small Scale Aquaculture – Importance of Horizontal/Vertical Business Integration and Role of ICT</u>** ➢ **Dr Tokio WADA, Executive Director, Japan Fisheries Research and Education Agency** **[Summary]** **Sustainable development under environmental and social constraints is a challenge for small scale aquaculture. To deal with the challenge, virtual horizontal/vertical business integration is an effective means, and ICT strongly promotes its implementation.**
14:30-14:50	**Presentation:**

	Pacific Ocean Perch: A US success story in science-based, sustainable management; and a brief introduction to new optical survey technologies ➢ **Ms Siri E. HAKALA, Mansfield Fellow from the United States** **[Summary]** **NOAA Fisheries uses science-based management to provide productive and sustainable fisheries as part of their mission to be stewards of the US's ocean resources. Ms Hakala will explain NOAA's approach to fisheries management through the Regional Fisheries Management Councils, and highlight the success story of Pacific Ocean Perch. Additionally she will talk about various new optical technologies being utilized to improve stock assessments.**
14:50-15:20	**Q & A , Discussion**
15:20-15:40	**Coffee Break**
3. Marine Environment Conservation and Enhancement of Resilience	
	Moderator: Dr Yoshihisa SHIRAYAMA, Executive Director, Japan Agency for Marine-Earth Science and Technology
15:40-16:00	**Presentation:** **Harmony of Coastal Fisheries Development and Ecosystem Conservation** ➢ **Dr Mitsutaku MAKINO, Head, Fisheries Policy Group, National Research Institute of Fisheries Science, Japan Fisheries Research and Education Agency.** **[Summary]** **Satoumi (Village coast) is a Japanese traditional idea of harmonizing coastal people's life and ecosystem conservation. In this presentation, Japanese examples of Satoumi will be presented.**
16:00-16:20	**Presentation:** **Plastic Debris Impact on the Marine Environment** ➢ **Dr Habib EL-HABR, Coordinator for the Global Program of Action for the Protection of the Marine Environment from Land-based Activities, UNEP** **[Summary]** **The presentation will be about the land based pollution specially the Marine Plastic and its impact on the marine environment. Touching upon the socioeconomic aspects from the developing countries point of view. I will also highlight the relation with Agenda 2030 and the linkages of the various Sustainable Development Goals.**
16:20-16:40	**Presentation:** **What is the Project TEAMS (Tohoku Ecosystem-Associated Marine Science) ー For Reconstruction from GEJE and for Restoring the Rich Ocean Through Science ー** ➢ **Dr Akihiro KIJIMA, Representative of TEAMS, Prof. Tohoku University** **[Summary]** **In the presentation, we would like to explain what happed in marine environment**

	and ecosystem by The Great East Japan Earthquake on March 11, 2011, and what is the TEAMS project for reconstruction through science.
16:40-17:00	Q & A , Discussion
17:00-17:05	Short Break (Change of desk layout for Group Discussion)
4. Group Discussion	
17:05-17:35	Group Discussion (by 4 groups consisting of participants from APEC economies and speakers only.)
17:35-18:15	Feedbacks from Group Discussion by each economy
5. Closing	
18:15-18:20	Closing Remark
Get Together	
18:40-	Leaving the workshop venue and walk to the Dinner Venue 'KAKIYASU'
19:00-21:00	Get Together Dinner at 'Kakiyasu'

29th June, Site Visit

8:45-8:55	Participants gather at the main entrance of the building of JAMSTEC Tokyo Office.		
9:00	Leaving Tokyo by chartered bus		
10:15-	**Visit Japan National Research Institute of Fisheries Science and National Research Institute of Fisheries Science, FRA, in Yokohama**		
Time	**Contents**	**Venue**	**Speaker/Facilitator**
10:15	Arrival	Pier	
10:20-10:40	Facility tour by 2 groups Stock Assessment Research in FRA	R.V. Soyo-maru	Capt. Yukio KUMAGAI, Dr Akira NISHIMURA
10:55	Arrival at National Research Institute of Fisheries Science	NRIFS	
11:00-11:20	Welcome Remarks from Director	Auditorium	Dr Ichiro NAKAYAMA
11:20-12:30	Facility tour by two groups Satellite Image Analysis Laboratory Marine Radioactivity Laboratory Marine Toxin Laboratory Exhibition room (stuffed fishes, historic documents)	Laboratory Building Administration Building Exhibition Room	Dr Ichiro NAKAYAMA, Dr Kinya NOGAMI
12:30-13:15	Lunch Break (Lunch Box)	Lounge	-
13:20	Departure		
14:00-	**Visit Japan Agency for Marine-Earth Science and Technology in Yokosuka**		
Time	**Contents**	**Venue**	**Speaker/Facilitator**
14:00-	Arrival	Administration building	Mr Tsuyoshi SUGIURA

14:00-14:05	**Welcome Remarks from Director**	**Seminar Room**	**Dr Asahiko TAIRA, President of JAMSTEC**
14:05-14:25	**Introduction of JAMSTEC**	**Seminar Room**	**Dr Yoshihisa SHIRAYAMA Executive Director**
14:25-15:15	**Facility Tour** **Remotely Operated Vehicle -KAIKO Mark V and Hyper Dolphin** **Autonomous Underwater Vehicle -Jinbei and Yumeiruka** **Marine Science Museum**	**ROV Maintenance Shop**	**Ms Kyoko TAKEUCHI**
15:30	**Departure**	**Administration Building**	**Mr Tsuyoshi SUGIURA**
(around 17:00)	**Arrival at Tokyo (back to the meeting point) by chartered bus**		

30th June, Departure Day of Participants

Opening Remarks

by Mr Masaaki KAI, Director General, National Ocean Policy Secretariat,
Cabinet Office, Government of JAPAN
28th June, 2017

Distinguished guests, ladies and gentleman.
First of all, I would like to express my hearty welcome and gratitude to all the participants, speakers and observers who take part in today's APEC Project 'Workshop on Marine Observation and Research towards Evidence Based Sustainable Ocean Governance'.
My deep appreciation also goes to related organizations and institutes, co-sponsor economies and APEC secretariat who made great efforts to realize this event.

The oceans are experiencing unprecedented changes and facing various challenges such as impacts of climate change, marine pollution, environmental conservation and sustainable use of resources and the like. Actually, the oceans are at the center of international agenda as the United Nations Ocean Conference or BBNJ process shows.

However, many parts of the oceans are not yet sufficiently observed, thus remain to be demystified. It is against this background that in 2016 Japan took the initiative as chair of G7 summit and ministerial meetings, in boosting global commitments to support scientific work to enhance global ocean observation and research with a view to introducing the evidence-based policy making (EBPM) in the field of oceans.

We believe that evidences obtained from marine observation are the crucial source of all kinds of ocean policy making, including fisheries. That is why we hold this project that aims at bridging science and policy making.

Today, many leading experts in various ocean fields are going to make their insightful presentations. I hope each participant will get some hints so that respective economy's ocean and fisheries policy making will be more evidence-based oriented. I also hope this workshop will give every one of you golden opportunities for capacity development, networking and good practices sharing.

Only global endeavors supported by scientific evidence and international cooperation can conserve our oceans and strengthen their sustainability for our future generations.

Finally, I hope participants coming all the way from abroad will spend wonderful time in Japan.
Thank you.

Chapter I

Combination of Marine Scientific Research and Evidenced Based Policy Making in Ocean Policy

Critical Situation of Ocean is a global common recognition

- **Five Threats to the Ocean (World Economic Forum 2014)**

- **1. Overfishing**
- **2. Coastal pollution**
- **3. Habitat destruction**
- **4. Warming**
- **5. Acidification**

1

G7 Ministers of Science Communiqué (Germany 2015)

- **Future of the Seas and Oceans**

- **G7 Ministers of Science recognize that all of the changes in the oceans, such as**

- **ocean acidification,**
- **warming and de-oxygenation,**
- **the loss of marine biodiversity, and**
- **degradation of marine ecosystems**

- **have profound impacts on human wellbeing and human societies in many regions of the earth.**

2

Succeeded to

G7 Science and Technology Ministers' Meeting in Tsukuba, Ibaraki

G7 2016 ISE-SHIMA SUMMIT

14 LIFE BELOW WATER

THE OCEAN CONFERENCE

3

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4

沿岸環境の汚染　　（Coastal pollution）

Sam Barratt
Chief of Public Advocacy & Communications
UN Environment Programme

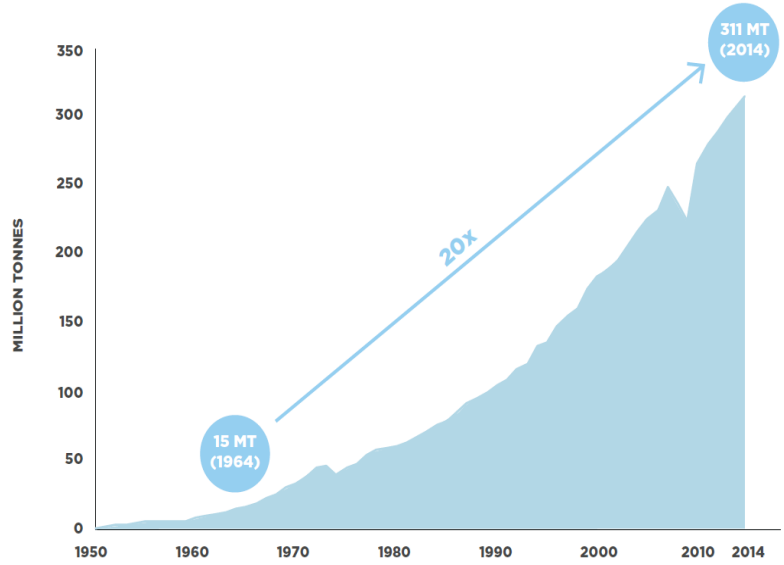
http://www.heraldonline.com/news/article31692431.html

WEF 2017 Report

More plastic in the sea than fish? Not if we do these 3 things

6

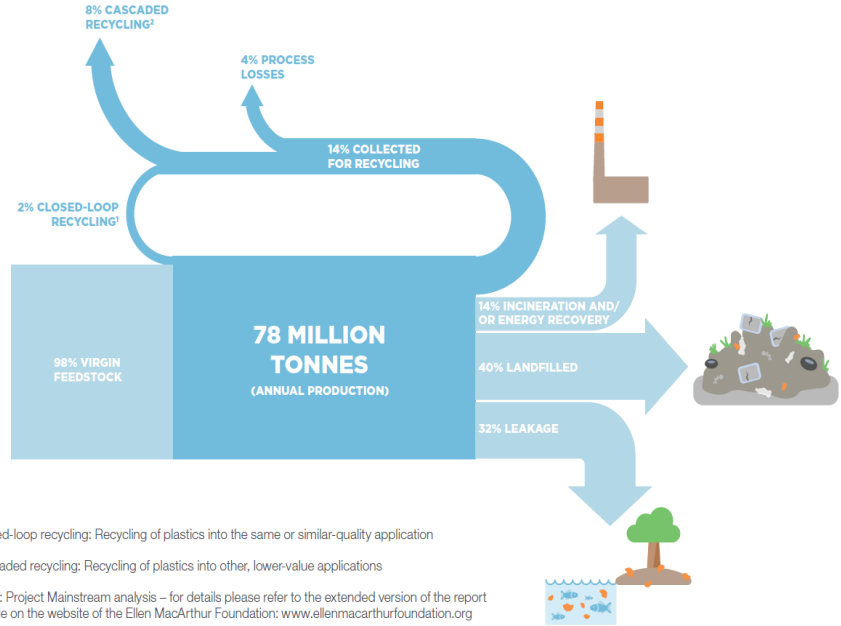
Figure 1: Growth in Global Plastics Production 1950–2014



Note: Production from virgin petroleum-based feedstock only (does not include bio-based, greenhouse gas-based or recycled feedstock)
Source: PlasticsEurope, Plastics – the Facts 2013 (2013); PlasticsEurope, Plastics – the Facts 2015 (2015).

7

Figure 4: Global Flows of Plastic Packaging Materials in 2013



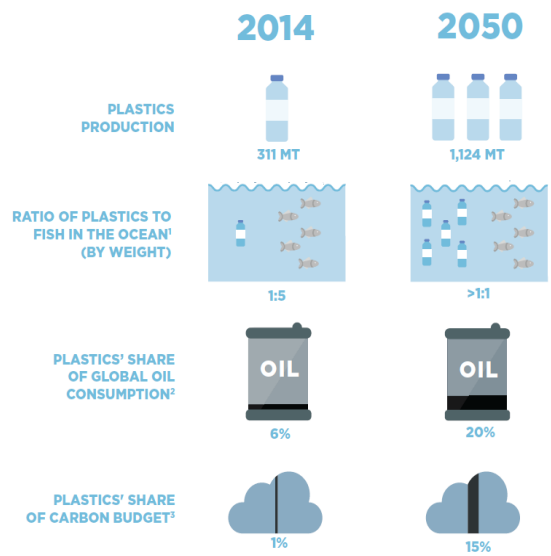
1 Closed-loop recycling: Recycling of plastics into the same or similar-quality application

2 Cascaded recycling: Recycling of plastics into other, lower-value applications

Source: Project Mainstream analysis – for details please refer to the extended version of the report available on the website of the Ellen MacArthur Foundation: www.ellenmacarthurfoundation.org

8

Figure 5: Forecast of Plastics Volume Growth, Externalities and Oil Consumption in a Business-As-Usual Scenario



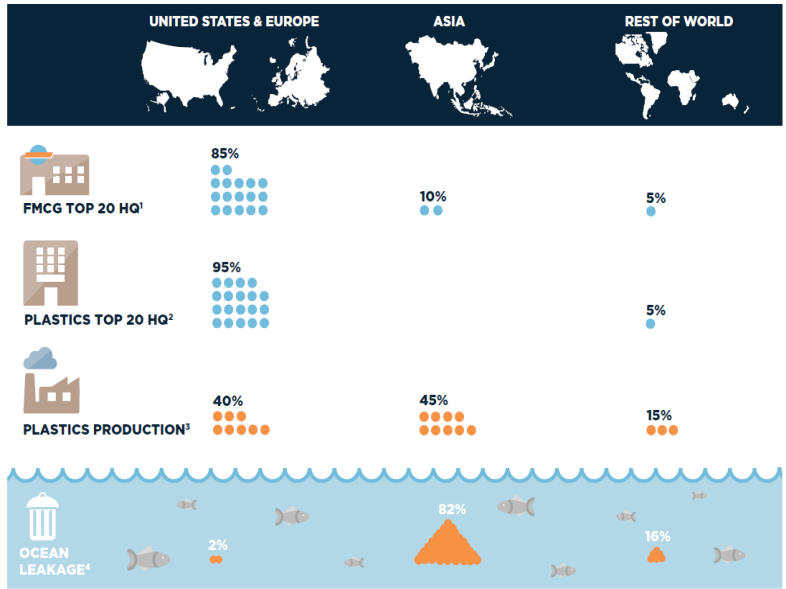
1 Fish stocks are assumed to be constant (conservative assumption)

2 Total oil consumption expected to grow slower (0.5% p.a.) than plastics production (3.8% until 2030 then 3.5% to 2050)

3 Carbon from plastics includes energy used in production and carbon released through incineration and/or energy recovery after-use. The latter is based on 14% incinerated and/or energy recovery in 2014 and 20% in 2050. Carbon budget based on 2 degrees scenario

9

Figure 8: Distribution of Plastics Headquarters, Production and Leakage



1 Headquarters of the global top 20 FMCG (Fast Moving Consumer Goods) companies (measured by 2014 global net sales)

2 Headquarters of the top 20 plastics and resin manufacturers (measured by 2015 global capacity)

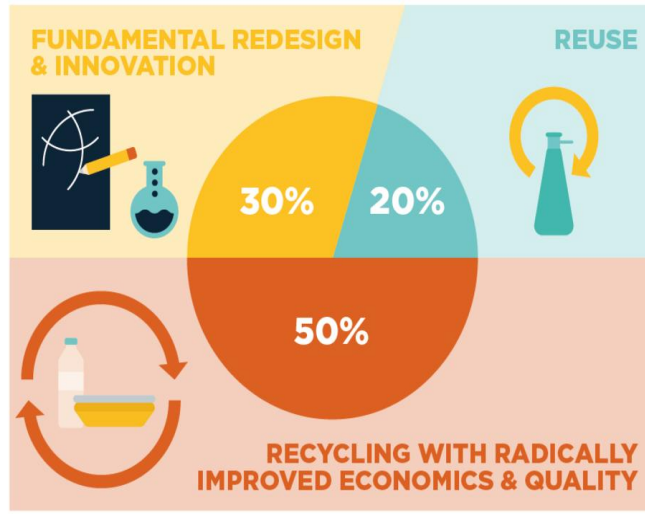
3 Production of plastics material volumes (excluding thermoplastics and polyurethanes)

4 Source of plastics leaked into the oceans (proportion of the total global leakage measured in million tonnes of plastic marine debris leaked per year)

Source: PlasticsEurope, Plastics – the Facts 2015 (2015); Statista; ICIS Supply and Demand; J. R. Jambeck et al., Plastic waste inputs from land into the ocean (Science, 13 February 2015)

10

Three strategies to transform the global plastic packaging market



World Economic Forum and Ellen MacArthur Foundation, with analytical support from SYSTEMIQ *The New Plastics Economy – Catalysing action* (2017, www.newplasticseconomy.org).

NEW PLASTICS ECONOMY

ELLEN MACARTHUR FOUNDATION

11

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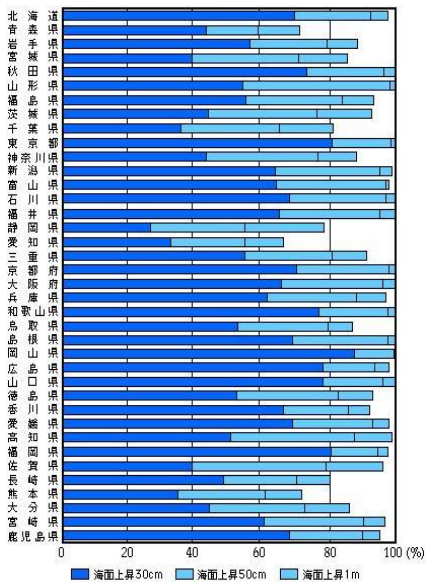
- **5. Acidification**

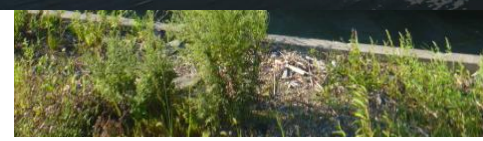
12

- 生息地の破壊 (Habitat destruction)



Ministry of the Environment

Sea level rise and loss of sandy shore.



写真：畠山　信

写真：山内　明美

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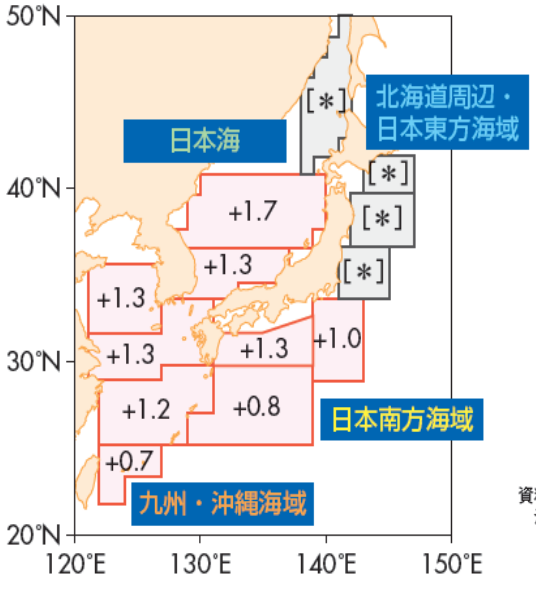
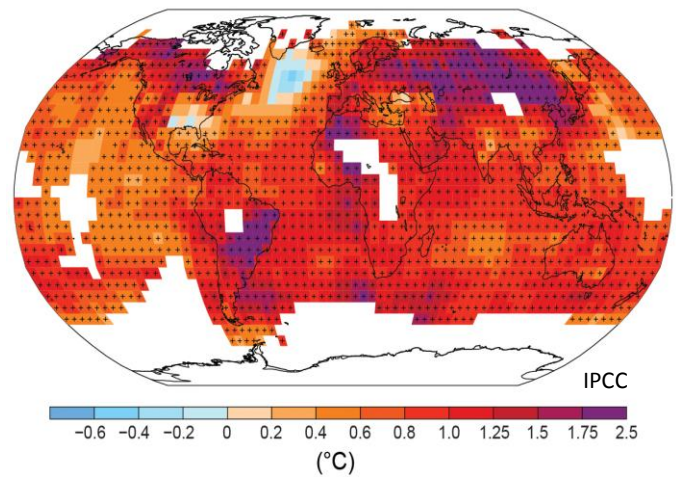
14

Global Warming





資料：気象庁「海洋の健康診断表『海面水温の長期変化傾向（日本近海）』2008年」
注：1） 数値は、年平均海面水温の100年当たりの上昇率（℃／100年）。
2） ［＊］で示した海域では、年平均海面水温に統計的に有意な長期変化傾向は見出せなかった。
3） オホーツク海域は1960年代以前のデータ数が少ないため、解析の対象外。

図Ⅱ－1－4 日本近海の海域平均海面水温（年平均）の長期変化傾向（℃／100年）

（水産庁）

15

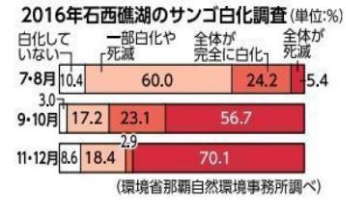
地球温暖化（Global Warming）

http://fish-exp.pref.shizuoka.jp/izu/0004/0001-isoyake.html

https://sangakukan.jp/journal/journal_contents/2009/11/articles/0911-03-2/0911-03-2_article.html

磯焼け　（Isoyake）

過酷な環境下で衰弱または死滅したサンゴ礁群落＝１２月２１日、石西礁湖（環境省那覇自然環境事務所提供）



サンゴの白化（Coral Bleaching）

16

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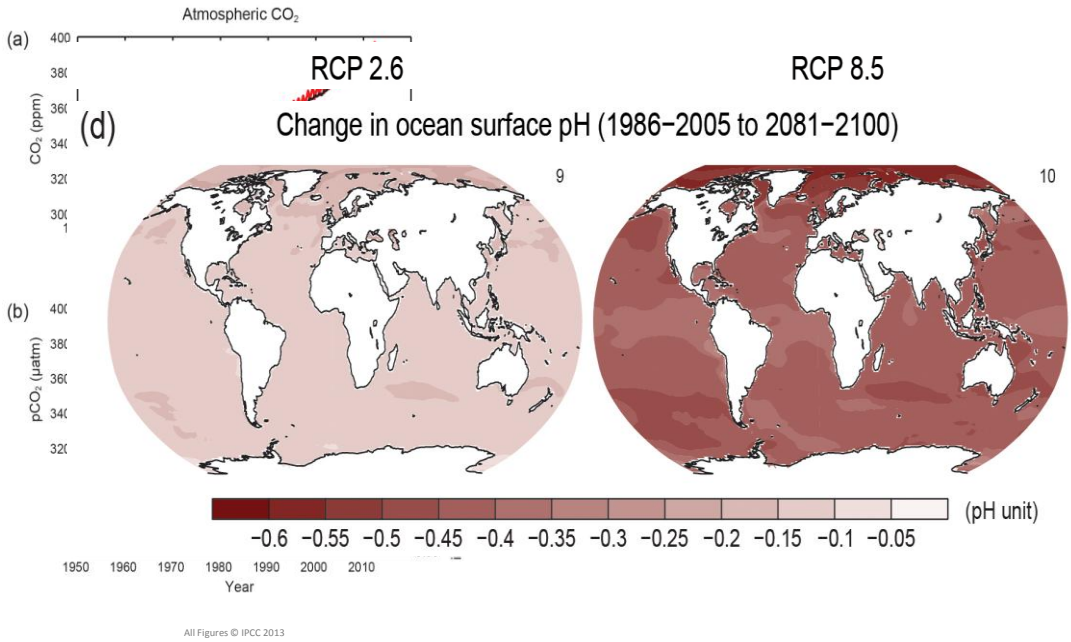
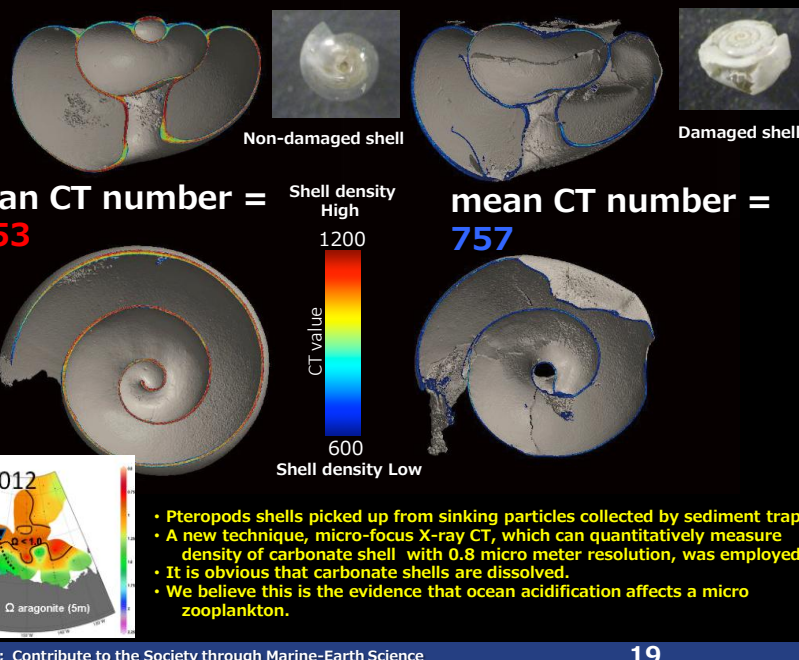
17

Ocean Acidification

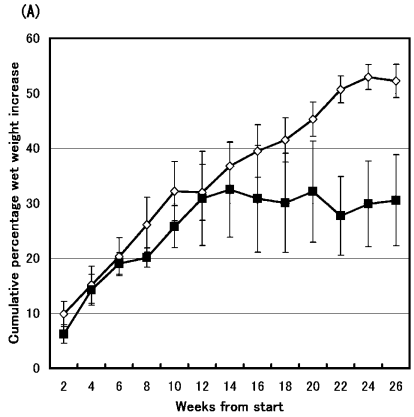


Dissolution of Pteropod shells found in the Arctic Ocean

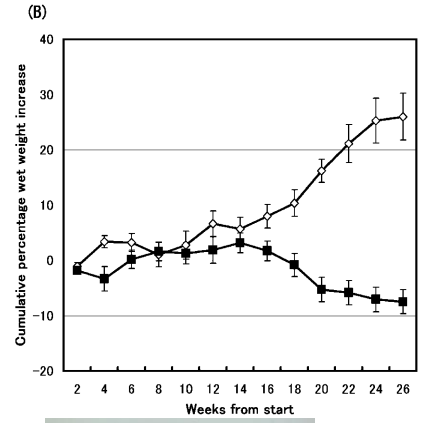


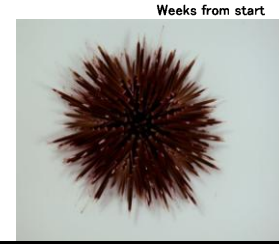
- Pteropods shells picked up from sinking particles collected by sediment trap.
- A new technique, micro-focus X-ray CT, which can quantitatively measure density of carbonate shell with 0.8 micro meter resolution, was employed.
- It is obvious that carbonate shells are dissolved.
- We believe this is the evidence that ocean acidification affects a micro zooplankton.

Impact of future acidic water on the growth of mussel and sea urchin



(n=30)





(n=30)

(Shirayama and Thornton)

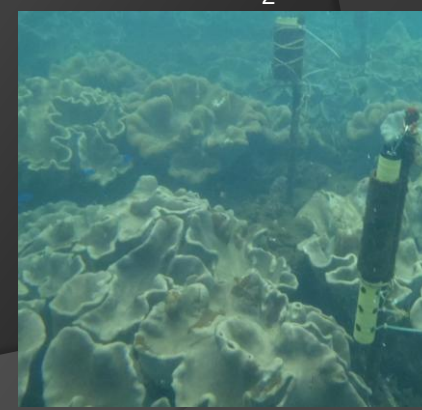
FUTURE OF ACIDIC OCEAN

Control site

Courtesy of Haruko Kurihara

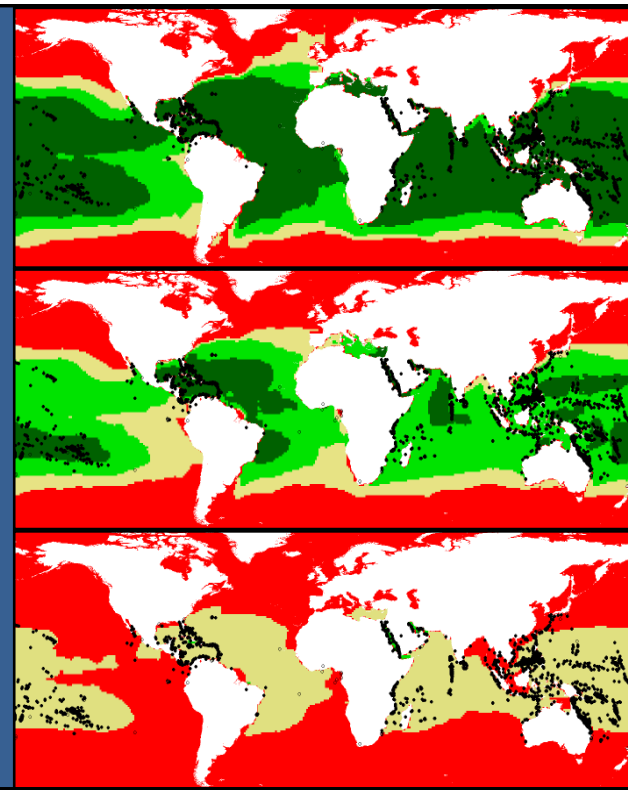
(Inoue et al. 2013 Nature Climate Change)

CO_2 vent site



Combination

Future environment for corals Predicted based on Temperature And pH



> 4.0 Optimal
3.5 - 4 Adequate
3 - 3.5 Marginal
< 3.0 Extremely Low

www.iobis.org

Poor Sushi in the High CO2 World?

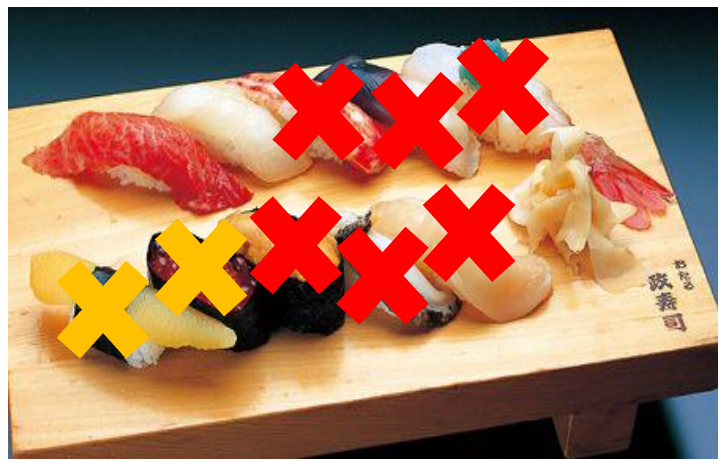


Photo: https://search.yahoo.co.jp/image/search?rkf=2&ei=UTF-8&p=%E6%8F%A1%E3%82%8A%E5%AF%BF%E5%8F%B8#mode%3Ddetail%26index%3D2%26st%3D0

What we need to do

- support sustainable fisheries
- cooperate to eliminate IUU

認証を受けた南三陸のカキとASC認証ラベル

Marine Stewardship Council
持続可能な漁業で獲られた認証水産物

24

What we need to do

- Reduce impact of Ocean Acidification through less nutrient run off
- 70% of marine debris is land origin
- Floating wood can be reduced by better land management

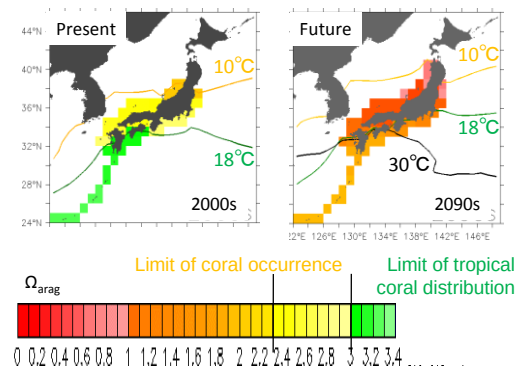
(西本　篤史)

Red Tide (& acidification) is caused by human

http://blogs.yahoo.co.jp/akaguminotocan/17509891.html http://www.isewan-db.go.jp/ise-kankyo/img/B1g/akashio.jp

26

Demise of corals may occur in this century under the "business as usual (A1)" CO_2 emission scenario



Orange line: 10˚C in winter [limit of coral occurrence]

Green line: 18˚C in winter [limit of tropical coral distribution]

Black line: 30˚C in summer [occurrence of bleaching]

Temperate area
Ocean acidification limits poleward expansion of coral habitats

Subtropical area
Frequent bleaching may occur

Shrinkage of potential habitats

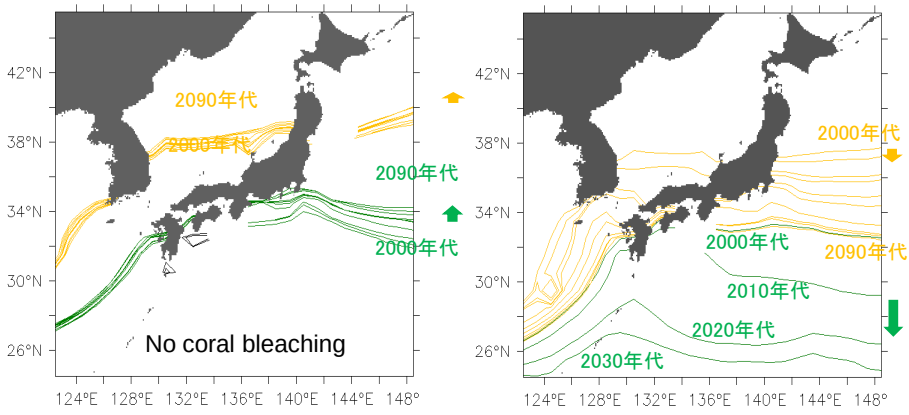
(Yara et al., 2012)

(Yara et al., 2012)

Future area where corals can grow under B1 Senari

The climate change is small enough to Prevent expansion of coral bleaching area

Ocean Acidification is not serious in the southern part of Japan



Northern limit for subtropical/tropical species (temperature)

If CO2 emission is controlled successfully, corals will survive around Japan

Southern limit for subtropical/tropical species (Aragonite saturation)

Recent cases of IUU fishing in the Northwest (NW) Pacific region, possible use of satellite remote sensing images

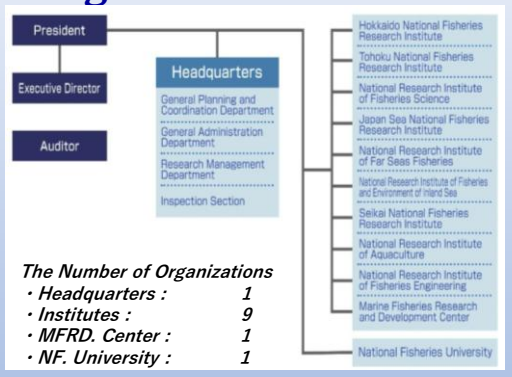
Masanori Miyahara

President, Japan Fisheries Research and Education Agency

Suomi National Polar Orbiting Partnership

Organization of Japan Fisheries Research and Education Agency (FRA)

● Organization



The Number of Organizations

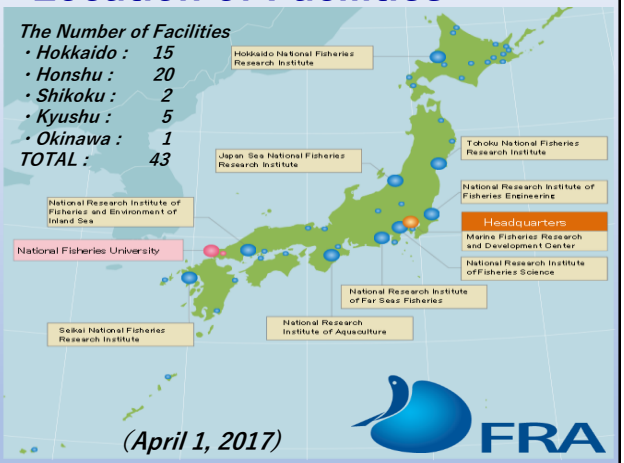
・Headquarters :	1
・Institutes :	9
・MFRD. Center :	1
・NF. University :	1

● Staff (1,127 persons)

Board members :	9 persons
Headquarters :	116 persons
Institutes & MFRD.C :	829 persons
NF. University :	173 persons

(April 1, 2017)

● Location of Facilities



● Research & Training Vessels

Fisheries research :	9 vessels
Fisheries training :	2 vessels

(April 1, 2017)

Mission for the 4th Medium to Long-term Objectives between FY2016-FY2020

Priority Items:

1. **Sustainable use of fishery resources**
2. **Sound development of the fishing industry and supply of safe fishery products**
3. **Marine and ecosystem monitoring and basic research**
4. **Education and Human resource development**

1. Sustainable use of fishery resources

"Assessment of each fish stock"

required data :

- Catch and effort
- Research outcomes on biology and environment

"Traceability Information to Consumers"

"Fishery management"

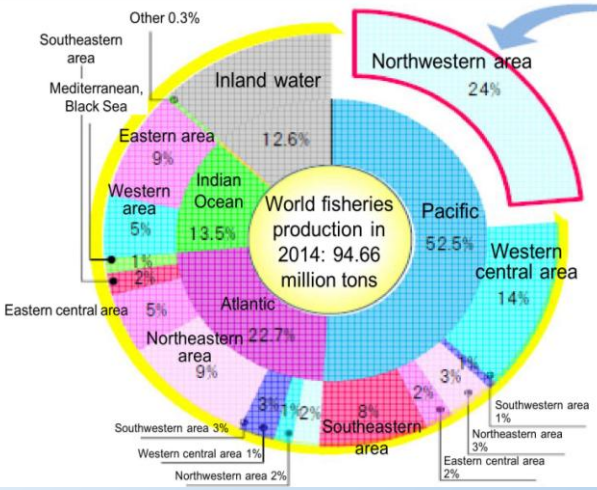
- TAC
- T/A closure
- Fishing Gear restriction

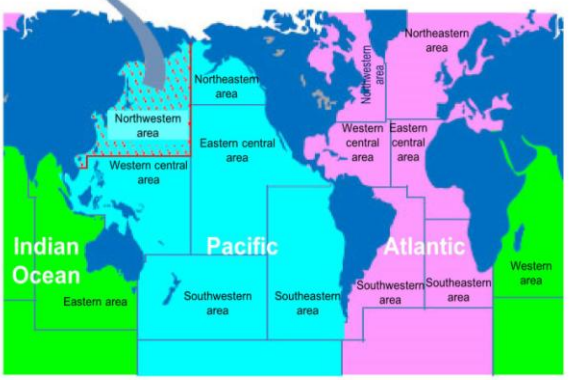
etc.

Reported data does not necessarily cover all fishing activities.

namely, IUU

1/4 of global fisheries catch is produced in the NW Pacific region





Source: FAO Fishstat (Capture production)

Fishing activities outside the Japanese EEZ in the NW Pacific ①

neon flying squid (*Ommastrephes bartramii*)

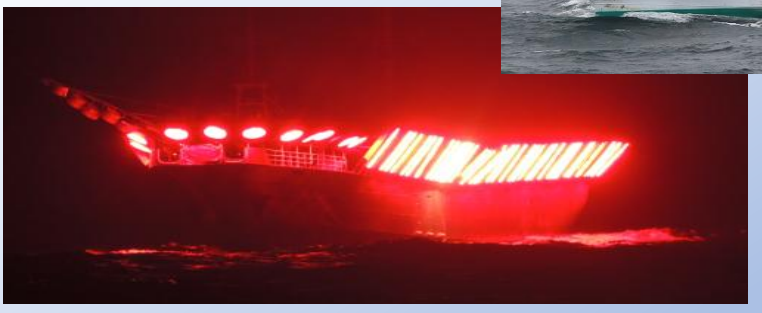
Squid jigging fishing boats
Ship length: 40 m, GRT: 340 ton
Recruitment of large fishing boats
Ship length: 71 -123m, GRT: 1,600-8,800 ton

(Japanese Fisheries Agency 2017)

Fishing activities outside the Japanese EEZ in the NW Pacific ②

Pacific saury (*Cololabis saira*)

(Japanese Fisheries Agency 2017)



Stick-held dip net (side) fishing boats
Ship length: 70 m, GRT: 1,500 ton

Japanese fishing boats
Ship length: 35 m, GRT: 185 ton

Fishing activities outside the Japanese EEZ in the NW Pacific ③

chub mackerel
(*Scomber japonicus*),
NW Pacific stock

Stick-held dip net (stem) fishing boats
Ship length: 70 m, GRT: 1,500 ton
Lighting purse seiner (tiger net)
Ship length: 55 m, GRT: 950 ton

(Japanese Fisheries Agency 2017)

Fishing activities outside the Japanese EEZ in the NW Pacific ④

- Fishing boats stay in the fishing grounds during the whole fishing season.
- Transport ships received fishes and supply fuel and foods to fishing boats.
- Refrigeration factory ships froze fishes and transported them to markets.

(Fisheries Research Agency 2015)

(http://www.hongtaiship.com/m/view.php?aid=24)

Refrigeration factory ships
Ship length: 98 m, GRT: *ca*. 3000 ton

First Information source:

North Pacific Fisheries Commission (NPFC) Vessel List

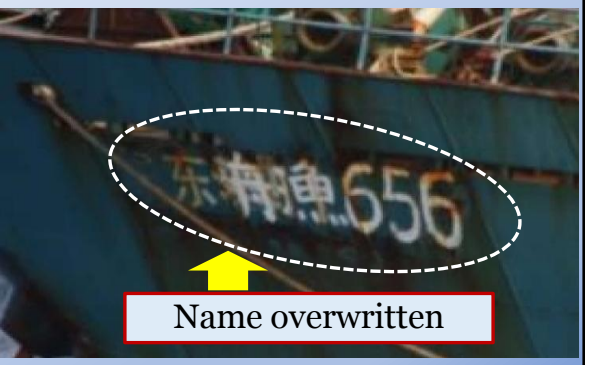
CHINA_NPFC_Vessel_Registration_Form-Purse_Seiner_Updated_29_NOV_2016.xlsx [読み取り専用] - Excel

Number 序号	Flag State 船旗国	Basic Information of Vessel船舶基础信息 Name of Vessel 船名	Registration Number 国籍证书号	Previous Name 曾用船名 (if known)	Port of Registry 注册港	Previous Flag 前船旗 (if any)	Call Sign 呼号 International Radio Call Sign 国籍无线电呼号	Type 船舶类型 Type of Vessel 船舶类型 (FAO ISSCFV) FAO船舶类型缩写
501	CHINA	JU LONG JIA YA 1	(LIAO)CHUANDENG(JI)(2014)FT-200070	NA	DALIAN		BZYS2	SP
502	CHINA	JU LONG JIA YA 3	(LIAO)CHUANDENG(JI)(2014)FT-200071	NA	DALIAN		BZYS4	SP
503	CHINA	JU LONG JIA YA 4	(LIAO)CHUANDENG(JI)(2014)FT-200068	NA	DALIAN		BZYS5	SP
504	CHINA	JU LONG JIA YA 7	(LIAO)CHUANDENG(JI)(2014)FT-200072	NA	DALIAN		BZYS8	SP
505	CHINA	JU LONG JIA YA 8	(LIAO)CHUANDENG(JI)(2014)FT-200065	NA	DALIAN		BZYS9	SP
506	CHINA	JU LONG JIA YA 9	(LIAO)CHUANDENG(JI)(2014)FT-200064	NA	DALIAN		BZYT2	SP

False identification of Fishing boats observed in the NW Pacific

Case 1:

Case 2:



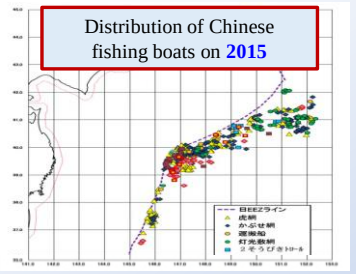
False identification of Fishing boats observed in the NW Pacific

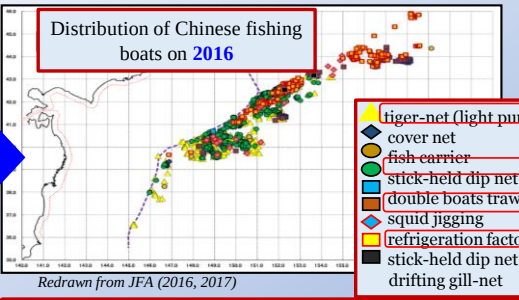
Case 3: Different boats displaying the same name

(Japanese Fisheries Agency 2017)

There are a large number of IUU fishing boats.

Observation by fisheries patrol vessels in the NW Pacific





Redrawn from JFA (2016, 2017)

Observed number of fishing boat including IUU fisheries (JFA)

year 2015	2016
194	288

Japanese patrol vessels can not cover all.

Need to establish a reliable tool for monitoring of overall fishing activities including IUU.

All fishing boats use lights to aggregate fishes

*Most fishes and squid gather to **the light at night***

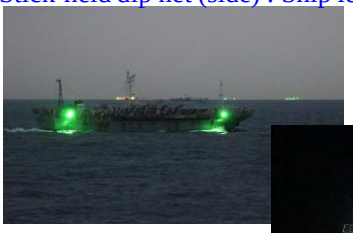
How strong the fishing lights of boats?

2 fishing boats

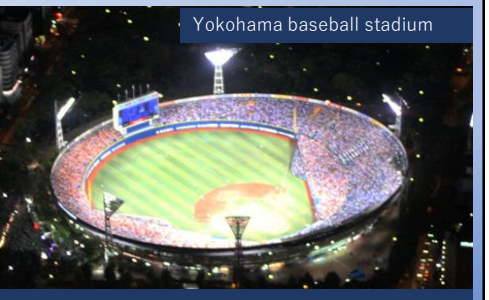
=

Fishing boats light power (500kW～)

Stick-held dip net (side) : Ship length: 70 m



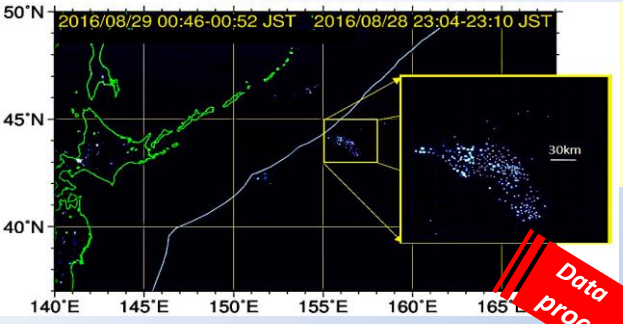
Stick-held dip net (stem) : Ship length: 70 m



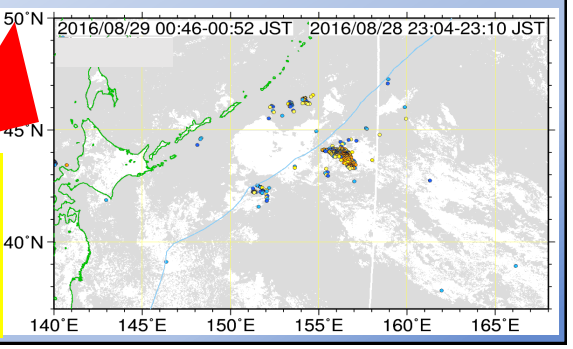
Metal halide lamps
1,500W × 708 = 1,062 KW

Second Information source:

Light points by satellite remote sensing images at the midnight



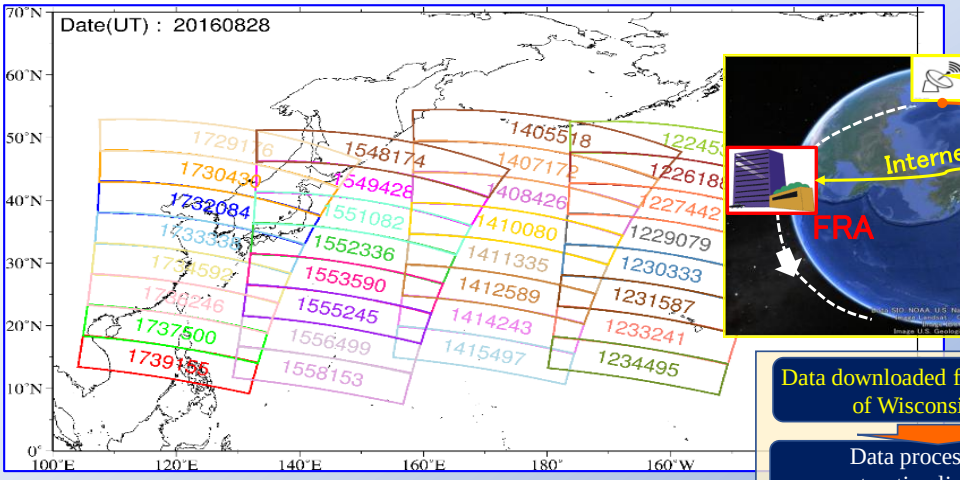
Data process



- *Light points extracted from the data of S-NPP satellite.*
- *Effects of sun light, moon and clouds are eliminated.*

- *Each light point corresponds to one fishing boat.*
- *Number of fishing boats in operation can be counted.*

Data processing procedure



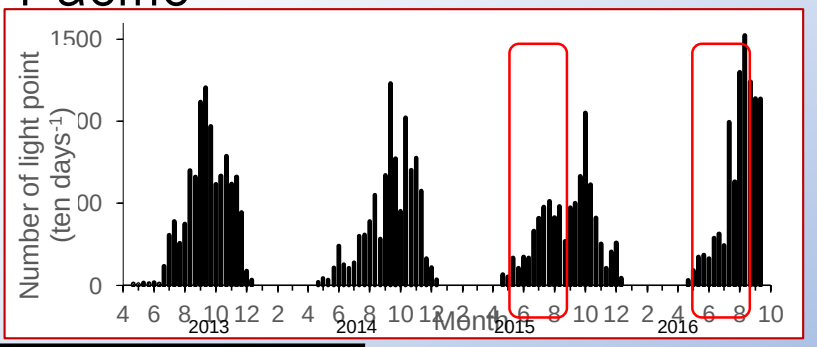
Data downloaded from the ftp site of Wisconsin Univ.

Data processing for extracting light points

Eliminating the effects of sun, moon and the reflection of clouds

Analyzing fishing activities of foreign fishing boats in the NW Pacific

Recent increase of light points in the NW Pacific



Year	Observation (JFA)		Light points (S-NPP) May - Nov.
2015	194		6,444
2016	288		11,015
2016 / 2015	1.5	≒	1.7

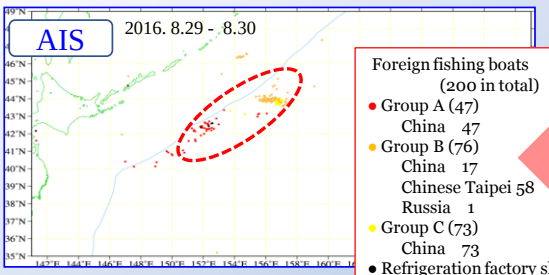
Recent increase of light points corresponds to the increase of fishing boats observed by fisheries patrol vessels.

But only with light points data, we cannot estimate catch amounts.

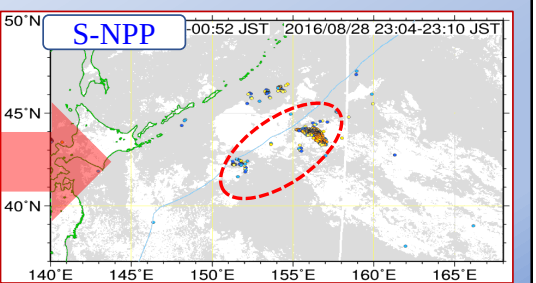
Third Information source:

Automatic Identification System (AIS)

- AIS is an automatic tracking system used for collision avoidance on ships.
- AIS information include MMSI code (ID), name, position, course, and speed.
- Satellite-AIS system provides the information of ships in high seas.



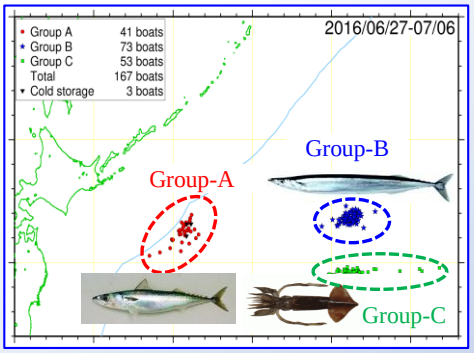
Foreign fishing boats
(200 in total)
- Group A (47)
  China 47
- Group B (76)
  China 17
  Chinese Taipei 58
  Russia 1
- Group C (73)
  China 73
- Refrigeration factory ship (4)
  China 4

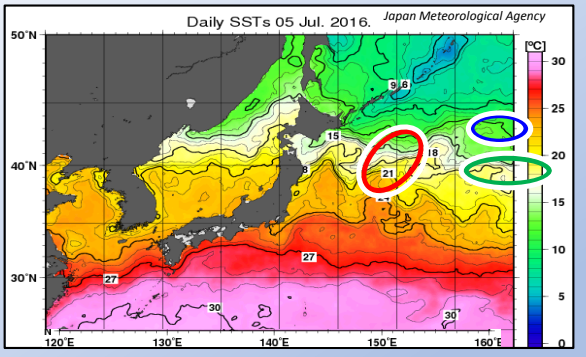


- Monitoring *only by AIS information is not reliable enough*.
- Intentional suspension of signal transmission from the onboard AIS, low reliability of AIS signal including incorrect datum.

Forth Information source:

Fishing ground and target species





- Target fish species in a certain area might be specified by sea surface temperature (SST) obtained from satellite remote sensing.
- Fishing boats belong to Group-A distributed at the area of 15-20℃ SST, where chub mackerel distributes in this season.

Fishing activities on chub mackerel were analyzed from June to September, 2016.

Fifth Information source:

Fish hold capacity and relevant information of fishing boats

Summary of NPFC vessel lists

Fishing boats	
Stick-held dip net (SDN)	
Number of boats	53
Ship length (m)	69.1 ± 2.81 (SD)
Freezing capacity (MT day^{-1})	98.9 ± 38.96 (SD)
Lighting purse seine (LPS)	
Number of boats	84
Ship length (m)	54.5 ± 6.04 (SD)
Freezing capacity (MT day^{-1})	27.8 ± 15.70 (SD)
Fish carrier ships	
Number of boats	34
Ship length (m)	132 ± 12.5 (SD)
Fish hold capacity (m^3)	11,056 ± 2,736 (SD)
Refrigeration factory ships	
Number of boats	7
Ship length (m)	72 ± 13.3 (SD)
Freezing capacity (m^3 day^{-1})	2,764 ± 1,280 (SD)

Information obtained by interviews on a certain fisheries company

Lighting purse seine	**8 vessels**
Length	59 m
Processable daily amount	25 MT day^{-1}
Tows per day	10 times day^{-1}
Maximum catch	20-30 MT day^{-1}
Minimum catch	1-2 MT day^{-1}
Fish carrier ship	**3 ships**
Length	68 m
Fish hold capacity (MT)	1,200 MT
3 ships are operated by rotation	
Annual catch by 8 vessels in 2015	
Chub mackerel	10,000 ton
Duration (Jul. – Nov.)	5 months
Estimated daily catch	12.5 MT ship^{-1} day^{-1}
assumption: 20 days' operation per month	
Refrigeration factory ship	
Length	100 m
Fish hold capacity	1,200 MT
Processable daily amount	120 MT day^{-1}

Estimated catch by fishing boats

(mid-June – early September)

- *More than 100 fishing boats caught chub mackerel in NW Pacific from June to September, 2016.*
- *Catch amount of chub mackerel was estimated to be **300,000-400,000 MT**, based on the ability of fishing boats.*

Reference information on chub mackerel

- Allowable biological catch (ABC)
  383,000 MT (2016)
- Japanese catch inside of EEZ
  ca. 400,000 MT (2016)
  (inc. spotted mackerel)
- Reported catch :
  143,000 MT (2016)

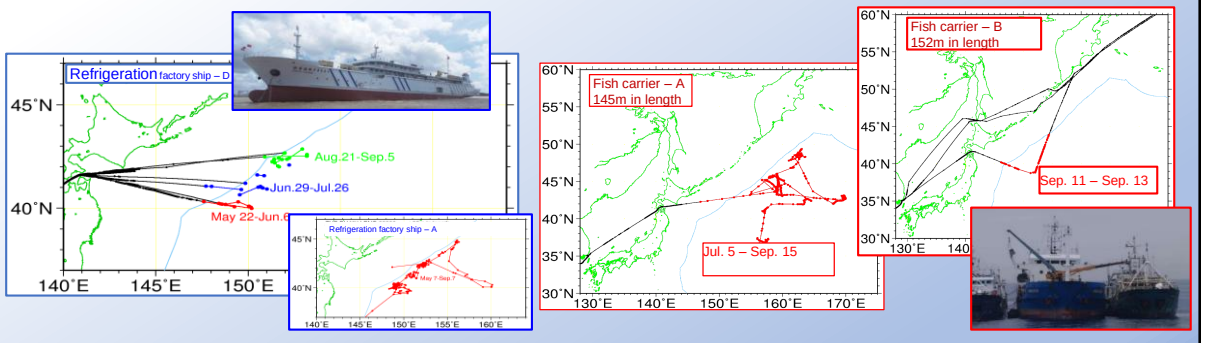
IUU fishing boats caught
***150,000-250,000 MT** chub mackerel .*

Sixth Information source:

AIS data of factory and transport vessels

Amount of transportation from fishing ground

(mid-June – early September)



*Total amount of annual transportation consisting of refrigeration factory ships and fish carriers was estimated to be **450,000-1,000,000 MT** based on the AIS information and light points.*

Summary ①

- *Six information sources were used to analyze the fishing activities in the high seas area adjacent to the Japanese EEZ in 2016.*
- *Total catch of chub mackerel was estimated to be **300,000-400,000 MT**, including IUU fisheries (**150,000-250,000 MT**).*
- *Total amount of annual transportation of fish caught in the area was estimated as **450,000-1,000,000 MT**.*

Summary ②

- *This type of analysis is needed in many areas to conduct proper stock assessment. Otherwise, assessment results would be too optimistic and could not be a basis for fisheries management.*
- *The analysis will be further improved and intensified in 2017.*

Thank you for listening.

Marine Scientific Research and Government Policy Initiatives –
The Case of TORI in Chinese Taipei

NARLabs 財團法人國家實驗研究院
台灣海洋科技研究中心
Taiwan Ocean Research Institute
Director General
Dr Hui-Ling Lin

Workshop on Marine Observation and Research Towards Evidence Based Sustainable Ocean Governance

June 28, 2017
Japan

承諾．熱情．創新

www.narlabs.org.tw

NARLabs
承諾．熱情．創新
TORI

Outline

1. **About TORI**
2. Core Technologies of TORI
3. Summary

NARLabs: Organization

- Ministry of Science and Technology
  - Board of Directors
    - President
      - Consultation Committee
      - Vice President
        - National Space Organization, NSPO
        - Taiwan Typhoon & Flood Research Institute, TTFRI
        - National Center for Research on Earthquake Engineering, NCREE
        - Taiwan Ocean Research Institute, TORI
        - Science & Technology Policy Research and Information Center, STPI
        - National Nano Device Laboratories, NDL
        - National Chip Implementation Center, CIC
        - National Center for High-performance Computing, NCHC
        - Instrument Technology Research Center, ITRC
        - National Laboratory Animal Center, NLAC

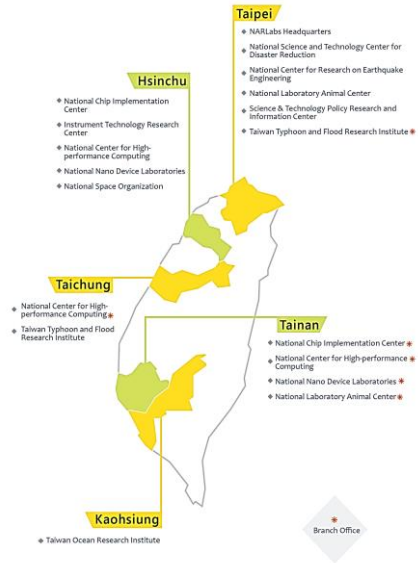
3

NARLabs: Research Domains

- NARLabs
  - Earth and Environment
    - NSPO
    - NCREE
    - TTFRI
    - TORI
  - Information and Communication Technology
    - NDL
    - NCHC
    - CIC
  - Biomedical Technology
    - ITRC
    - NLAC
  - Science and Technology Policy
    - STPI



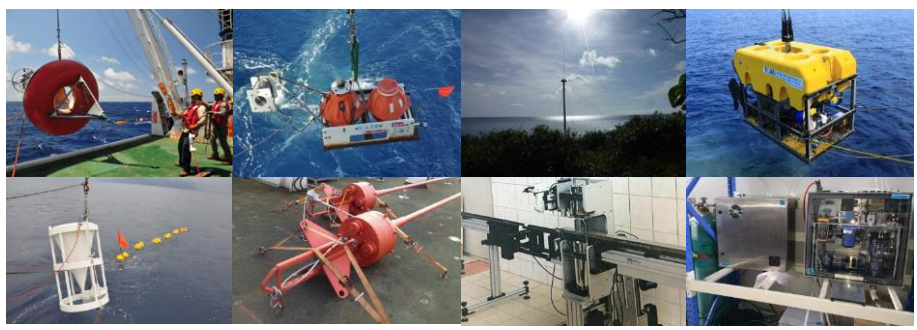

NARLabs: Locations



5

NARLabs: TORI

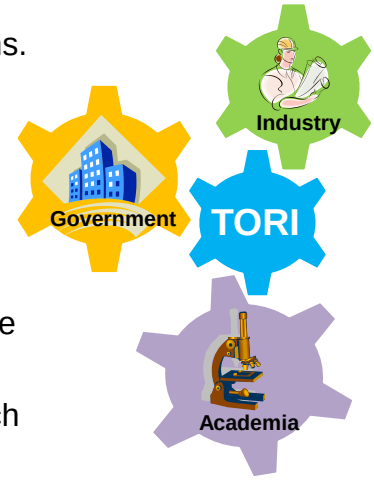
Founded in 2008, The Taiwan Ocean Research Institute (**TORI**) is a federally funded research and development agency devoted to research and education in oceanology and related sciences.



6

Missions

- Integrate Marine Technology and Ocean Science Research Platforms.
- Operate and Maintain Ocean Research Vessels.
- Support and Enhance National Marine Technology and Ocean Science Researches.
- Promote and Motivate Cutting-edge Ocean Research.
- Develop and Train Ocean Research Personnel.



7

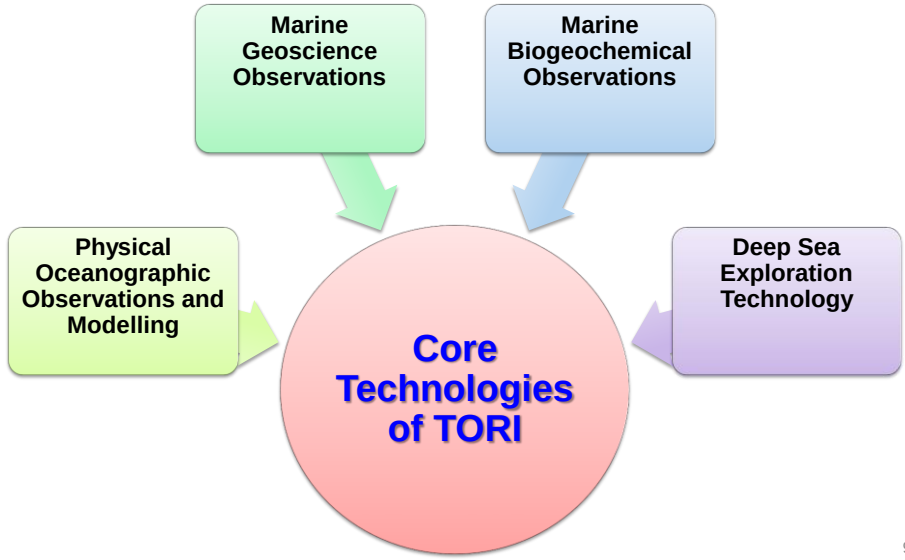
NARLabs
承諾．熱情．創新
TORI

Outline

1. About TORI
2. **Core Technologies of TORI**
3. Summary

8

Core Technologies



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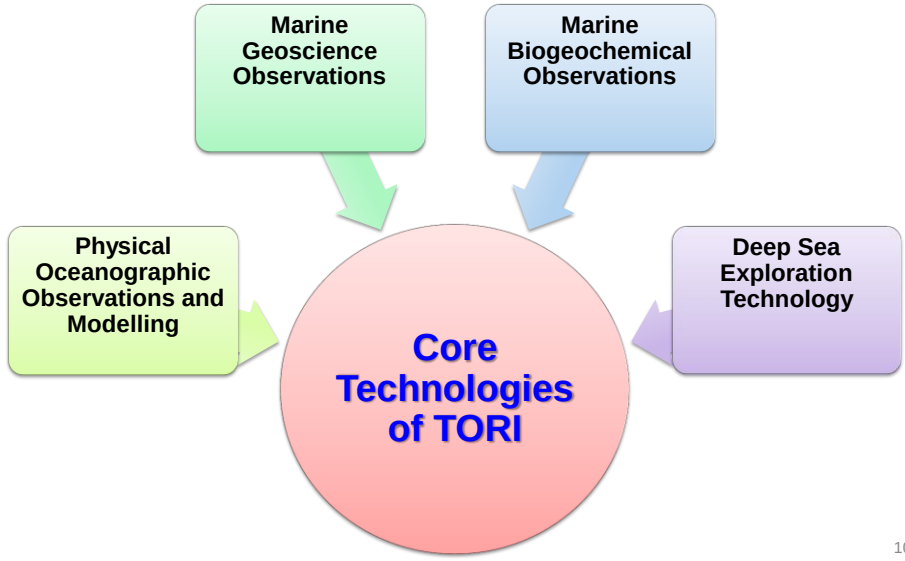
Core Technologies

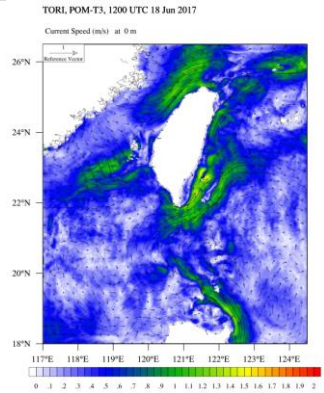


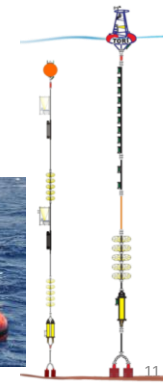
10

Physics

Developing offshore, deep sea, near real-time, long-term observations.

- **Taiwan Ocean Radar Observing System (TOROS)**
- **Numerical Modeling System for Marine Weather Forecasts (NMS-MWF)**
- **Long-term Deep-sea Moorings**

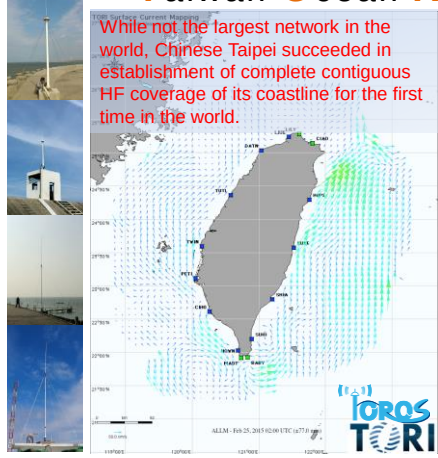


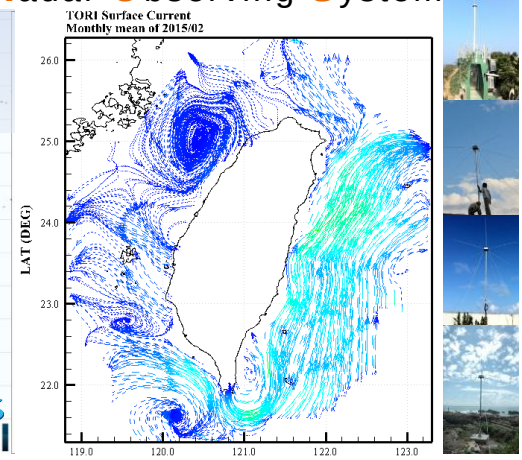


Physics: TOROS

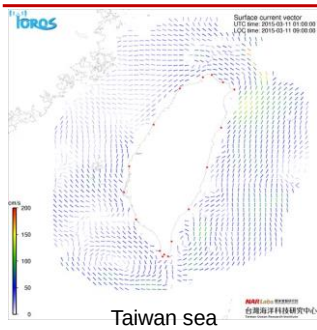
*T*aiwan *O*cean *R*adar *O*bserving *S*ystem

While not the largest network in the world, Chinese Taipei succeeded in establishment of complete contiguous HF coverage of its coastline for the first time in the world.

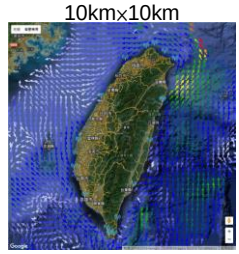


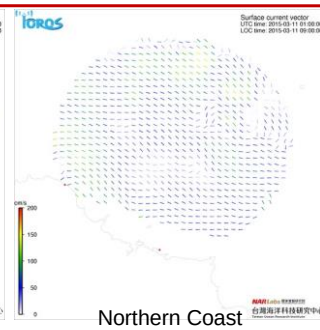


Operational HFR Surface Current Products

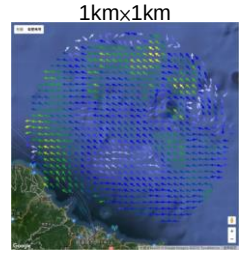


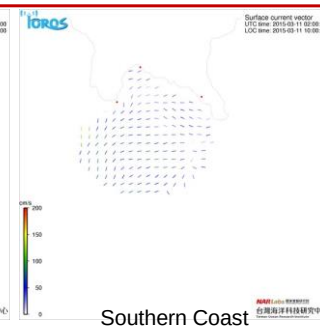
Taiwan sea
10km×10km



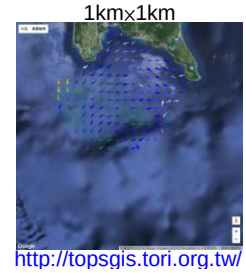


Northern Coast
1km×1km



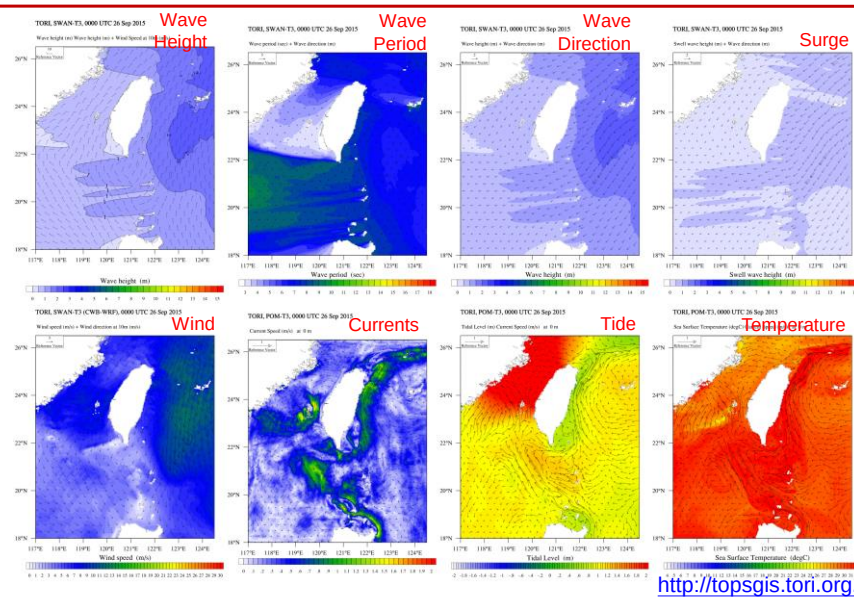


Southern Coast
1km×1km



http://topsgis.tori.org.tw/

Operational Ocean Prediction System



http://topsgis.tori.org.tw/

Ship of Opportunity Program

- ✓ Meteorological Instruments
- ✓ ADCP current profiler
- ✓ Echo sounder

15

Applications

Marine Recreational Risk Management

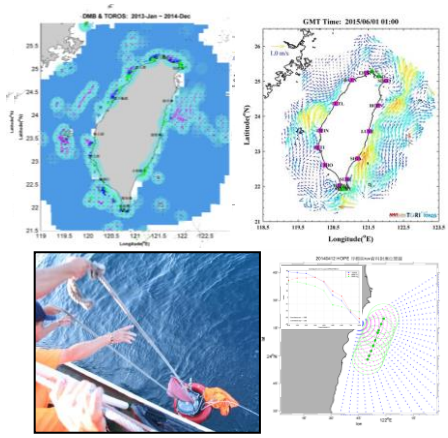
Ocean Weather Information for Public and Resort Management

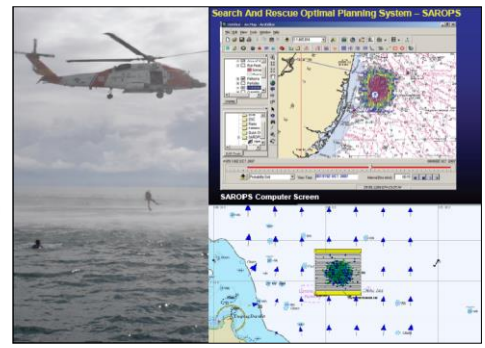
http://topsgis.tori.org.tw/

16

Applications
Marine Search & Rescue

Search And Rescue Optimal Planning System (SAROPS) for Coast Guard of Chinese Taipei





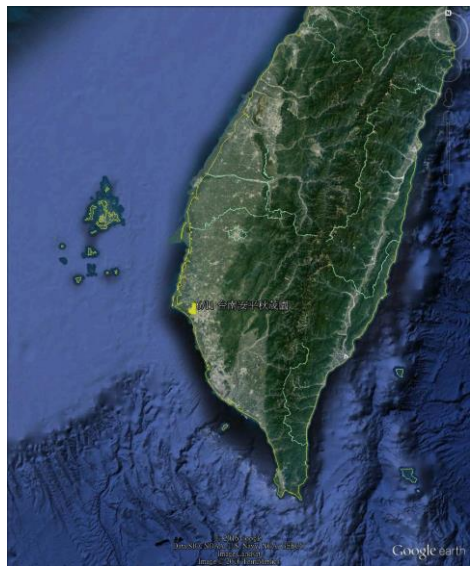
17

Applications
Marine Pollutant Dispersion

Oil Spill Dispersion Simulation and Impact Assessment

18

Applications
Tracking of Smuggling



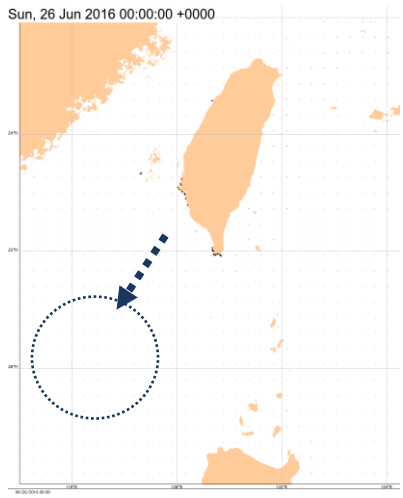
List of the found locations and times :
6/11 : Anping, Tainan (台南安平)
6/16~6/25 : Kenting, Pingtung (屏東墾丁)
6/22 : Zengwen river mouth, Tainan (台南曾文溪口)
6/23 : Cieding, Kaohsiung (高雄茄萣)
6/26 : Baishatun, Maoli (苗栗白沙屯)

A total of 21,662 packets of cigarettes were found during the period from 6/11 to 6/26.

19

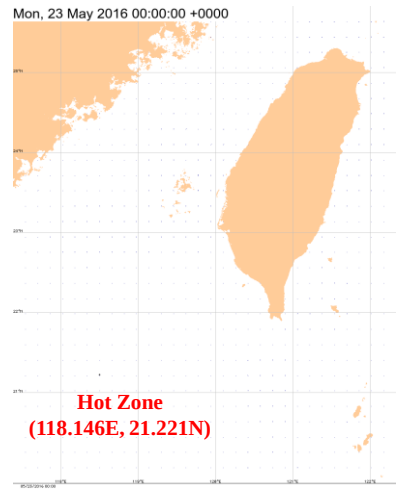
Simulation of Drifting Cigarettes

Backward-in-time tracking



The optimal combination of wind, current and the driving coefficient

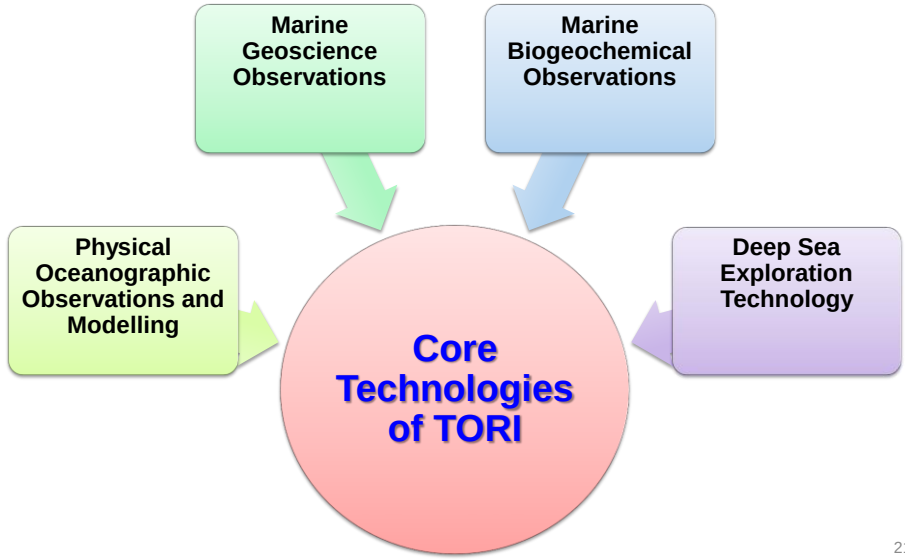
Forward-in-time tracking



Smuggling cigarettes drifting simulation of the optimal case

20

Core Technologies

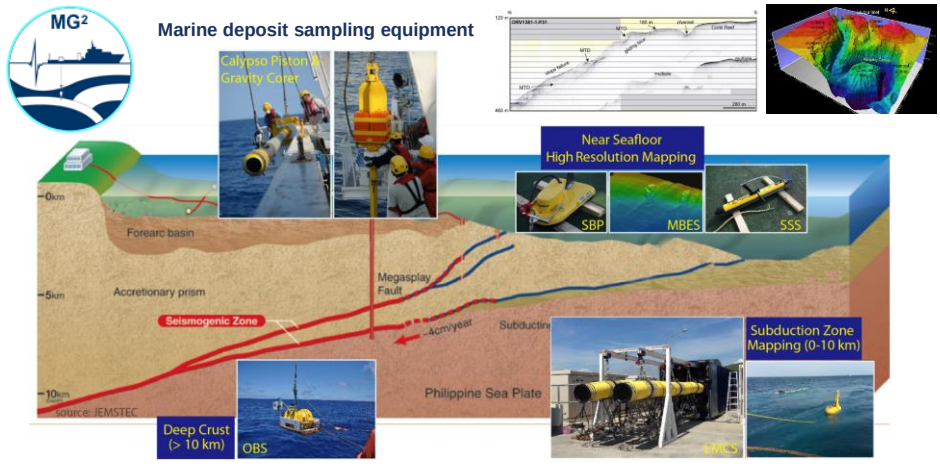


21

Marine Geosciences

Establishing crustal cross-sectional surveying and mapping technology to understand the marine geohazards.

Marine deposit sampling equipment

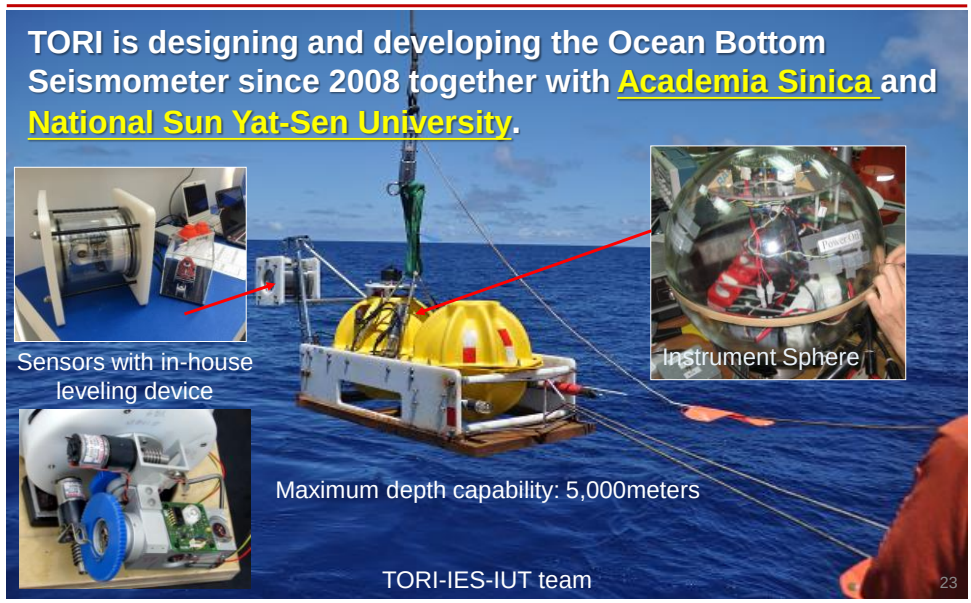


Ocean Bottom Seismometers: the seismic station deployed on the seafloor

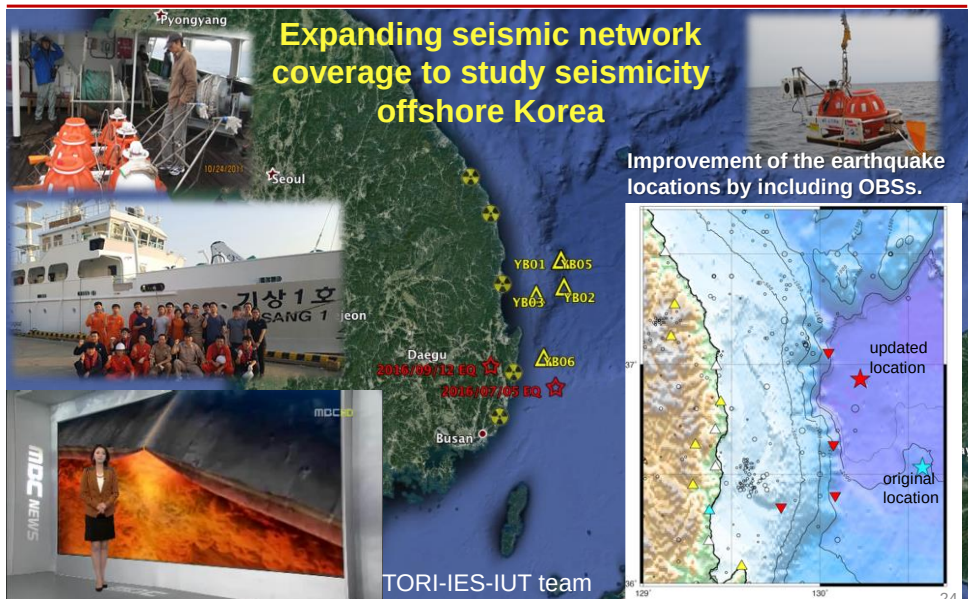
Container-type vibration source buoy array and air guns for the long-offset multi-channel seismic system

22

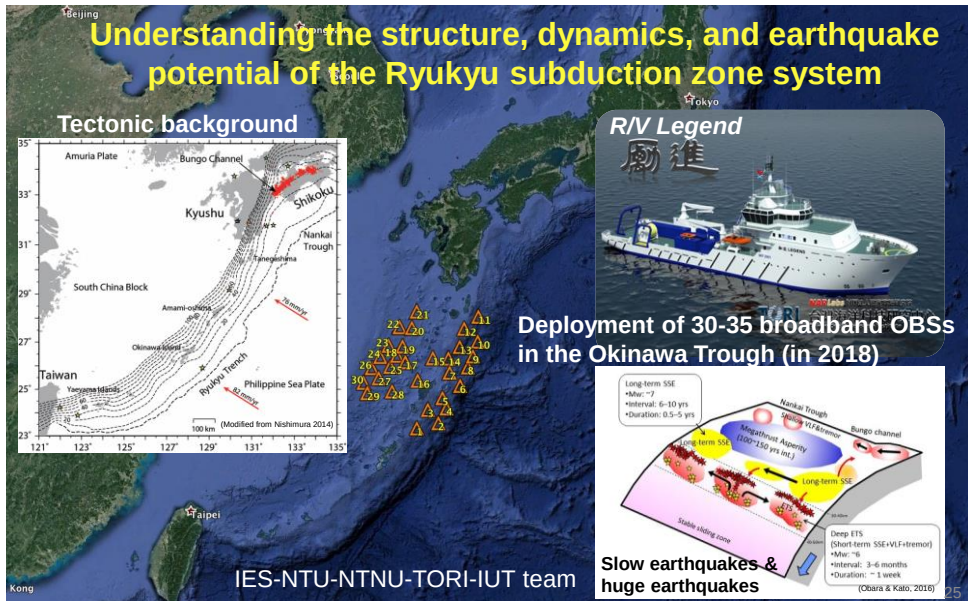
Ocean Bottom Seismometers



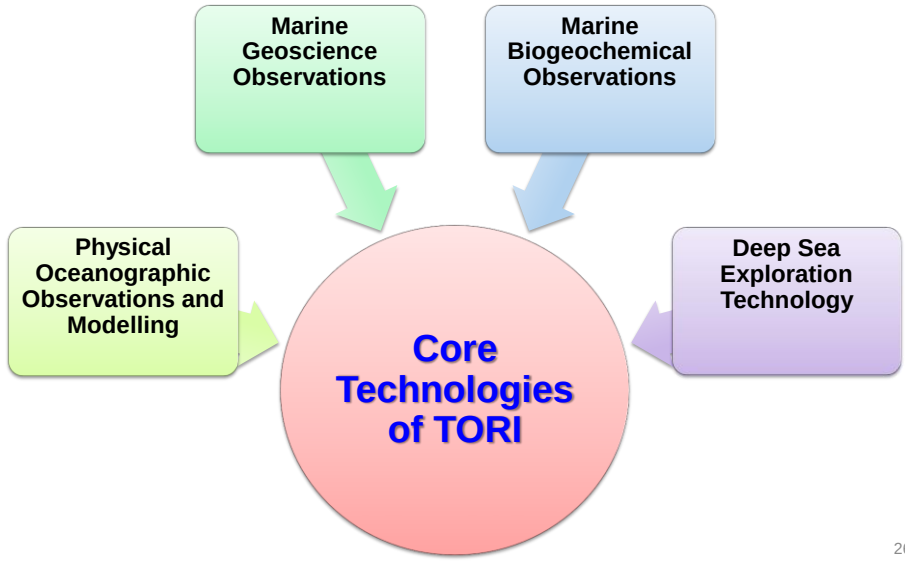
International Collaborations



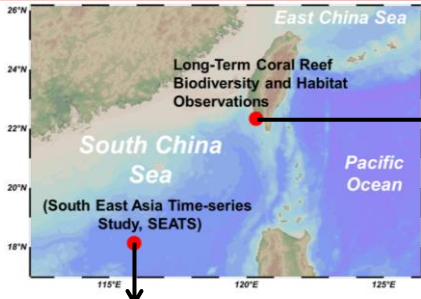
International Collaborations



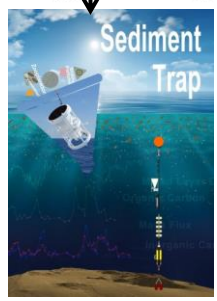
Core Technologies



Marine Biogeochemistry



Snapshots at Liuqiu Island



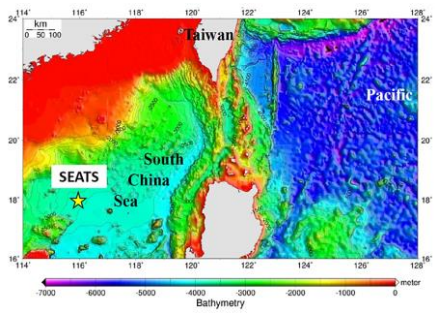
Long-Term Observations for Changes in:

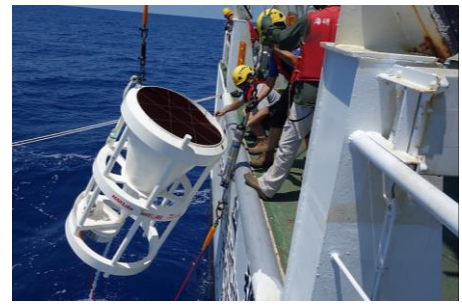
- **Carbon and Trace metals Cycles**
- **Marine Habitat and Ecosystem**
- **Marine Biodiversity**
- **Biogeochemical Cycles**
- **Seawater Chemistry**

27

SEATS in the SCS

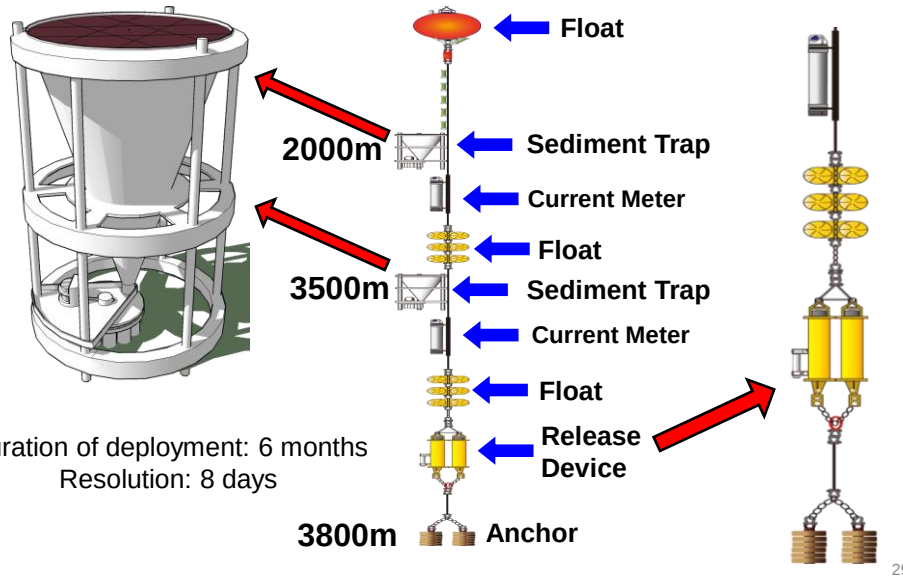
- **South East Asia Time-Series Study (SEATS)**
  - Joint Global Ocean Flux Study (JGOFS)
  - Moored sediment trap
  - Studies: C-N-P cycling; ^{234}Th-^{228}Ra-^{210}Pb; Paleoceanography; TEIs





28

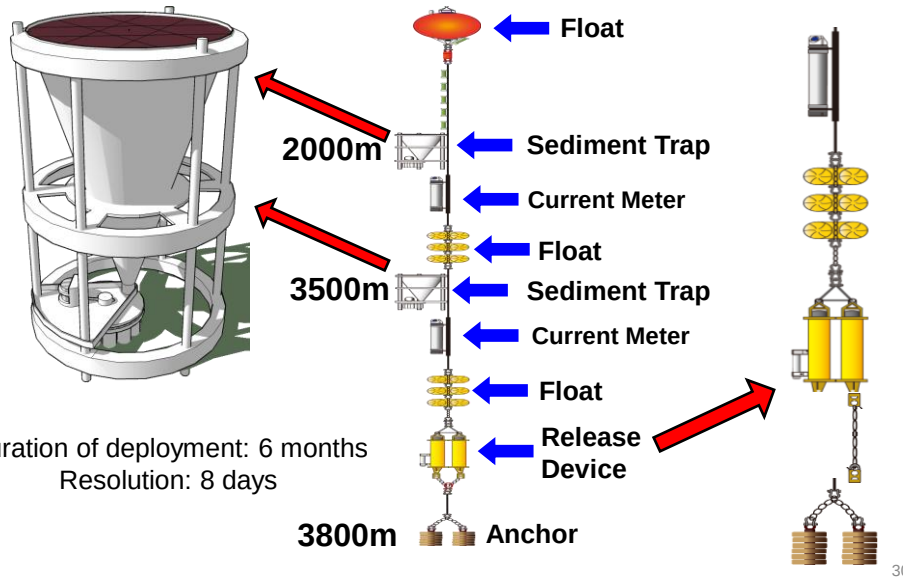
Sediment trap



Duration of deployment: 6 months
Resolution: 8 days

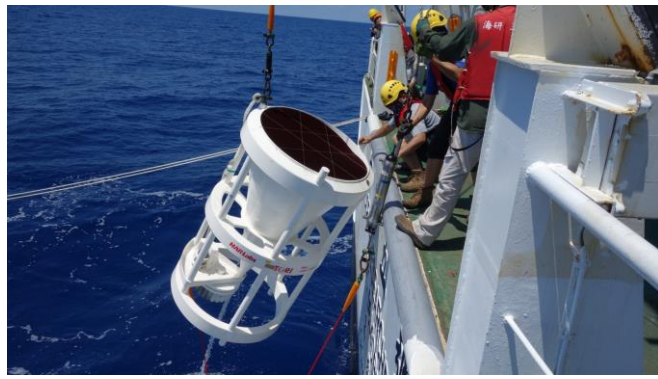
29

Sediment trap



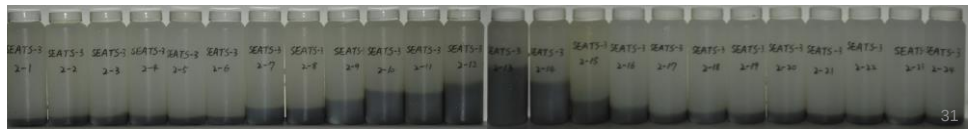
Duration of deployment: 6 months
Resolution: 8 days

30



2014/11/21~ 2015/5/31 (2000m)

2014/11/21~ 2015/5/31 (3500m)



31

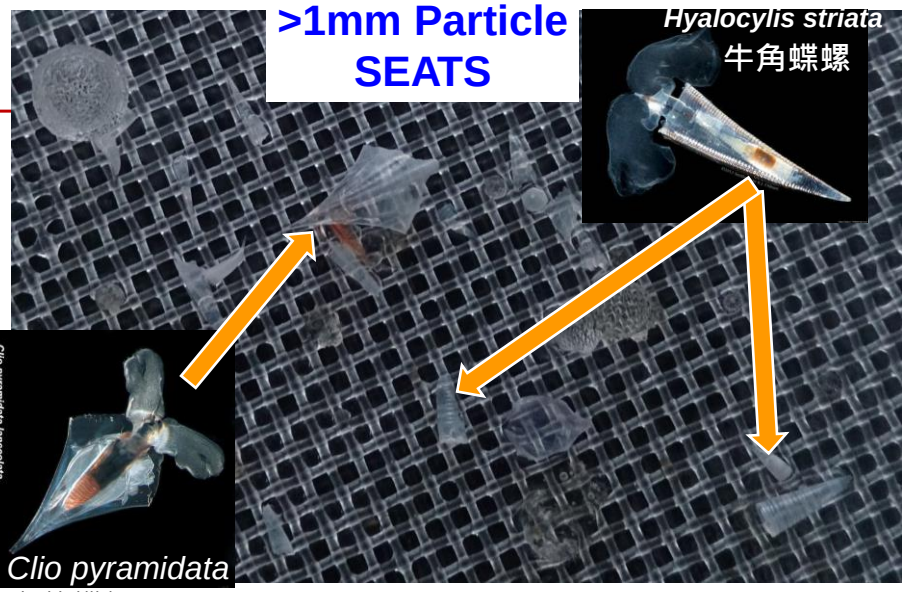


Photo of *Hyalocylis striata* : Taken from Sea butterflies: Extraordinary pteropods in peril
http://www.mnn.com/earth-matters/animals/blogs/sea-butterflies-extraordinary-pteropods-in-peril;
Photo of Clio pyramidata: Taken from http://pelagics.myspecies.info/file/58

32

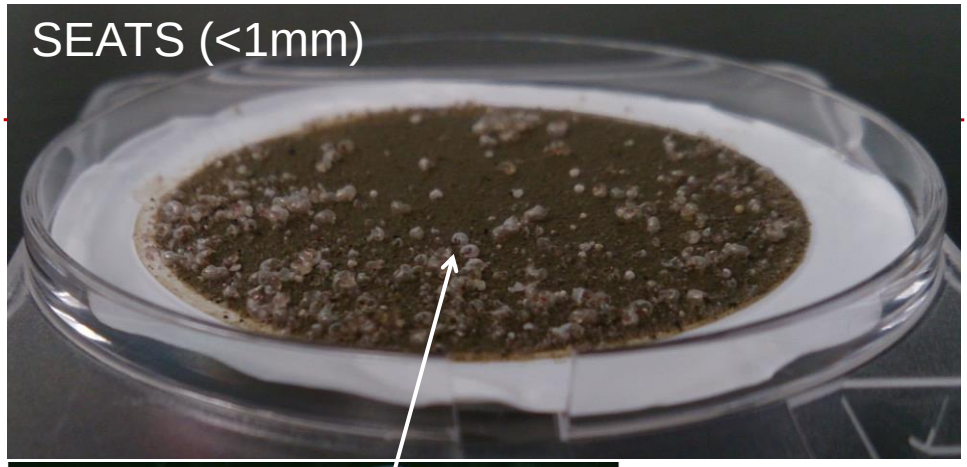


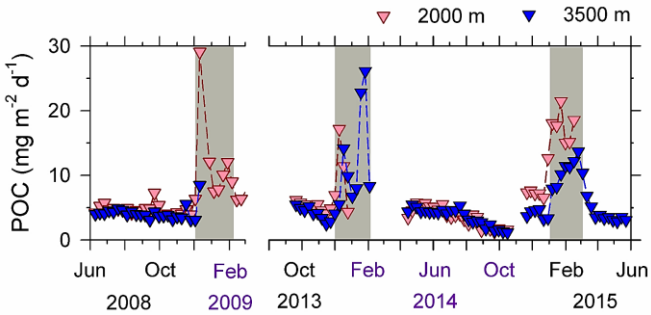
Photo of Sea Butterfly:
Taken from : J.B. Ries, 2012.
Nature Geoscience, 5, 845-846.)

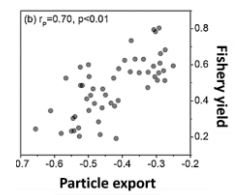
33

Particle Export Flux

NARLabs TORI

- Winter monsoon → Mixed layer → Primary productivity → Plankton biomass (phyto-, zoo-) → **POC export**
- **POC flux** → Trophic level→ **Fisheries yield**





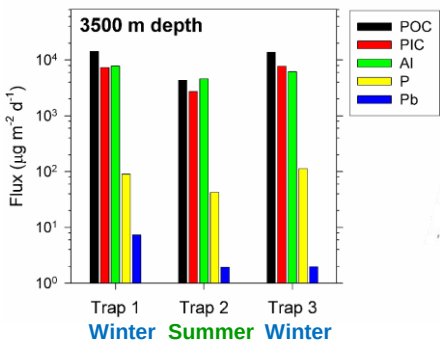
(Friedland et al., 2012)

Our next question:
Is high productivity equivalent to high fishery catches?

34

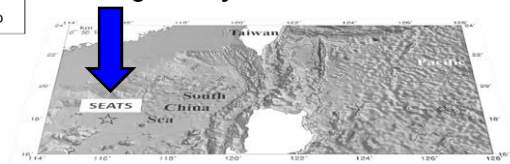
Environmental Assessment

- Transformation of particle-bound elements in water column
- Marine pollution assessment
  - Pollutant pathways → Ecological/Environmental impact



Burial of reactive Pb: 1.1 kg km^2 yr^{-1}

9% organically-bound



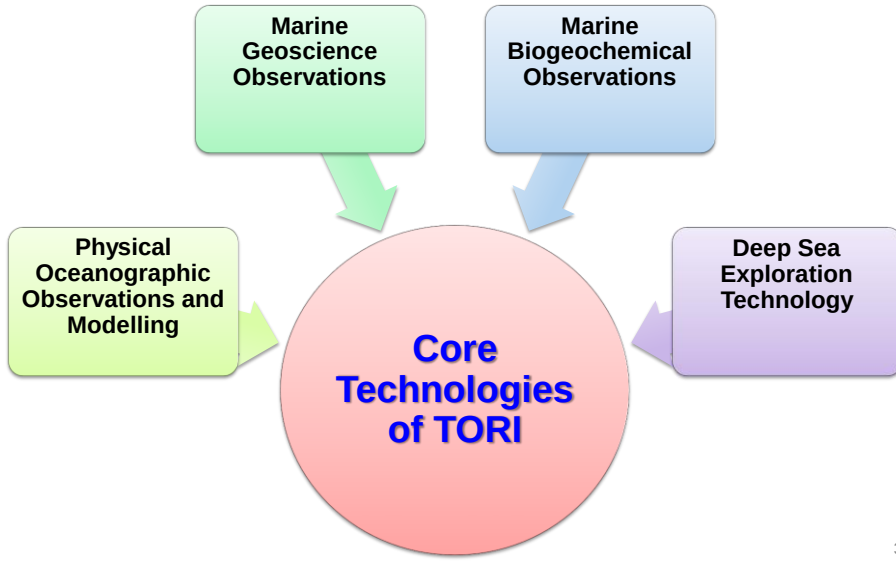
Atlantic Ocean: **0.2** kg Pb km^2 yr^{-1}

Pacific Ocean: **0.15 to 1.5** kg Pb km^2 yr^{-1}

(Sherrell & Boyle, 1992; Wu *et al*., 2010; Zubrick *et al*., 2017)

35

Core Technologies



36

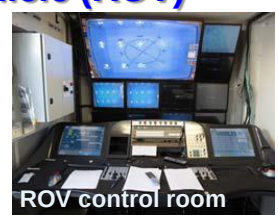
Deep-Sea Exploration

- **Marine exploration technologies R&D, development and system integration**
  - Ocean Bottom Seismometer series
    - Sub-broadband OBS
    - Broadband OBS
    - Short period OBS (in progress)
    - OBEM
  - Others
    - Mini TOWCAM
    - Deep-sea Camera/Light
- **Operate and maintain ROV**

37

Deep-Sea Exploration: ROV

Remotely Operated Vehicle (ROV)

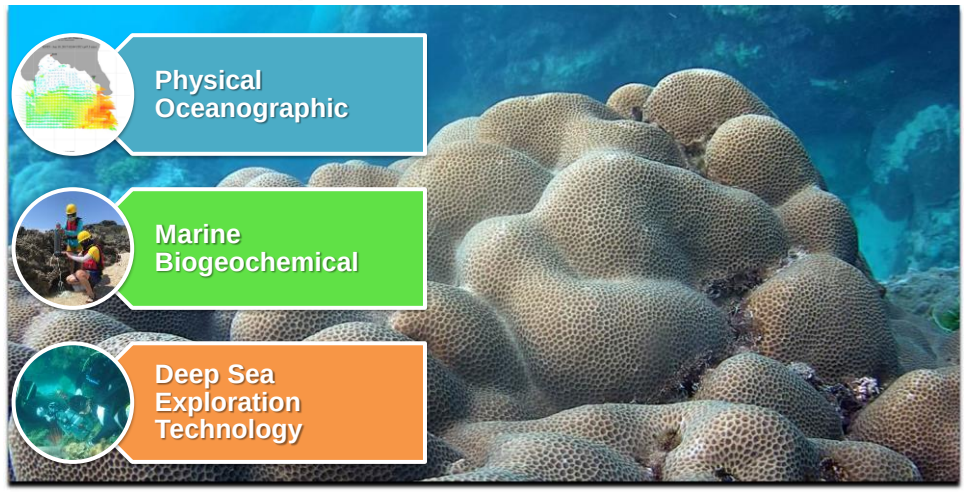


ROV Sea Trial in Liuqiu

38

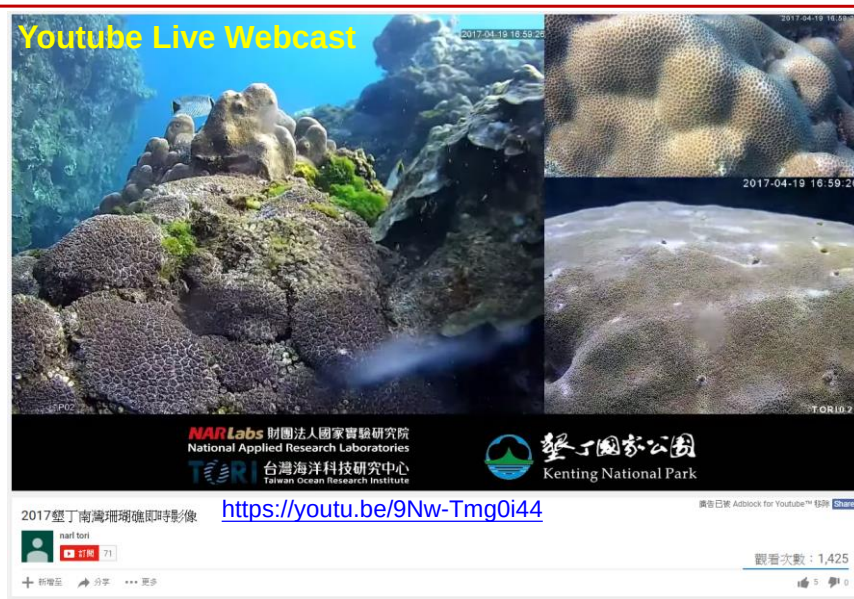
Coral Spawning Live

Interdisciplinary research



39

Coral Spawning Live



40

NARLabs 承諾·熱情·創新 TORI

Outline

1. About TORI
2. Core Technologies of TORI
3. **Summary**

41

Summary

NARLabs TORI

- The government and marine scientific research institutions should encourage efficient communication channels to optimize their mutual goals of managing ocean affairs, defending maritime rights and protecting ocean resources.

The Minister of Coast Guard Administration visited TORI

Signing of MOU between Marine National Park Headquarters and TORI .

42

Acknowledgements

- Dr **Lai**, Jian Wu
- Dr **Liau**, Jian Ming
- Dr **Lin**, Pei Ying
- Dr **Lui**, Hon Kit
- Dr **Wang**, Bo Shian

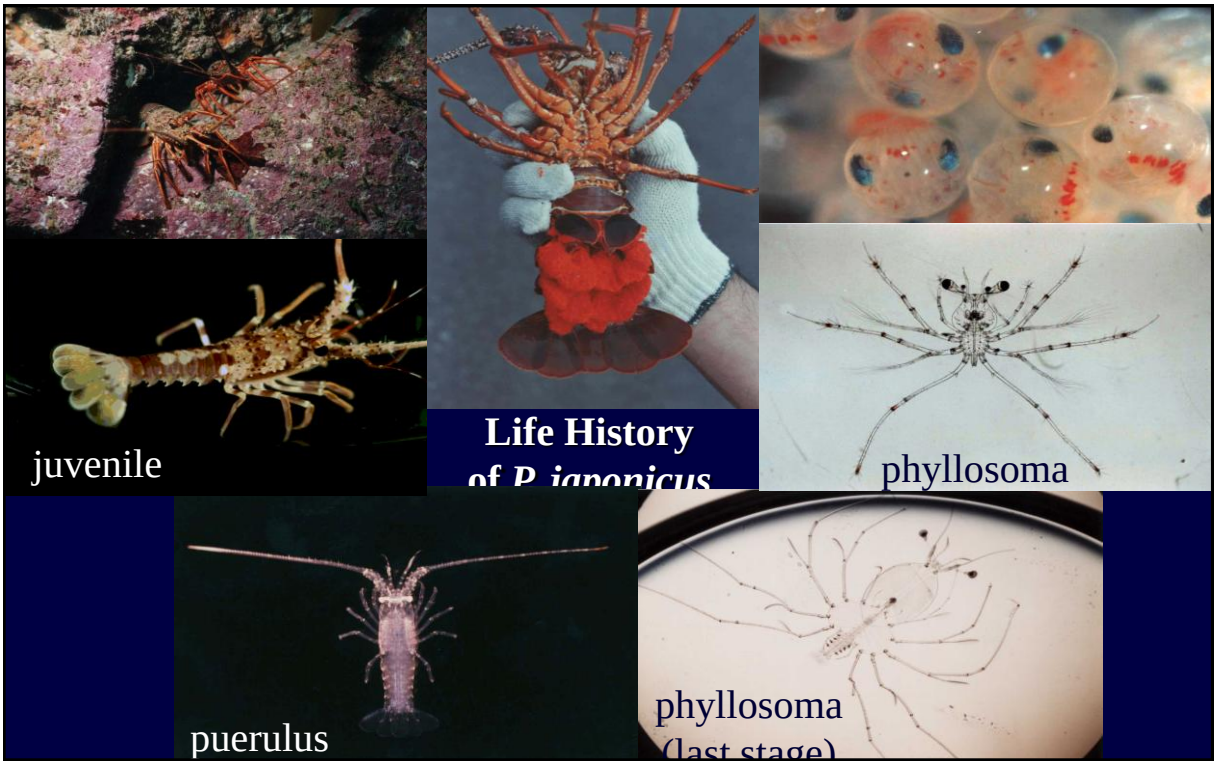
44

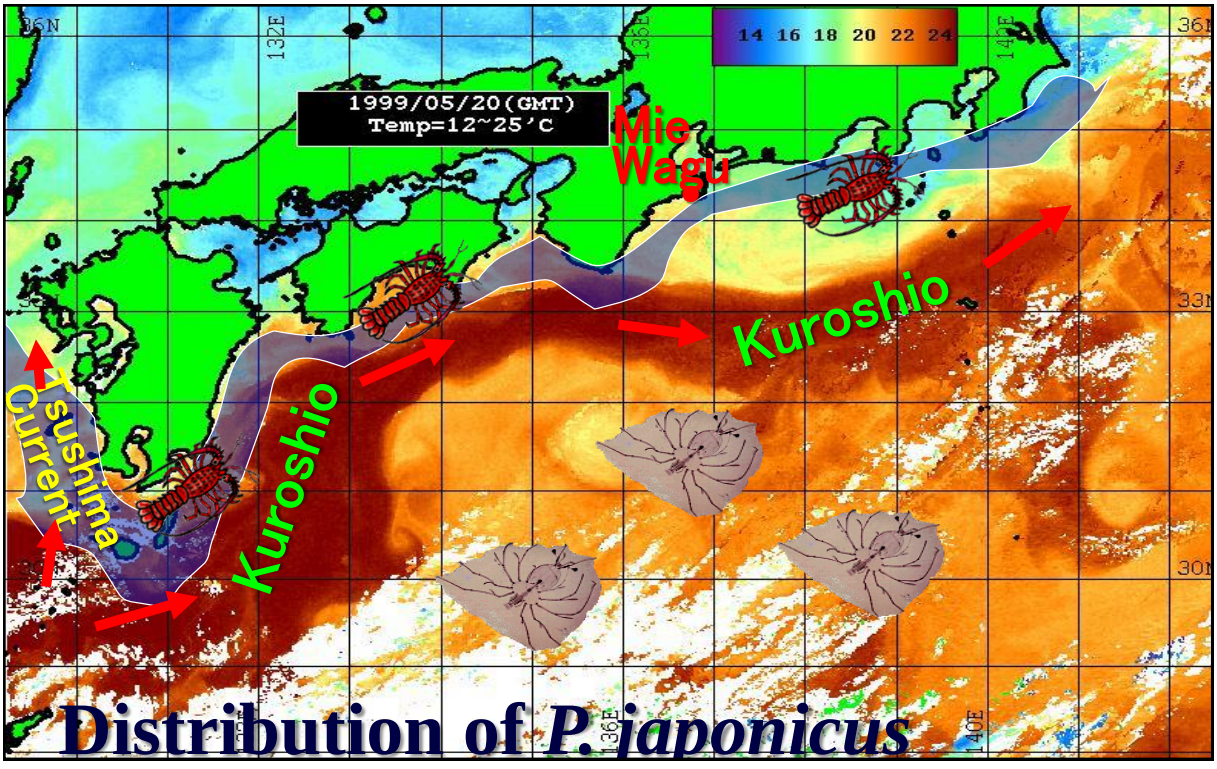
Chapter II

Sustainable Management of Biological Resources

Sustainable management of coastal fishery resources in Japan

Takashi YAMAKAWA
Department of Aquatic Bioscience,
Graduate School of Agricultural and Life Sciences,
The University of Tokyo

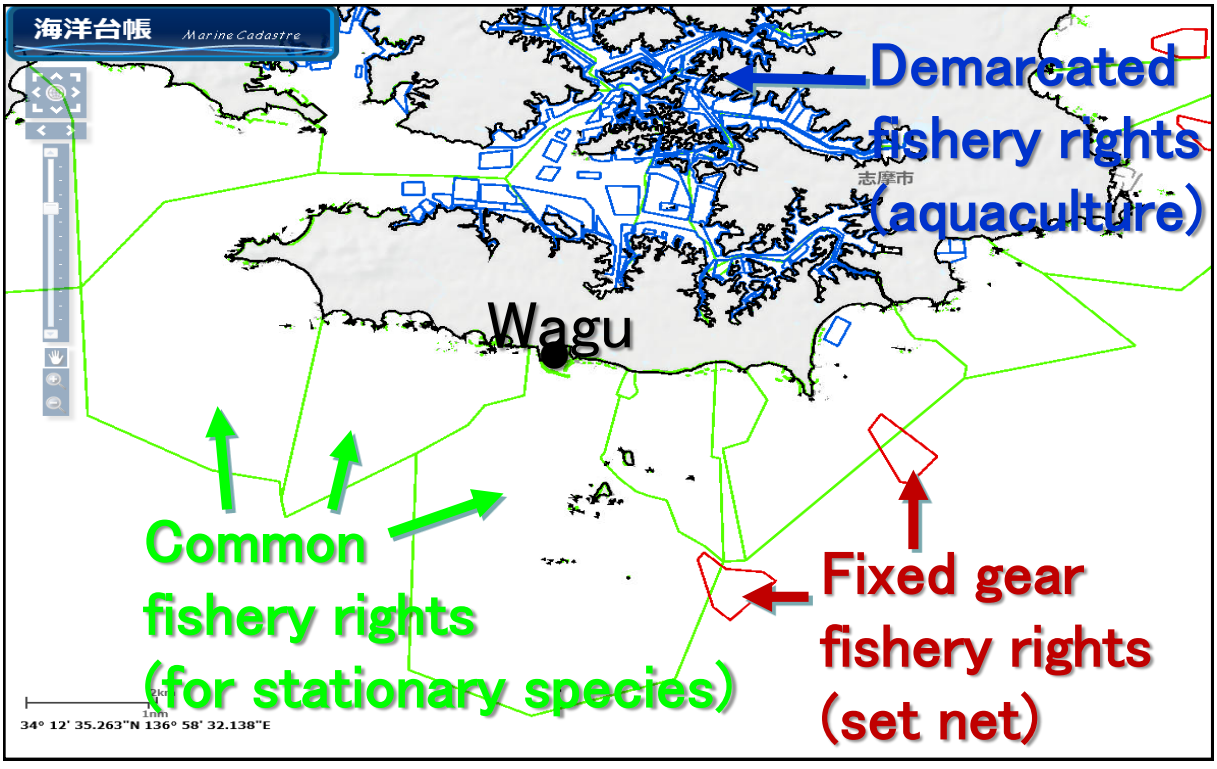


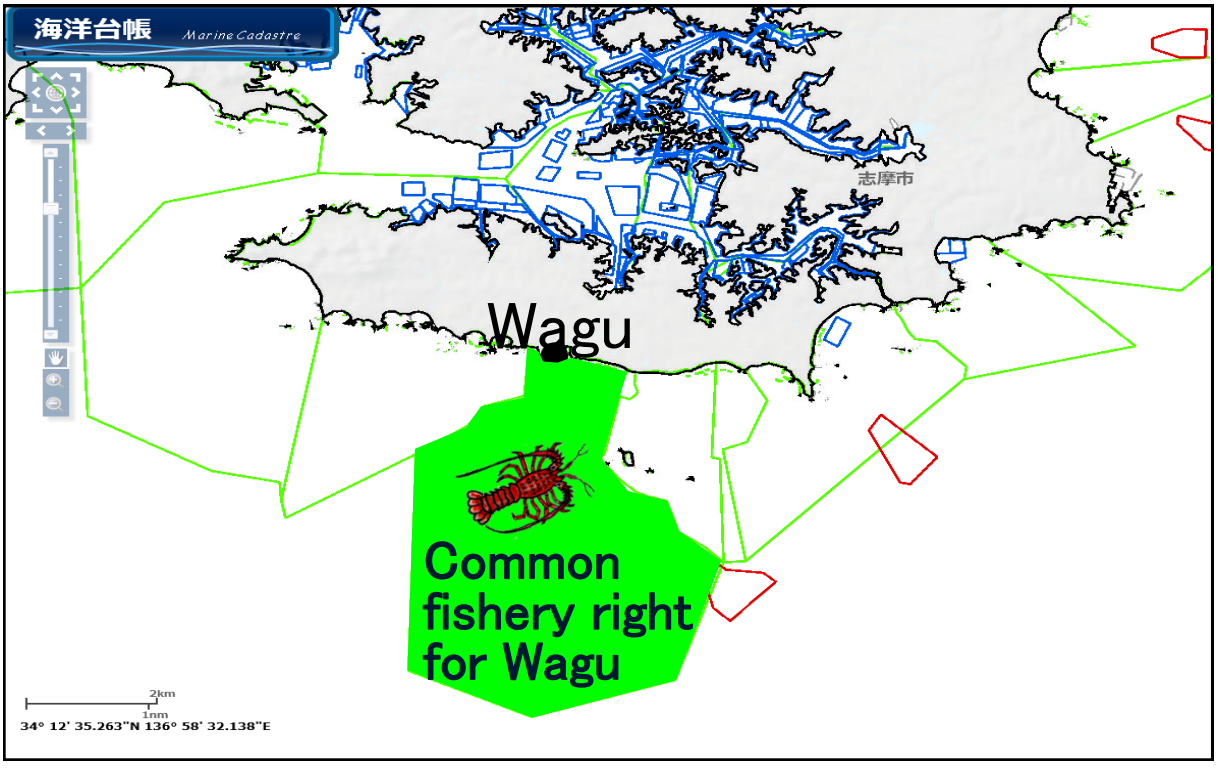


Coastal Fisheries Management in Japan

- **Fishery Rights** are assigned to:
  Fisheries Cooperative Associations *etc.*
  (962 coastal FCAs in 2016)
  under the authority of **prefectural government**
  (**Territorial Use Rights in Fisheries (TURFs)**)
- **Bottom-up**, democratic, and self-motivating **community-based** management by fishermen
  (consensus-building & mutual surveillance)
- **Prefectural ordinances** (basic minimum rules)

→Co-management by fishermen and government


海洋台帳
Marine Cadastre
Demarcated
fishery rights
(aquaculture)
志摩市
Wagu
Common
fishery rights
(for stationary species)
Fixed gear
fishery rights
(set net)
34° 12' 35.263"N 136° 58' 32.138"E


海洋台帳
Marine Cadastre
志摩市
Wagu
Common
fishery right
for Wagu
34° 12' 35.263"N 136° 58' 32.138"E

Lobster Fishery

Mainly caught by tangle nets (single net / trammmel net)

Nets are set in the evening, and raised at the next dawn.

Fishing Season:
October-April in Mie Prefecture
(defined by prefectural ordinance)

Formal prefectural ordinances for closed seasons and minimum size limits

Prefecture	Closed Season: Apr	May	Jun	Jul	Aug	Sep	Size Limit	Remarks
Chiba			■	■			BL 13cm	
Tokyo			■	■	■		BL 13cm	
Ogasawara			■	■	■	■	BL 22cm	*1
Kanagawa			■	■			BL 13cm	
Shizuoka		■	■	■	■	■	BL 13cm	
Mie		■	■	■	■	■	CL 4.2cm	
Wakayama		■	■	■	■	■	BL 15cm	
Tokushima		■	■	■	■	■	BL 13cm	
Kochi		■	■	■	■	■	BL 13cm	
Ehime			■	■	■		BL 15cm	
Ohita			■	■	■		BL 20cm	
Miyazaki	■	■	■	■	■		BL 15cm	
Kagoshima		■	■	■	■		BL 13cm	*2
Fjukuoka	■	■	■	■	■		BL 20cm	
Saga	■	■	■	■	■		BL 15cm	
Nagasaki	■	■	■	■	■		BL 15cm	
Kumamo		■	■	■	■		BL 20cm	
Okinawa	■	■	■				BL 18cm	*3

North ↓ South

*1 for *P. longipes / penicillatus / versicolor / ornatus*

*2 for *P. japonicus / penicillatus / ornatus /versicolor / longipes*

*3 for *P. japonicus / ornatus / versicolor*

Others for *P. japonicus*

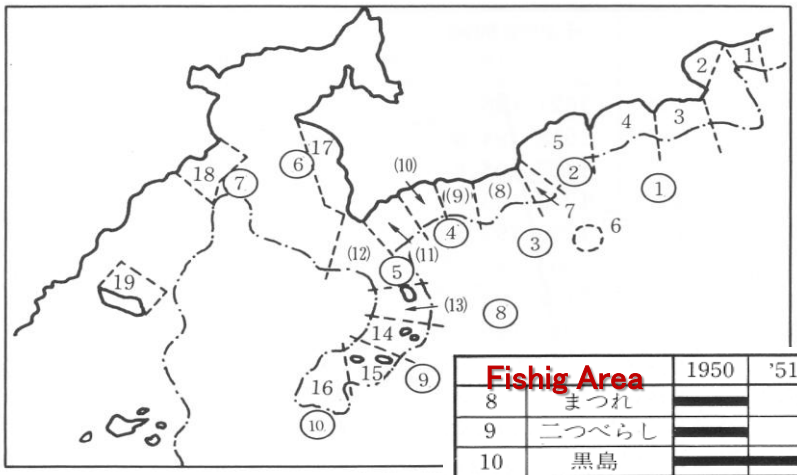
Conventional management measures voluntarily esytablished by fishermen

Introduction of various constraints for gear
(type of nets, mesh size, number of nets per boat, thickness or quality of the net yarn, *etc*.)

Elongation of closed season and/or enlargement of minimum size limits in addition to prefectural rules,

Establishment of closed areas, including year-by-year rotation system of the closed areas,

Year-by-year rotation system of closed areas at Nishiki in Mie Prefecture



Cited from Nonaka (1988)

Fishig Area		1950	'51	'52	'53	'54	'55	'56
8	まつれ	■			■	■		■
9	二つべらし	■			■	■		■
10	黒島	■	■				■	
11	おひら方		■	■			■	■
12	目戸		■	■			■	■
13	高島			■	■			

Bars represent closed years for each fishing area

Conventional lobster management measures at Wagu before 1990s

Trammel Net Lobster Fishermen Group was established in 1932.

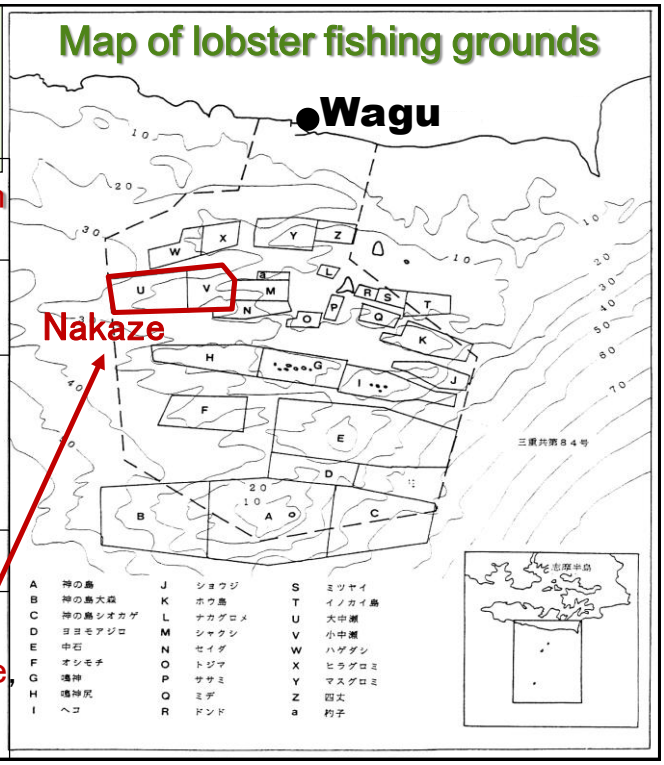
Number of allowable nets per boat : 15 nets → 13 nets

Allowable mesh size of nets and thickness of net yarn : over 2.3寸 and 10 treads (1寸≒3.8cm)

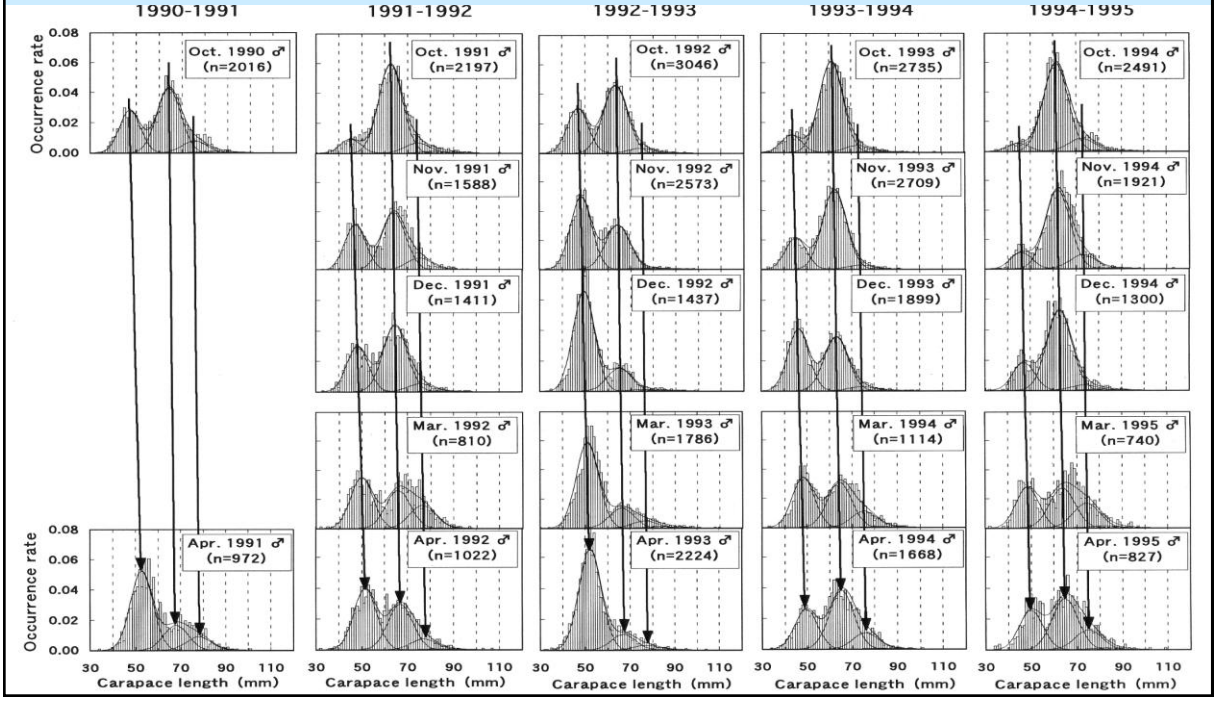
Release individuals under 80g.

Income pooling system at a particular fishing ground, Nakaze, through cooperative operation

Map of lobster fishing grounds



Shift in carapace length frequencies by month (♂)



Estimated growth of *P. japonicus* in Mie Prefecture

(Ages are expressed in years after settlement as pueruli)

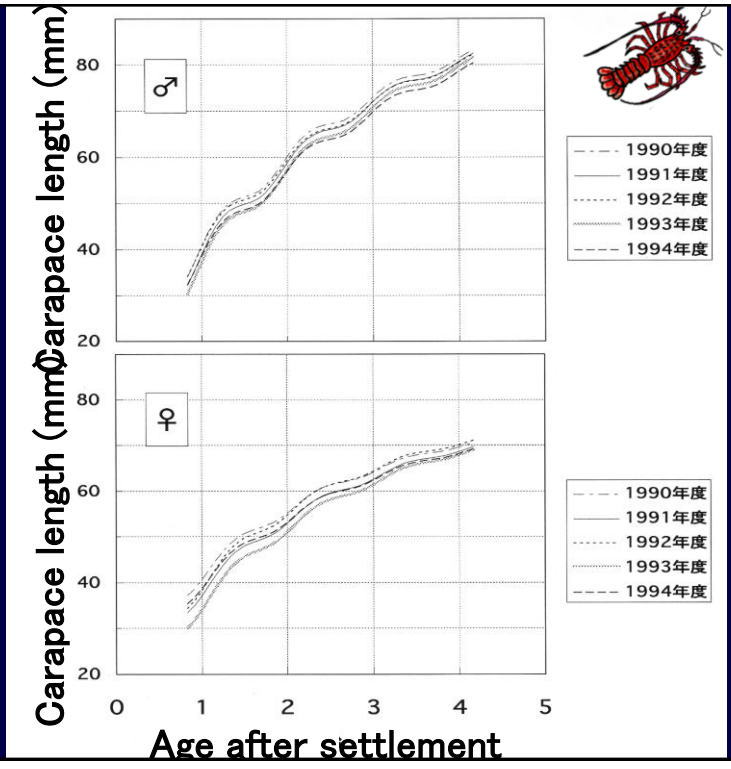
Body Weight

Males

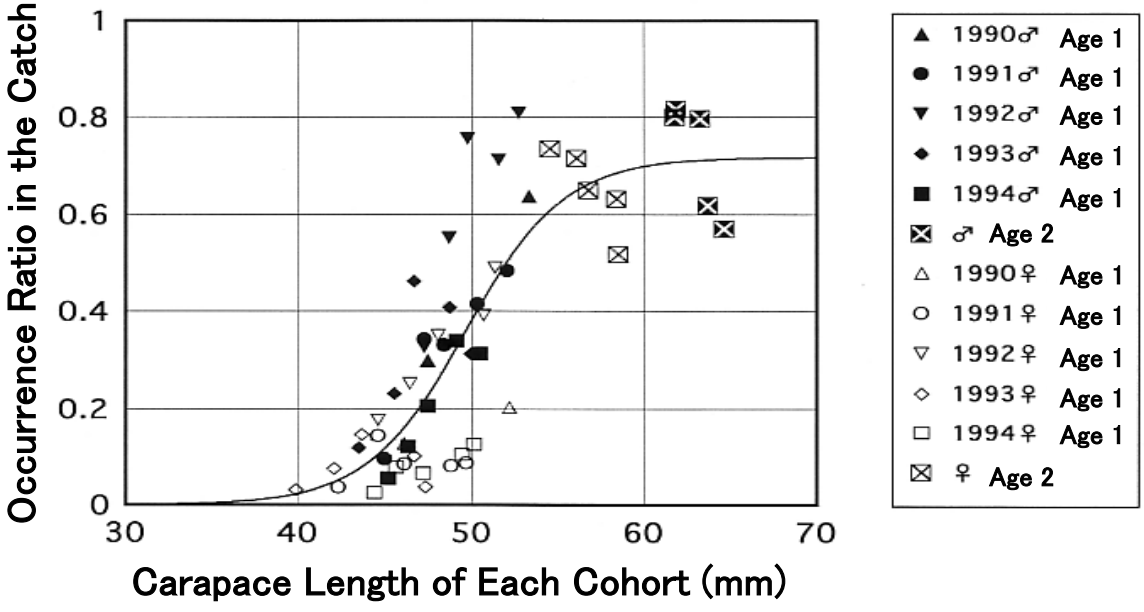
Age1	2	3
79g	207g	344g

Females

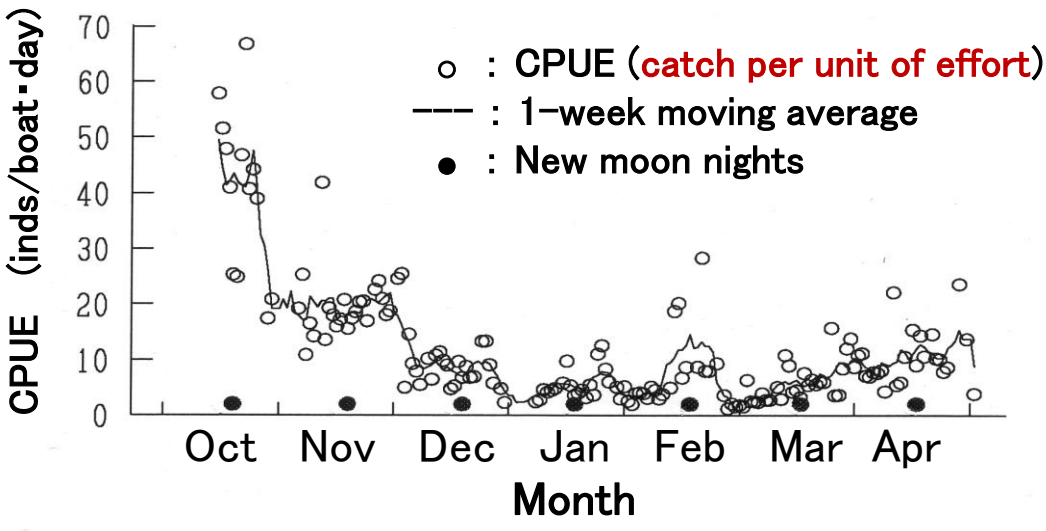
Age1	2	3
70~	158~	227~



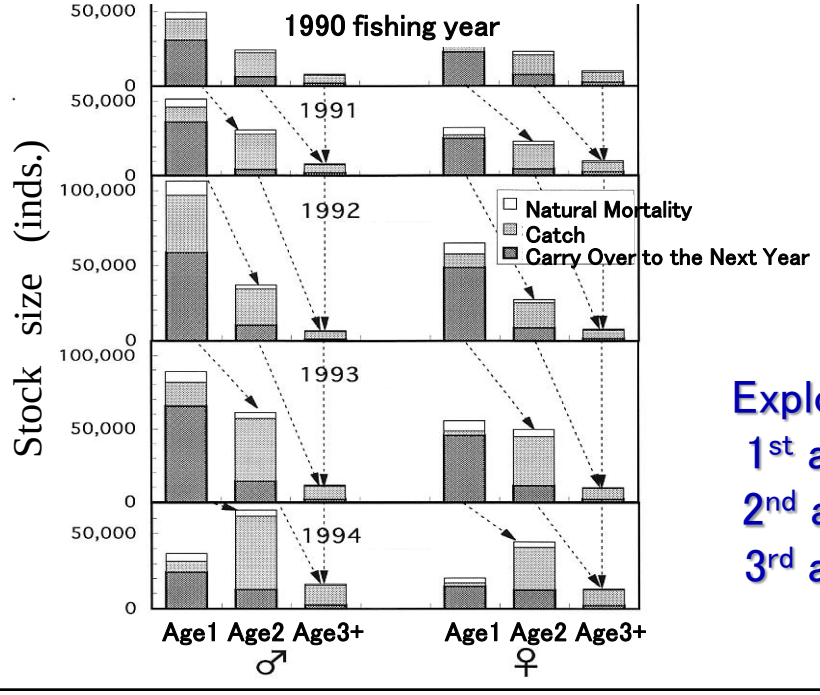
Size selectivity of the trammel net



Shift in CPUE in a fishing season at Wagu, Mie (Oct. 1990 – Apr. 1991)

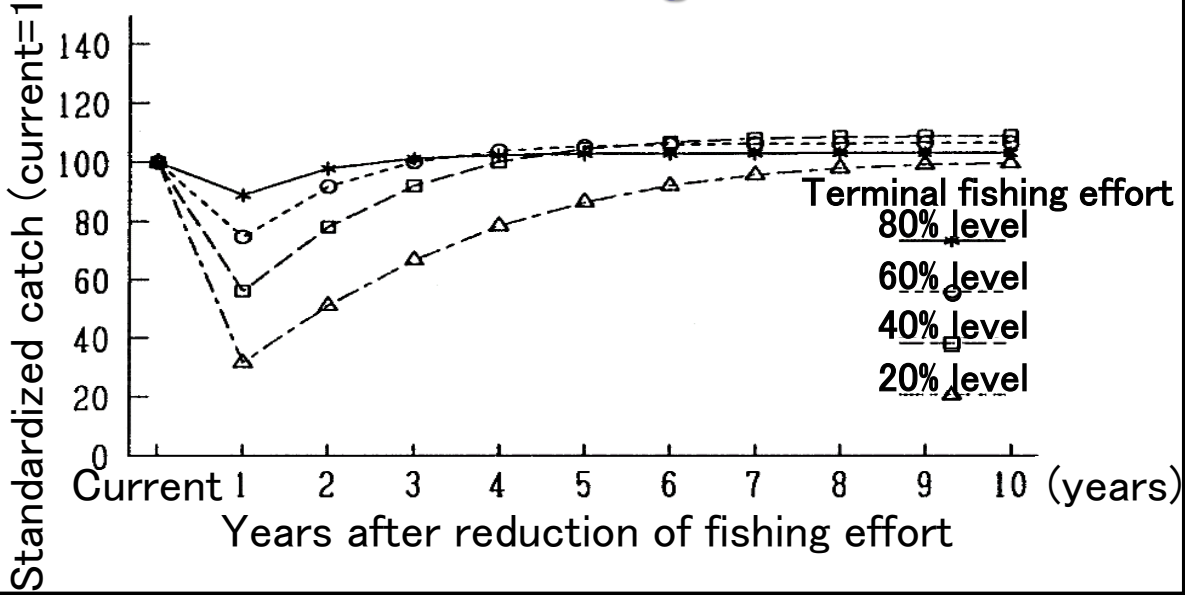


Shift in stock size of each cohort over years at Wagu

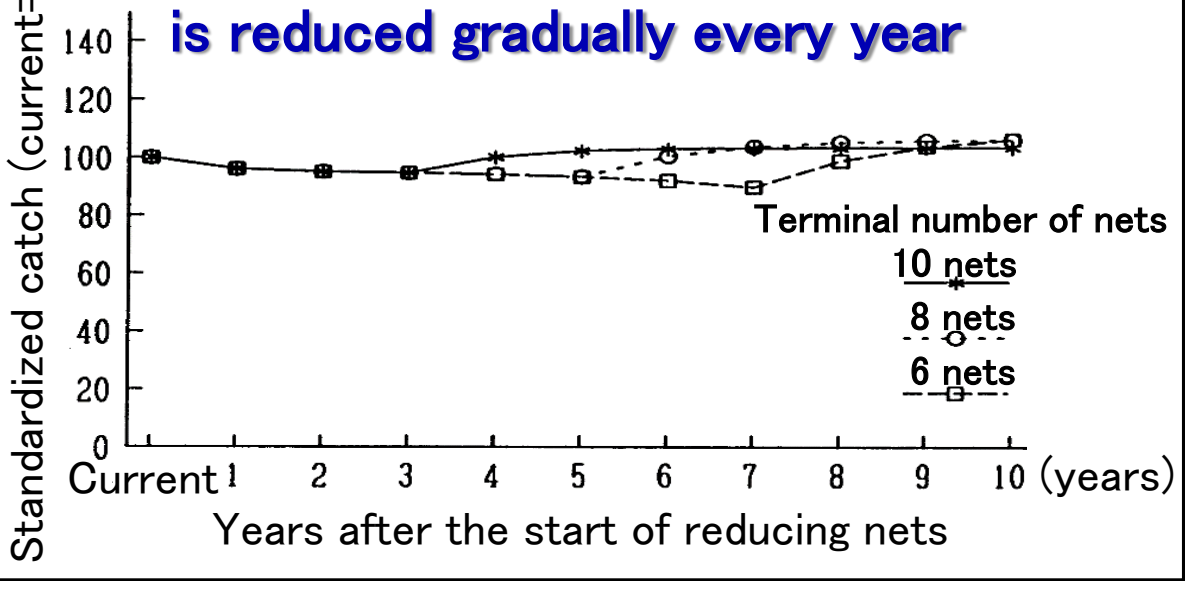


Exploitation rate
1st age: 10–30%
2nd age: 50–75%
3rd age: 60–80%

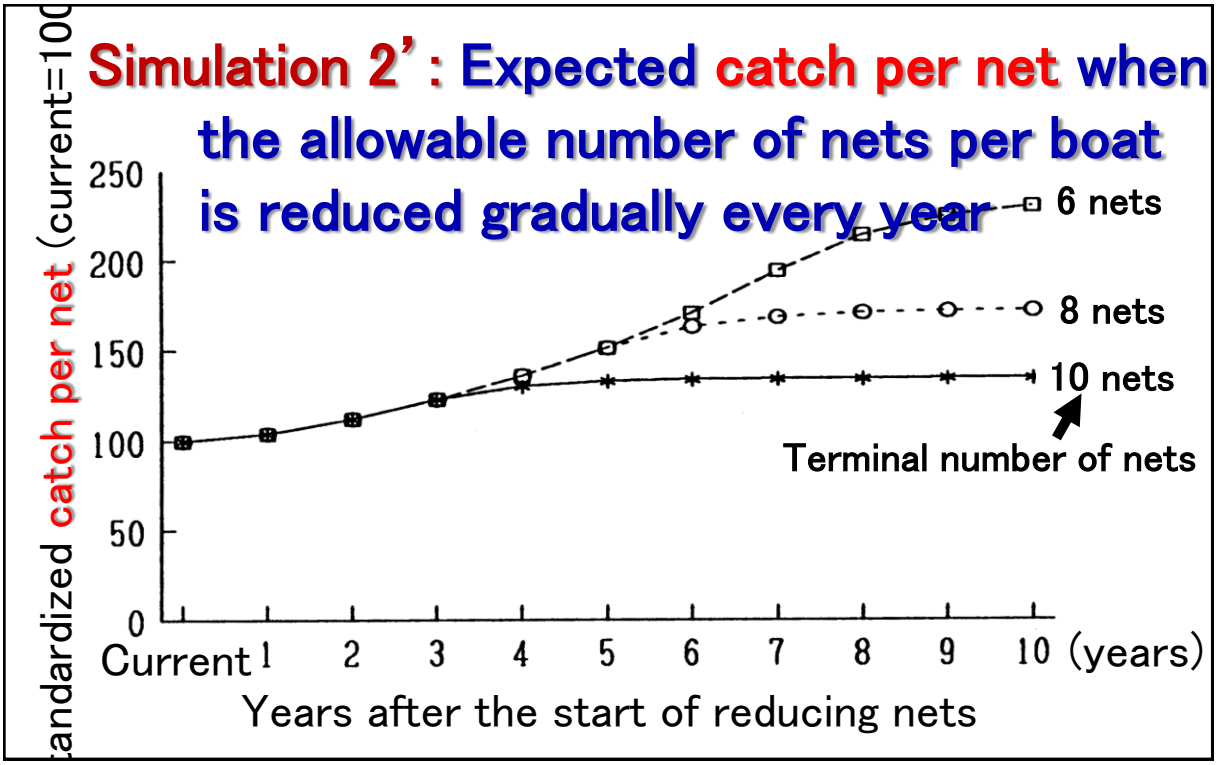
Simulation 1: Shift in expected catch when fishing effort is reduced



Simulation 2: Shift in expected catch when the allowable number of nets per boat is reduced gradually every year



Simulation 2': Expected catch per net when the allowable number of nets per boat is reduced gradually every year

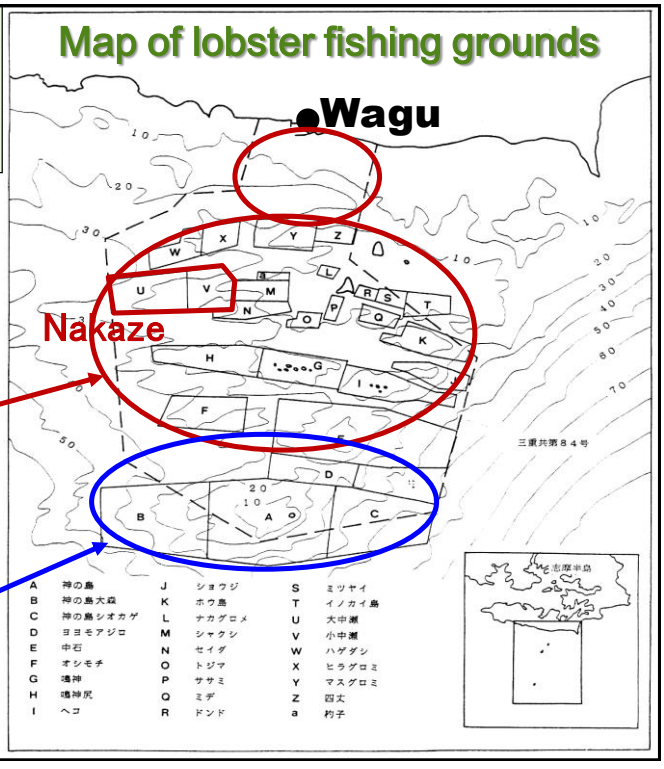


Recent improvement of lobster management system at Wagu

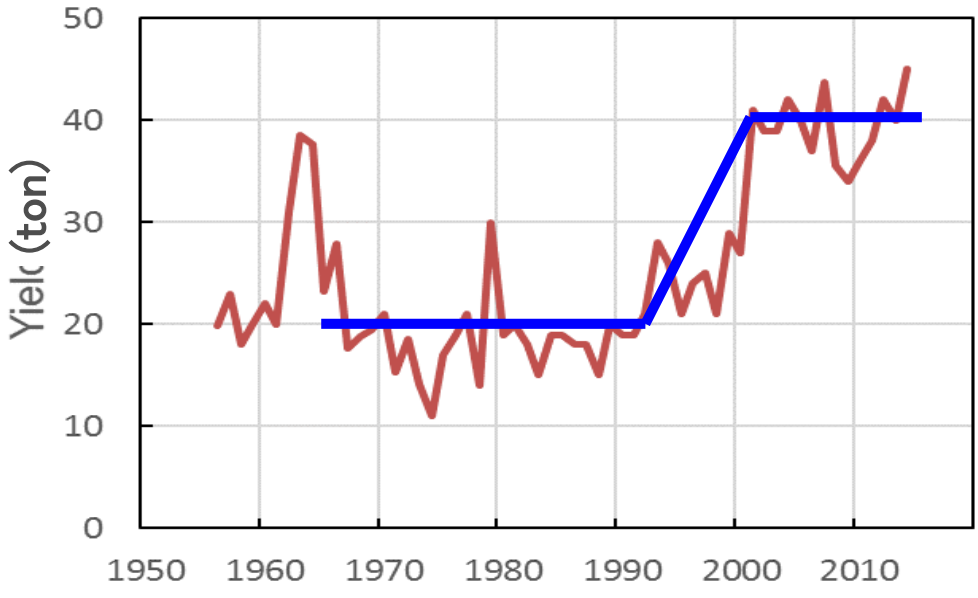
Income pooling system through cooperative operation in the entire period from Oct. to Dec. using only two nets per boat

Significant expansion of fishing grounds assigned to the pooling system

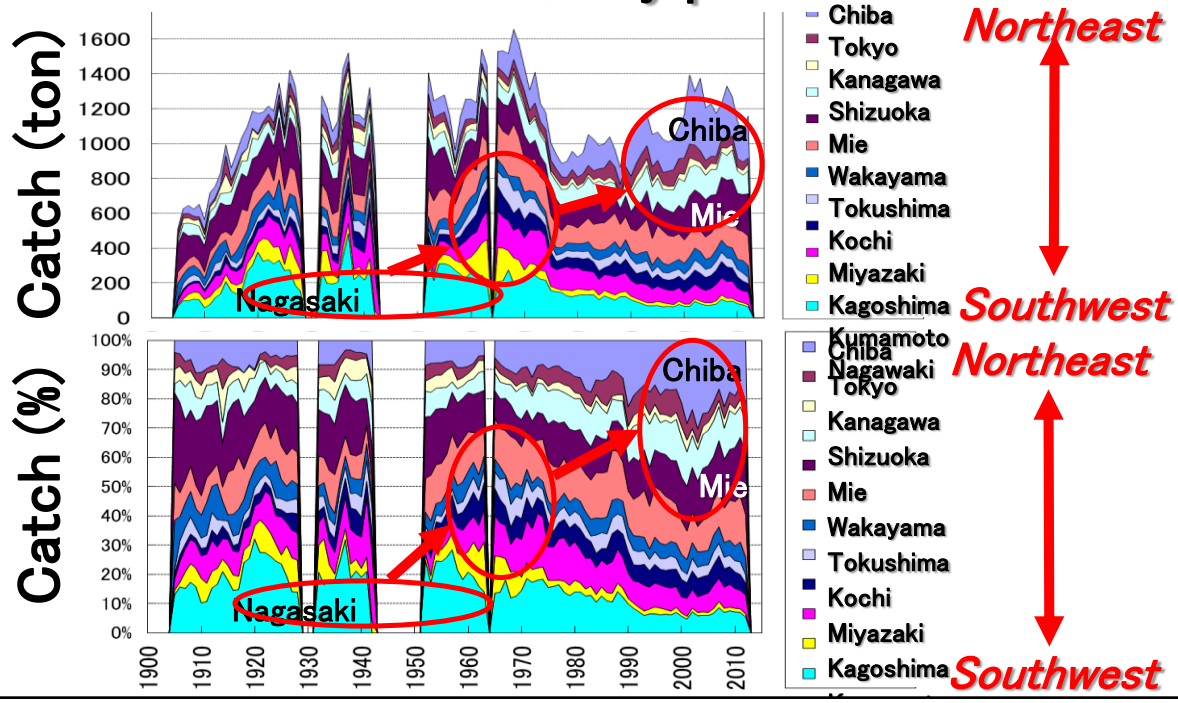
Ground for conventional competitive fishery has been restricted to an offshore area and is opened as late as in Jan. by using 10 nets per boat

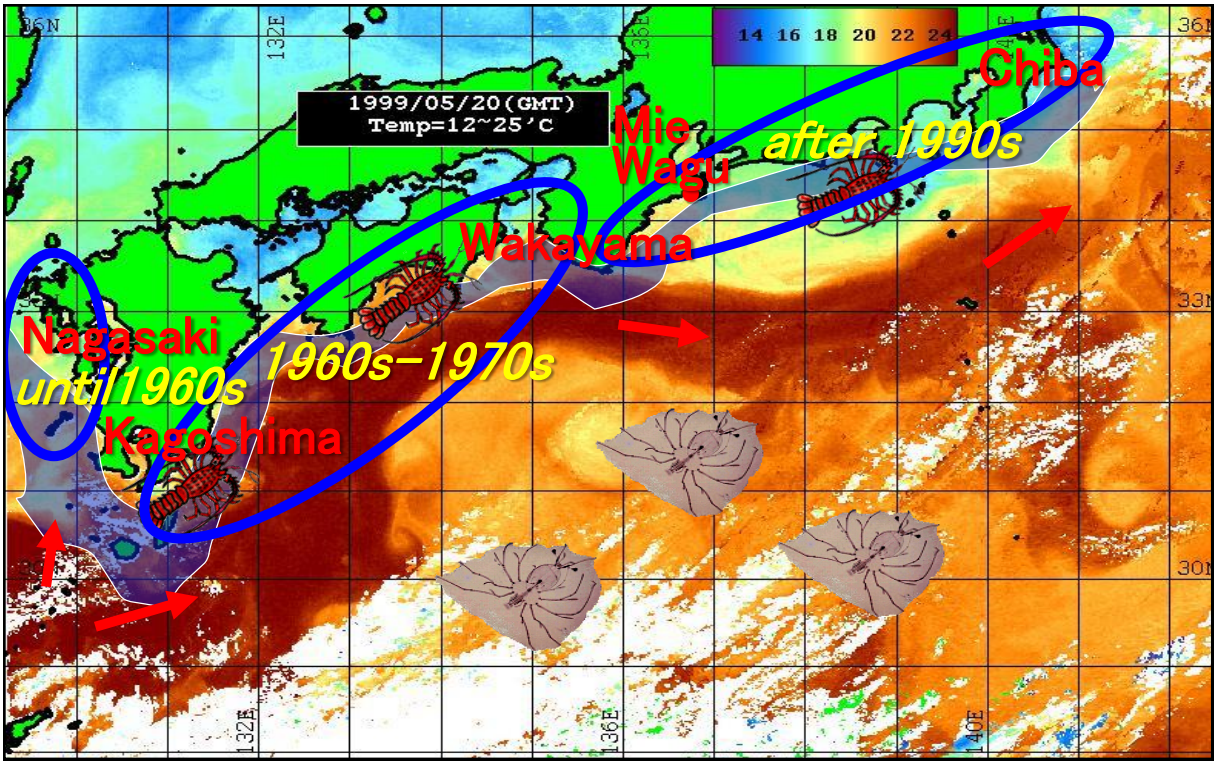


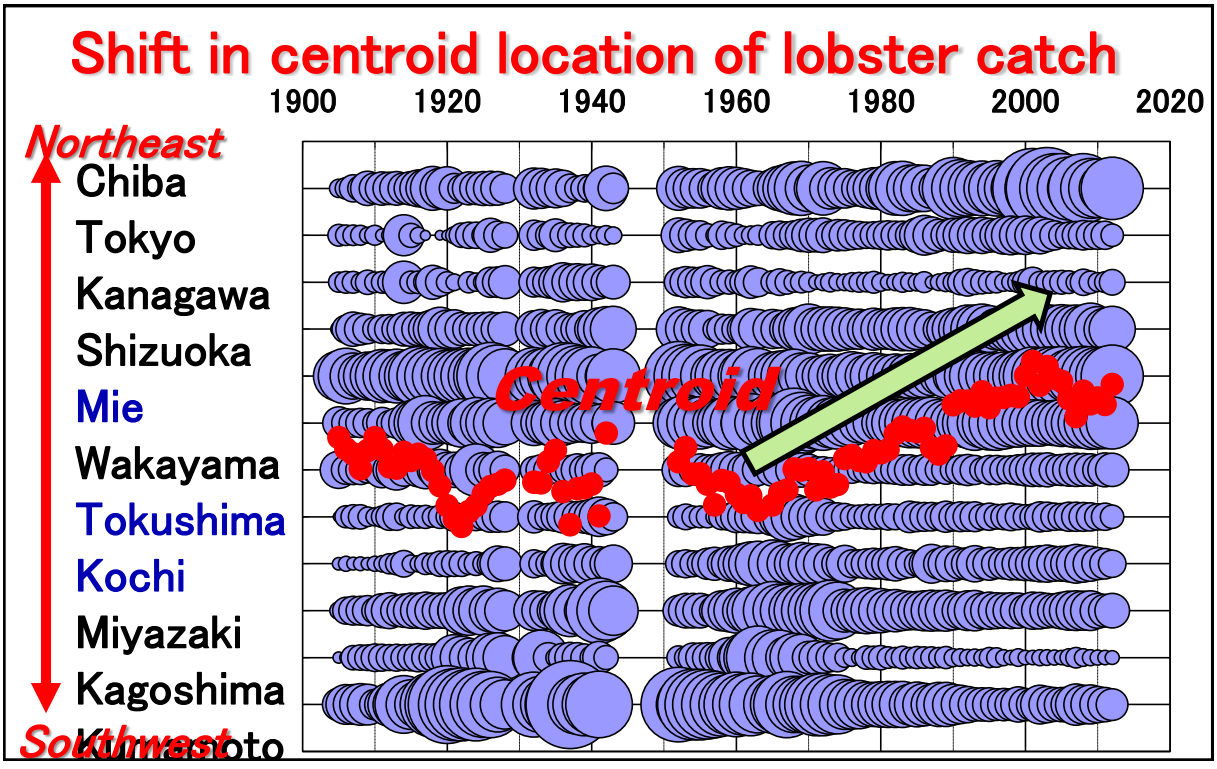
Shift in lobster catch at Wagu

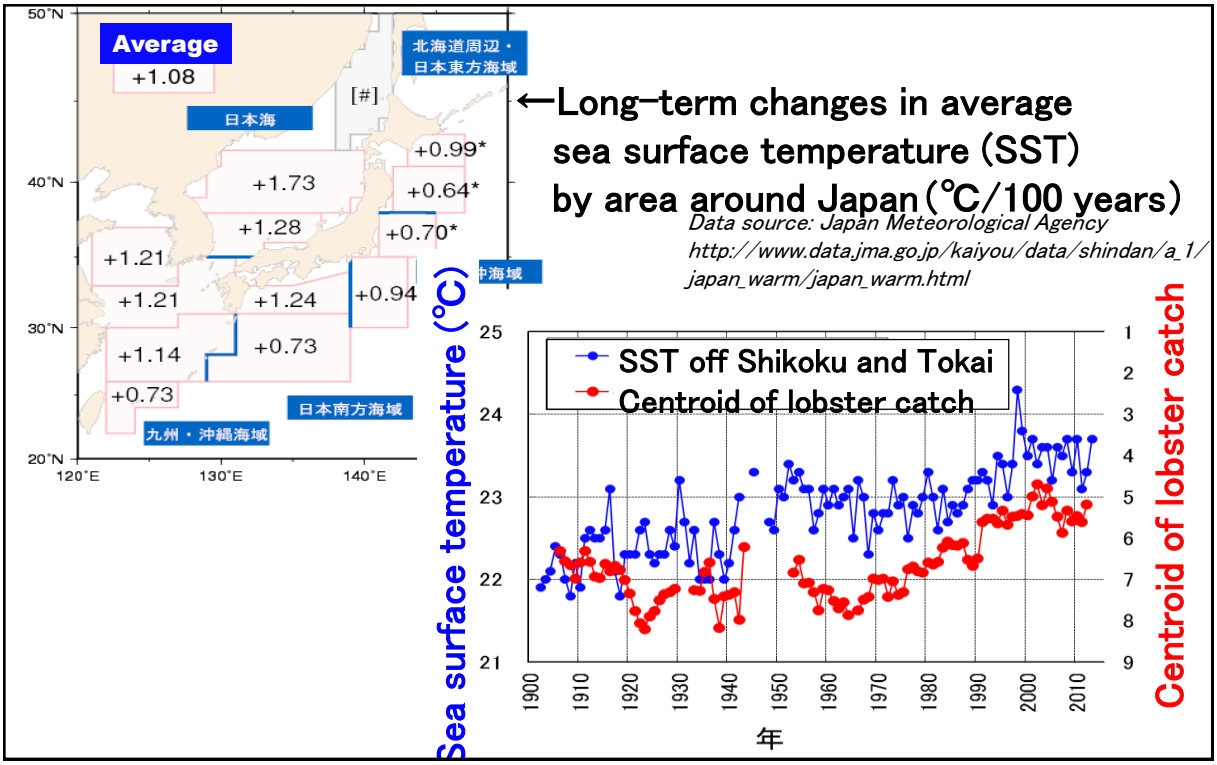


Shift in lobster catch by prefecture




1999/05/20(GMT)
Temp=12~25°C
14 16 18 20 22 24
Chiba
after 1990s
Mie
Wagu
Wakayama
Nagasaki
until1960s
1960s-1970s
Kagoshima
36N
132E
136E
140E
33N
30N


Shift in centroid location of lobster catch
1900
1920
1940
1960
1980
2000
2020
Northeast
Chiba
Tokyo
Kanagawa
Shizuoka
Mie
Wakayama
Tokushima
Kochi
Miyazaki
Kagoshima
Southwest
Centroid



Coastal Fisheries Management in Japan

- **Fishery Rights** are assigned to:
  Fisheries Cooperative Associations *etc.*
  (ca. 1,000 FCAs in 2012)
  under the authority of **prefectural government**
  (**Territorial Use Rights in Fisheries (TURFs)**)
- **Bottom-up**, democratic, and self-motivating **community-based** management by fishermen
  (consensus-building & mutual surveillance)
- **Prefectural ordinances** (basic minimum rules)

→Co-management by fishermen and government

. . . supported by Scientific Advice


Thank you
for your attention!
juvenile
Life History
of P. japonicus
phyllosoma
puerulus
phyllosoma
(last stage)

Information technologies for sustainable fishery

Masaaki WADA Future University Hakodate
Katsumori HATANAKA Tokyo university of Agriculture

Employment history

marine_IT
FUTURE UNIVERSITY HAKODATE

- 1993 - 2004
  - ✓ Towa Denki Seisakusho Co., Ltd.
  - ✓ Engineer
    - Squid fishing machine for labor saving
- 2005 - present
  - ✓ Future University Hakodate
  - ✓ Researcher
    - IT for sustainable fishery
- 2016 - 2021
  - ✓ SATREPS (JST and JICA)
  - ✓ Principal investigator
    - Optimizing mariculture in Indonesia

Today's topics

1. Resource management
   - ✓For capture fishery
     - Sea cucumber and Squid
2. Marine observation
   - ✓For culture fishery
     - Oyster, Kelp and Grouper
3. Artificial intelligence
   - ✓For set-net fishery
     - Bluefin tuna

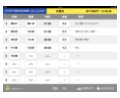
Examples of IT fishing

Resource management for capture fishing

Real-time evaluation system of resources

Backgrounds
1. Popularity of sea cucumber increased in Chinese market
2. Catch competition caused overfishing of sea cucumber
3. Sea cucumber resources had drastically decreased

Steps for visualization
- Introducing iPad
- Sharing catch records
- Sharing GPS records



Effects of IT fishing
- State of resources have been visualized
- Realized the resource management based on data
- Resource amount recovered to stable level

Operational status
Service provided by IT firm

Marine observation for culture fishing

Real-time observation system of environment

Backgrounds
1. Environmental change caused by global warming
2. Sudden mass death of scallop
3. Experience has become useless

Steps for visualization
- Introducing buoys
- Multipoint observation
- Multilayer observation

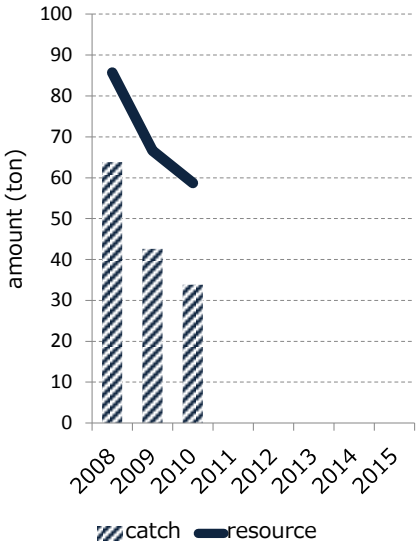
Effects of IT fishing
- State of environment have been visualized
- Supported the experience with data
- Adaptation to the environment became possible

Operational status
Commercialization by several manufacturers

Resource management

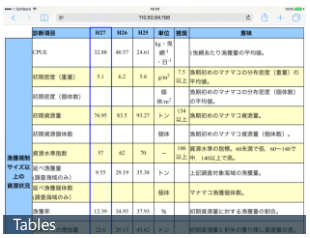
Sea cucumber

Dredge net fishing

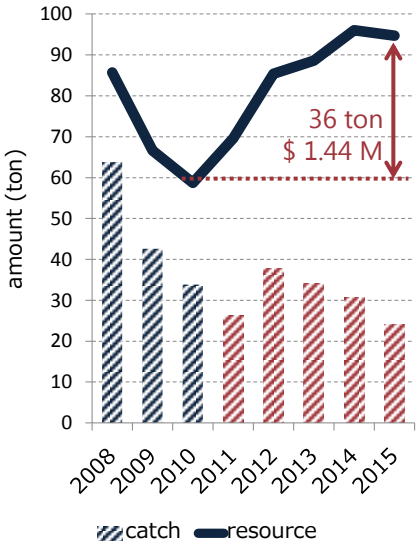


Resource management

Maps

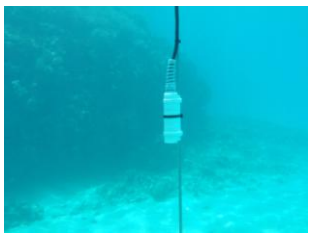


Tables



Marine observation

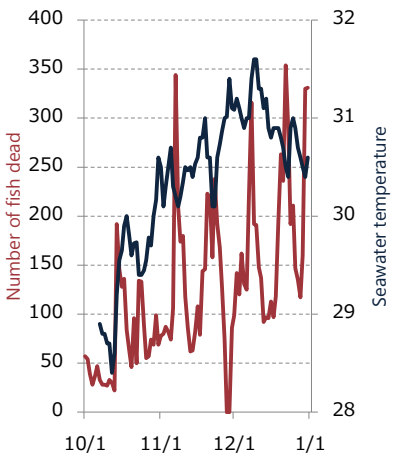
- Shell fish culture
  - ✓Seawater temperature
  - ✓Chlorophyll
- Seaweed culture
  - ✓Seawater temperature
  - ✓Salinity
- Fish culture
  - ✓Seawater temperature
  - ✓Dissolved oxygen



Shell fish culture (Oyster)

Seaweed culture (Kelp)

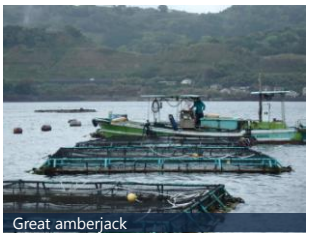
Fish culture (grouper)

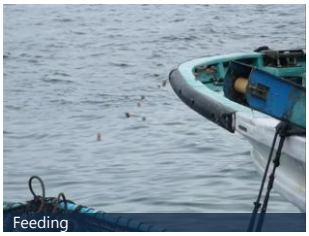


Feeding


Sea bream


Dissolved oxygen sensor


Great amberjack


Feeding

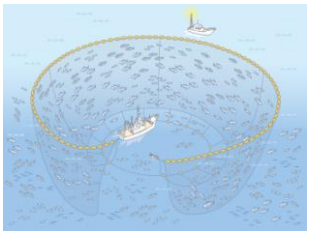
Artificial intelligence

- Characteristics of set-net
  - ✓Passive catch
    - Clean fishing
  - ✓Unselectable catch
    - Various fish species

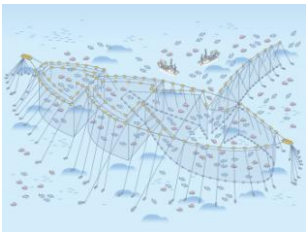
- Issues of set-net
  - ✓Unstable catch
  - ✓Bycatch
    - Juvenile tuna

Fishing method of tuna

- Round haul net
  - ✓2,000 ton/year allotment
  - ✓Active fishing
  - ✓More than 99% tuna

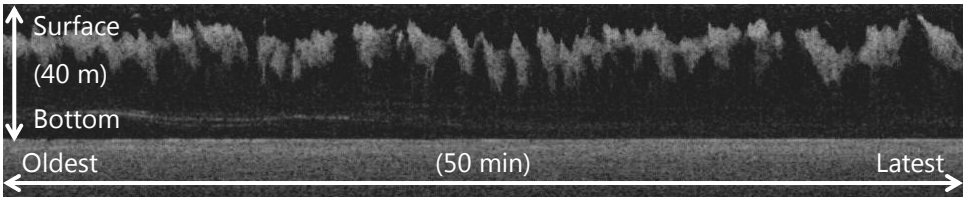


- Set-net
  - ✓2,007 ton/year allotment
  - ✓Passive fishing
  - ✓Less than 1% tuna



Remote fish finder for set-net

Acoustic image



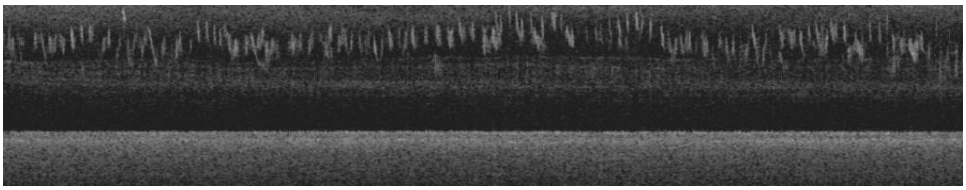
Classification of fish species

- Assumption
  - ✓Swimming around the net
  - ✓Specific swimming speed
  - ✓Specific swimming depth

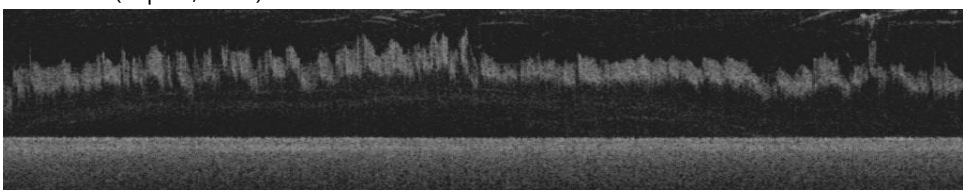
- Analysis method
  - ✓Calculate the cycle
  - ✓Classified by cycle and depth

Acoustic images

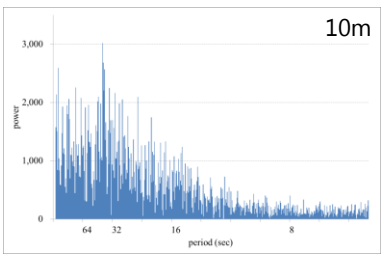
Juvenile tuna (Oct 3, 2015)

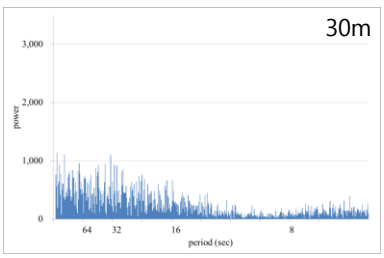


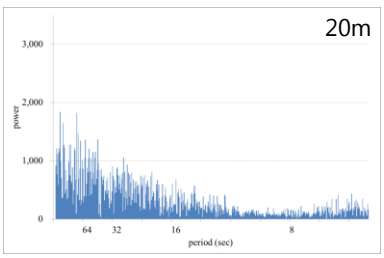
Mackerel (Sep 29, 2015)

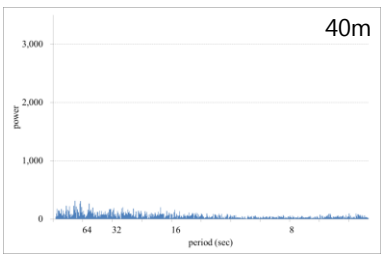


FFT results of juvenile tuna

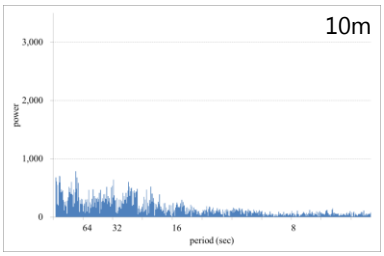


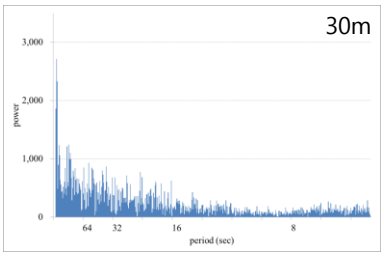


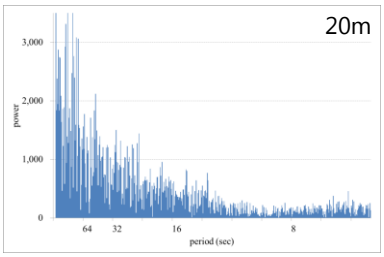


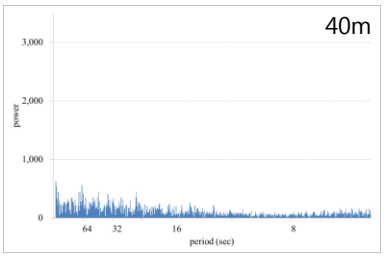


FFT results of mackerel



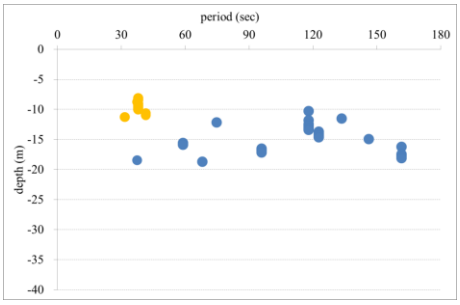




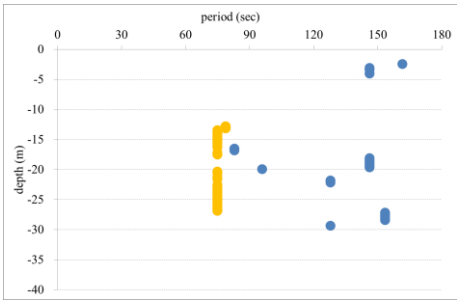


Distribution of cycle and depth

Juvenile tuna (Oct 3, 2015)



Mackerel (Sep 29, 2015)



Conclusion

1. Acquiring data
2. Accumulating data
3. Analyzing data
   - ✓ Visualization of conditions
     - Adaptation to the environment
     - Preservation the resources
4. Learning data
   - ✓ Optimization of fishery
     - Realization of sustainable fishery

Information technologies for sustainable fishery

Masaaki WADA Future University Hakodate
Katsumori HATANAKA Tokyo university of Agriculture

Workshop on Marine Observation and Research
towards Evidence Based Sustainable Ocean Governance

3. Sustainable use of marine biological resources in coastal area

June 28, 2017 Tokyo, Japan

(3) Toward the sustainable development of small scale aquaculture
- Importance of horizontal/vertical business integration and role of ICT

Tokio Wada
Japan Fisheries Research and Education Agency
(FRA)

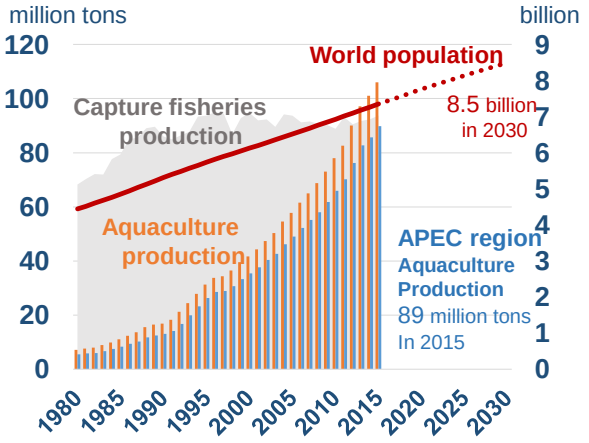
Contents

- In APEC region, particularly in Asian region, aquaculture is quite important in terms of food supply, employment creation, increasing income.
- However, its business scale is generally small, therefore, how to achieve its sustainable development is a big challenge.

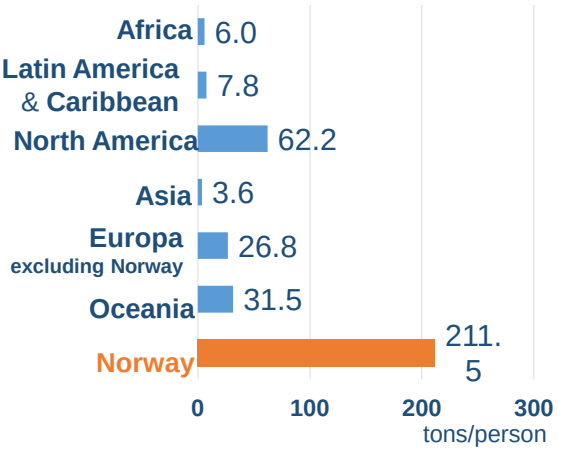
- Status of aquaculture in APEC region
- Three aspects of sustainable aquaculture
- Horizontal/vertical business integration in aquaculture
- Available means for the integration in small scale aquaculture
- Case study on yellowtail farming in Japan
- Role of ICT for sustainable aquaculture

Status of aquaculture in APEC region

- Changes in world population and capture fisheries and aquaculture production



- Aquaculture production per fish farmer by region



➢ Majority of the world's aquaculture, especially aquaculture in APEC region is a small business conducted by family labor

(Data: FAO FISHSTATJ, SOFIA 2016)

3

Three aspects of sustainable aquaculture

- **Environmental sustainability**
  - Aquaculture should not create significant disruption to ecosystem

    water quality and sediment control; efficient fishmeal and fish oil use; responsible sourcing of broodstock and juvenile; control of escapes and minimizing biodiversity and wildlife impact

- **Social sustainability**
  - Aquaculture must be socially responsible and contribute to community well-being

    establish well-defined aquaculture zones and responsibilities for fish farmers; regulatory compliance and effective enforcement; community involvement; working safety, fair labor practice

- **Economic sustainability**
  - Aquaculture must be a viable business with good long-term prospects

    effective biosecurity and disease control; minimal antibiotic and pharmaceutical use; maintain global standards for hygiene; humane harvest and transport; accountable record-keeping and traceability; profitability

(Modified from World Bank 2014)

4

Increase of environmental / social constraints

- Increased social concern for ecosystem conservation

Environmental sustainability
・Minimizing ecological impact

Social sustainability
・Co-existence with community
・Social fairness

Economic sustainability
・Traceability and safety
・Profitability

- Environmental sustainability as a background of traceability and safety
- Increase of social concern for traceability and safety of products
- Environmental / Social constraints = Costs for Economic sustainability

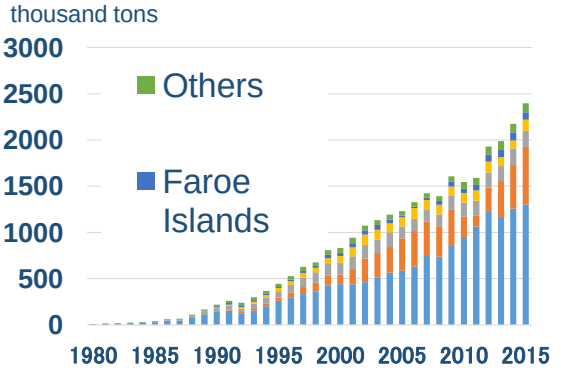
➢ How to achieve economic sustainability under environmental / social constraints is a key issue for achieving sustainable aquaculture

5

Horizontal/vertical business integration in aquaculture
- Marine farming of Atlantic salmon

➢ Achievement of economies of scale through horizontal integration
➢ Implementation of effective production through vertical integration

- Growth of farmed Atlantic salmon production



Top 15 companies produce 50% or more!

(Data: FAO FISHSTATJ)

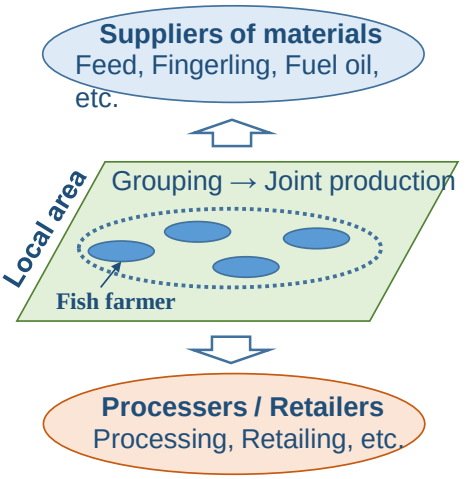
- Value chain of salmon farming

Feed/Smolt Production
Farming
Harvesting Transportin
Processing
Shipping

- Companies consistently carry out from smolts and feed production to shipping of products
- Improving productivity and profitability
- Enhancing international competitiveness
- Developing as a global export industry

6

Available means for horizontal/vertical integration in small scale aquaculture



- **1st step: Cooperation between fish farmers**
  - Formation of a group for joint aquaculture production
  - Adjustment of amount of production
    → *Avoidance of excessive competition*
  - Sharing information on farming techniques
    → *Improvement of production efficiency*
- **2nd step: Cooperation with upstream/ downstream industries**
  - Cooperation with suppliers of materials
  - Collective procurement → *Reduction of costs*
  - Cooperation with processers and retailers
  - Joint shipment → *Stabilization of supply and demand*
    Reasonable sales price

➢ Implementation of virtual integration → Construction of value chain
→ Improving productivity / profitability of small scale aquaculture

7

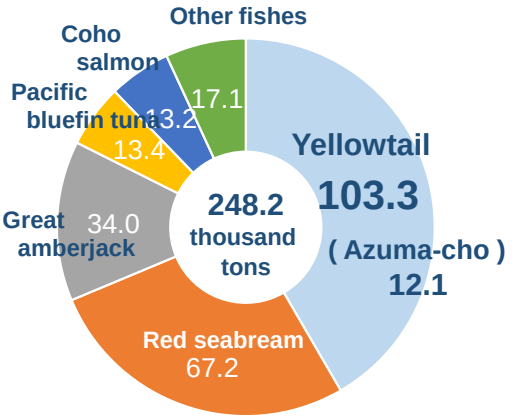
Case study on yellowtail farming in Japan
- Efforts by Azuma-cho fisheries cooperative

- **Outline of Azuma-cho cooperative**
  - Number of Cooperative member: 373
  - Fish farming on yellowtail and red seabream, coastal capture fisheries, etc.
- **Yellowtail farming in Azuma-cho cooperative**
  - Number of yellowtail farmer: 126
  - Number of cage: 1,400 (8m x 8m)
  - Production volume: 200 million fishes or 12 thousand tons/year
  - Export volume: 2thousand tons in 2016

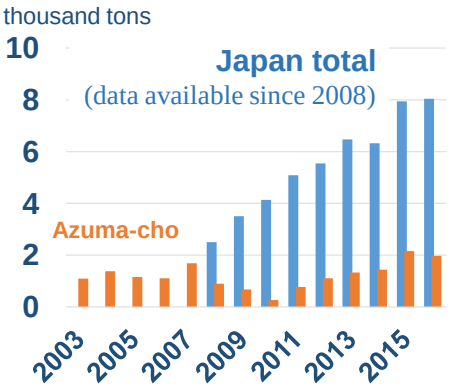
8

Japanese production and exports of farmed yellowtail

- Japanese marine fish farming production by species in 2016



- Export volume of farmed yellowtail in Japan

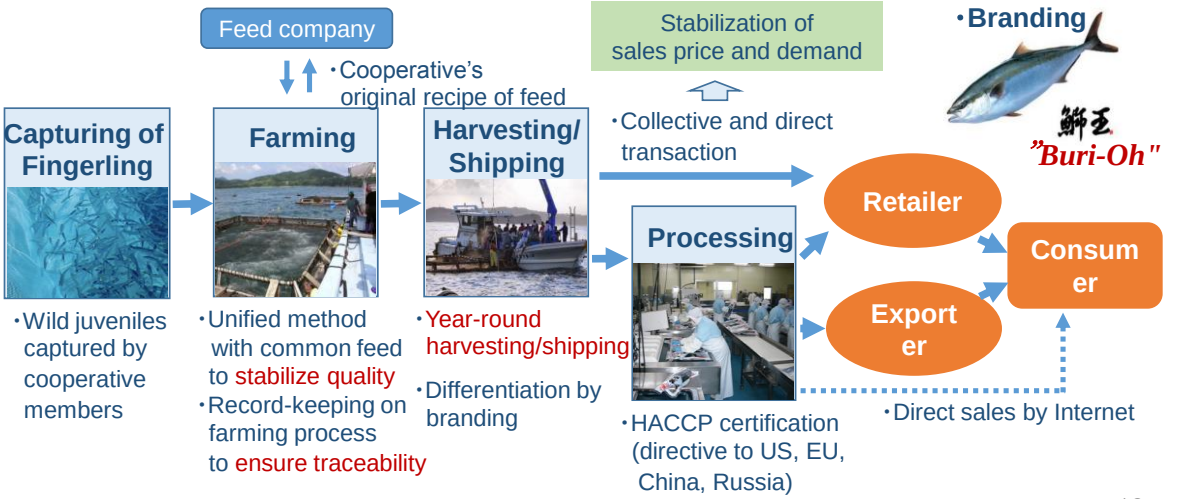


(Data: MAFF, MOF, Azuma-cho Cooperative)

9

Value chain of yellowtail farming in Azuma-cho cooperative

- Aquaculture cages are privately owned by fish farmers
- Fish farmers conduct the farming cooperatively and consistently from capture of fingerlings to processing and shipping of products



10

Future challenge of Azuma-cho cooperative

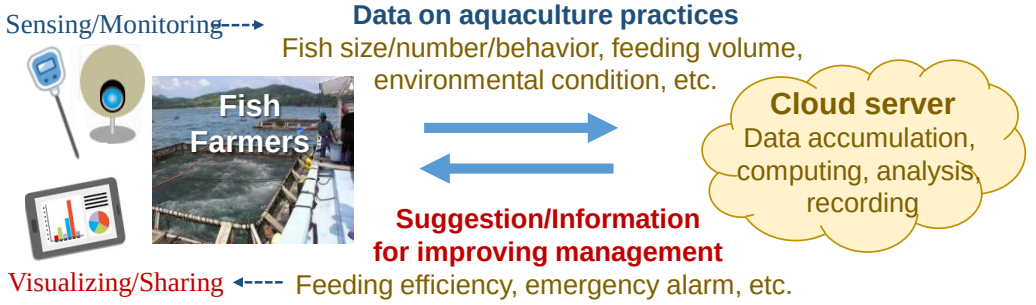
・Saturation of domestic market
・Sluggish exports to US

➢ Expansion of exports to other countries (Asia, Europa)

・Strict management of quality of products and production costs
→ Strengthening of export competitiveness

- **Introduction of ICT (i.e. cloud computing system) to fish farming**

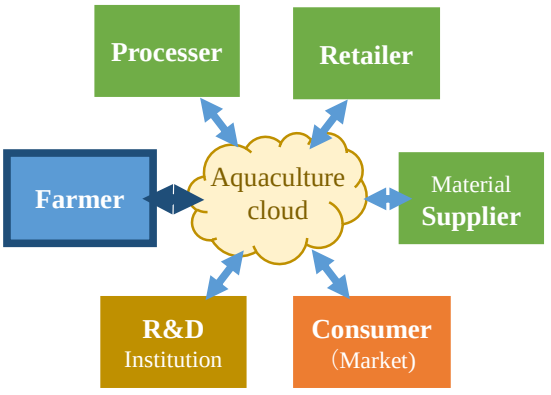
Visualization of farming process → Detection and sharing of improvement points



11

Role of ICT for sustainable small scale aquaculture

➢ Eliminate information gap between fish farmers and related industries / consumers



- **Farmer and Farmer**
  ・Improve technology / quality of products / profitability of business, etc.
- **Farmer and Processor/Retailer/Supplier**
  ・Planned shipment and purchase / stabilization of supply and demand / reasonable price formation, etc.
- **Farmer and Consumer**
  ・Understanding market preferences / improve reliability on production process and products, etc.
- **Farmer and R&D**
  ・Support for technological innovation

➢ Promotion of implementation of virtual horizontal/vertical integration and construction of value chain through information sharing

12

Conclusions

- Virtual horizontal/vertical business integration in local areas is necessary and effective to achieve sustainable development of small scale aquaculture under environmental and social constraints.
- ICT, such as cloud computing system, promotes strongly to implement the integration and to construct value chain through information sharing between fish farmers and related industries and consumers.
- Continuous improvement of aquaculture technology is also necessary to reduce negative impacts on environment and ecosystems.

13

Acknowledgement

I would like to thank

Mr Hitoshi Matsuo (Azuma-cho Fisheries Cooperative) and Drs Keiyu Murakami and Kenzo Yoseda (Japan Fisheries Research and Education Agency)

for their kind support to prepare this presentation.

Thank you very much

14

Pacific Ocean Perch: A US success story of science-based, sustainable management

Presented by Siri Hakala, with slides from Dana Hanselman and Benjamin Richards

MIKE MANSFIELD FELLOWSHIP PROGRAM

Outline

Pacific ocean perch (*Sebastes alutus)*

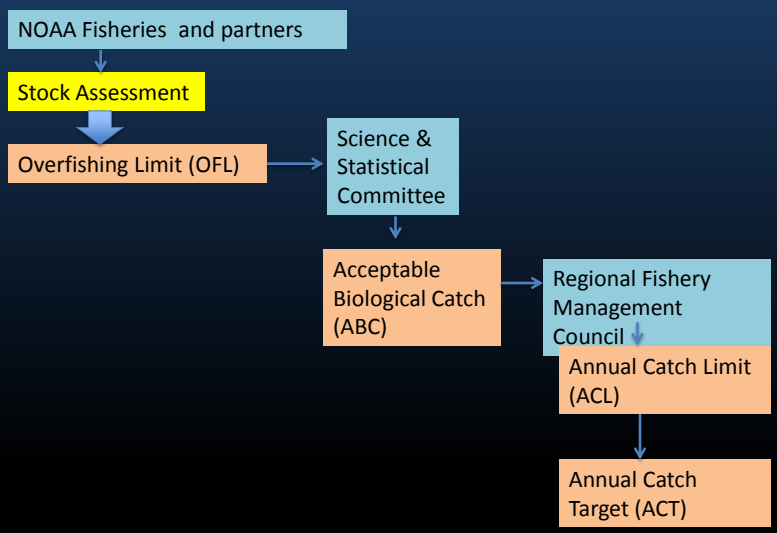
Science-based management success story

Technological advances in observing and quantifying the marine environment and fish stocks

Themes

- Main fisheries law in US has strong focus on resource conservation
- Effect of uncertainty on management decisions
- Increased data could increase catch limits
- Uses of new technology to improve and increase data streams

How fishery catch limits are determined



8 Regional Fishery Management Councils

NORTH PACIFIC Fishery Management Council

New England Fishery Management Council

MID-ATLANTIC FISHERY MANAGEMENT COUNCIL

South Atlantic Fishery Management Council "To Conserve and Manage"

Caribbean Fishery Management Council CFMC

Fishery Management Councils:

- Develop and amend Fishery Management Plans
- Convene committees and advisory panels and conduct public meetings
- Develop research priorities in conjunction with a Scientific and Statistical Committee
- Select fishery management options
- Set annual catch limits based on best available science
- Develop and implement rebuilding plans

The Magnuson-Stevens Act, as amended, sets out ten national standards with which all fishery management plans must be consistent:

- 1. Conservation and management measures shall **prevent overfishing** while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.
- 2. Conservation and management measures shall be **based upon the best scientific information** available.
- 3. To the extent practicable, an **individual stock of fish shall be managed as a unit throughout its range**, and interrelated stocks of fish shall be managed as a unit or in close coordination.

National Standards for Fishery Conservation and Management

- 4. Conservation and management measures **shall not discriminate between residents of different States.** If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be A) fair and equitable to all such fishermen; B) reasonably calculated to promote conservation; and C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.
- 5. Conservation and management measures shall, where practicable, **consider efficiency in the utilization of fishery resources**; except that no such measure shall have economic allocation as its sole purpose.
- 6. Conservation and management measures shall take into account and **allow for variations** among and contingencies in, fisheries, fishery resources, and catches.

National Standards for Fishery Conservation and Management

- 8. Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), **take into account the importance of fishery resources to fishing communities** in order to A) provide for the sustained participation of such communities, and B) to the extent practicable, minimize adverse economic impacts on such communities.
- 9. Conservation and management measures shall, to the extent practicable, A) **minimize bycatch** and B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.
- 10. Conservation and management measures shall, to the extent practicable, **promote the safety of human life at sea**.

Gulf Of Alaska Fishery Management Plan

In the Fishery

Target Species

- Walleye po
- Pacific cod
- Sablefish F
  flatfish, de
  sole, flathe
  flounder)
- Rockfish (P
  northern r
  rougheye
  rockfish, p
  demersal s
  thornyhea
- Atka mack
- Skates (big
  and other
- Squid
- Sculpin
- Shark
- Octopus

Ecosystem Component

Prohibited Species

- Pacific halibut

elts)

ennys,

and anglemouths)

Grenadiers

- Pacific grenadier
- Popeye grenadier
- Giant grenadier

Management Objectives- per GOA Fishery Management Plan

- Prevent Overfishing
- Promote Sustainable Fisheries & Communities
- Preserve Food Web
- Manage Incidental Catch and Reduce Bycatch and Waste
- Avoid Impacts to Seabirds and Marine Mammals
- Reduce and Avoid Impacts to Habitat

Management Objectives- per GOA Fishery Management Plan

- Promote Equitable and Efficient Use of Fishery Resources
- Increase Alaska Native Consultation
- Improve Data Quality, Monitoring and Enforcement

Pacific Ocean Perch Distribution

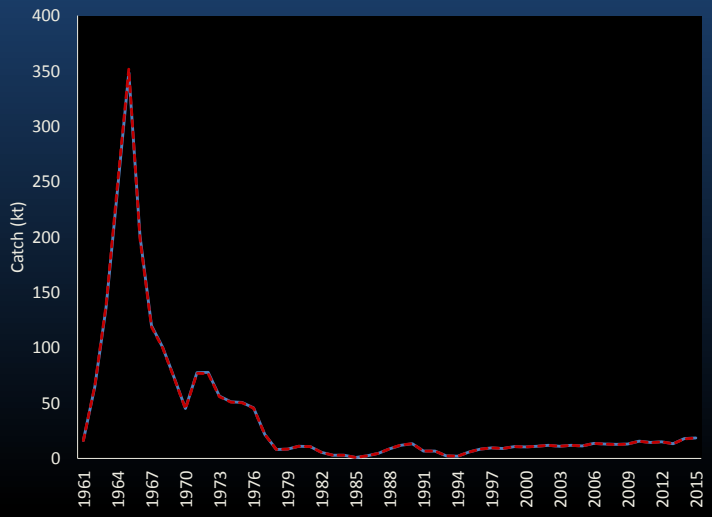
Slide credit: Dana Hanselman

Pacific Ocean Perch Biology

- Distributed all over N. Pacific slope
- Found between 100-450 m
- Grow to ~50 cm
- Live to be ~80 years old, maybe older
- Eat euphasiids, shrimps and squid
- Dominant commercial rockfish (~65%)
- ABC set at 21,436 mt (2016)
- Highly aggregated
- Taken primarily by trawler, recently catcher boats are taking a large chunk by Kodiak

Slide credit: Dana Hanselman

Pacific Ocean Perch - Catch



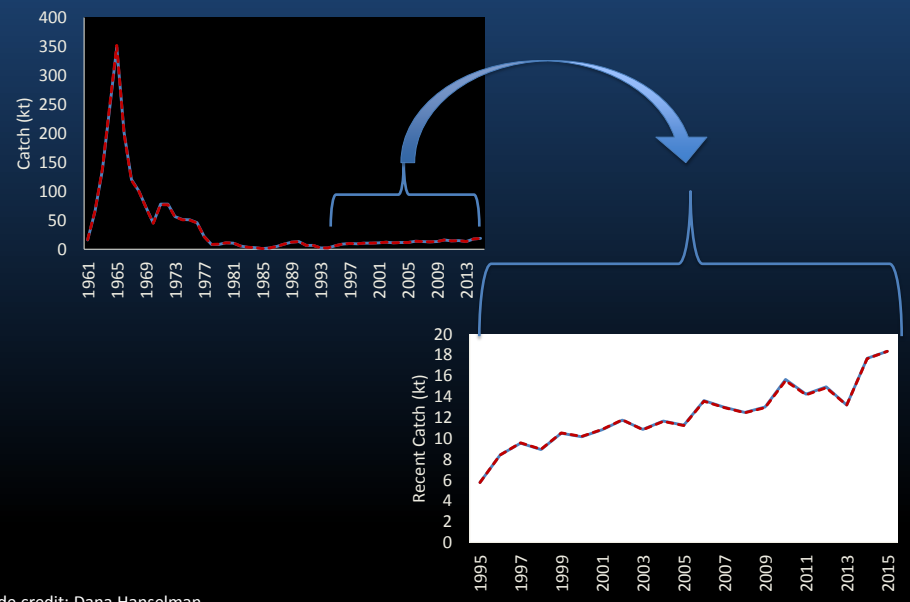
Slide credit: Dana Hanselman

Management Restrictions

In the years 1991-95, overall catches of slope rockfish diminished as a result of the more restrictive management policies enacted during this period. The restrictions included:

- (1) establishment of the management subgroups, which limited harvest of the more desired species;
- (2) reduction of total allowable catch (TAC) to promote rebuilding of POP stocks; and
- (3) conservative in-season management practices in which fisheries were sometimes closed even though substantial unharvested TAC remained.

Pacific Ocean Perch - Catch



Slide credit: Dana Hanselman

Total catches, pre-season catch specifications, and exploitable biomass of Pacific Ocean Perch* in the GOA, 1990-2015 (in mt).

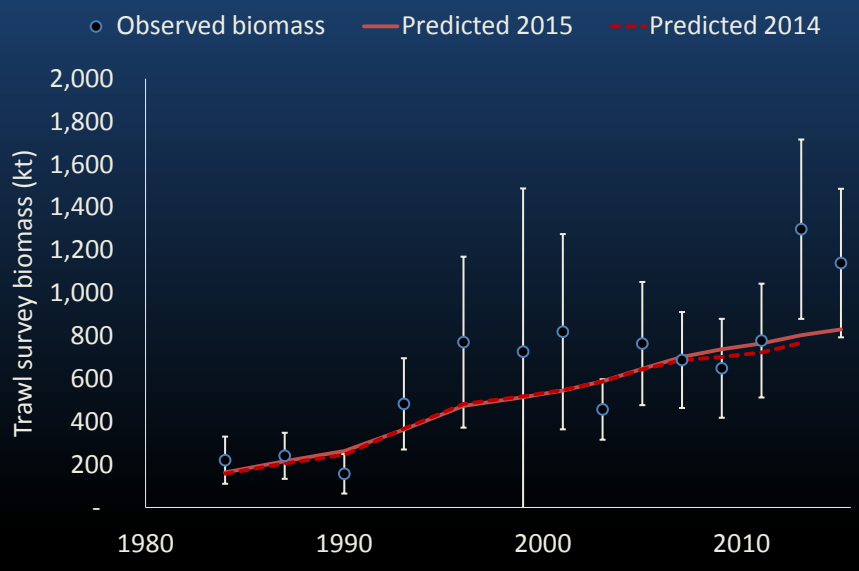
Year	Catch[1]	TAC	ABC	OFL	Biomass[2]
1991	6,632	5,800	5,800	-	-
1992	6,158	5,200	5,730	5,730	229,100
1993	2,119	2,560	3,378	3,378	156,300
1994	1,853	2,550	3,030	3,940	101,800
1995	5,742	5,630	6,530	8,232	142,465
1996	8,459	6,960	8,060	10,165	163,220
1997	9,531	9,190	12,990	19,760	301,084
1998	9,266	10,780	12,820	18,090	242,300
1999	10,802	12,590	13,120	18,490	228,190
2000	10,157	13,020	13,020	15,390	200,310
2001	10,860	13,510	13,510	15,390	211,160
2002	11,729	13,190	13,190	15,670	293,240
2003	10,911	13,660	13,660	16,240	298,820
2004	11,528	13,340	13,340	15,840	266,960
2005	11,440	13,575	13,575	16,266	286,367
2006	13,590	14,261	14,261	16,927	312,968
2007	13,046	14,635	14,636	17,158	315,507
2008	12,400	14,999	14,999	17,807	317,511
2009	12,985	15,111	15,111	17,940	318,336
2010	15,520	17,584	17,584	20,243	334,797
2011	14,211	16,997	16,997	19,566	330,480
2012	14,911	16,918	16,918	19,498	348,168
2013	13,183	16,412	16,412	18,919	345,260
2014	17,368	19,309	19,309	22,319	410,712
2015		21,012	21,012	24,360	416,140

* Separated from Slope Rockfish in 1991.
[1] Catch data through November 2014.
[2]Biomass from annual SAFE report projections.

History of Gulf of Alaska Pacific Ocean Perch Catch and Catch Limits

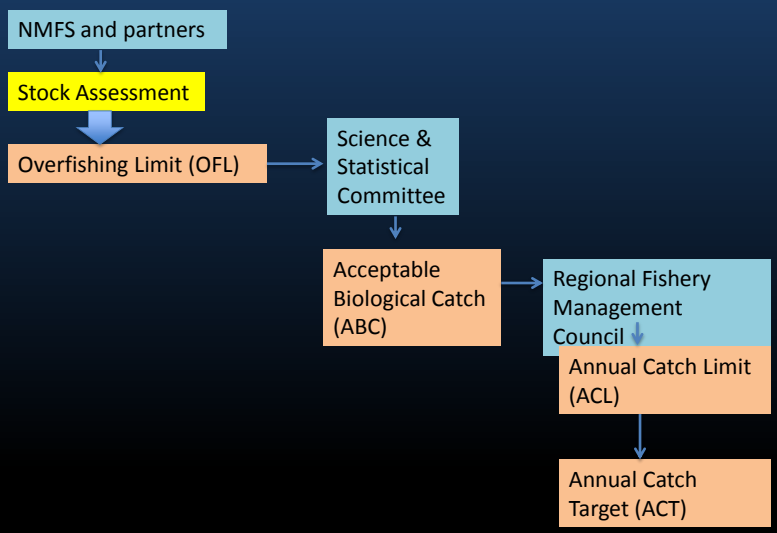
https://www.npfmc.org/wp-content/PDFdocuments/resources/SpeciesProfiles2015.pdf

Pacific Ocean Perch – Survey Biomass

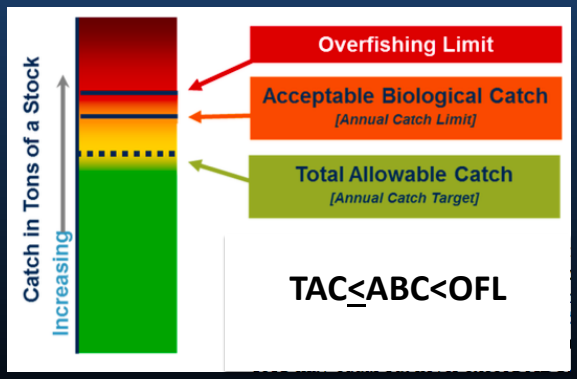


Slide credit: Dana Hanselman

How fishery catch limits are determined



Setting catch limits



The buffer between these reference points allows for **scientific uncertainty** in single species stock assessments and ecosystem considerations, and operational management of the fishery.

https://www.npfmc.org/wp-content/PDFdocuments/resources/SpeciesProfiles2015.pdf

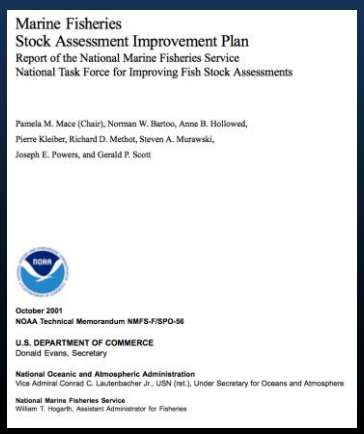
So…

How do we reduce scientific uncertainty?

NOAA Fisheries Strategic Initiative on Automated Image Analysis

Benjamin L. Richards
NOAA Fisheries, Pacific Islands Fisheries Science Center
Fisheries Research and Monitoring Division, Stock Assessment Program

Stock Assessment Data Needs



Marine Fisheries
Stock Assessment Improvement Plan
Report of the National Marine Fisheries Service
National Task Force for Improving Fish Stock Assessments

Pamela M. Mace (Chair), Norman W. Bartoo, Anne B. Hollowed,
Pierre Kleiber, Richard D. Methot, Steven A. Murawski,
Joseph E. Powers, and Gerald P. Scott

October 2001
NOAA Technical Memorandum NMFS-F/SPO-56

U.S. DEPARTMENT OF COMMERCE
Donald Evans, Secretary

National Oceanic and Atmospheric Administration
Vice Admiral Conrad C. Lautenbacher Jr., USN (ret.), Under Secretary for Oceans and Atmosphere

National Marine Fisheries Service
William T. Hogarth, Assistant Administrator for Fisheries

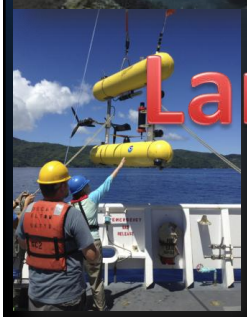
Mace et al. 2001

- Accurate and precise estimates of species-specific size-structured abundance

  Numbers – species – length

- "Greatest impediment to producing accurate, precise, and credible stock assessments is the lack of adequate input data"
- Improved technologies to:
  - sample, survey, or experiment with species of interest in situ,
  - decrease sampling error,
  - increase sampling intensity,
  - increase the area or number of species covered.

Optical Technologies



Really Large Data Sets

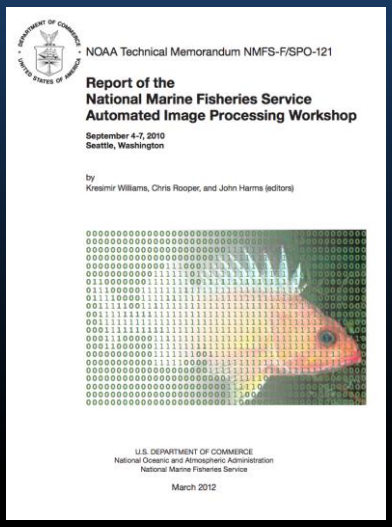
- Fishery-Independent
- Non-extractive
- Increase efficiency
- More accurate, precise, and synoptic
- Reduced measurement/calibration errors
- Increase temporal and spatial survey coverage
- Deployable from vessels of opportunity

Challenges

- Data streams exceed capabilities of human analysts
  - 100,000 - millions of images in a matter of days
- Data products not available quickly enough for use in stock assessments
- Automated tools must be developed to increase speed of analysis, reduce costs, improve assessments

Workshop on Automated Image Processing

- Recommendations
  - Inter-disciplinary collaboration
  - Create international forum or working group for automated analysis of images from marine image-based sampling systems
  - Development of a database to facilitate in feature recognition for marine organisms
    - Shared image bank
  - Optimal allocation of automation in analysis
    - Easy vs Hard problems
    - Partial automation
  - Modular approach with medium for exchange


NOAA Technical Memorandum NMFS-F/SPO-121

Report of the
National Marine Fisheries Service
Automated Image Processing Workshop

September 4-7, 2010
Seattle, Washington

by
Kresimir Williams, Chris Rooper, and John Harms (editors)

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

March 2012

Williams et al (2012)

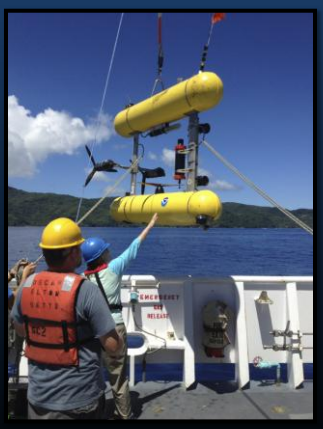
NMFS Strategic Initiative on Automated Image Analysis

- Mission
  - Develop guidelines, set priorities, and fund projects to develop broad-scale, standardized, and efficient automated analysis of still and video imagery for use in stock assessment

- Benjamin Richards *(chair)*
  NOAA Pacific Islands Fisheries Science Center
- Alexandra Branzan Albu
  University of Victoria
- *Elizabeth Clarke*
  NOAA Northwest Fisheries Science Center
- George "Randy" Cutter
  NOAA Southwest Fisheries Science Center
- Duane Edgington
  Monterey Bay Aquarium Research Institute
- Dvora Hart
  NOAA Northeast Fisheries Science Center
- David Kriegman
  University of California, San Diego
- *Clay Kunz*
  Google
- Michael Piacentino
  SRI International
- Lakshman Prasad
  Los Alamos National Laboratory
- Charles Thompson
  NOAA Southeast Fisheries Science Center
- Kresimir Williams
  NOAA Alaska Fisheries Science Center

Example Data Streams

- Single Camera Still Imagery
  - Aerial Photography – Seals
- Stereo Still Imagery
  - AUVs - Groundfish
- Single Camera Video
  - Towed Camera Systems – Scallops
  - ROVs – West Coast Groundfish
- Stereo-Video
  - Fixed Camera Systems – Reef and Hawaii Bottomfish
  - Trawl nets – Alaska Pollock
  - AUVs – Hawaii Bottomfish
  - Submersibles – West Coast Groundfish

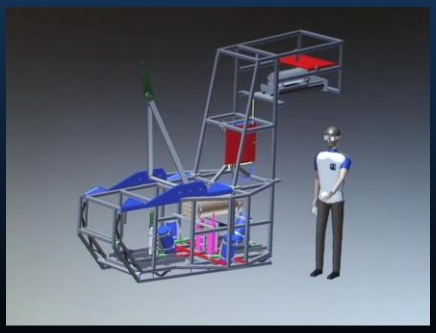


Towed-Diver Benthic Surveys

- Williams et al. (PIFSC)
- Cameras
  - Digital, Mono, Still, Color, Downward-Facing
  - Canon EOS 50D
  - Frame Rate: 1 image/15 sec
- Lighting: Ikelite DS50
- Background: Moving, Complex
- Target: Benthic Cover
- Survey Speed: <1 kt
- Height above bottom: ~1 m
- Yearly Acquisition
  - Missions: 1-2
  - Still Images: 60,000
- Data Archive:
  - Still images: 600,000
- Human analysts: 5

Towed Camera Benthic Surveys

- HabCam (Hart et al. NEFSC)
  - Cameras
    - Digital, Stereo, Still, Color, Downward-Facing
    - Model: Prosilica 1380C
    - Frame Rate: 6 fps
    - Baseline: 22 cm
  - Lighting: VIGI-Lux
  - Background: Moving, Complex
  - Target: Scallops, Benthic Inverts, Fish
  - Survey Speed: 5-7 kt
  - Height above bottom: 1-3 m
  - Yearly Acquisition
    - Missions: 3-4
    - Image Pairs: 6 million
  - Data Archive:
    - Image Pairs: 15 million
  - Human analysts: ~10
    - crowd-sourcing (http://www.seafloorexplorer.org)



Towed Camera Benthic Surveys

- HabCam (Hart et al. NEFSC)
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  - Data Archive:
    - Image Pairs: 15 million
  - Human analysts: ~10
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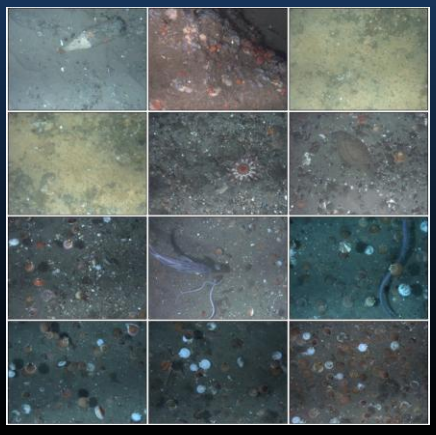
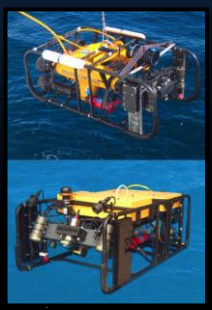
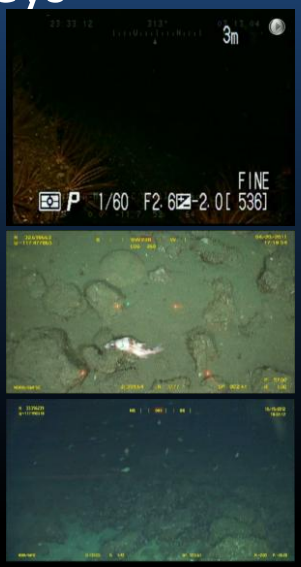


ROV Fish Surveys

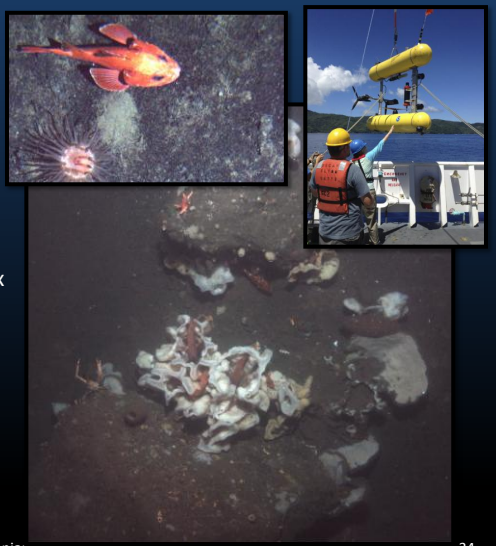
- Phantom DS4 & Custom (Yoklavich & Cutter, SWFSC)
  - Cameras
    - Video:
      - Insite Pacific NTSC (520x480)
      - Insite Pacific Zeus (1080)
      - Frame Rate: 29.97
      - Background: Moving, Complex
    - Still:
      - Insite Pacific Scorpio Plus (Nikon Coolpix 3mpx)
      - Background: Moving, Complex
  - Lighting: DSPL Multi Sea Light & Multi-SeaLite Matrix
  - Target: Demersal Fishes
  - Survey Speed: <1 kt
  - Height above bottom: <3 m
  - Yearly Acquisition
    - Missions: 1-5
    - Video: 150
    - Still Images: 8000
  - Data Archive:
    - Video: 1,100 hrs
    - Still images: 49,000
  - Human analysts: 3





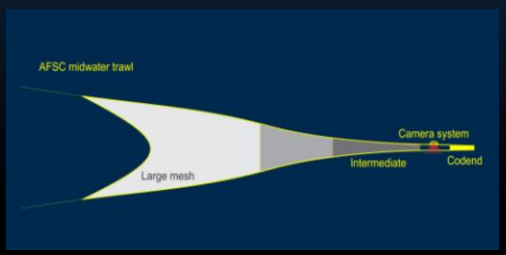
Demersal Fish AUV Surveys

- SeaBED AUV (Clarke et al. NWFSC)
  - Cameras
    - Digital, Stereo, Still, Color, Downward-Facing
    - Model: Prosilica GC2450c (5pmx) & GE4000c (11mpx)
    - Frame Rate: 1 per 7 sec
    - Baseline: 10 cm
  - Lighting: White light Xenon DSLR strobe
  - Background: Moving, Complex
  - Target: Rockfish
  - Survey Speed: 0.25 mps
  - Height above bottom: 3 m
  - Yearly Acquisition
    - Missions: 2-3
    - Still images: 100,000
  - Data Archive:
    - Still images: 350,000
  - Human analysts: 1



Net Camera Platforms

- CamTrawl (Williams et al. AFSC)
  - Cameras
    - Digital, Stereo, Still, Monochrome, Side-Facing
    - Model: JAI RM4200 GigE (4mpx)
    - Frame Rate: 5fps
    - Baseline: 28 cm
  - Lighting: 4 BridgeLux LED arrays
  - Background: Static, Simple
  - Target: Walleye Pollock
  - Yearly Acquisition
    - Missions: 3-4
    - Image Pairs: 3-4 million
  - Data Archive:
    - Image Pairs: 8.2 million
    - Human analysts: 2



Net Camera Platforms

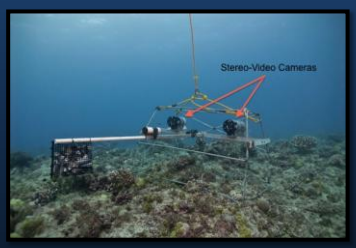
- CamTrawl (Williams et al. AFSC)
  - Cameras
    - Digital, Stereo, Still, Monochrome, Side-Facing
    - Model: JAI RM4200 GigE (4mpx)
    - Frame Rate: 5fps
    - Baseline: 28 cm
  - Lighting: 4 BridgeLux LED arrays
  - Background: Static, Simple
  - Target: Walleye Pollock
  - Yearly Acquisition
    - Missions: 3-4
    - Image Pairs: 3-4 million
  - Data Archive:
    - Image Pairs: 8.2 million
    - Human analysts: 2

Stereo-Camera Platforms: Reef Fish

- QuadCam (Thompson et al. SEFSC)
- Camera
  - 4 camera still/stereo-video combination
  - Orthogonal positioning for 270° non-overlapping field of view
  - Video
    - Color
  - Still
    - Monochrome
    - Frame Rate: 1.2 fps
    - Baseline: 9 cm
  - Lighting: Ambient
  - Background: Moving, Complex
  - Target: Reef Fish
  - Height above bottom: 0 m
  - Yearly Acquisition
    - Missions: 4
    - Video: 1,200 hours
    - Still Images: 13.7 million
  - Data Archive:
    - Video: 15,000 hrs (7,000 digital)
    - Still images: 83 million
  - Human analysts: 4

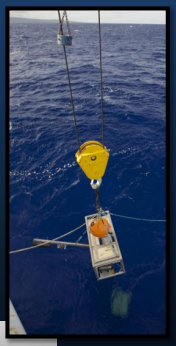
Stereo-Camera Platforms: Reef Fish

- BRUVS (Asher et al. PIFSC/UWA)
  - Cameras
    - Digital, Stereo, Video, Color, Forward-Facing
    - Sony CX12
    - Frame Rate: 29.97
    - Baseline: 75 cm
  - Lighting: Ambient
  - Background: Moving, Complex
  - Target: Reef Fish
  - Height above bottom: 0 m
  - Yearly Acquisition
    - Missions: 1-3
    - Video: 100 - 600 hrs
  - Data Archive:
    - Video: 1,200 hrs
  - Human analysts: 1



Stereo-Camera Platforms: Bottomfish

- BotCam (Richards et al. PIFSC UH)
  - Cameras
    - Analogue, Stereo, Video, Monochrome, Forward-Facing
    - ROS Navigator
    - Frame Rate: 29.97
    - Baseline: 75 cm
  - Lighting: Ambient
  - Background: Moving, Complex
  - Target: Bottomfish
  - Height above bottom: 5 m
  - Yearly Acquisition
    - Missions: 3
    - Video: 100 hrs
  - Data Archive:
    - Video: 1,500 hrs
  - Human analysts: 3



Thank you!

- Acknowledgements:
  - Thank you to: The Oceans Policy Secretariat for inviting me; Dana Hanselman, Ben Richards, Dave Witherell, Julie Bonney and John Henderschedt for their input on this talk; the Maureen and Mike Mansfield Foundation; Japan Fisheries Research and Education Agency; Japan Fisheries Agency; Kikawada-sensei's office; and to NOAA Fisheries for allowing me to be away from my desk for an entire year

Thank you & ありがとうございます!

- If you have general questions, please contact me at: sirihakala@gmail.com

  -or, after July 1, at siri.hakala@noaa.gov

- If you have questions on the optical survey technology, please contact:
  - Dr Benjamin Richards at: Benjamin.Richards@noaa.gov

Catch Limit Control Rules

Catch Limit Control Rules for North Pacific Groundfish.

Tier 1: Reliable point estimates of B and B_{MSY} and pdf of F_{MSY}.
- 1a) Stock status: $B/B_{MSY} > 1$
  $F_{OFL} = mA$, the arithmetic mean of the pdf
  $F_{ABC} \leq mH$, the harmonic mean of the pdf
- 1b) Stock status: $\alpha < B/B_{MSY} \leq 1$
  $F_{OFL} = mA \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
  $F_{ABC} \leq mH \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
- 1c) Stock status: $B/B_{MSY} \leq \alpha$
  $F_{OFL} = 0$; $F_{ABC} = 0$

Tier 2: Reliable point estimates of B, B_{MSY}, F_{MSY}, $F_{35\%}$, and $F_{40\%}$.
- 2a) Stock status: $B/B_{MSY} > 1$
  $F_{OFL} = F_{MSY}$
  $F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%})$
- 2b) Stock status: $\alpha < B/B_{MSY} \leq 1$
  $F_{OFL} = F_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
  $F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
- 2c) Stock status: $B/B_{MSY} \leq \alpha$
  $F_{OFL} = 0$; $F_{ABC} = 0$

Tier 3: Reliable point estimates of B, $B_{40\%}$, $F_{35\%}$, and $F_{40\%}$.
- 3a) Stock status: $B/B_{40\%} > 1$
  $F_{OFL} = F_{35\%}$; $F_{ABC} \leq F_{40\%}$
- 3b) Stock status: $\alpha < B/B_{40\%} \leq 1$
  $F_{OFL} = F_{35\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$
  $F_{ABC} \leq F_{40\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$
- 3c) Stock status: $B/B_{40\%} \leq \alpha$
  $F_{OFL} = 0$; $F_{ABC} = 0$

Tier 4: Reliable point estimates of B, $F_{35\%}$, and $F_{40\%}$.
$F_{OFL} = F_{35\%}$; $F_{ABC} \leq F_{40\%}$

Tier 5: Reliable point estimates of B and natural mortality rate M.
$F_{OFL} = M$; $F_{ABC} \leq 0.75 \times M$

Tier 6: Reliable catch history from 1978 through 1995.
OFL = the average catch, unless an alternative value is established by the SSC.
$ABC \leq 0.75 \times$ OFL

Chapter III

Marine Environment Conservation and Enhancement of Resilience

SATOUMI:

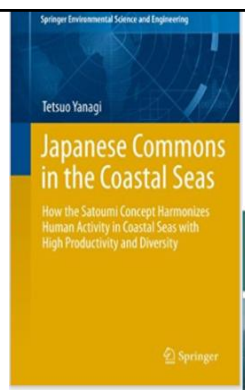
Harmony of coastal fisheries development and ecosystem conservation.

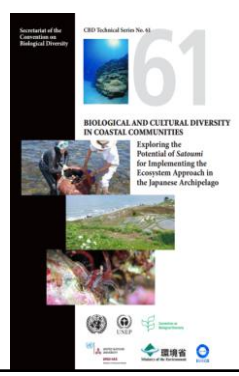
Mitsutaku MAKINO, M.A., M.Phil., Ph.D.
Japan Fisheries Research and Education Agency

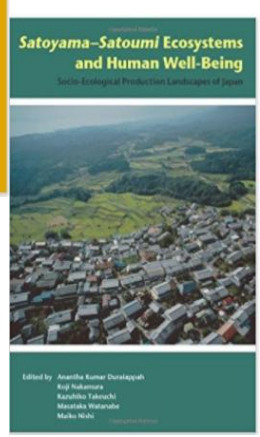
1

SATOUMI　里海
(Village Seas or Community Coast)

- Defined as “a coastal area with high productivity and biodiversity due to human interaction” (Yanagi 2013)
- Basically, it is a Japanese term meaning a harmony of local peoples’ life and coastal ecosystem conservation.
- Many countries around the world would have similar concepts.







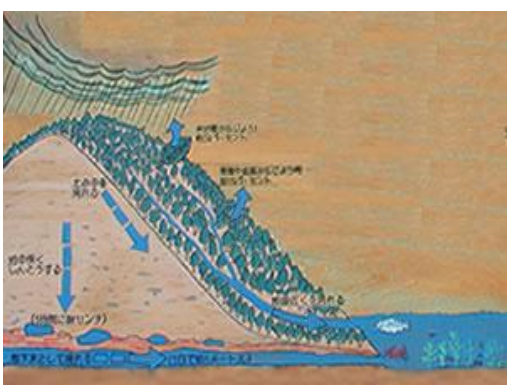
2

Why such concept is attracting attentions?

- Traditional "good scientific advice (biophysical or ecological) for management actions" are often not accepted or implemented by local people because of the perceived socio-economic or cultural costs (Makino and Criddle 2013).
- An integrated understanding is necessary to improve the stewardship of marine ecosystems (the SES approach).
- The SES approach sees social (human) and ecological (biophysical) subsystems in two-way feedback relationships (Berkes 2011, Armitage et al., 2017).
- SATOUMI is a Japanese version of such interactions, where the local people is the indispensable part of the system.

3

Examples of local fishers' activities



Local legend says

"Forests are the roots of fish"

(http://www.jf-net.ne.jp/amhiranaigyokyo/)

Forestation activities by local fishers

(http://www.jf-net.ne.jp/hkyubetsu/sigen.htm)

4

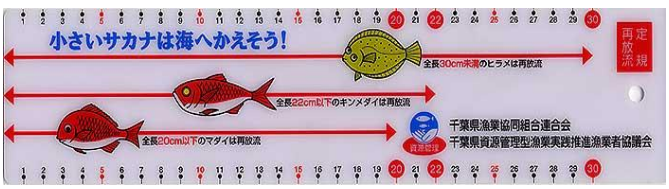
Promotion of environmentally-friendly detergent produced by the Federation of small-scale fishers.

(http://www.jf-net.ne.jp/fsgyoren/work1.html)

Cleanup activities by local fishers family

(http://www.minato-j.fks.ed.jp/seito/gyouji/shizen/shizen.html)

5



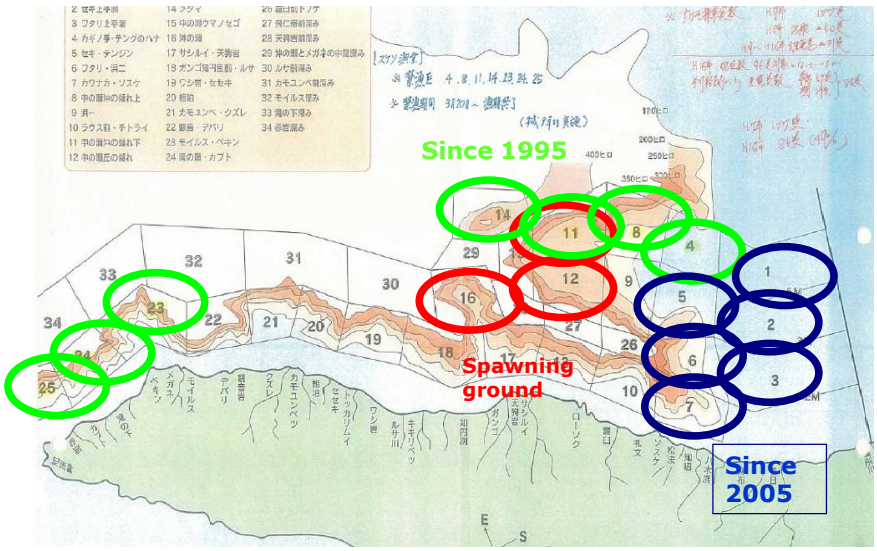
Fish scale produced by local FCA

(http://www.jf-net.ne.jp/cbgyoren/sigen.html)

Autonomous resource assessment and setting Individual catch Quota for some species

6

MPAs in the Shiretoko World Natural Heritage, set by local fishers



UNESCO World Heritage Committee (2013) said

"an excellent model"

7

Meetings and discussions at Local Fisheries Cooperative Association (FCA)

More flexible, high compliance, and very cheap! (Fisheries co-management)

http://www.pref.mie.jp

http://www.pref.iwate.jp

8

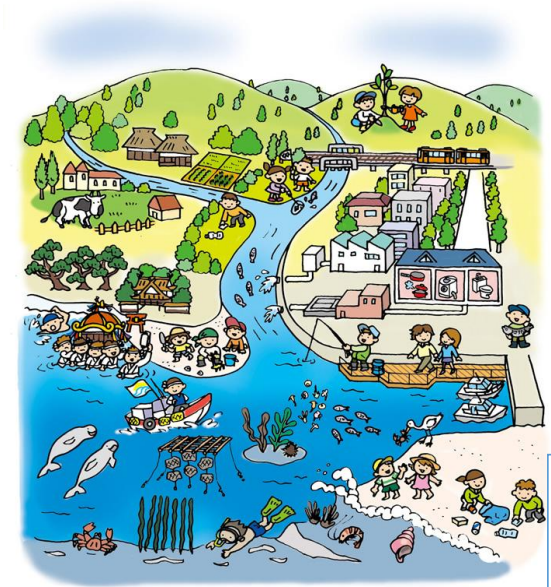
Meaning of “Conservation” in Japan

Unless the objective of ecosystem conservation is to go back to the original wilderness hundreds of years ago, local people’s life is not something to be eliminated from the “original” ecosystems, but the indispensable component of the local ecosystem.

9

Makino (2011) in CBD Tech. Ser. 61

Image of SATOUMI by
Ministry of Environment, Japan



https://www.env.go.jp/water/heisa/satoumi/index.html

Image of the “Goal” defined by the Sekisei Lagoon Nature Restoration Committee

(the Sekisei Lagoon Nature Restoration Committee Masterplan, 2005)

Local people is indispensable

Then how to fish?

What is the best way to catch fish from the marine ecosystems?

The Balanced Harvesting

11

IUCN CEM FEG IUCN Fisheries Expert Group

- Established in 2008.
- To bridge the “Protection of Wilderness” and the “Sustainable use”
- IUCN Officer：*François Simard*
  Deputy Director and Senior Advisor for Fisheries

12

IUCN-FEG Members

Chair: Serge M. Garcia (France)

Vice-Chair: Jake Rice (Canada)

Coordinator: Despina Symons (Belgium)

Johan C. Augustyn (South Africa)

Serge Beslier (France)

Annadel S. Cabanban (Philippines)

A.T. Charles (Canada)

Kjartan Hoydal (Faroe Island)

Richard Kenchington (AU)

Jeppe Kolding (Norway)

Mitsutaku Makino (Japan)

Bonnie McCay (USA)

Hazel Oxenford (Barbados)

Qisheng Tang (China)

Paper published on *SCIENCE* (2012)

POLICYFORUM

CONSERVATION

Reconsidering the Consequences of Selective Fisheries

Balanced fishing across a range of species, stocks, and sizes could mitigate adverse effects and address food security better than increased selectivity.

S. M. Garcia,[1]* J. Kolding,[1,2]* J. Rice,[1,3]* M.-J. Rochet,[4]*† S. Zhou,[5]* T. Arimoto,[6] J. E. Beyer,[7] L. Borges,[8] A. Bundy,[9] D. Dunn,[10] E. A. Fulton,[11] M. Hall,[12] M. Heino,[2,13,14] R. Law,[15] M. Makino,[1,16] A. D. Rijnsdorp,[17] F. Simard,[18] A. D. M. Smith[11]

Concern about the impact of fishing on ecosystems and fisheries production is increasing (*1*, *2*). Strategies to reduce these impacts while addressing the growing need for food security (*3*) include increasing selectivity (*1*, *2*): capturing species, sexes, and sizes in proportions that differ from their occurrence in the ecosystem. Increasing evidence suggests that more selective fishing neither maximizes production nor minimizes impacts (*4*–*7*). Balanced harvesting would more effectively mitigate adverse ecological effects of fishing while supporting sustainable fisheries. This strategy, which challenges present management paradigms, distributes a moderate mortality from fishing across the widest possible range of species, stocks, and sizes in an ecosystem, in proportion to their natural productivity (*8*), so that the relative size and species composition is maintained.

which are not going to be used," i.e., by-catch (*13*). Fisheries worldwide have used species and size limits (*9*, *14*), gear technology (*5*, *15*), and spatial and temporal fishing restrictions (*16*) to reduce fishing impacts while pursuing human benefits.

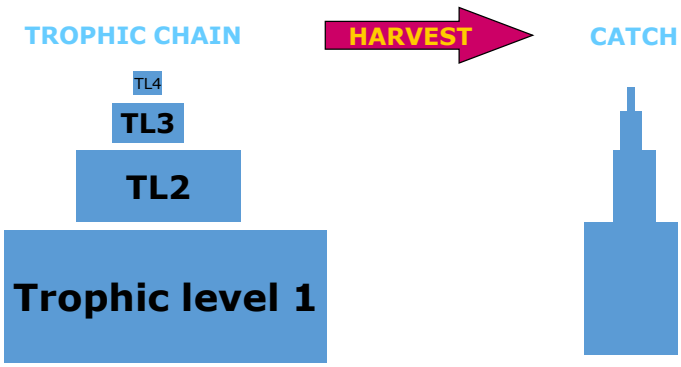
But selective removals will inevitably alter the composition of a population or community and, consequently, ecosystem structure and biodiversity. Old individuals contribute the most to reproduction (*17*). Even moderate fishing reduces the proportion of large and old fish in a population. Selectively

species and individuals in the North Sea (*22*) (fig. S1). By contrast, in several African small-scale inland fisheries, the fish size spectrum (*23*) has been maintained under intense and diverse fishing activities that cause high mortality with low selectivity (*5*, *24*) (fig. S1).

Results from models suggest that moderating fishing mortality across a wide range of species and sizes maximizes overall catch summed across species while better conserving biodiversity. Multispecies fishery models show that increased mesh sizes may reduce

Balanced harvesting … distributes a moderate mortality from fishing across the widest possible range of species, stocks, and sizes in an ecosystem.

Balanced Harvesting (BH)

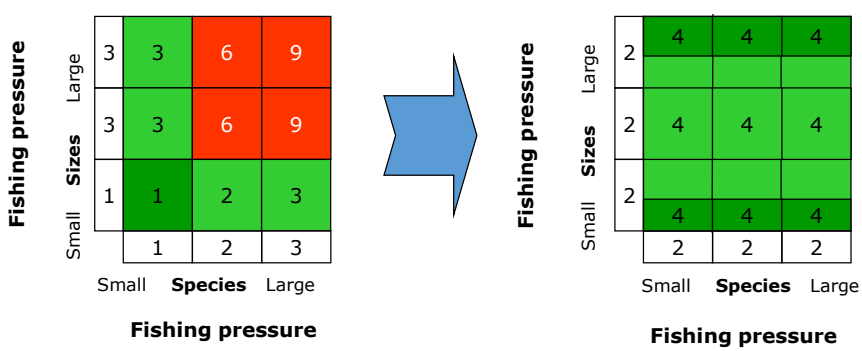


Utilize the resources
from the Top to the Bottom of the system

15

Less larger fish and more smaller fish

in a BALANCED way

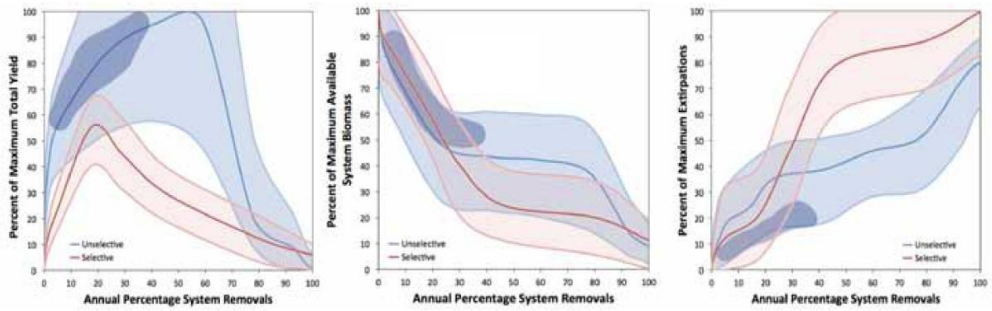


Present: excessive selective

Balanced harvesting

Note: overfished stock should be recovered first!

16



Effects of conventionally selective (red), unselective (blue), and balanced (dark blue) fishing. Unselective fishing harvests all exploitable nonmicrofauna and nonlarval ecosystem components. Balanced fishing mortality rates are set in proportion to productivity per biomass for each group. **(Left)** Results for total catch weight (as a percentage of the maximum total yield for a system across all fishing scenarios), **(middle)** total available biomass (i.e., biomass that could be harvested), and **(right)** extirpations (number of groups that have dropped below 10% of their unfished levels). All values are plotted against the maximum system level exploitation rate (i.e., roughly total catch as a proportion of total available biomass). For each fishing type (conventionally selective or unselective), the solid line is the average across 36 ecosystem models, and the lower and upper bounds of the lightly shaded areas represent the 5th and 95th percentiles across models. The darker blue shaded areas encompass >90% of the balanced harvest scenarios across the ecosystems. See SOM for details; the selective fishing results were part of supplementary fig. S1 in (*2*).

More harvests and less extinction risks

17

latesjp11.seesaa.net

http://www.zukan-bouz.com/detail.php?id=48

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city.sendai.jp

howdy.co.jp

フライ

オリーブオイルヅケ

cyclothone.blogspot.com

たづくり

http://recipe.rakuten.co.jp/recipe/1390001286/?l-id=foot_reco_ashiato_0-ashiato_1390001286

生シラス

http://www.zukan-bouz.com/detail.php?id=48

甘露煮

dmall.jp

18

Local people and local culture is the key

- Local people have accumulated ecological knowledge over generations, which complements the modern scientific knowledge.
- Local people can effectively and adaptively implement the conservation measures with low costs. Such adaptive capacity is indispensable to enhance the local community's resilience against the global changes (CC, ocean acidification, economic globalization, new tech, etc.)
- To fully utilize the small fish and achieve the balanced harvest, the local food culture is very important. Enjoying the seafood is the best way to make people convince of the importance of marine resource management and ecosystem conservation. 19

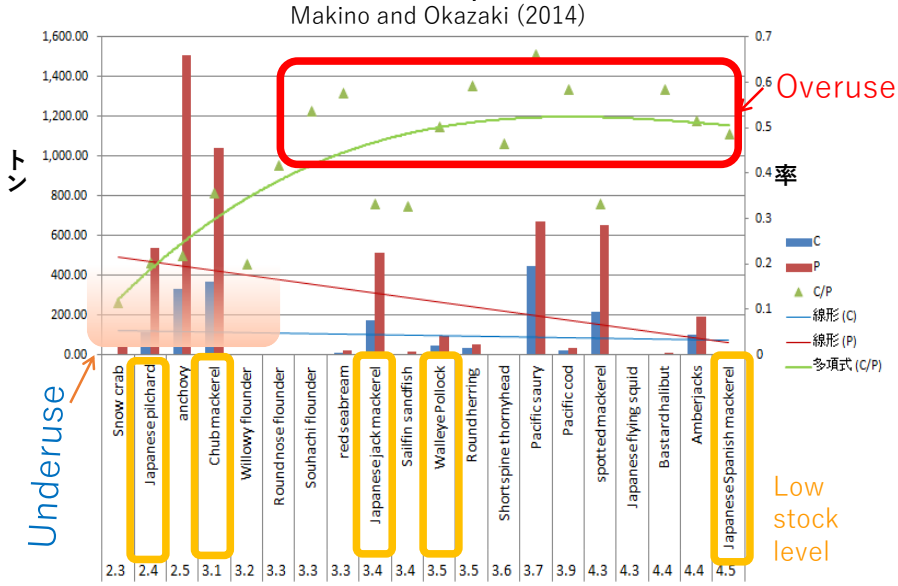
Summary

- SATOUMI means a harmony of local peoples' life and coastal ecosystem conservation.
- Understanding the interactions btw ecological and social systems (SES) are important for designing and implementing conservation measures in effective ways.
- The Balanced Harvesting (less larger fish and more smaller fish) is theoretically compatible to conserve the ecosystem structure.
- Local people and culture is the key to increase the resilience against global changes.

Thank you very much!!

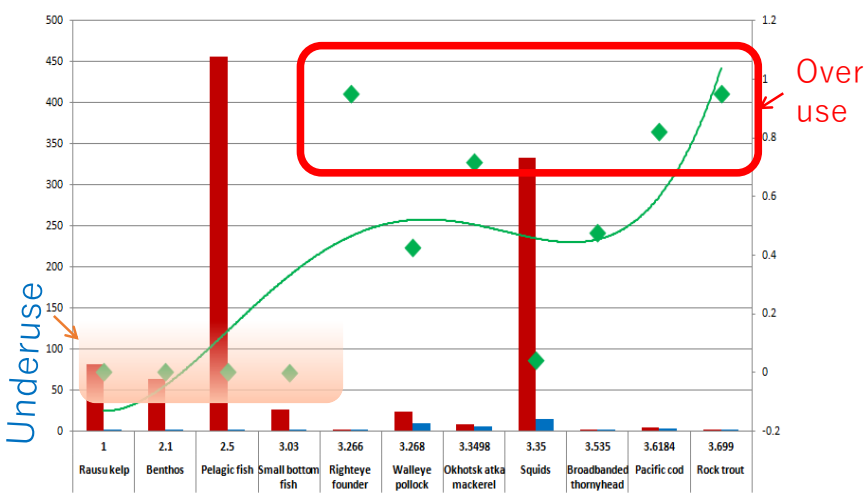
Within the Japanese EEZ

Makino and Okazaki (2014)

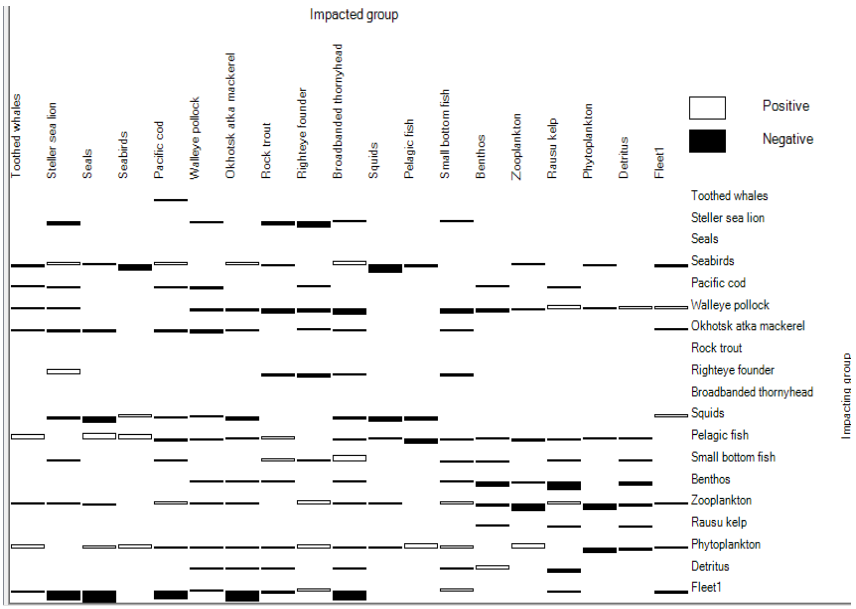


Case of Shiretoko WNH

Makino and Okazaki (2014)



Stellers' sealion should be balanced (Ecopath Mixed Trophic Impact analysis)



23

Introduction

GPA Global Programme of Action for the Protection of the Marine Environment from Land-based Activities

1. Short Background of GPA
2. Ecosystem Impacts of Marine litter
   a) Wildlife Entanglement
   b) Wildlife Ingestion
3. Economic Impacts of Marine Litter
   a) Vessel Damage and navigational hazard
   b) Tourism
   c) Maritime Industry
4. Marine litter and agenda 2030

2

GPA: Overview

The Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities

- Adopted in 1995, it is a voluntary, action-oriented, intergovernmental programme, led by UN Environment, to prevent the degradation of the marine environment from land-based activities
- Brings together Governments, private sector actors, NGOs, and the scientific community to discuss solutions and catalyze action

3

Why is GPA needed?

Our oceans are facing severe degradation from human activities:

- Ninety percent of wastewater generated in developing countries is discharged untreated
- Over 400 “dead zones” are found globally in coastal waters
- Minimum of eight million metric tonnes of plastic enter our oceans and every year

4

GPA

Global Programme of Action for the Protection of the Marine Environment from Land-based Activities

The GPA is the only intergovernmental mechanism explicitly addressing the linkages between freshwater, coastal and marine environments.

GPA: Source categories

- Sewage/wastewater
- Physical alterations and destruction of habitats
- Nutrients
- Sediments mobilization
- Persistent and organic pollutants
- Oils
- Litter
- Heavy metals
- Radioactive substances

7

GPA: Partnerships

GPA has since 2012 focused its work on the establishment and continued strengthening of three partnerships:

- The Global Partnership on Nutrient Management (GPNM)
- The Global Partnership on Marine Litter (GPML)
- The Global Wastewater Initiative (GW^2I)

8

Global Partnership for Marine Litter

- Launched in Rio+20, June 2012 to protect human health and the environment by the reduction and management of ML;
- **Stand alone resolutions on marine plastic litter and microplastics adopted both at the First and Second United Nations Environmental Assembly (1/6 and 2/11)**
- Voluntary multi-stakeholder partnership ~ 100 partners, many networks in their own right (Clean Europe Network?);
- Help countries reach their targets related to Sustainable Development Goal target 14.1

9

Approximately **8 million tons** of plastic leak into the ocean every year

The New Plastics Economy, 2016

10

Marine Litter Impacts: Overview

- Over 600 species are impacted (through ingestion and entanglement) – of which 15% are endangered
- Major economic losses in different sectors including tourism, maritime industries and fisheries
- Biodegradable plastic is **not** a solution as it needs an extremely long time to biodegrade once it reaches the ocean

11

Impacts: Wildlife Entanglement

Entanglement can cause:

- Quick or a slow death
- Injury that cause infection

89 different species of fish and 16 species of whales
have documented records of marine debris entanglement

12

Impacts: Wildlife Ingestion

52% of all sea turtles worldwide have eaten plastic

5 different species of penguins have documented records of marine debris ingestion

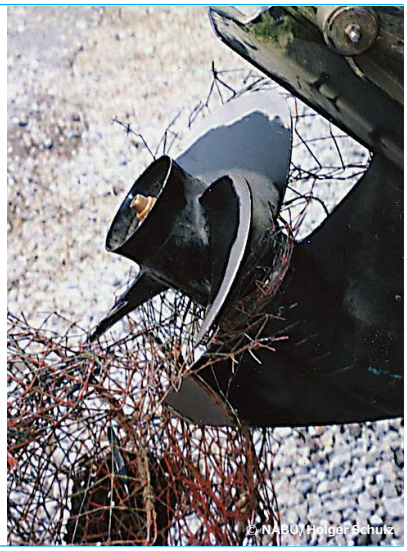
By 2050, **99% of seabirds** are likely to have ingested plastic

13

Economic loss: Vessel Damage and navigational hazard

Marine litter costs the European Union fishing fleet an estimated

USD 82 million per year



14

Economic Loss: Tourism

Annual loss in tourism caused by marine litter is estimated to be
>USD 600 million

15

Economic Loss: Marine Industry

The estimated cost to the marine industries in the Asia-Pacific region is approximately
€1 billion/year

It is equivalent of **0.3 %** of the gross domestic product for the marine sector of the region

16

Agenda 2030 and SDG ~~implementation~~

17

SDG Implementation

We need to act urgently and take significant actions to:

- protect our planet
- reduce the degradation of natural habitats
- halt the loss of biodiversity
- protect and prevent the extinction of threatened species

18

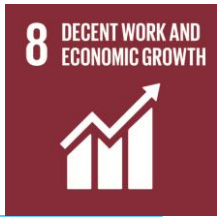
SDG Implementation

- We need to build partnerships and change our consumption and production patterns and review the structure of our cities and communities

19

SDG Implementation

- Providing clean water and sanitation, clean and affordable energy, reducing inequalities and reaching economic growth



20

SDG Implementation

By taking actions we will be able to reach Goals 13, 14, 15

21

SDG Implementation

22

Thank you

UN environment

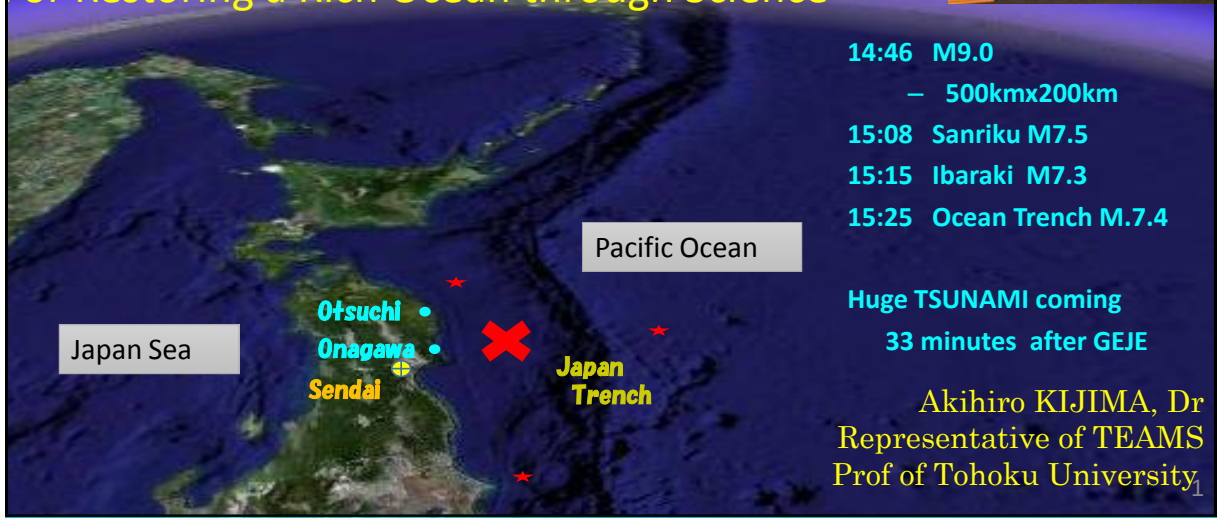
www.unep.org

What is the TEAMS Project

(Tohoku Ecosystem-Associated Marine Science)

For Reconstruction from GEJE and

For Restoring a Rich Ocean through Science



14:46 M9.0

– 500kmx200km

15:08 Sanriku M7.5

15:15 Ibaraki M7.3

15:25 Ocean Trench M.7.4

Huge TSUNAMI coming

33 minutes after GEJE

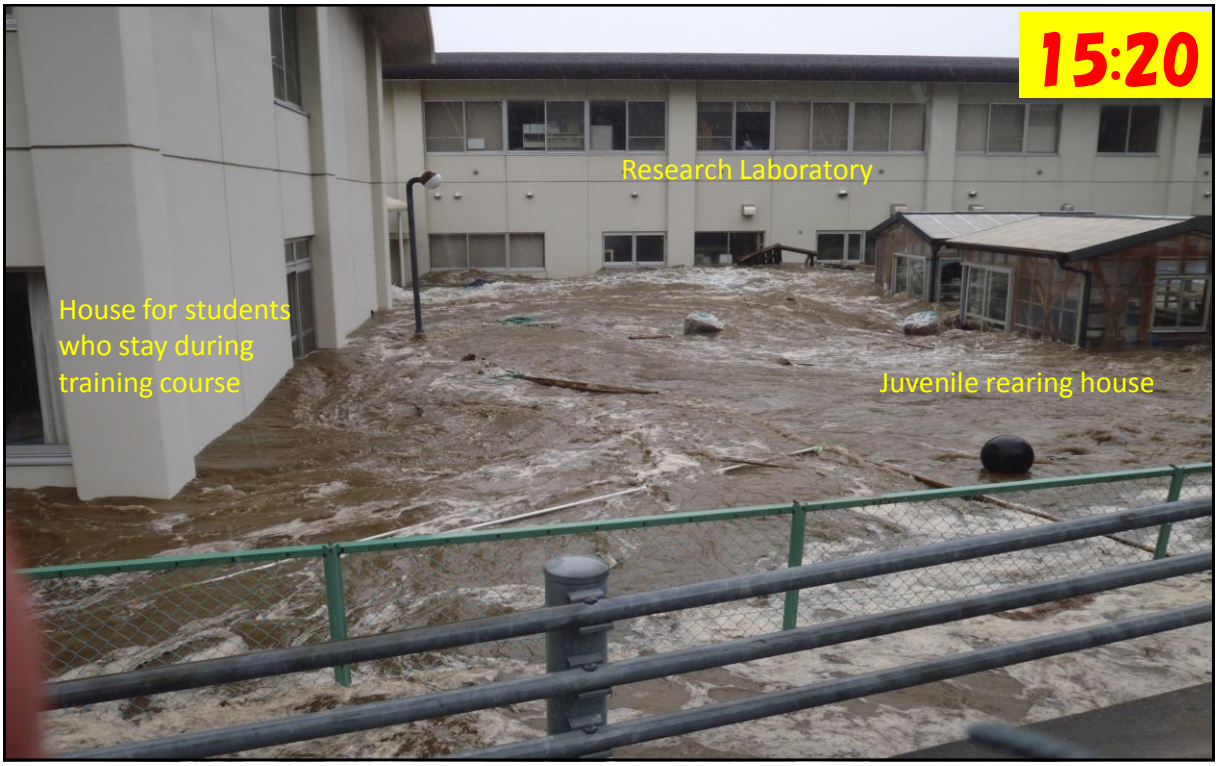
Akihiro KIJIMA, Dr
Representative of TEAMS
Prof of Tohoku University

1

Onagawa Field Center of Tohoku University Before TSUNAMI


Onagawa Field Center of Tohoku University
Before TSUNAMI
First Tsunami coming at15:19


15:19
Fishermen village
House for students
who stay during
training course


15:20
Research Laboratory
House for students
who stay during
training course
Juvenile rearing house


15:21
House for students
who stay during training course
Roof of hatching room
for invertebrates


15:22
Research Laboratory


15:23
Floating our staffs house


15:31


15:42


16:00
Second Tsunami


12.Mar.2011


12.Mar.2011


12.Mar.2011


12.Mar.2011


16.Mar.2011


30.Mar.2011


Before Earthquake
Before Earthquake
30.Mar.2011

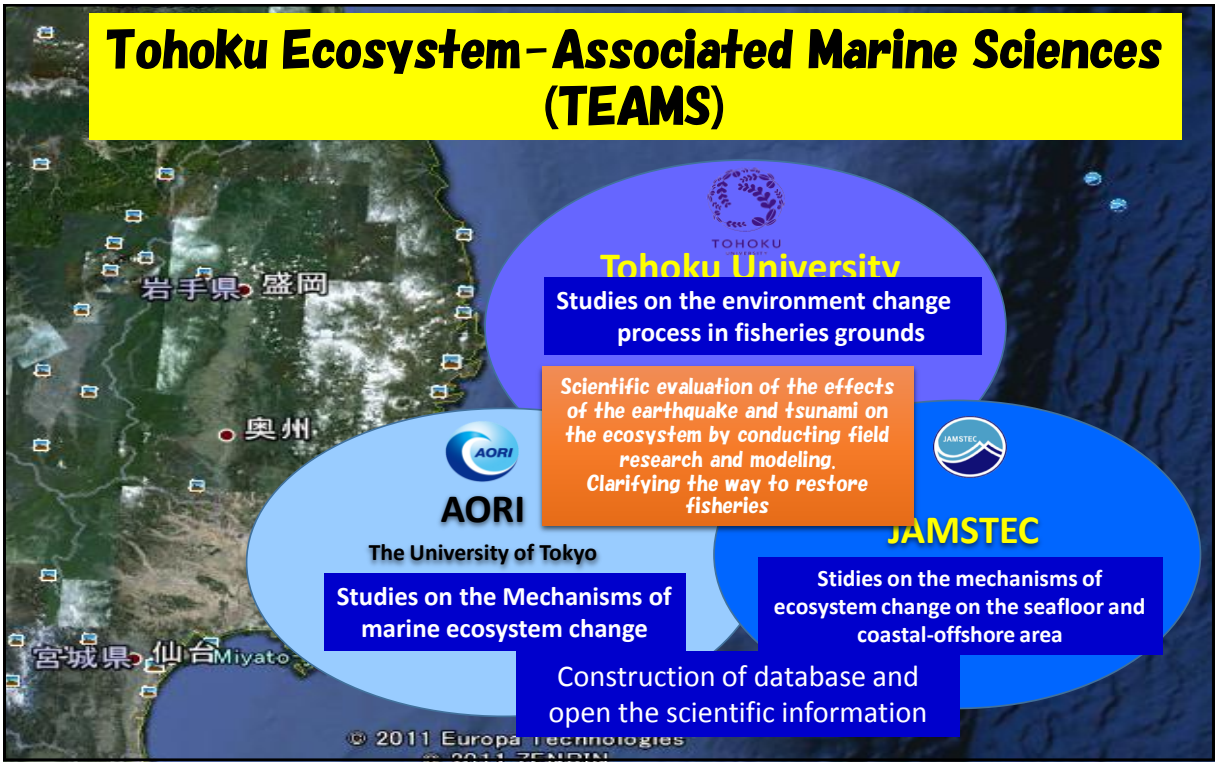

1.May.2011


1.May.2011


1.May.2011


1.May.2011


1.May.2011


Tohoku Ecosystem-Associated Marine Sciences (TEAMS)
岩手県
盛岡
奥州
宮城県
仙台
Miyato
TOHOKU UNIVERSITY
Tohoku University
Studies on the environment change process in fisheries grounds
Scientific evaluation of the effects of the earthquake and tsunami on the ecosystem by conducting field research and modeling.
Clarifying the way to restore fisheries
AORI
AORI
The University of Tokyo
Studies on the Mechanisms of marine ecosystem change
JAMSTEC
JAMSTEC
Stidies on the mechanisms of ecosystem change on the seafloor and coastal-offshore area
Construction of database and open the scientific information
© 2011 Europa Technologies


Shinsei-maru


Environmental Research
Water temp, Salinity, Ch

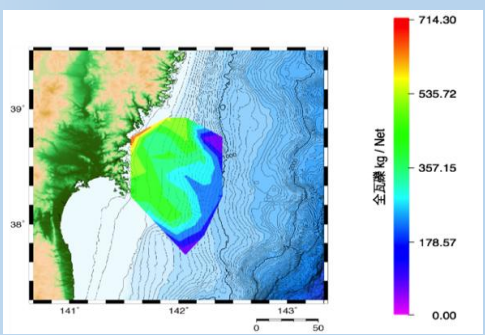

Investigation of
distribution of
plankton


Investigation of flow direction and velocity

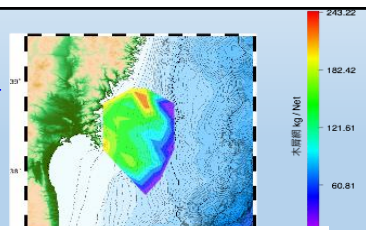

Ecological Research on Sea weed forest in Shizugawa Bay

Debris Analyses: Field data are provided from fishermen's activities of Miyagi Prefecture

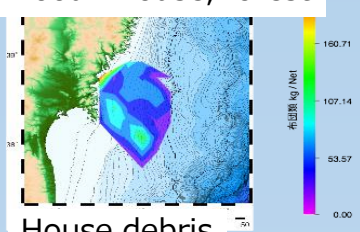
Debris from fishing field（Kesen-numa, Miyagi） FAJ HP



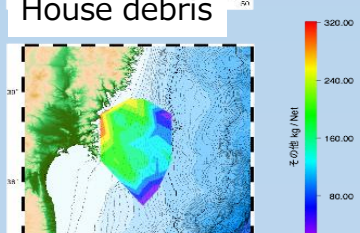
Marine debris mainly distributes along coast



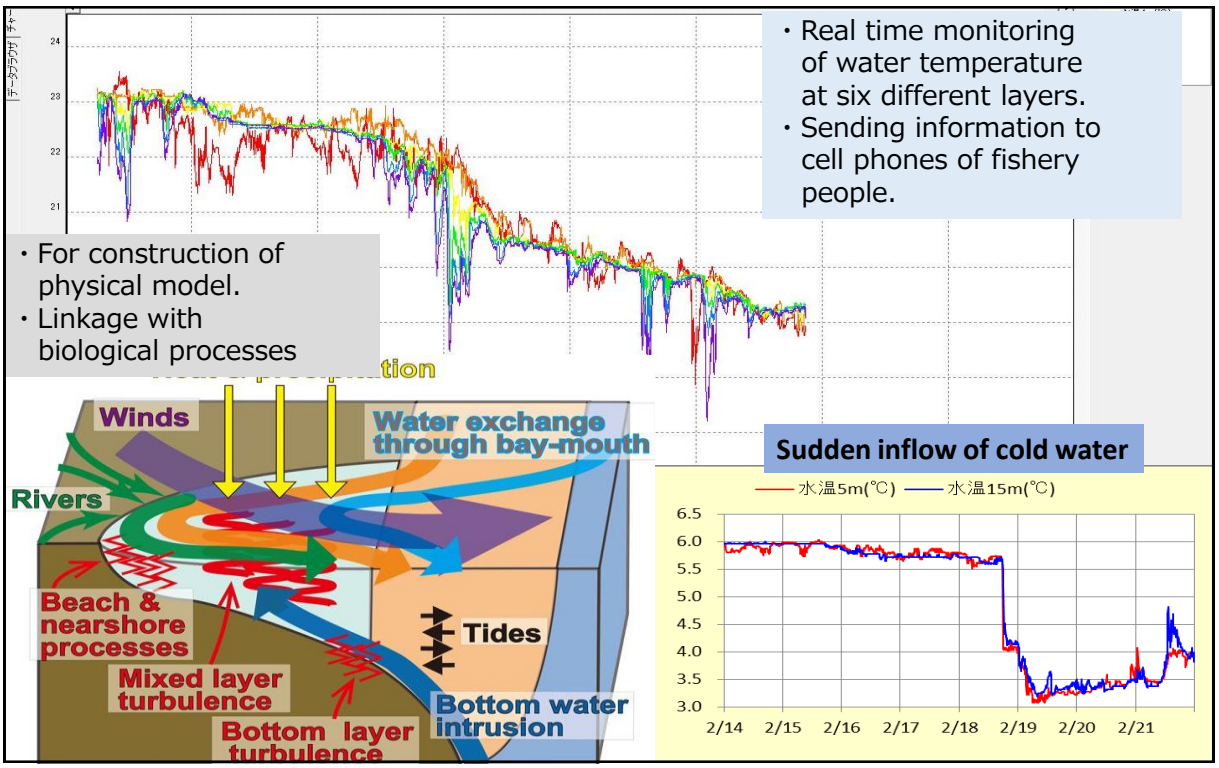
Wood : house, forest



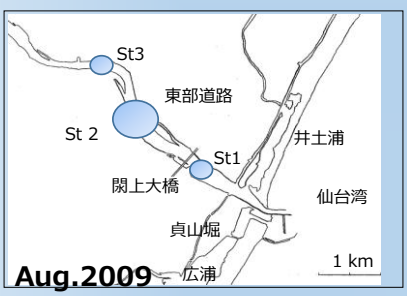
House debris



others : plastics and metals



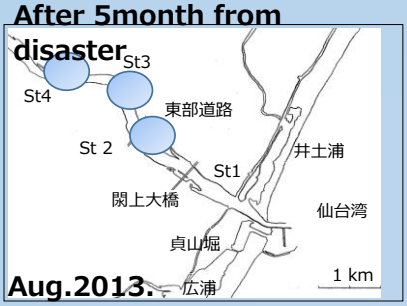
Density distribution of Shijimi clam After Tsunami in Natori river



Aug.2009 before disaster

Aug..2011 After 5month from disaster

Apr.2012 After 1 year from

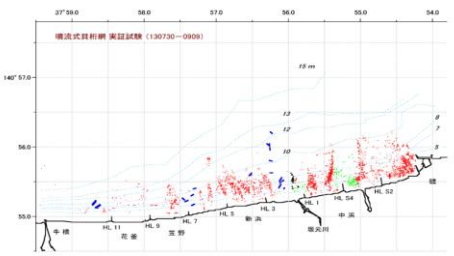


Aug.2013. After 2-y 5month from

(n/㎡)
0.1 -1
1 - 10
10 - 20
20 - 40

- After Tsunami, the distribution area change to upstream area (about 1 Km) because of land subsidence by

The present condition of the rubble residual fishery of the southern Sendai bay

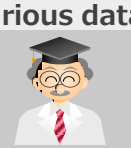


Map of the distribution of rubble

Broken Fishing gear for Surf clam

Database and their utilities

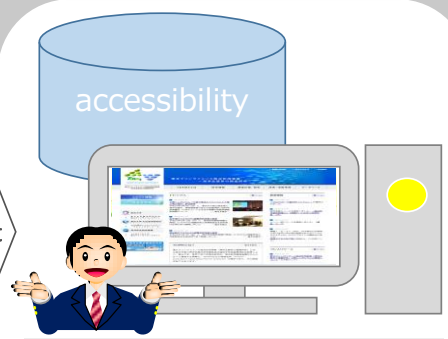

Various data


scientists

(Research Teams)
Tohoku U., Kitasato U., AORI, Univ. Tokyo, Tokyo Univ., Mar. Sci. and Tech., Iwate U., JAMSTEC, Tokai Univ., and others

Monitoring and researches

input



Systems management: Unit 4

- Research data storage, archiving and provide them to the public
- Collect Information and release
- Data flow system construction and others

Comment and request

Collecting resea
and scientific res
searching for n
both fisheries
stakeholde


Fishermen

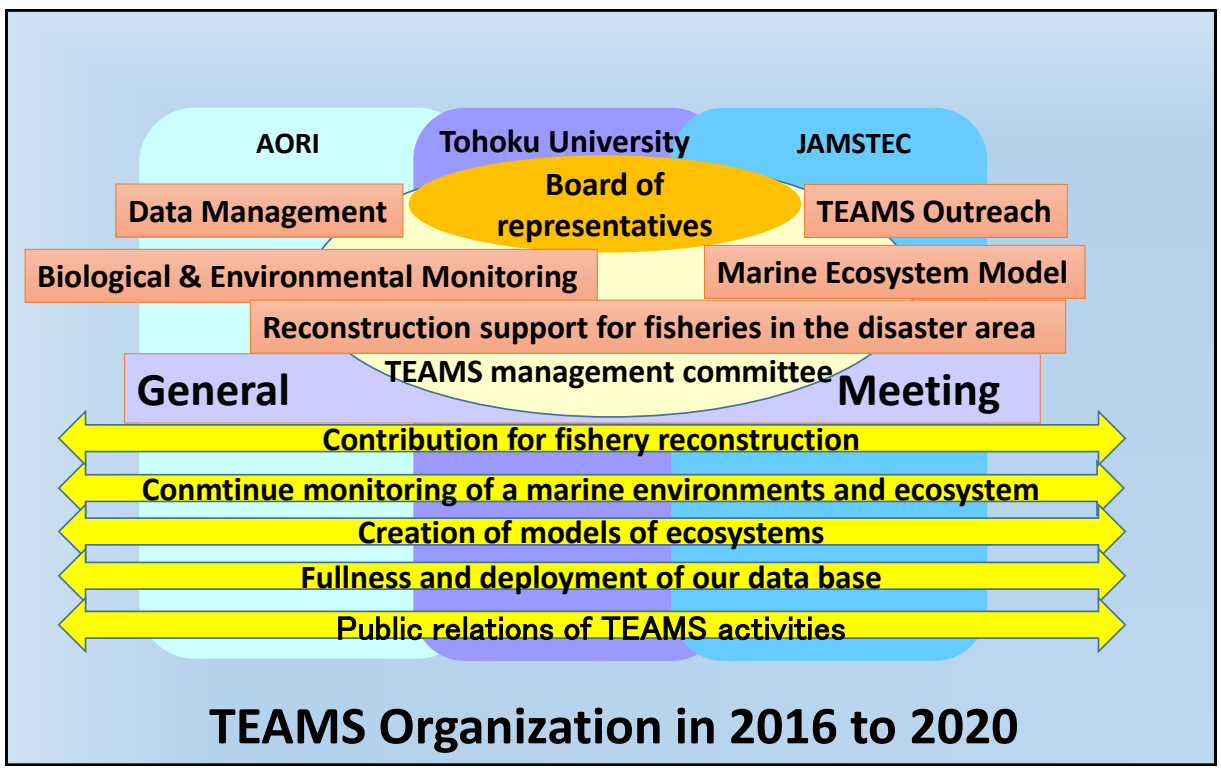
Release information


stakeholder

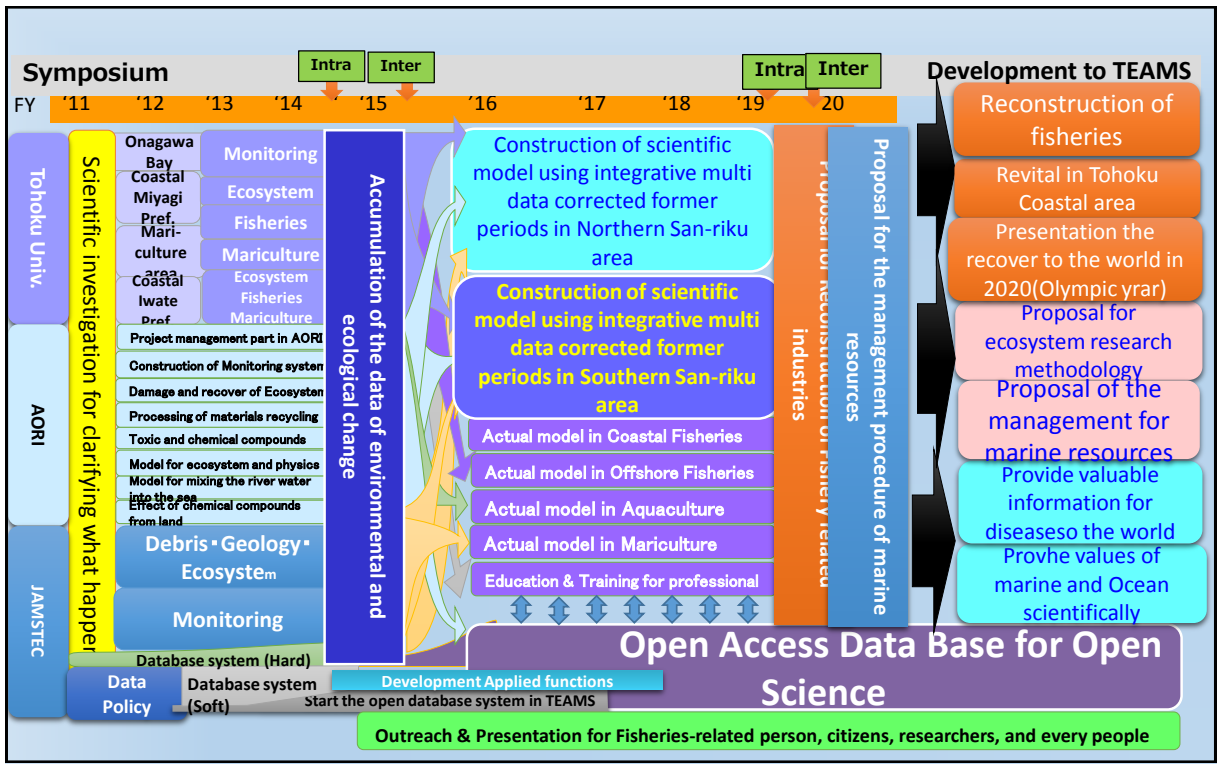

citi


teac

DIAS JODC OBIS IODE
Domestic and international project



TEAMS Organization in 2016 to 2020


Symposium
Intra
Inter
Intra
Inter
Development to TEAMS
FY '11 '12 '13 '14 '15 '16 '17 '18 '19 20
Tohoku Univ.
AORI
JAMSTEC
Scientific investigation for clarifying what happe
Onagawa Bay
Coastal Miyagi Pref.
Mari-culture area
Coastal Iwate Pref.
Monitoring
Ecosystem
Fisheries
Mariculture
Ecosystem Fisheries Mariculture
Project management part in AORI
Construction of Monitoring systen
Damage and recover of Ecosysten
Processing of materials recycling
Toxic and chemical compounds
Model for ecosystem and physics
Model for mixing the river water into the sea
Effect of chemical compounds from land
Debris・Geology・Ecosystem
Monitoring
Database system (Hard)
Data Policy
Database system (Soft)
Accumulation of the data of environmental and ecological change
Construction of scientific model using integrative multi data corrected former periods in Northern San-riku area
Construction of scientific model using integrative multi data corrected former periods in Southern San-riku area
Actual model in Coastal Fisheries
Actual model in Offshore Fisheries
Actual model in Aquaculture
Actual model in Mariculture
Education & Training for professional
Proposal for reconstruction of fishery related industries
Proposal for the management procedure of marine resources
Development Applied functions
Start the open database system in TEAMS
Open Access Data Base for Open Science
Outreach & Presentation for Fisheries-related person, citizens, researchers, and every people
Reconstruction of fisheries
Revital in Tohoku Coastal area
Presentation the recover to the world in 2020(Olympic yrar)
Proposal for ecosystem research methodology
Proposal of the management for marine resources
Provide valuable information for diseaseso the world
Provhe values of marine and Ocean scientifically


New Onagawa Field Center reconstructed in 2014 September
Restoring our rich Ocean through Science
Thank you for your attention
http://www.i-teams.jp/
Onagawa Field Center, Tohoku Univ.
TEAMS Onagawa Base

Chapter IV

Policy Recommendation

Policy Recommendation

24 July 2017

APEC Project (OFWG 03 2016)

'APEC Workshop on Marine Science, Technology and Innovation towards Science Based Management and Sustainable Use of Oceans and Marine Resources'

28 June 2017, Tokyo, Japan

●Importance of marine science and technology and evidence-based policy making for sustainable use of oceans and marine resources are emphasized by international fora as follows:

1. ***Xiamen declaration of the APEC Ocean-Related Minister Meeting in 2014*** adopted 4 priority area including "(3) Marine Science, Technology and Innovation".

2. ***G7 leader's agreement (2016, Ise-Shima, Japan)*** agreed to support scientific work to enhance global ocean observation and assessment for science based management, conservation and sustainable use of marine resources.
   G7 Science Minister's Meeting (2016, Tsukuba-Ibaraki Japan) also confirmed importance of confirmed evidence based deliberation in implementation of marine policy.
   G7 Environment Minister's Meeting (2016, Toyama Japan) confirmed importance of efforts to conserve and sustainably use marine biodiversity with the ocean governance and recognized marine litter as global challenge.

3. ***Call for Action in the high-level United Nations Conference to Support the Implementation of Sustainable Development Goal 14*** adopted "10. We stress the importance of enhancing understanding of the health and role of our ocean and the stressors on its ecosystems, including through assessments on the state of the ocean, based on science and on traditional knowledge systems. We also stress the need to further increase marine scientific research to inform and support decision-making, and to promote knowledge hubs and networks to enhance the sharing of scientific data, best practices and know-how".

●To boost this momentum in the APEC region, Japan hosted 'APEC Workshop on Marine Observation and Research towards Evidence Based Sustainable Ocean Governance' and the participants confirmed the importance of the following;

- ✓ **To recognize that global endeavours supported by evidence-based deliberations and international cooperation can help conserve oceans,**
- ✓ **To strengthen coherence between policy and marine science and technology through marine scientific research and observation, and further regional and global collaboration;**
- ✓ **To acknowledge that there is abundant potential in the oceans and in evidence-based, wise, and sustainable use of oceans, and that will benefit from sustainable development;**
- ✓ **To promote capacity development, networking, and sharing of best practices and knowledge, including innovative approaches for sustainable use of oceans;**
- ✓ **To take into consideration not only scientific evidence, but also traditional and social knowledge of local people and communities in making and implementing sustainable ocean policy,**
- ✓ **To acknowledge that a holistic approach is necessary for the implementation of SDG14, and such efforts will also contribute to the achievement of other SDG goals.**

Appendix

List of Experts and the CV

List of Participants

Project Proposal (OFWG2016 03)

Photograph

Curriculum Vitae

date prepared: May13, 2017

Name: Yoshihisa SHIRAYAMA (Male)

Date of Birth: February 15, 1955

Place of Birth: Tokyo, Japan

Nationality: Japanese

Professional Affiliation: Japan Agency for Marine-Earth Science and Technology

Address:, 2-15 Natsushima Cho, Yokosuka City, Kanagawa 237-0061, Japan

TEL: +81-46-867-9000 FAX:+81-46-867-9005

e-mail: yshira@jamstec.go.jp

Education:

1970-1973: Toyama Metropolitan High School

1973-1977: Institute of Zoology, Faculty of Science, The University of Tokyo

1977-1982: Graduate School, Faculty of Science, The University of Tokyo

Occupation:

1982-1984: Postdoctoral Fellow, Japan Society for Promotion of Sciences

1984-1991: Assistant Professor, Ocean Research Institute, University of Tokyo

1991-1997: Associate Professor, Ocean Research Institute, University of Tokyo

1997- : Professor, Seto Marine Biological Laboratory, Faculty of Science, Kyoto University

1998- : Director and Professor, Seto Marine Biological Laboratory, Graduate School of Science, Kyoto University

2003- : Director and Professor, Seto Marine Biological Laboratory, Field Science Education and Research Center, Kyoto University

2007- : Director, Field Science Education and Research Center, Kyoto University

2011- :Executive Director of Science, Japan Agency for Marine-Earth Science and Technology

Awards:

1988: Okada Prize (Distinct Young Scientist Award, Oceanographical Society of Japan)

1988-1989: Postdoctoral Fellowship, Smithsonian Institution

2007: Novel Peace Prize as a member of IPCC

2011: Prize of Minister, Ministry of Environment Japan

Publications

Original Papers: 83 (in English), 5 (in Japanese)

Reviews (refereed): 2 (in English) 13 (in Japanese)

Other articles: 59 (in Japanese)

Curriculum Vitae

President, Japan Fisheries Research and Education Agency

Personal Information

Name : Masanori MIYAHARA

Age : 61

Birth Place: Tokyo, Japan

Education

1978 BS Faculty of Fisheries Science, University of Tokyo

1985 MA Department of Political Science, Duke University

Employment History

1978 Technical Officer, Fisheries Agency of Japan

1986-90 First Secretary, Embassy of Japan in United State

1994-97 Director of Fishery Division, Ishikawa Prefecture, Japan

2005-08 Director, Fisheries Coordination Division, Fisheries Agency

2008-11 Senior Counselor, Resources Management Department, Fisheries Agency

2011-14 Deputy Director-General, Fisheries Agency

2014-present

President, Japan Fisheries Research and Education Agency

And Special Adviser to Minister of Agriculture, Forestry and Fisheries

Other:

2002-05 Chairman of International Commission for Conservation of Atlantic Tunas (ICCAT)

2011-13 Chairman of ICCAT

2013-present

Visiting Professor, Nagoya University, Japan

Curriculum Vitae

Date prepared: June 16, 2017

Name : HUI-LING LIN/林慧玲
Date of Birth : 1 February, 1961
Place of Birth : Tainan, Chinese Taipei
Citizenship : Republic of China

Address : Department of Oceanography
National Sun Yat-Sen University
Kaohsiung, Chinese Taipei 804, R.O.C.
Telephone : 886-7-525-2000 ext. 5139
FAX : 886-7-525-5149
E-mail : hllin@mail.nsysu.edu.tw

EDUCATION

1983 B.S. in Geology, National Taiwan University, Taipei, Chinese Taipei.
1985 M.S. in Geology, National Taiwan University, Taipei, Chinese Taipei.
1992 Ph.D. in Marine Geology and Geophysics, University of Miami, Miami, Florida.

B. PROFESSIONAL EXPERIENCES

Positions Held

1985-1993	Instructor, National Sun Yat-Sen University.
1988-1990	Teaching Assistant, University of Miami.
1991-1992	Research Assistant, University of Miami.
1993-2004	Associate Professor, National Sun Yat-Sen University.
2004-present	Professor, National Sun Yat-Sen University.
2007-2013	Director, Institute of Marine Geology and Chemistry, NSYSU.
2013-2014	Chair, Department of Oceanography, NSYSU
2014-2017	Director General, Taiwan Ocean Research Institute, NarLabs.

PUBLICATIONS

Papers published in peer reviewed journals: 40
Conference abstracts: 49

Assoc. Prof. TAKASHI YAMAKAWA

Contact Information	Department of Aquatic Bioscience Graduate School of Agricultural and Life Sciences The University of Tokyo 1-1-1 Yayoi, Bunkyo, Tokyo 113-8657, Japan	TEL: +81-3-5841-5279 FAX: +81-3-5841-8165 e-mail: ayamakw@mail.ecc.u-tokyo.ac.jp

Academic Degree	Ph.D in Agricultural Science, The University of Tokyo, Japan (Mar. 1996) Dissertation: "Stock assessment and fisheries management of the Japanese spiny lobster *Panulirus japonicus*."
Education	**The University of Tokyo**, Japan (Apr. 1983 – Mar. 1985) M.Sc. in Agricultural Science (Department of Fishery) **The University of Tokyo**, Japan (Apr. 1979 – Mar. 1983) B.Sc. in Agricultural Science (Department of Fishery)
Professional Experience	Associate Professor (Jan. 2002 – present) Graduate School of Agricultural and Life Sciences, The University of Tokyo Senior Researcher (Apr. 1997 – Dec. 2001) Fishery Research Institute of Mie Prefecture Researcher (Apr. 1985 – Mar. 1997) Fishery Research Institute of Mie Prefecture
Expertise	Researches on fisheries resources and their management
Scientific Activity	Member of the International Independent Panel for the "Independent Review of Australian SBT Farming Operations Anomalies" (CCSBT, Feb. 2006–Jun. 2006) Advisory member of the Review Meeting for Fish Stock Assessment (Fisheries Research Agency, Japan, 2004–present) Member of the Technical Advisory Committee on "the Project of Sustainable Fisheries Management for the Gulf of Nicoya, Costa Rica" (Japanese International Cooperation Agencies (JICA), Jun. 2003–Mar. 2004) Member of the editorial board of "Fisheries Science" and "Nippon Suisan Gakkaishi" (2009– 2015) Chairman of the Steering Committee for the Colloquium on Fisheries, the Japanese Society of Fisheries Science (2015-2016) Board director of the Japanese Society of Fisheries Oceanography (2017–) Chief editor of the "Bulletin of the Japanese Society of Fisheries Oceanography" (2017–) Member of the Advisory Board of Fishery Policy in Japan (2011–present) Member of the Pacific Area Fisheries Regulatory Commission (2009–present)

Curriculum Vitae

Masaaki WADA, Ph.D.
Professor, Future University Hakodate

Personal Information:

Name:	Masaaki WADA
Age:	46 (March 29, 1971)
Birth Place:	Shizuoka, Japan

Education:

1993	B.S.	School of Fisheries Sciences, Hokkaido University
2004	Ph.D.	Graduate School of Fisheries Sciences, Hokkaido University

Employment History:

1993-2004	Engineer, Towa Denki Seisakusho Co., Ltd., Japan
2005-2011	Associate professor, Future University Hakodate, Japan
2012-present	Professor, Future University Hakodate, Japan

Awards:

2013	Hokkaido science and technology Award
2014	Hokkaido Bureau of Telecommunications Award
2016	Minister for Internal Affairs and Communications Award

Other:

2016-present	Adviser, Ministry of Internal Affairs and Communications
2016-present	Principal Investigator, SATREPS Project

Curriculum Vitae

Tokio WADA, PhD
Executive Director, Japan Fisheries Research and Education Agency

Personal Information

Name:	Tokio WADA
Age (Birth Date):	62 (June 10, 1954)
Birth Place:	Kyoto, Japan

Education:

1977	BS	Faculty of Fisheries Science, Nagasaki University
1986	PhD	University of Tokyo

Employment History:

1977	Researcher, Hokkaido National Fisheries Research Institute, Fisheries Agency of Japan
1995-2000	Head, Fisheries Management Section, National Research Institute of Fisheries Science, Fisheries Agency
2004-2007	Counsellor, Resource Enhancement Promotion Department, Fisheries Agency
2008-2009	Director, National Research Institute of Fisheries Engineering, Fisheries Research Agency of Japan
2009-2011	Director, Research Management Department, Fisheries Research Agency of Japan
2011-2012	Director, National Research Institute of Fisheries Science, Fisheries Research Agency of Japan
2012-present	Executive Director, Japan Fisheries Research and Education Agency

Other:

2006-2010	Chairman, North Pacific Marine Science Organization (PICES)
2011-2017	President, Japanese Society of Fisheries Oceanography
2016-present	Vice President, Japanese Society of Fisheries Science

SIRI E. HAKALA, M.A.
Biologist, Protected Species Division
Pacific Islands Fisheries Science Center
NOAA/NMFS
1845 Wasp Blvd.
Honolulu, HI 96818, USA

EDUCATION

M.A. in Psychology/ Marine Mammal Behavior and Biology August 2004
University of Hawaii at Manoa

B.A. in Biology (Minor in Chemistry) June 1998
University of Minnesota at Morris

WORK, RESEARCH AND MANAGEMENT EXPERIENCE

Mansfield Fellow, 21st Class (still a NOAA federal employee)
The Maureen and Mike Mansfield Foundation July 2016-current

Biologist (on detail to cover International Science Coordination)
Office of Science & Technology/ NOAA Fisheries October - December 2015

Biologist (in the capacity of Division Deputy)
Protected Species Division, Pacific Islands Fisheries Science Center/ NOAA Fisheries June 2012-current

Biologist
Southwest Fisheries Science Center/NOAA Fisheries Dec 2007-June 2012

Biological Technician/ Policy & Communication Specialist
Aquatic Farms contractor for Southwest Fisheries Science Center Jan 2006 – Dec 2007

University Instructor/ High school Teacher
University of Hawaii (UH), University of Hawaii Outreach College (UH-OC), and La Pietra School for Girls March- July 2005

Field Biologist
Independent contractor for NOAA and various independent organizations 2004-2007

MAKINO Mitsutaku　Curriculum Vitae

Birth: June 23, 1973 at Karatsu city, Saga Prefecture, Japan.
Nationality: Japanese

<Affiliation>
Head, Fisheries Policy Group, Research Center for Fisheries Economics & Business Administration, National Research Institute of Fisheries Science, Japan Fisheries Research and Education Agency.

<Education>
Bachelor (Fisheries Science)　Kyoto Univ.
Master of Philosophy (Institutional Economics) Univ. of Cambridge
Doctor of Philosophy (Natural Resource Management Policy) Kyoto Univ.

<International Academic Activities>
- IUCN CEM-Fisheries Expert Group member, PICES (North Pacific Marine Science Organization) Human Dimension Committee Vice-Chair, ICES JMS Editor, etc.

<Main publications in recent years>

- **Makino M**. (2011) *Fisheries Management in Japan: its institutional features and case studies (Fish and Fisheries Series Vol.34)*, Springer.
- **Makino M,** Sakurai Y (2012) Adaptation to climate change effects on fisheries in the Shiretoko World Natural Heritage area, Japan. ***ICES Journal of Marine Science***, 69: 1134-1140.
- Garcia S.M., Kolding J., Rice J., Rochet Marie-Joelle, Zhou S., Arimoto T., Beyer J. E., Borges L., Bundy A., Dunn D., Fulton E. A., Hall M., Heino M., Law R., **Makino M**., Rijnsdorp A. D., Simard Francois, Smith A. D.M. (2012). Reconsidering the Consequences of Selective Fisheries, ***Science***, 335: 1045-1047.
- **Makino M**, Sakurai Y (2014) Towards the integrated research in fisheries science. ***Fisheries Science***, 80: 227-236.
- Bundy A, Chuenpagdee R, Cooley SR, Defo O, Glaeser B, Guillotreau P, Isaacs M, **Makino M**, Perry RI (2015) A decision support tool for response to global change in marine systems: the IMBER-ADApT Framework. *FISH and FISHERIES*, 17: 1183-1193.
- **Makino M** (2017) Institutional and economic analysis on the Japanese fisheries management, and its expansion to the marine ecosystem conservation. *AGri-Bioscience Monographs*, 7: 1-24.

Dr Habib EL-HABR

Habib joined UNEP in November 1988, becoming Officer-in-Charge and Deputy Chief of the Freshwater Unit in Nairobi until 1995, when he moved to Japan to assume the functions of the Deputy Director of UNEP/IETC. From September 1996 to December 1998, Habib was the Regional Coordinator for UNEP/EAS-RCU in Bangkok. Then he moved to Bahrain to become the Director and Regional Representative of UNEP/ROWA until July 2011. Prior to his arrival in Nairobi to take up the positon of the Coordinator of the GPA, Habib was the Deputy Coordinator of UNEP/MAP in Athens.

Habib holds a Masters Degree in Public Health from the American University of Beirut, Lebanon and a Ph.D. in Freshwater Ecology from the University of Lyon, France. Before joining UNEP in 1988, he worked at the National Scientific Research Council in France as a Water Research Specialist.

Besides his expertise in freshwater resources and coastal and marine management, Habib will bring both the global and the regional perspectives which he gained in fulfilling his several managerial positions in various duty stations within UNEP. His knowledge of the major players in the various regions where he served, his experience in intergovernmental processes, his expertise in programming, budgeting, office management, projects development and management, resource mobilization, partnership networking and human resources management coupled with his fluency in Arabic, French and English will be assets to DEPI. Habib's strength is in the development of policy options and advice to the concerned governments on major environmental issues. He is also member of the United Nations Disaster Coordination Team.

Habib holds dual nationalities, Lebanese and French. He is married and has 2 children.

Curriculum Vitae

Name: Akihiro KIJIMA
Date of Birth: 6th March 1953

Present Position:
Professor of Tohoku University, Graduate School of Agricultural Science （1996～present）
Representative of Tohoku Ecosystem-Associated Marine Sciences: TEAMS （2011～present）
Research Professor of Tohoku University（2016～present）

Education:

1971-1976	Faculty of Agriculture, Tohoku University (Fishery Science)
1976-1978	Master Course of Graduate School of Agricultural Science, Tohoku University
1978-1981	Doctor Course of Graduate School of Agricultural Science, Tohoku University Ph.D. titled "Genetic study on population structure of chum salmon"
1981-1982	Research Student in Graduate School of Agricultural Science, Tohoku University

Professional Background

1982-1983	Post Doctoral fellowship in Tohoku University supported by JSPS
1983-1987	Assistant Professor in Kochi University (Fish ecology)
1987-1996	Associate Professor in Tohoku University (Applied population genetics)
1996-Present	Professor, Integrative Aquatic Biology
2008-2013	Vice President (Education of Liberal Arts)
2009-2014	Director, Tohoku University Office of Japan-Russia Relations
2012-Present	Representative of TEAMS
2016-Present	Research Professor of Tohoku University

Related Paper: Kijima, A., Kogure,K.,Kitazato,H. and Fujikura,K. (2017) Reconstruction and restoration after the Great East Japan Earthquake and Tsunami: Tohoku Ecosystem-Associated Marine Sciences project activities. Springer Nature, inpress

Major Scientific Field: Fish Genetics & Breeding Science, Conservation Biology

List of Participants

Speakers

No.	Title	Name	Position
1	Dr	Habib El-HABR	Coordinator for the Global Program of Action for the Protection of the Marine Environment from Land-based Activities, UNEP
2	Ms	Siri E HAKALA	Mansfield Fellow, The Maureen and Mike Mansfield Foundation
3	Dr	Hui-Ling LIN	Director General, TORI, Chinese Taipei
4	Dr	Akihiko KIJIMA	Professor, Graduate School of Agriculture Field Science Center, Graduate School of Agricultural Science, Tohoku University and Project Representative of Tohoku Ecosystem-Associated Marine Science Project
5	Dr	Mitsutaku MAKINO	Group Head, Fisheries Management Policies Group, National Research Institute of Fisheries Science, Japan Fisheries Research and Education Agency
6	Mr	Masanori MIYAHARA	President, Japan Fisheries Research and Education Agency
7	Dr	Yoshihisa SHIRAYAMA	Executive Director, Japan Agency for Marine-Earth Science and Technology
8	Dr	Takashi YAMAKAWA	Associate Professor, Department of Aquatic Bioscience, Graduate School of Agricultural and Life Science, The University of Tokyo
9	Dr	Masaaki WADA	Professor, Schools of Systems Information Science, Future University Hakodate
10	Dr	Tokio WADA	Executive Director, Japan Fisheries Research and Education Agency

（alphabetical order by surname）

Participants from APEC Economies

No.	Economy	Title	Name	Position
11	Chile	Ms	Jenny MATURANA	Directorate General of the Maritime Territory and Merchant Marine, DGTM, Environmental Preservation, Marine Pollution and Climate Change Department
12	China	Dr	Daqian WU	Deputy Director, Division of Supervision, Department of Ecological Environment Protection, State Oceanic Administration
13	China	Ms	Rui HUO	Researcher Assistant, APEC Marine Sustainable Development Center(AMSDC), Third Institute of Oceanography(TIO), State Oceanic Administration

14	Indonesia	Dr	Aryo HANGGONO	Expert staff of Ecology and Marine Resources, Ministry of Marine Affairs and Fisheries
15	Indonesia	Dr	I Nyoman RADIARTA	Director, Institute for Marine Research and Observation
16	Malaysia	Prof	Mohamad Rosni OTHMAN	Senior Lecturer, School of Maritime Business and Management , University of Malaysia Terengganu
17	Malaysia	Ms	Sabrina KAMIN	Science Officer, Ministry of Science, Technology and Innovation
18	Peru	Dr	Pedro Ramiro CASTILLO VALDERRAMA	General Manager of Research in Hydroacustics, Sensing and Fishing Gear, Peruvian Sea Institute (IMARPE)
19	Peru	Ms	Nally Silvana QUINTEROS MALPALTIDA	Director of Fisheries Policy and Management, Ministry of Production
20	Philippines	Dr	Wilfredo Lopez CAMPOS	Professor, Division of Biological Science, University of the Philippines
21	Philippines	Ms	Criselda CASTOR	Senior Ecosystems Management Specialist, Department of Environment and Natural Resources, Biodiversity Management Bureau
22	Russia	Ms	Anna VAZHOVA	Researcher, International Department, Pacific Scientific Research Fisheries Centre
23	Chinese Taipei	Prof	Yi CHANG	Assistant Professor, National Cheng Kung University, Tainan
24	Thailand	Ms	Narumol KORNKANITHAN	Marine Biologist, Department of Marine and Coastal Resource
25	Thailand	Mr	Wudtichai WUNGKHAHART	Fisheries Biologist, Department of Fisheries
26	Viet Nam	Mr	Le Tran Nguyen HUNG	Deputy Director of Fisheries resources protection and conservation Department
27	Viet Nam	Ms	Nguyen Thi Hong NHUNG	Expert of Science, Technology and International Cooperation Department

（alphabetical order by economy）

Participants from Embassies of APEC Economies in Japan

No.	Economy	Title	Name	Position
28	Mexico	Ms	Emy KAMETA	Third Secretary, Official in Charge of Academic, Science & Technology, and International Cooperation at the Embassy of Mexico in Japan
29	United States of America	Ms	Raquel CANTU	Oceanography/Fisheries, Environment, Science Technology and Health Unit, Economic Affairs, Embassy of United States in Japan

30	United State of America	Ms	Keiko KANDACHI	NOAA Fisheries Representative for Asia National Oceanic and Atmospheric Administration U.S. Department of Commerce

（alphabetical order by economy）

Observers

No.	Title	Name	Position
31	Dr	Katsumori HATANAKA	Professor, Faculty of International Agriculture and Food Studies, Department of International Bi-Business Studies, Tokyo University of Agriculture
32	Ms	Eka HIGUCHI	Program Officer, Ocean Policy Research Institute, The Sasakawa Peace Foundation
33	PhD	Hiroe ISHIHARA	Research Fellow, Laboratory of Global Fisheries Science Graduate School of Agriculture and Science, University of Tokyo
34	Ms	Ayuko ISHII	Secretary for Legislative Affairs, Office of Member of House of Representative Mr. Hitoshi KIKAWADA
35	Mr	Hitoshi KIKAWADA	Member of the House of Representatives
36	PhD	Miko MAEKAWA	Program Officer, Ocean Policy Research Institute, The Sasakawa Peace Foundation
37	PhD	Lev NERETIN	Senior Coordinator, Northwest Pacific Action Plan (NOWPAP) Regional Coordinating Unit, Toyama
38	PhD	Yoshioki OOZEKI	Councilor, Japan Fisheries Research and Education Agency
39	Mr	Tsuyoshi SUGIURA	Deputy Manager, International Affairs Division, Innovation promotion, Cooperation and Partnerships Department, JAMSTEC
40	Mr	Tomohiko TSUNODA	Program Officer, Ocean Policy Research Institute、The Sasakawa Peace Foundation
41	Mr	Hiroshi TERASHIMA	President, The Ocean Policy Research Institute, The Sasakawa Peace Foundation
42	Dr	Genki TERAUCHI	Senior Researcher, NOWPAP CEARAC

（alphabetical order by surname）

Government of Japan (Observer)

No.	Title	Name	Position
43	Mr	Masahiko FUKUSHIMA	Science and Technology Expert, International Science Cooperation Division Disarmament, Non-Proliferation and Science Department Ministry of Foreign Affairs JAPAN
44	Mr	Takeshi MAKI	Official, Ocean and Earth Division Research and

			Development Bureau, Ministry of Education, Culture, Sports, Science and Technology
45	Mr	Shinji MINAMI	Director, APEC Division, Economic Affairs Bureau, Ministry of Foreign Affairs
46	Mr	Yasushi NAKAZATO	Director, Office of Marine Environment, Water Environment Division, Environmental Management Bureau, Ministry of the Environment
47	Ms	Kumi SAKURAI	Global Environment Division, International Cooperation Bureau, Ministry of Foreign Affairs
48	Dr	Kanako SATO	Official, Office of Marine Environment, Water Environment Division, Environmental Management Bureau, Ministry of the Environment
49	Mr	Tatsuya WATANABE	Director for Deep Sea Research, Ocean and Earth Division, Research and Development Bureau, Ministry of Education, Culture, Sports, Science and Technology
50	Ms	Kayoko YABATA	Deputy Director, Director, APEC Division, Economic Affairs Bureau, Ministry of Foreign Affairs
51	Ms	Mari YAMAZAKI	Technical Official, Office of Marine Environment, Water Environment Division, Environmental Management Bureau, Ministry of the Environment

Government of Japan (Host Only)

No.	Title	Name	Position
52	Mr	Masaaki KAI	Director General, National Ocean Policy Secretariat, Cabinet Office, Government of Japan
53	Mr	Toshihiko HORIUCHI	Project Overseer Counselor, National Ocean Policy Secretariat, Cabinet Office, Government of Japan
54	Mr	Toru KUMATANI	Counselor, National Ocean Policy Secretariat, Cabinet Office, Government of Japan
55	Mr	Akihiro SETA	Deputy Director, National Ocean Policy Secretariat, Cabinet Office, Government of Japan
56	Mr	Tomohiro KONDO	Cabinet Official, National Ocean Policy Secretariat, Cabinet Office, Government of Japan

Appendix B

APEC Project Proposal

Please submit through relevant APEC Secretariat Program Director.

Proposals must be no longer than 12 pages, including budget and title page.

Project title and number:	APEC Workshop on Marine Science, Technology and Innovation towards Science Based Management and Sustainable Use of Oceans and Marine Resources		
Source of funds *(Select one):*	■General Project Account		
APEC forum:	OFWG		
Proposing APEC economy:	Japan		
Co-sponsoring economies:	Chile, Indonesia, Malaysia, Mexico, Peru, Thailand, Viet Nam		
Expected start date:	June 2017		
Expected completion date:	December 2017		
Project summary: **Describe the project in under 150 words. Your summary should include the project topic, goals, planned activities, timing and location:** *(Summary must be no longer than the box provided. Cover sheet must fit on one page)*	This project aims to share good practices and knowledge of combination of the latest scientific marine research and observation and science-based marine policy-making among decision makers and researchers through 1 day international workshop and half a day site visit in Japan in 2017. This project also encourages promotion of networking and building capacities of stakeholders tackling various marine challenges in APEC region. Oceans have faced many challenges and the importance of the health of oceans is widely acknowledged in SDG 14 and other international fora. However, many parts of oceans are not sufficiently observed. This project will provide opportunity with APEC economies to promote making and implementing of science-based ocean policy to achieve sustainable use of oceans.		
Summary of Proposed Budget (USD) :	**APEC funding**	**Self-funding**	**Total**
	155,000	0	155,000

Project Overseer Information and Declaration:

Name: Toshihiko Horiuchi

Title: Cabinet Counselor

Organization: Secretariat of the Headquarters for Ocean Policy, Cabinet Secretariat, Government of Japan

Postal address: 16th Flo.3-7-1 Kasumigaseki,Chiyoda ward, Tokyo, 100-0013 JAPAN

Tel: **+81-3-3504-1978** ***E-mail:*** toshihiko.horiuchi@cas.go.jp

As Project Overseer and on behalf of the above said Organization, I declare that this submission was prepared in accordance with the **Guidebook on APEC Projects** and any ensuing project will comply with said Guidebook. Failure to do so may result in the BMC denying or revoking funding and/or project approval. I understand that any funds approved are granted on the basis of the information in the document's budget table, in the case of any inconsistencies within the document.

Toshihiko Horiuchi

Name of Project Overseer / Date

Project Details

Please answer each question succinctly. Suggested section lengths are provided as a guide. Proposals must be no longer than 12 pages, including budget and title page.

SECTION A: Relevance to APEC

[Answers to questions 1–3 may be taken or adapted from the Concept Note]

1. **Relevance: What problem or opportunity will the project address and why is it important? How will the project benefit APEC members and the region? Which Rank on this year's *APEC Funding Criteria* does this project fall under? Briefly explain why. Is it also linked to other Ranks? If so, which topics and how?** *[½ page]*

The oceans are changing rapidly, with over use and destruction of marine habits, climate change and more. The health of oceans has rightly been recognized as a crucial development issue and was included as the United Nations Sustainable Developments Goal 14 (SDG 14). Despite this progress, many parts of the oceans are not sufficiently observed. Acknowledging the above, it is crucial to develop far more scientific knowledge necessary to assess the ongoing changes and their global impact. It is also important to develop appropriate policies to ensure the sustainable use of oceans while conserving the marine environment. To tackle this issue, coordinated international observational effort is necessary.

The Importance of marine science and technology and science based ocean management to achieve sustainable ocean use are widely acknowledged in various ocean related international fora including Xiamen declaration at the Fourth APEC Ocean Ministerial Meeting in 2014, SDG14, G7 Summit Meeting 2016 and other relevant international meetings etc.

This project aims to share good practices and knowledge of combination of the latest marine scientific research and observation and marine policy-making in APEC region.

Furthermore, the concept of this project was also led by the outcome of Japan's first APEC project in OFWG *'Workshop on the Climate Change Impact on Oceans and Fisheries Resources' (OFWG 02 2014)* that stressed the importance of coordinated science-based ocean management and sharing scientific knowledge and good practices and success stories of the adaptation with innovative approaches'.

This project contributes to Rank 1(Ocean related issues for economic growth), Rank 2(Sustainable growth, Secure growth, Innovative growth) and Rank 3(Xiamen Declaration).

2. **Objectives: Describe the 2-3 key objectives of the project. (e.g. to ensure workshop participants will be able to...; to create a framework...; to develop recommendations...;**

to build support...; to revise strategies...; to create an action plan; …improve capacity in; etc.) *[¼ page]*

Key objectives are

(1) To share good practices and experiences of ocean policy-making for sustainable marine use based on the latest marine science and technology

(2) To promote networking among policy makers and researchers and relevant stakeholders

(3) To build capacities of people working on various marine issues

(4) To develop recommendations to OFWG and reflect them in outcomes of various APEC and non-APEC ocean related meetings

As of now, the workshop consists of general theme and 2 sub-themes. Each sub-theme will be discussed under the general theme. *The content of workshop will be elaborated after submission of this proposal.*

General Theme: 'Marine Science, Technology and Innovation towards Science Based Management and Sustainable Use of Oceans and Marine Resources'

(Possible agenda: to introduce importance and good practices of science based ocean management and policy-making, to introduce promotion of marine scientific research with the latest marine technology, Etc)

-Sub-theme 1 Food security

(Possible agenda: to introduce *the latest technology and experiences on food security and sustainable use of biological resources including fishery and aquaculture,* Etc)

-Sub-theme 2 Harmonization of Marine Environment and Human Activities, and Enhancement of Resilience of Ocean Related Risks

(Possible agenda: to introduce the latest marine science and technology on Sustainable coastal management, Marine Debris, Impact of climate change, Etc, and *to introduce the latest marine science and technology on ocean related to ocean related disaster management and enhancement of resilience*, Etc)

3. **Alignment: Describe specific APEC priorities, goals, strategies, workplans and statements that the project supports, and explain how the project will help achieve them. Explain how it is aligned with your forum's workplan / strategic plan.** *[less than ½ page]*

This project will contribute to all 4 priority areas adopted by Xiamen declaration of the APEC Ocean-Related Minister Meeting in 2014 as follows:

(1) Coastal and marine ecosystem conservation and disaster resilience;

(2) The role of the ocean on food security and food-related trade

(3) Marine Science, Technology and Innovation

(4) Blue Economy

This project directly supports *(3) Marine Science, Technology and Innovation*, in particular. In addition, data and discoveries by marine scientific research and technology can give sound basis to all policy making by the stakeholders tackling challenges of all 4 priority areas.

4. **For TILF Special Account applications: Briefly describe how the project will contribute to APEC trade and investment liberalization and facilitation with reference to specific parts of the Osaka Action Agenda (Part 1, Section C and, where appropriate, Part 2).**

For APEC Support Fund applications: Briefly describe how the project will support the capacity building needs of APEC *developing economies*, and how they will be engaged. *[¼ page]*

SECTION B: Project Impact

Outputs: Describe products or services that the project will create. This may include workshop, reports, tools, research papers, recommendations, best practices, action plans etc. *[½ to ¾ page]*

The main part of the project will be implemented through 1 day international workshop and half a day site visit Tokyo or its suburb in Japan in June 2017 (detailed date will be confirmed later). The project will focus on the following objectives through the workshop.

(1) To share good practices and experiences of ocean policy-making for sustainable marine use based on the latest marine science and technology

(2) To promote networking among policy makers and researchers and relevant stakeholders

(3) To build capacities of people working on various marine issues

(4) To develop recommendations to OFWG and reflect them in outcomes of various APEC and non-APEC ocean related meetings

Workshop presentations and outcomes are planned to be compiled into a report, allowing lessons learnt to be disseminated not only within APEC economies but also for the relevant international communities through various international occasions.

The direct beneficiaries of the project are ocean-dependent communities in APEC economies, especially of their citizens, most specifically those who rely on oceans activities and products for their livelihoods, including women in the communities.

Outcomes: Describe the specific changes the outputs are expected to achieve in the medium-term. What changes in policy, processes or behavior will the project lead to? *[½ to ¾ page]*

Attended economies are expected to gain ideas of importance of evidence-based ocean policy making and necessity of further promotion of marine scientific research both domestically and internationally that provide indispensable and fundamental parts of all marine policies that should aim to achieve sustainable use and preservation of oceans more effectively and globally. Practical knowledge including capacity building and networking among experts gained by participants (policy makers and researchers, etc.) in the project will provide opportunities and clues with attended economies to review efficiency of their marine scientific researches and necessity of international cooperation over it. As a result, evidence-based policy making based on reviewed marine scientific researches will be promoted both domestically and internationally and it will bring about political and actual benefits to both local and international society.

Beneficiaries: Who are the direct project participants and users of the outputs? Describe their qualifications, level of expertise, roles/level of responsibility, gender, economies represented, government departments, APEC fora involvement etc.. Explain how they will use and benefit from the outputs. Who else will benefit from the project and how? *[½ to ¾ page]*

The main beneficiaries are all the marine related stakeholders including government officials (Ocean related ministries like fisheries, environment, natural resources, etc.), researchers (marine science institutes, fisheries research institutes, etc.) and marine field academics. Possibly it might include private enterprises, civil societies and others whose activities are linked to the ocean related issues. Expected level of experience or expertise of participants are from intermediate level to professional level of experiences over policy making or marine researches. Beneficiaries will acquire comprehensive practical knowledge and information about combination of updated marine science and technology and policy making and its administration. Promoted implementation of evidence-based deliberation of ocean policies or measures through the latest marine technology will be beneficial to all users of oceans.

Participants from all APEC economies are expected. The expected number of participant area more than 50 persons.

<u>Dissemination:</u> Describe plans to disseminate results and/or outputs of the project, including:

- **The number, form and content of any publications. (Note: APEC will not fund publications that are only presentation slides, or website maintenance. Electronic publication encouraged.)**
- **The target audience.**
- **Any intention to sell outputs arising from this project.** [*less than ½ page]*

The project will produce presentation papers, booklets for the effective distribution through APEC economies and the relevant APEC fora, including the dissemination in both electronic format in the APEC website and physical format.
These outcome documents will be also sent to other international and regional organizations and research institution etc.
The project will also create a platform for exchanging and sharing information with key beneficiaries, stakeholders, decision makers and policy makers, researchers and representative of relevant organizations.
The project will demonstrate the efficiency and effectiveness of evidence-based deliberation that is promoted by use of updated marine technology and science and also elaborate practical recommendations to meet sustainable use of oceans and fisheries resources.

<u>Gender:</u> What steps will the project take to ensure the participation and engagement of both men and women in project activities? How do project objectives benefit women? *[less than ½ page]*

Women in the oceans communities will be actively involved throughout the planning, implementation, and delivery phases. There is an intention to identify and engage female experts to present during the workshop, in the adaptations efforts to the impact of the climate change on the oceans. Each APEC economy is also encouraged to put forward qualified female participants in the workshop. Half of participants could be women.

SECTION C: Project Effectiveness

5. **<u>Work plan:</u> Provide a timeline of actions you will take to reach your objectives. For each, include:**

- **How it will be implemented; how member economies, beneficiaries & others will be involved**

Regarding post-workshop feedback process, Japan's PO will report outcomes of the project and also receive feedbacks and reviews from members of OFWG though OFWG meetings.

We will take the feedbacks and comments given to us as valuable tips to develop Japan's future APEC project in OFWG.

- **Related outputs for that particular step (e.g. contract, agenda, participant list, workshop, report)** *[1-2 pages. Answers may be taken or adapted from the Concept Note]*

Date	Task
November 2016 to May 2017	The project initially develops the program of the workshop, including arrangement of the concrete direction of the theme and agenda setting, as well as the coordination of the logistic preparation such as the meeting venue. Then, the coordination between each agenda and lecturer follows the theme setting. Dissemination image is also built through consultations with some key lecturers. The participants from eligible APEC economies are selected by each economy.
In OFWG 2017(TBC)	Raising awareness and interest of the project among OFWG members
By May 2017	Finalization of invited attendees and speakers
In June 2017	The project conducts one day workshop and a half day site visit
To December 2017	Publishing outcomes PO submits completion report.

<u>Risks:</u> What risks could impact project implementation and how will they be managed? *[⅛ to 1 page, depending on project nature/complexity]*

<u>Schedule conflicts, lecturers' unavailability:</u>

Account will be taken of the meeting dates of relevant international fora, such as UN related meetings and RMFOs, in order to avoid schedule conflicts. Project oversees also liaises with 2017 Host Economy, Viet Nam and APEC secretariat and key lecturers to avoid schedule conflict of the workshop as possible. The schedule and contents of the workshop will be freely accessible for all APEC economies as well as relevant international communities.

<u>Lack of participants' interests:</u>

Co-sponsors will be consulted on agenda and speakers to ensure relevance. Information about the workshop will be provided at the OFWG and circulated to all relevant APEC fora. The schedule and contents of the workshop will be widely distributed to all APEC economies.

6. **<u>Monitoring and Evaluation:</u> How will you know whether the project achieved its objectives?**

- **What information will be collected to assess progress and impact (e.g. stakeholder feedback, website hits, participant stats)? How will gender impacts be measured?**
- **How will you collect it (e.g. surveys, meetings, interviews, peer review, records review)?**
- **What <u>indicators</u> will you use and/or measure to know if the project is on track (monitoring) and successful in meeting its objectives (evaluation)?** *[½ page]*

The project will be monitored and evaluated through extensive reviews and improvements of the relevant theme setting, appropriate agenda and lecture coordination, effective and constructive consultations with lecturers, reflection on the prior consultations with participants to gather their desires, initial feedback using a questionnaire distributed through the project.

Post-workshop feedback process will be also conducted, in order to accumulate the further opinions with regard to the outcomes of the workshop. PO conducts reviews and final project report including monitoring based through the suggestions.

7. **<u>Linkages:</u> Describe the involvement of other APEC fora, and other relevant organizations. Include:**

- ***Engagement:* How are you engaging other relevant groups within and outside APEC?**
- ***Previous work:* How does this project build on, and avoid duplication of, previous or ongoing APEC initiatives, or those of other organizations working in this area?**
- ***APEC's comparative advantage:* Why is APEC the best sources of funds for this project?** *[¼ to 1 page. Answers may be taken or adapted from the Concept Note]*

<u>Engagement:</u>

This project can have a close collaboration with PPFS and PPSTI and other related APEC sub-fora. For instance, to accept participation from related APEC sub-fora on its own financial basis or to report feedback of the project at the meeting of related sub-fora. Also non-APEC stakeholders from private sectors, relevant academic institutions and IGOs will be possibly involved in the implementation of workshop.

<u>Previous work:</u>

Importance of the issue of promotion of evidence-based deliberation through use of innovative marine science and technology is widely accepted by the various international fora and administrative frameworks. But there was less opportunity and networking and information for

policy makers to be updated about practical knowledge and approaches on evidence-based deliberation. As long as we referred to the history of OFWG APEC project before, this project will be the first OFWG APEC project that mainly focuses on coherent political combination of marine science and technology and policy making and the implementation.

APEC's comparative advantage:

As APEC economies account for 70 percent of global consumption of fish products and 90 percent of global aquaculture production, the APEC is the best international body to address the economic and social impacts related to the oceans and the benefit from oceans, with a sense of ownership. This requires widely acceptable and flexible approach enabled by APEC non-binding principles and consensus-based procedure.

SECTION D: Project Sustainability

Sustainability: Describe how the project will continue to have impact after the APEC funding is finished.

- **How will beneficiaries be supported to carry forward the results and lessons from the project?**
- **After project completion, what are the possible next steps to build on its outputs and outcomes? How will you try to ensure these future actions will take place? How will next steps be tracked?**
- **How will progress on the outcomes and impacts (Question 6) be measured?** *[less than 1 page]*

The workshop presentations and documents will be complied, enabling workshop participants to disseminate the outcome materials more broadly within their economies. The workshop outcomes materials will be also available via the APEC meeting document portal, and will thus remain accessible to not only participants but also everyone in the future.
We'd plan to create and adopt outcome or recommendation in the workshop possibly and to reflect it on OFWG future work plan or other related documents. Regarding follow up activities, we also plan to provide the essence of the workshop with other ocean related international fora and meetings and to urge to foster international trend of globally coordinated marine research as one of the key idea of the workshop.
We also expect our project provides opportunities with all economies to promote marine research and observation and possibly urge or support them to promote their ideas like forming new project both domestically and internationally.

The project will also create a platform for exchanging and sharing practical information of know-how of evidence-based deliberation and any innovative measures with key beneficiaries, stakeholders, decision makers and policy makers. It helps the enhancement of the networks

building and capacity of policy making and implementation throughout the beneficiaries and stakeholders.

<u>Project Overseers:</u> Who will manage the project? This includes managing of contractors and specialists. Please include brief details of the PO and any other main point(s) of contact responsible for this project. *[less than ½ page]*

The project will be overseen by Mr Toshihiko Horiuchi. Mr Horiuchi is a Cabinet Counsellor, The Secretariat of Headquarters for Ocean Policy in Japanese Government that is initially in charge of implementation and coordination of comprehensive ocean policy of Japanese government. He joined Ministry of Foreign Affairs of Japan in 1990, and has tackled many international issues including ocean policy in his professional career in MOFA.

SECTION E: Project Efficiency

<u>Budget:</u> Complete the budget and budget notes for the project in the template below. The budget should include calculation assumptions (e.g., unit costs) and self-funding contributions. Please consult the *Guidebook on APEC Projects* for eligible expenses.

Group Photo

The workshop

Group Discussion

Get Together Dinner

Site visit at Japan National Research Institute of Fisheries Science

Site visit at Japan Agency for Marine-Earth Science and Technology