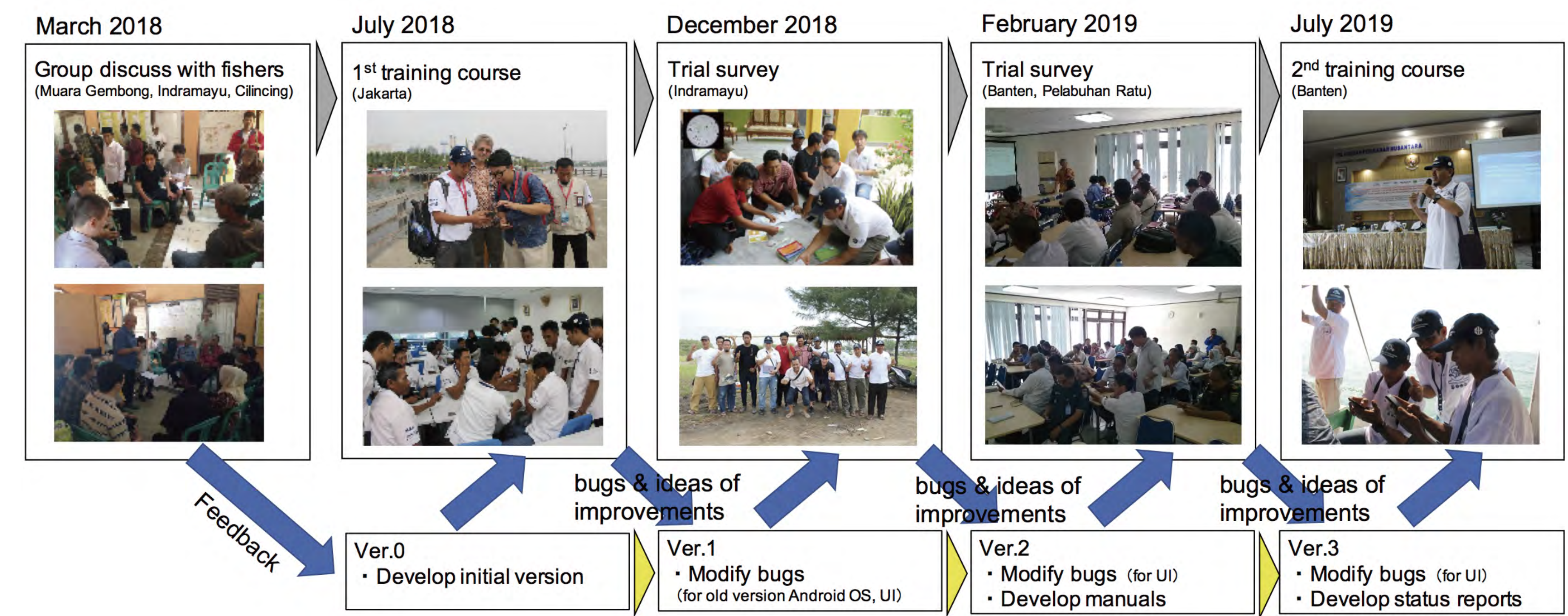# Developing a community-based coastal environmental monitoring system in Indonesia using smartphone app

○ Takemura, S. (FRA, Japan), Makino, M. (AORI, Japan), Kogushi, S. (GFL Co., Ltd, Japan), Tojo, N. (Hokkaido Univ., Japan), Wells, M. (Univ. of Maine, USA) and Sachoemar, S. (BPPT, Indonesia)

Introduction

* Citizen science is an effective research approach used to understand large-scale patterns of change in the distribution, abundance, and presence of organisms across time and space (1).
* There are many successful examples of citizen-based monitoring in developed countries (2, 3).
* However, this approach has not been widely applied yet for collecting environmental and fisheries data in developing nations (4).

* The objective of this research was to develop a community-based coastal environmental monitoring system using a smartphone app in Indonesia where coastal ecosystems face various challenges due to ecological and social changes.

Method (Transdisciplinary research approach)

March 2018 — Group discuss with fishers (Muara Gembong, Indramayu, Cilincing)
July 2018 — 1st training course (Jakarta)
December 2018 — Trial survey (Indramayu)
February 2019 — Trial survey (Banten, Pelabuhan Ratu)
July 2019 — 2nd training course (Banten)

Feedback — bugs & ideas of improvements — bugs & ideas of improvements — bugs & ideas of improvements

Ver.0 · Develop initial version
Ver.1 · Modify bugs (for old version Android OS, UI)
Ver.2 · Modify bugs (for UI) · Develop manuals
Ver.3 · Modify bugs (for UI) · Develop status reports

## Results and Discussion

1 Smartphone App (IKAN-GIS)

1. Water quality (suspended sediments, chlorophyll)
2. Red tide/fish kill
3. Fish landings
4. Illegal fishing vessels
5. Floating garbage

Photos and videos are reported by IKAN-GIS app.

Water quality is reported by HydroColor app.
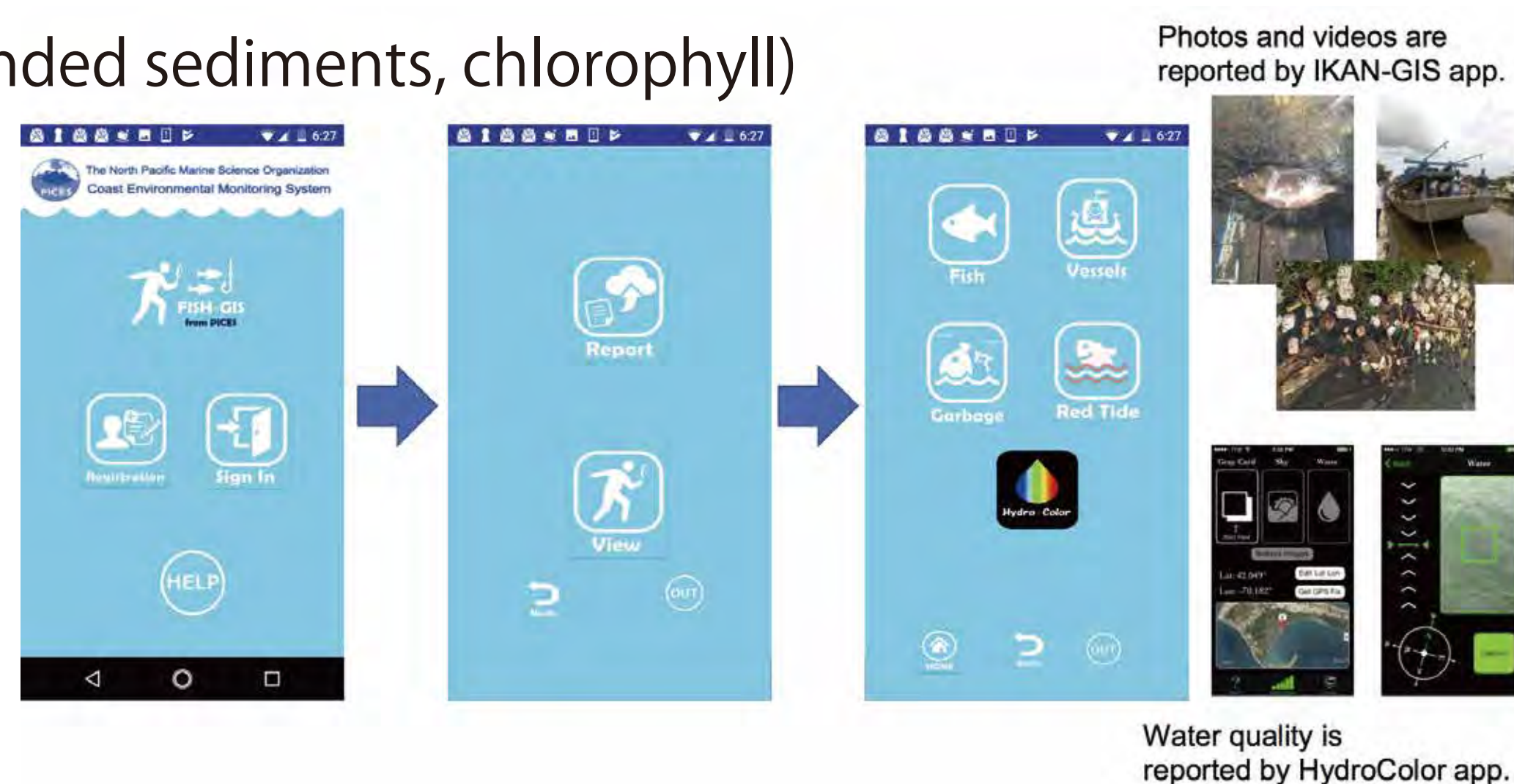
Local fishers can easily report photos & vedeos for cpastal enviromental changes.

2 Modified App with local stakeholders

Fish speceis

Before — After
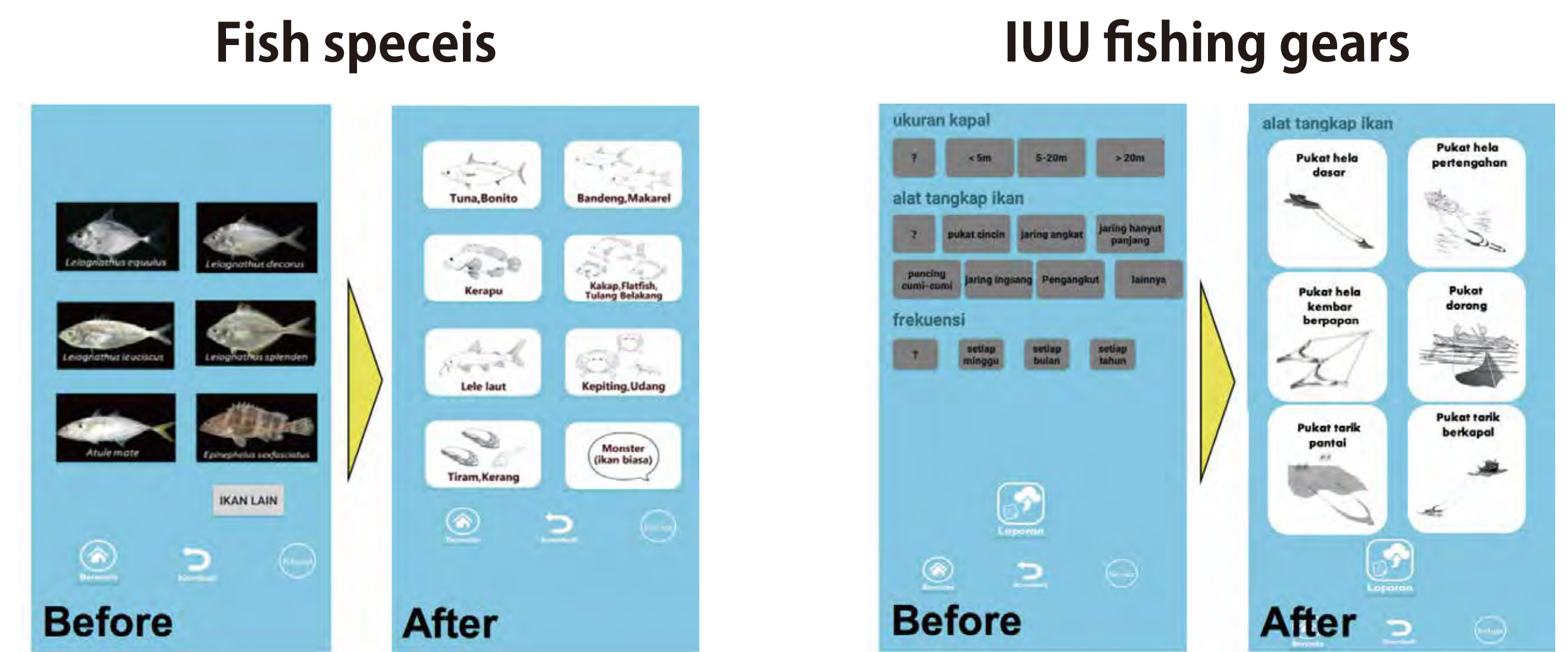
* Local fishers pointed out the gaps between the App and the fish species on thier fishing grounds.
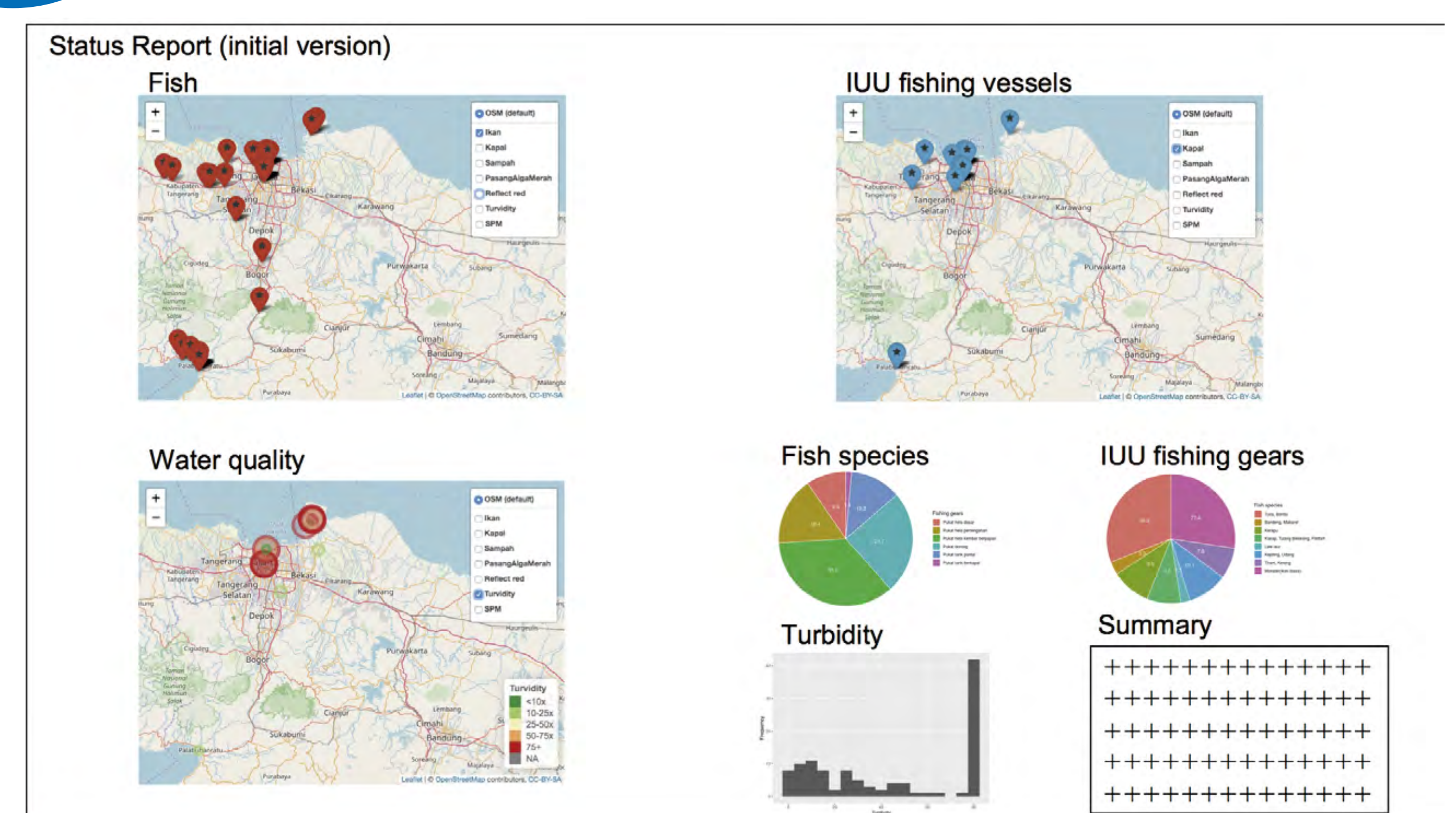* We added some fish species and re-categorized them based on the ecological characteristics.

IUU fishing gears

Before — After

* Government officers pointed out the gaps between the App and the list of illegal fishing gears by Indonesian government.
* We re-categorized fishing gears based on the goverment's list.
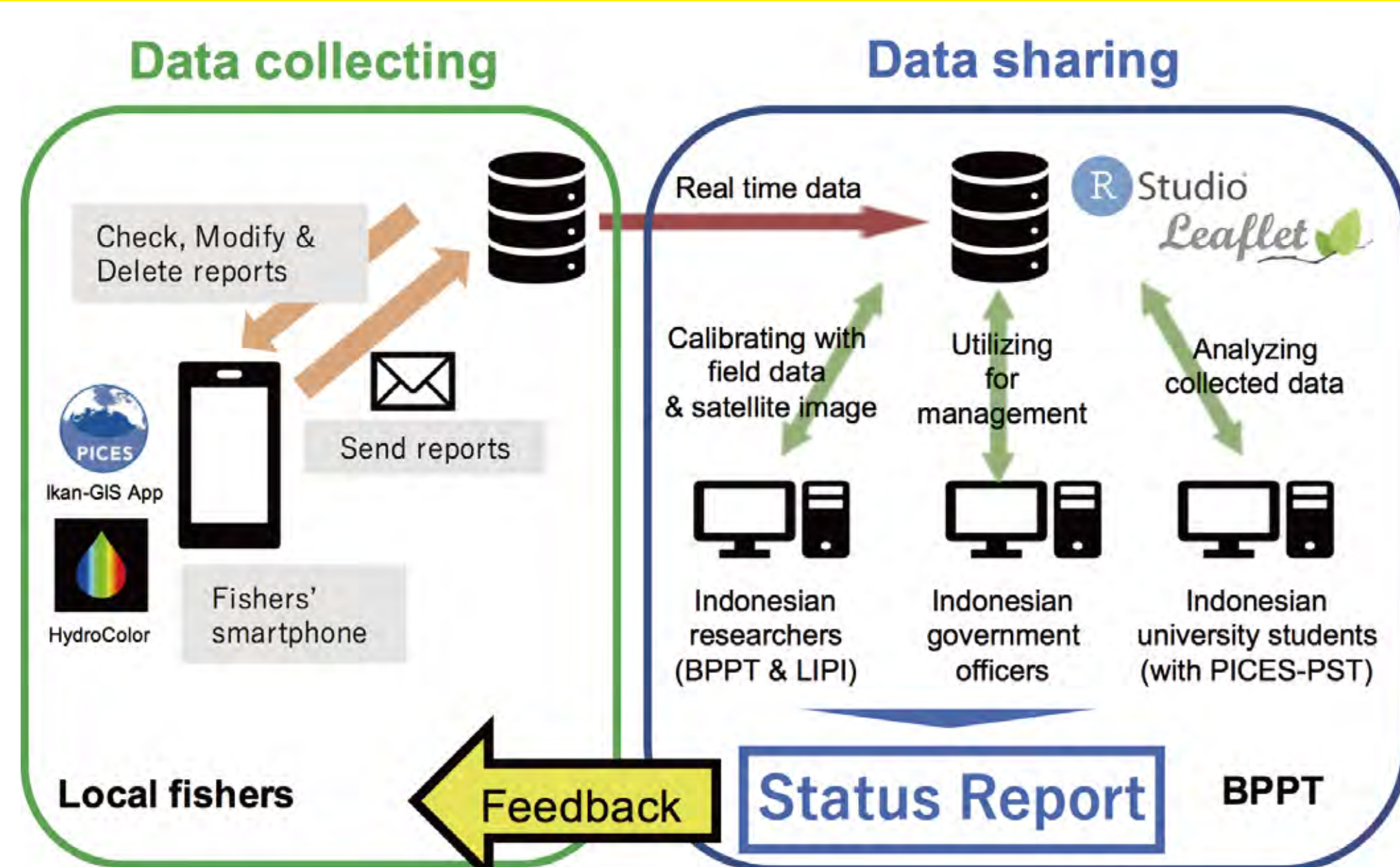
3 Operation manuals
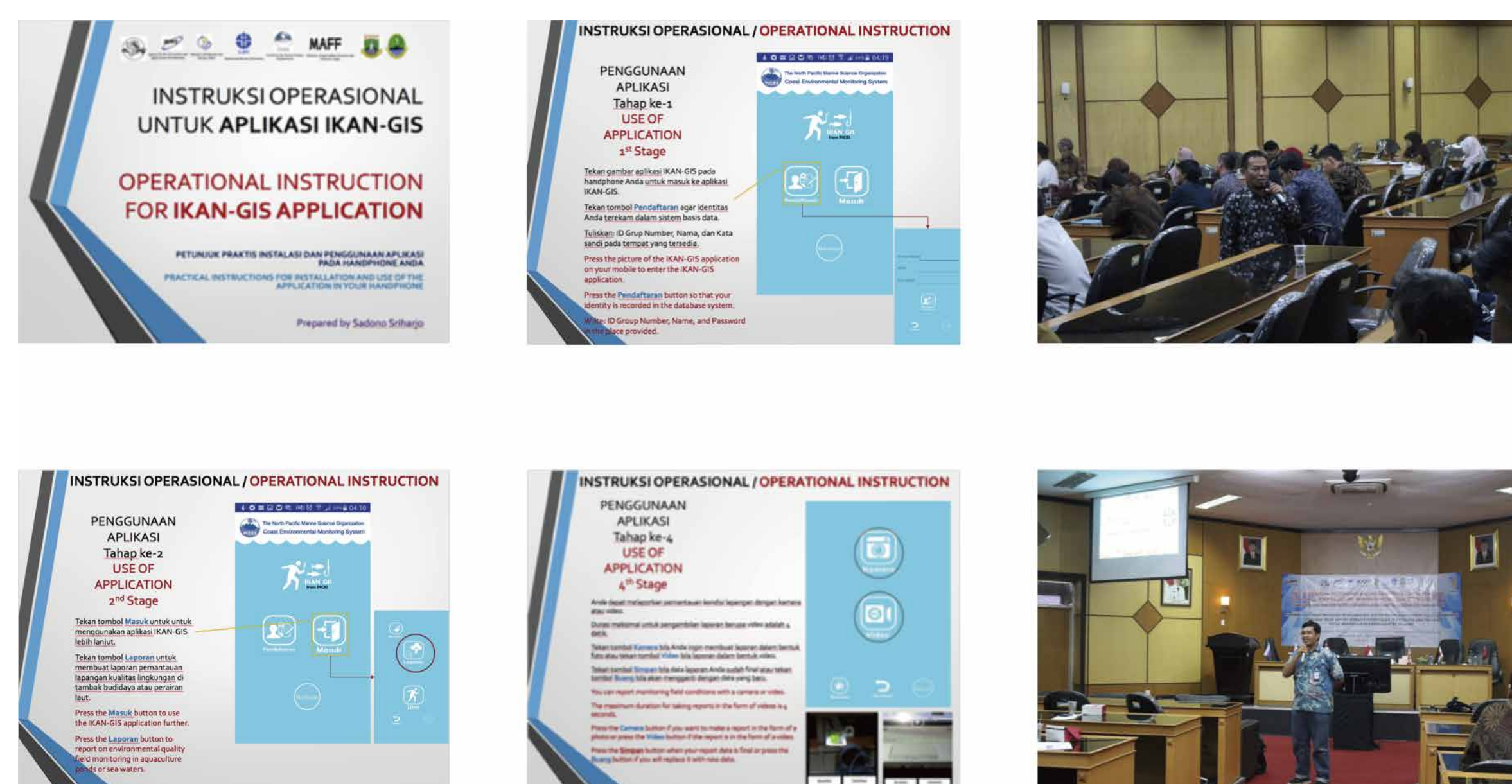
* BPPT staffs prepared the operation manuals of IKAN-GIS app (Indonesian and English) and teached how to use IKAN-GIS app to fishers at training course.
* Local fishers can easily install the app on their own smartphone and try to report by themselves through the training course.

4 Data sharing system

Status Report (initial version)
Fish — IUU fishing vessels
Water quality — Fish species — IUU fishing gears
Turbidity — Summary

* Monitoring results are stored on the cloud server.
* A preliminary status report can be automatically outputed from the database in the cloud server.

Conclusion

Data collecting — Data sharing

Check, Modify & Delete reports — Send reports
PICES Ikan-GIS App — HydroColor — Fishers' smartphone
Local fishers — Feedback — Status Report — BPPT

Real time data — R Studio Leaflet
Calibrating with field data & satellite image — Utilizing for management — Analyzing collected data
Indonesian researchers (BPPT & LIPI) — Indonesian government officers — Indonesian university students (with PICES-PST)

* Administrative officers and researchers in Indonesia can utilize IKAN-GIS system for research projects and coastal management.

Working on the smartphone app, we faced various challenges.

* Local fishers' smartphone device and OS are often old .
* Cell phone signal is weak at fishing ground in Indonesia.

But, these challenges proved to be an opportunity to learn from each other.

* The local fishers and government officers learned the concepts and importance of coastal monitoring from the PST,
* we learned the realities and needs of the local communities on how to implement the monitoring using smartphone technology.

Smartphone technology facilitates dialogue and discussion between local fishers, local goverment officers, BPPT staffs and PST as boundary object.

References: 1. Dickinson et al. 2010. Annual Review of Ecology, Evolution, and Systematics 41:149–172.
2. eBird. https://ebird.org/home
3. iNaturalist. https://www.inaturalist.org/
4. Humber et al. 2017. Fisheries Research 186:131–143.