SCIENTIFIC PROGRESS REPORT FOR YEAR 1 (ENDING MARCH 31, 2018)

1. BACKGROUND

PICES member countries have significant resources for monitoring environmental conditions and fisheries in coastal waters, while developing nations are far more limited in their capacity for collecting data needed to improve their management practices. Citizen-based monitoring is an approach designed to improve the efficiency and effectiveness of monitoring efforts when technical and financial resources are not sufficient. There are successful examples of citizen-based monitoring in developed countries, however this approach has not been widely applied yet to the collection of environmental and fisheries data in developing nations.

In December 2016, the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Japan, through the Fisheries Agency of Japan (JFA), approved funding from the Official Development Assistance (ODA) Fund for a 3-year (expected to be completed March 31, 2020) PICES project entitled "*Building capacity for coastal monitoring by local small-scale fishers*" (FishGIS). The overall goal of the project is to enhance the capacity of local small-scale fishers to monitor coastal ecosystems and coastal fisheries in Pacific Rim developing countries. The project key questions are: (a) how do global changes in climate and economy affect coastal ecosystems? and (b) how may enhanced capacity for monitoring activities by local fishers help to improve fisheries management in coastal areas?

Indonesia was chosen as a developing Pacific Rim country to implement the project. The importance of having more effective fisheries management practices is widely recognized in Indonesia, and this leads to support by the government and the willingness of local communities and stakeholders to consider new approaches such as development and implementation of a fisherman/citizen-based observation system, linked with fisheries scientists and managers.

The following organizational principles (Project Principle 3) agreed to by MAFF/JFA and PICES apply to the project:

- The project will interact with, and support relevant activities of, PICES Scientific Committees on Human Dimension (HD) and Fishery Science (FIS), PICES Technical Committees on Data Exchange (TCODE) and on Monitoring (MONITOR), and PICES FUTURE (**F**orecasting and **U**nderstanding **T**rends, **U**ncertainty and **R**esponses of North Pacific Marine **E**cosystems) Science Program (Research Theme 3 on "*How do human activities affect coastal ecosystems and how are societies affected by changes in these ecosystems?*").
- The project will be directed by a Project Science Team (PST), with membership from within or outside of PICES Committees and expert groups, as deemed appropriate. All above mentioned groups are expected to be represented on PST.
- The PST will be co-chaired by PICES members, with one of Co-Chairmen being from Japan – Dr. Mitsutaku Makino (Japan Fisheries Research and Education Agency; mmakino@affrc.go.jp). The PST Co-Chairmen are responsible for the scientific implementation of the project and annual reporting to MAFF and to PICES Science Board through the HD Committee. The report to MAFF/JFA should be submitted within 90 days after the close of each project year ending March 31.

This progress report summarizes the activities carried out for Year 1 (ended March 31, 2018) and includes a workplan for Year 2 (April 1, 2018 to March 31, 2019).

The Project Coordinator, Dr. Alexander Bychkov (bychkov@pices.int), is responsible for the management of the fund and annual reporting on its disposition to MAFF/JFA and to PICES Governing Council through the Finance and Administration Committee. The financial report to MAFF/JFA should be submitted within 90 days after the close of each project year, and the Year 1 financial report was sent as a separate document to the JFA Principle Research Coordinator on June 18, 2018.

2. WORKPLAN AND PROGRESS FOR YEAR 1

2.1 Project Science Team

PST membership

The PST was established in November 2017 based on principles and procedures detailed in *the PICES Policy for approval and management of special projects* (PICES Governing Council Decision 2017/A/7; http://meetings.pices.int/publications/annual-reports/2017/2017-GC-Decisions-Vladivostok.pdf). The current PST membership is drawn from PICES Committees and expert groups, and all Contracting Parties and all Committees mentioned in Project Principle 3 are represented on PST (Table 1 and Fig. 1). Dr. Mitsutaku Makino (Japan) and Dr. Mark Wells (USA) were appointed as PST Co-Chairmen. Dr. Alexander Bychkov serves as an *ex-officio* member of the team. Contact information for PST members is provided in Appendix 1.
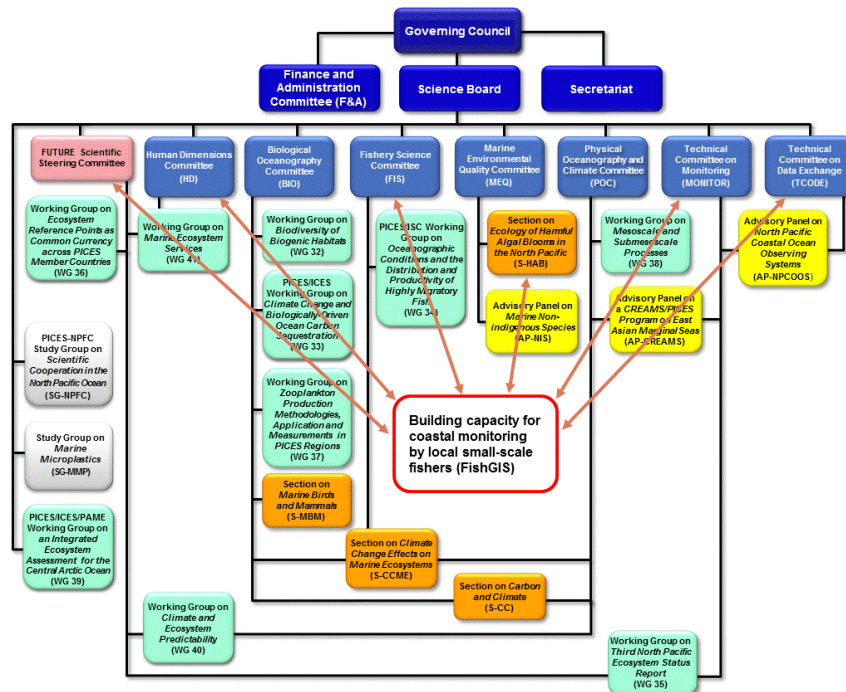

Fig. 1   PICES (North Pacific Marine Science Organization) structure for 2017–2018 showing links between the FishGIS project and PICES Committees and expert groups.

Table 1   Membership of the Project Science Team

Name	Affiliation	Country/Group
Vladimir Kulik	TINRO-Center	Russia/MONITOR
Joon-Soo Lee	KODC, National Institute of Fisheries Science	Korea/TCODE
Mitsutaku Makino	Japan Fisheries Research and Education Agency	Japan/HD
Shion Takemura	Japan Fisheries Research and Education Agency	Japan/HD
Naoki Tojo	Hokkaido University	Japan/FIS
Charles Trick	Western University	Canada/S-HAB
Mark Wells	University of Maine	USA/S-HAB
Chang-an Xu	Third Institute of Oceanography, SOA	China

First PST meeting

The first PST meeting was held January 17–19, 2018, at the Headquarters of Japan Fisheries Research and Education Agency in Yokohama, Japan. The main objectives of the meeting were to: (1) discuss the overall strategy and general directions for the project and develop timelines for project activities and deliverables, (2) review and refine the workplan for Year 1, and (3) draft the workplan for Year 2.

The main discussion points and results from the meeting can be summarized as follows:
- General framework, objectives and deliverables of the project were discussed.
- The overview of the 2012–2017 PICES/MAFF project on "*Marine ecosystem health and human well-being*" and information on other relevant activities, including Dr. Shion Takemura's PhD study using the GIS technology and citizen-based monitoring for mangrove conservation, were presented.
- The major initiatives of the project were approved (Table 2). These initiatives will be supported by a series of training/capacity building workshops, led by scientists from PICES member countries.
- A basic framework for a smartphone-based GIS system (fisheries data application) to be used by local small-scale fishers was introduced by Dr. Shigeharu Kogushi (Green Front Laboratory, Japan) and reviewed by PST.
- Information on the existing water quality assessment smartphone application (HydroColor) and a cheap and easy-to-use instrument for analysis of phytoplankton species composition (foldscope or paper origami microscope) was presented.
- Preliminary discussion on selection of potential case study sites in Indonesia was held.
- The overall project workplan (Table 3) was discussed; the workplan and budget for Year 1 were reviewed and refined, and the workplan for Year 2 was drafted.

The PST meeting report will be posted on the project website (http://meetings.pices.int/projects/FishGIS) in July 2018.

2.2   Case studies

Partner organization

One of the first, and strongest, lessons learned from the previous PICES/MAFF projects is the importance of connecting with organizations in a developing country which could facilitate and advance the project. This organization and the key people are needed to understand the project and to translate it into the local context. The PST concluded that the Indonesian Agency for the Assessment and Application of Technology (BPPT) is the ideal partner for this project for two main reasons: 1) BPPT is responsible for leveraging advances in technology for the study of environmental systems to enhance Indonesian economic and societal development, and 2) a productive working relationship with BPPT was developed during the PICES/MAFF project on "*Marine ecosystem health and human well-being*" (2012–2017), and the current project can build upon this collaborative foundation. The strategy during Year 1 was to introduce the project to BPPT colleagues to seek their advice on possible approaches for its implementation, including suggestions on potential locations for the demonstration case studies. On March 19, 2018, during a visit of PST members to Indonesia, the Letter of Intent (LOI) between BPTT and PICES was signed as a basis for collaboration on the project, and a Focus Group discussion on project implementation was held (Fig. 2).

Table 2   Major initiatives of the FishGIS project

1.   Coastal ecosystem monitoring activities by local small-scale fishers to detect ecosystems changes (*e.g.*, deviations in water quality and changes in community composition)
2.   Coastal fisheries monitoring activities by local small-scale fishers to improve coastal fisheries management (*e.g.*, information about fishing operation or species composition on the market)
3.   Coastal and estuarine water monitoring activities by local small-scale aquaculture fishers to measure the effects of government clean water initiatives on water quality for aquaculture operations (*this initiative was added after a visit of PST members to potential case study sites in March 2018*)

Table 3   Initial overall workplan for the FishGIS project

Year 1
- Form a Project Science Team (November 2017) - Design a basic concept for the project (November – December 2017) - Develop a prototype version of the smartphone-based GIS system (December 2017 – March 2018) - Hold the first PST meeting (January 2018) - Organize a visit to Indonesia for selecting case study sites, identifying needs for training and testing the prototype version of the smartphone-based GIS system (March 2018)
Year 2
- Develop Ver. 1 of the smartphone-based GIS system (April – June 2018) - Organize a series of training/capacity building workshops in Indonesia (June – July 2018) - Develop Ver. 2 of the smartphone-based GIS system (July – August 2018) - Start collecting data at selected case study sites (August 2018) - Hold the second PST meeting (November 2018, in conjunction with PICES-2018) - Finalize selection of an additional case study site (February – March 2019)
Year 3
- Start collecting data at the new site (April 2019) and continue collecting data at other selected sites - Hold the third PST meeting (October 2019) - Conduct social survey to assess the effects of this project (December 2019 – January 2020)

Fig. 2   Visit of the PICES Team to the Indonesian Agency for the Assessment and Application of Technology (BPPT) on March 19, 2018: Signing Ceremony for the Letter of Intent between BPPT, represented by the BPPT Chairman, Mr. Unggul Priyanto, and PICES, represented by Dr. Mitsutaku Makino (top left); PICES Team members and BPPT leadership posing after the ceremony (top right); Focus Group discussion (bottom left), and Prof. Suhendar Sachoemar (left) leading discussion (bottom right).

Case study sites selection

From March 19–23, 2018, a group of PICES experts, including all PST members, visited Indonesia in order to (1) finalize the selection of case study sites, and (2) identify the key local individuals who will participate in the project, the type of training/capacity building needed, and the logistics for providing this training. Immediately after the LOI Signing Ceremony and Focus Group discussion at BPPT, the PICES team and BPPT staff visited three potential case study sites: Muara Gembong on March 20, Indramyu District on March 21, and Cilincing on March 22 (Fig. 3), to evaluate which have the overall best conditions for implementing the project.
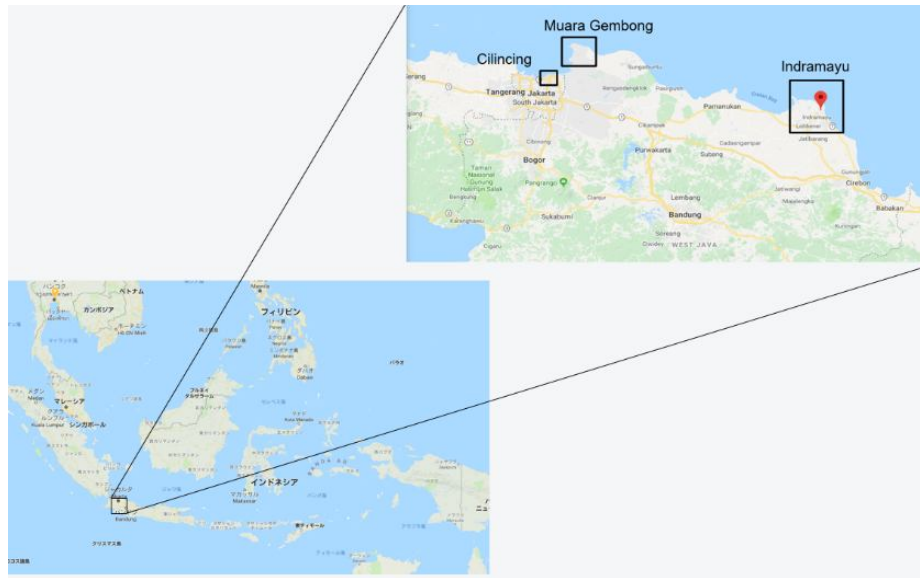

Fig. 3   Potential case study sites in Indonesia.

Joint meetings and small group interviews were held in each community with local fishers and aquaculture farmers who were interested in hearing about the project, and willing to communicate their knowledge of the region (Fig. 4). The primary goal was to learn from these local citizen-experts on the state of their fisheries, their environment, and their primary concerns for local fisheries in the future. On completion of these community forums, the three sites were ranked in terms of the project goals using several criteria relevant to success of the project, including the presence of a strong local coordinator (considered vital to project success), ecosystem changes recognized by the people, evaluation of their recognition of the relationship between environment and fisheries (wild caught and aquaculture), and the overall interest in the community for education and training. Community members in all three case study sites were found to have mobile phones suited for the project, and each site had sufficient cellular signal strength to support the planned data transfer needs of the smartphone applications. Muara Gembong and Indramyu District were selected as the demonstration sites for the project. Cilincing was reluctantly ruled out due to several reasons, with the main ones being the high level of pollution from Jakarta, and that the community and its fishing operations are likely to be in transition over the next 5 years because of local commercial development.

At a wrap-up discussion with Indonesian partners held March 23, linkages with other components of BPPT and other agencies were identified as being beneficial to the project, namely the BPPT Center of Technology Development for Regional Resources Development, the Indonesian Ministry of Marine Affairs and Fisheries, and the Indonesian Institute of Sciences (LIPI). The first PICES/MAFF project on "*Development of the prevention systems for harmful organisms' expansion in the Pacific Rim*" (2007–2012) included harmful algal bloom training with researchers of LIPI, and the intention is to utilize this local expertise to help identify phytoplankton community composition changes and the appearance of

harmful algal species in the case study sites. Preparations were initiated for a series training/capacity building workshops to be held early in Year 2 of the project.

The report of the March 2018 visit to Indonesia will be posted on the project website in July 2018.

Fig. 4   Visits of the PICES Team and BPPT staff (March 20–22, 2018) to Indonesian communities considered as potential case study sites: Discussions with local fishers and fish/seaweed farmers at Muara Gembong (top row), Indramayu District (middle row) and Cilincing (bottom row).

2.3   Analytical tools and knowledge bases preparation

The extensive use of smartphones in developing countries, offers a creative potential for implementing major project initiatives through a smartphone-based monitoring system used by local fishers and that could help to (1) inform fisheries managers on the near real-time spatial catch data and fishing intensity, and (2) monitor useful water quality parameters.

Significant progress was made on the development of the smartphone-based system for coastal ecosystem monitoring. The initial GIS-based fisheries data application, created through a contract with Green Front

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Laboratory (Japan), was reviewed at the first PST meeting, and several additional considerations were suggested centered on (1) the form and details of data collections, (2) the logistics and practicality of these wishes, and (3) the ease of use and functionality of the application in the hands of community fishers. The visits to the potential case study sites in March 2018 enabled testing of the application, both in terms of connectivity to data storage sites and in the ease of use for community members. A revision plan for the prototype application was designed based upon these efforts.

The established application for measuring water quality (HydroColor) was also tested during the site visits and found to work well – no significant modification was considered necessary.

3. WORKPLAN FOR YEAR 2

Analytical tools – modification and refinement of the smartphone applications

The project is supporting the development of a GIS-based fisheries data application that is using smartphone location data with photographs of fisheries catches to develop a fish catch database to inform fisheries management. The prototype application was tested during the March 2018 visit, and several added features were determined to be advantageous (*e.g*., addition of fish species notations, delayed data transmission to facilitate data transfers when a signal strength is high, translation into Indonesian language – bahasa Indonesia, *etc*.). These additions will be incorporated into the application before the training/ capacity building workshops in Year 2, and the revised product will be distributed to local fishers for beta-testing under real-world conditions.

The existing water quality assessment application HydroColor is available for both Android and iPhone products, but some modifications (automation of the existing manual data upload capacity and translation into bahasa Indonesia) are needed to optimize its use in the project. These changes also will be completed before the Year 2 training/capacity building workshops, and the application will be distributed for beta-testing by the local fishers.

Training and capacity building workshops

The training/capacity building workshops will comprise four phases: 1) training of fishers (defined here as including both wild- and aquaculture-based fisheries) in the use of the GIS-based fisheries data smartphone application under development in this project, 2) training of fishers in use of the existing water quality assessment smartphone application (HydroColor), 3) training of leading community members in water collection and phytoplankton observations (species composition) using foldscopes (paper origami microscopes that enable cellphone photograph of phytoplankton community composition), and 4) educating BPPT staff and scientists on using their established expertise towards calibration for the HydroColor application to enable automated determination of chlorophyll concentrations, and verification of data on suspended sediments and turbidity measurements.

For phases 1–3, training of fishers and interested community members will take place in Muara Gembong and Indramyu District and will include participation of PICES experts, and BPPT and LIPI staff and scientists. The phase 4 effort will be conducted in Jakarta. At this time, all workshops are expected to be held over a single, prolonged visit of PICES experts to Indonesia in July 2018.

Project Science Team

The second PST meeting is scheduled for November 2, 2018, in conjunction with the PICES Annual Meeting in Yokohama. The meeting will review the early data collections in Muara Gembong and Indramyu District, and evaluate any steps needed for further modification of the smartphone applications. This review will serve as a first assessment of the project outcomes relative to the project goals. Discussion also will be held to identify a potential third case study site to expand the project to a fishery region distinct from the current study sites in order to assess the effectiveness of the citizen-science fisheries data collections under broader social and environmental situations. This selection will be finalized during a visit of PICES experts to Indonesia in February 2019.

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