

The Pew Charitable Trusts  
1<sup>st</sup> Global Artificial Intelligence in Fisheries  
Monitoring Summit Report  
2023



Kyle LaFerriere WWF-US

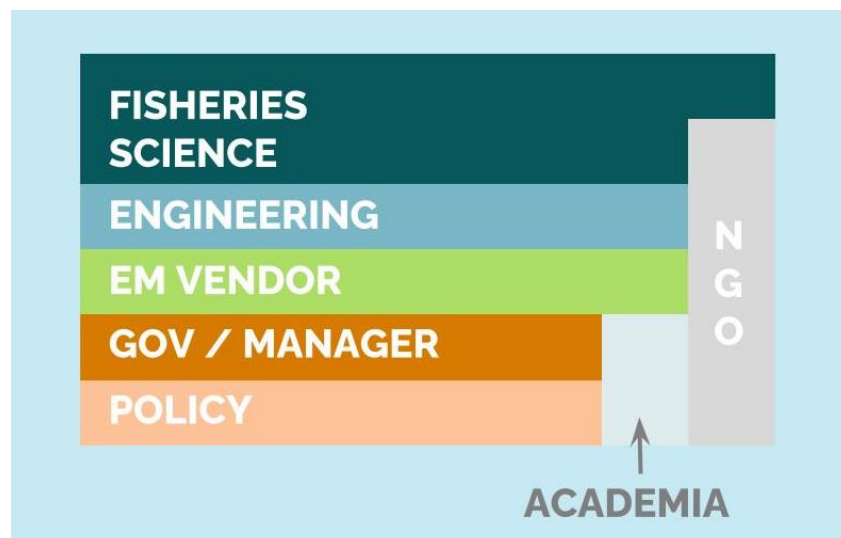
The Pew Charitable Trusts hosted a Global Artificial Intelligence in Fisheries Monitoring Summit in Atlanta, Georgia from January 17-18, 2023. It brought together 40 experts from across the globe (Asia, Africa, North America, Europe, Australia, and the Pacific Islands) to discuss how artificial intelligence and machine learning (AI/ML) can help secure greater transparency and accountability throughout the world's fisheries. Attendees presented their experiences implementing these emerging technologies and discussed perceived obstacles to its expanded use alongside ways to overcome those challenges.

The two days were divided into seven sessions, which included presentations, panel discussions, Q&A sessions, and breakout groups. Many of the topics discussed were first raised during Pew's [Global Electronic Monitoring Symposium](#) in 2022. The sessions and the main takeaways from each are summarized below.

## Pre-Summit Survey

Before the Summit, attendees completed a short survey to gather information on their role and background, how they define AI, how they are currently using AI for electronic monitoring (EM), and where they would like to use AI by 2025.

Most participants had a background in fisheries science or engineering with fishery managers, government, academic, and NGO representatives also present.

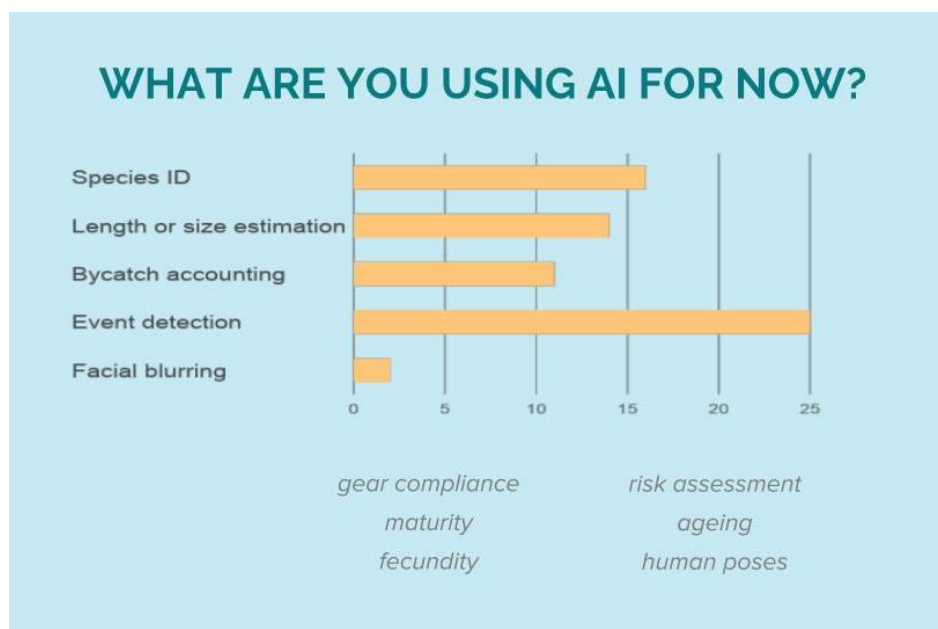


When asked to define artificial intelligence, participants generally described AI as:

- Machines or programs that **SIMULATE** or mimic human intelligence;
- A way to automate processes that find patterns, streamline review, increase efficiency, etc. **BETTER** than humans can;
- Able to make decisions **INDEPENDENTLY** of humans;



When asked on their current applications of AI in the electronic monitoring of fisheries, most participants indicated event detection, followed by species identification and length/size estimation.



Looking ahead, participants were asked about their goals for AI by 2025. Overall, participants were interested in AI because of the potential to make things easier and cheaper, especially for those activities that are challenging, repetitive, and/or time consuming for humans.

### 2025 FISH AI GOALS:

reduce costs	risk assessment
reduce manual (human) review / fully automate review	labor issues
reduce footage size	automated analysis that improves timeliness
protected species ID/event detection	activity recognition
"untoward behaviors"	fish quality
recruitment forecasting	bycatch survival

## Introduction to AI/ML

The session started with a presentation on AI/ML 101, which included an introduction to terminology and the basics of automating data flows. It also included a Q&A session.

The discussion focused on three areas: development, costs, and the evaluation and acceptance of AI models.

### Model Development

- 85% of algorithm projects don't make it into production – they are too costly, too complex, and/or they take too long to develop.
- When considering incorporating AI into an EM system or program, program managers first need to decide why AI is required, then develop a model, figure out how to utilize or deploy the model, then revise the model based on experiences and outcomes.
- The first step when thinking about utilizing AI is identifying goals for its utilization, as they will directly impact the cost of development
- Program managers and developers should avoid adding complexity if it will not improve performance.

## Costs

- Most of the cost of incorporating AI into EM is not driven by model development and training, but spent on data curation and then maintenance.
- Maintenance costs are driven by the level of automation and complexity of the task.
- Costs will also increase if there are higher integration needs (e.g. with multiple software vendors or software programs).

## Evaluating and Accepting AI Models

- There are several questions that can help evaluate the effectiveness or acceptability of an AI product:
  - What happens if the model sees something new?
  - How confident is the model in its output - can the results be trusted?
  - Can it flag when it's uncertain?
  - What types of error is it prone to?
  - When looking at the full cost of developing, implementing, and maintaining the product, is it really addressing a pain point or saving time or money? (Money savings may not come up front, but there may be an immediate value added in terms of speed or capacity).
- Acceptance requirements will be different for models that flag activity for further human review, and for those that fully automate the process.

## A Snapshot of AI Applications

The session included presentations on completed projects, including AI applications that focused on identifying fishing operations, gears, and species, estimating fish lengths, highlighting discards, monitoring vessels leaving and entering ports, detecting transshipments, and identifying safety risks onboard. The presentations were followed by a Q&A and discussion session.

During the discussion, there was general agreement that:

- Going from proof of concept to a fully integrated and approved tool can be a slow process, and requires early buy-in/support from project funders and/or regulators.
- It is important for governments to identify AI as an essential tool to help solve management problems, in order to catalyze model development.

- Commercial fishing entities are more likely to fund the development of private AI applications when they are not linked to government requirements (logbooks, etc.), but instead promote things like health and safety and/or improve business operations or reduce costs.
- In some cases, including with heterogeneous fleets, it does not matter how good an algorithm is if it's only been trained from data from 5% of the fleet, as it won't be representative of, or applicable to, the full fleet. In a limited data situation, it is better to have less data from more vessels.

## Governments as the End User

The session focused on developing AI models for governments, including group discussion on current roadblocks for effective solicitation, development, and implementation.

During the discussion, there was general agreement that:

- When soliciting AI models, governments need to be clear about what needs to be achieved, improved, and/or enhanced; the desired level of veracity that the model can achieve; the acceptance and verification protocols that will be used to judge the model's performance; and the steps and requirements of the procurement process.
- Clear objectives are necessary, but developers also need information on metrics for successes, weighting for scoring the proposals, and the specific evaluation steps.
- Data availability (for algorithm training purposes) continues to be an issue – there is a need for countries to work together, including with 3rd parties, to increase the amount of publicly-available images and footage.
- Provider input to the government development process can be very helpful to develop effective and realistic short, medium, long term investment plans.

## Performance Metrics & Confidence Levels

This session included presentations on increasing the accuracy of model results, sources of model error, and validating the effectiveness of AI models. The presentations were followed by a Q&A and discussion session.

During the discussion, there was general agreement that:

- Transferability, or the ability for an algorithm to effectively function across multiple environments (different fleets, gear configurations, etc.) is tough to ensure, especially for rare events.
- There needs to be a balance between recall (correctly identifying the number of events) and precision (correctly categorizing an event) when designing AI models.
- There is a need to explore ways for analysts to create training images during their reviews, especially for rare events.
- When evaluating model performance, decision makers should not let “the perfect get in the way of the good enough”.
- There should be consideration in using other sensors or sources of data to support or validate AI models.

## Tackling AI Assumptions & Managing Expectations

This session included presentations on AI-related assumptions and expectations from the viewpoints of a government regulator and an EM developer, followed by a Q&A and discussion session.

During the discussion, there was general agreement that:

- Program managers can build mutual understanding by creating an environment where there is freedom to be curious and ask questions as well as develop a common understanding of what is required from each party. Questions that should be asked include:
  - What data do regulators require?
  - How is AI developed - what are the steps and the language?
- Developers should avoid overpromising on timeframes and/or cost.
- Stakeholders, including governments need to be clear on restraints, such as procurement processes and rules; acceptance and deployment requirements; limits on long-term contracts; and privacy regulations.
- AI software is not a one-time investment, it needs constant attending
- Governments usually only want to be involved with one company for their EM program - not multiple vendors.
- There is a tendency to be too critical and/or strict on AI performance compared to accepted standards for EM reviewers/human observers.

## Next Steps: Terminology & Glossary Development and Identifying Future Areas of Work

During the Summit, attendees were divided into breakout groups where they discussed terms that should be included in an AI/ML glossary for stakeholders. A provisional list was developed, and will be further refined in the future.

Attendees also discussed priority areas for exploration and progress, including potential topics for future research, including (in no particular order):

- Creating a benchmark for evaluation metrics
- Presentations of case studies on contracts and procurement, including examples of full development and implementation cycle
- Improving the amount & quality of available training data, including increasing data sharing and mining of existing data
- Legal implications of using AI for enforcement
- Data retention, disposal, and security
- Creating flexible regulations & policies when technology keeps evolving
- Use AI to increase protect fisher privacy
- Program structures and business model that drive progress
- Standards and formats for data exchange between EM vendors and AI vendors
- How to evaluate success using real-life examples of metrics and confidence levels, testing, evaluation, and auditing
- Scalability/transferability
- AI beyond EM
- Edge based processing

Pew is currently planning to hold the next AI in Fisheries Summit in January 2024, where several of these topics may be discussed in more depth.

## Acknowledgements

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