The Fisheries Integrated Modeling System, a new modular paradigm for fisheries stock assessment software

Christine Stawitz

NOAA Fisheries, Office of Science and Technology

Fisheries Integrated Modeling System

A flexible suite of software tools to support sustainable fishery management

What is FIMS?

- A suite of software tools.
- Stock assessment at core.
- Connects to ecosystem, climate, and economic models/data.
- Very flexible for innovative future modeling work.
- Collaborative community effort.
- Addresses numerous priorities.

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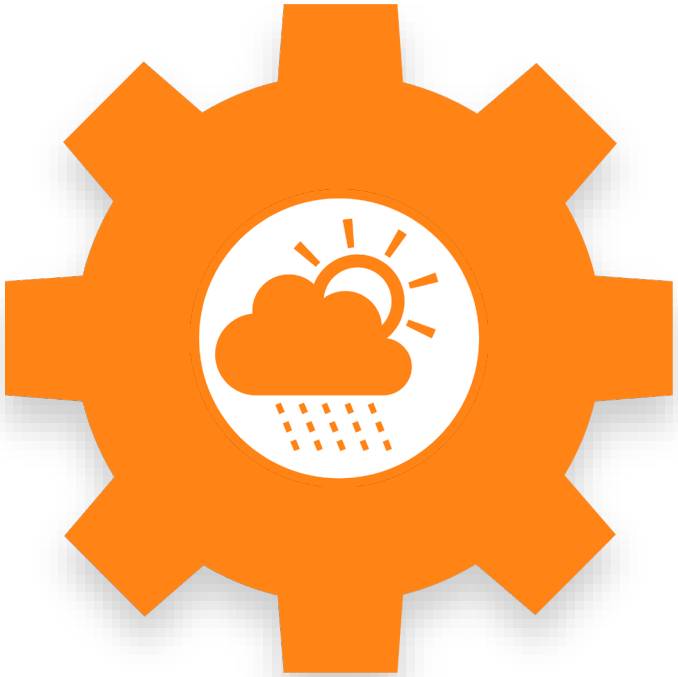
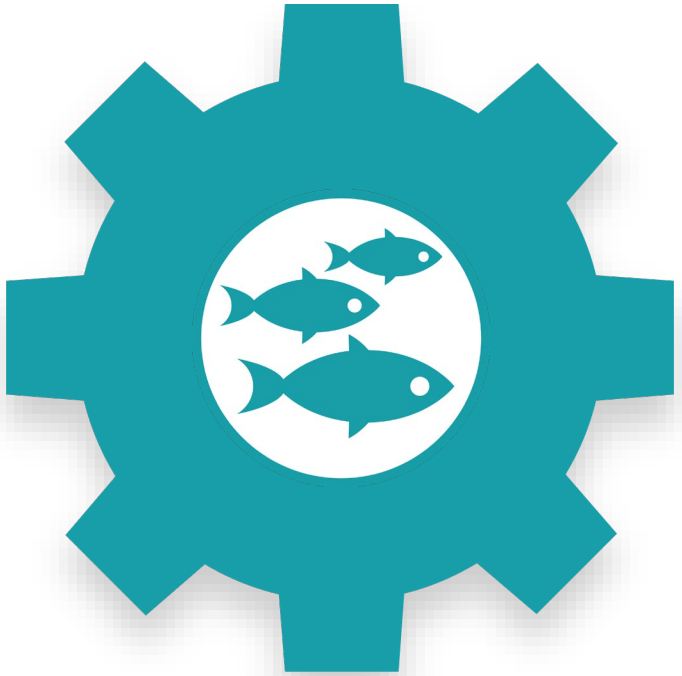
Why is FIMS needed?



Climate and Ecosystem



Fish Species
Population Dynamics

Human Dimensions

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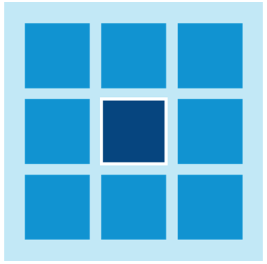
Why is FIMS needed?



Models developed in a research context are not scalable, flexible, or maintainable.

Inflexible	Difficult to maintain	Can't leverage modern computing
• Hard to customize. • Hard to add new features.	• Not modular. • No dedicated support structure.	• Dependent on legacy platforms and software languages.

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Collaborating to Build FIMS

Developed and maintained by a community of collaborators.

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Leadership
- Oversight

Office of Science and Technology Team
- Project management
- Testing
- Software development

Science Center Representatives
- Software co-development

Subject Matter Experts
- Advice (on ecosystem and socioeconomic development)

Review and Feedback

Council of External Partners and Experts
- Bi-annual meetings
- Peer review and feedback

Open Science Community

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Collaborating to Build FIMS

Implementation Team

Office of Science and Technology

Project Management

- Christine Stawitz

Software Development

- Matthew Supernaw
- Andrea Havron (ECS Federal)
- Kathryn Doering

Testing and Documentation

- Bai Li (ECS Federal)

Subject Matter Experts

- Kristan Blackhart
- Howard Townsend

Regional Experts

- Jon Brodziak (PIFSC)
- E.J. Dick (SWFSC)
- Kelli Johnson (NWFSC)
- Huihua Lee (SWFSC)
- Chris Legault (NEFSC)
- Tim Miller (NEFSC)
- Cole Monnahan (AFSC)
- Ian Taylor (NWFSC)
- Jane Sullivan (NEFSC)
- Kyle Shertzer (SEFSC)
- Nathan Vaughan (Vaughan Analytics)

Collaborating to Build FIMS

Individual Advice and Information Sharing

FIMS Council

Academic Partners
- UW
- UC - Davis
- Rutgers

Fishery Management Council SSC
- NPFMC
- MAFMC

International Management Bodies
- ICES
- CSIRO

International Model Developers
- NIWA
- JRC

Synergistic NOAA Groups

NOAA Fisheries
- Climate Fisheries Initiative
- Ecosystem Modeling Strategy
- Human Integrated - EBFM
- SAIP Implementation
- Fisheries Integrated Toolbox
- EBFM Roadmap

Greater NOAA
- Unified Modeling Committee
- OAR
- NESDIS

Project plan

Timing and software development lifecycle

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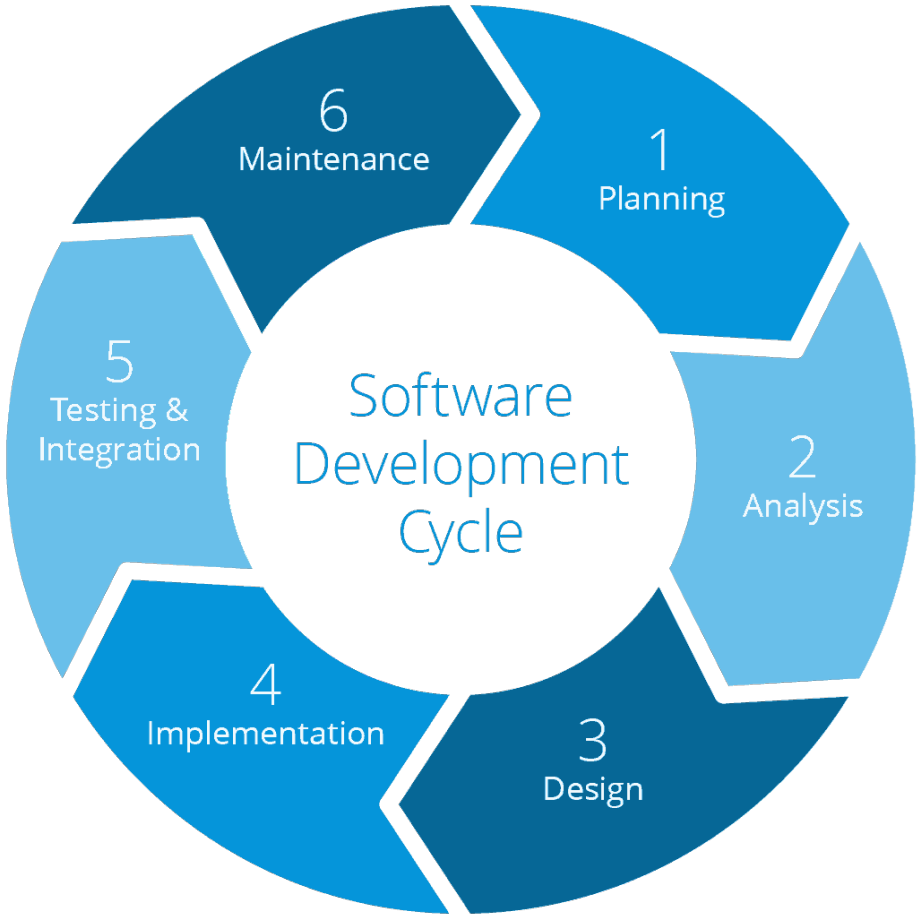
Software development lifecycle

Development is one part of the cycle.



- Planning and requirements process before implementation.
- Iteration allows for testing and incremental builds = greater stability.
- Production-level software.
- A research and development branch that becomes integrated into production.

Development timeline

Fall-Winter 2022
Integrating, testing, and stabilizing

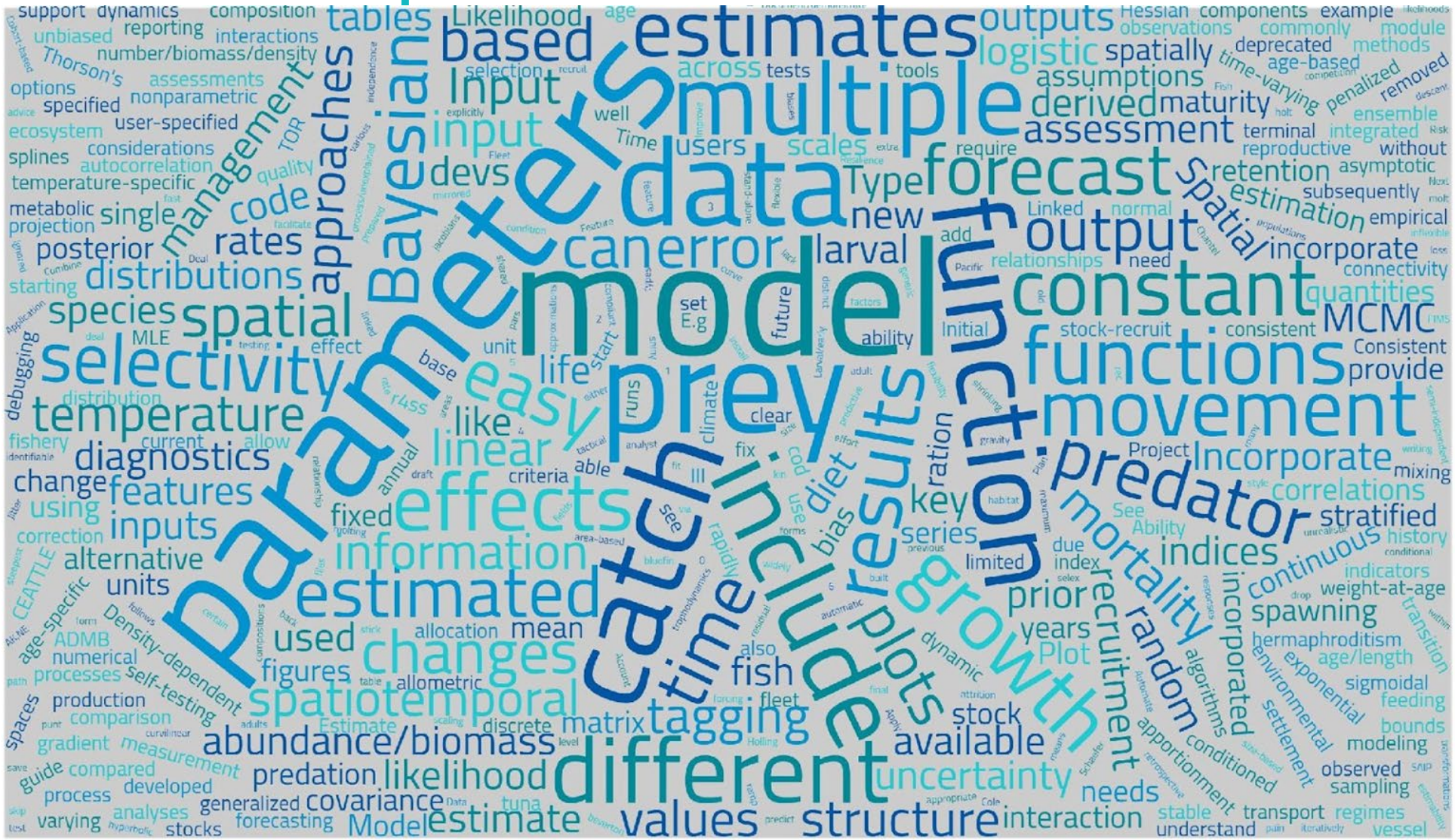
Assembling team
Eliciting and prioritizing requirements
Outlining and writing implementation plan

We are here

Spring - Summer 2022
Development milestone 1

Writing software design and developer handbook

Elicited requirements



FIMS timeline for future cycles

- M1: Get output that matches Li et al.'s model comparison project (Sept-Oct)
- Run FIMS with pilot stocks from each region (2023)
- M2: Present comparisons to regional councils (2023-2024)
- Apply FIMS in tactical assessments used for management (2025-on)

Sharing the model and facilitating an open-source-like development and user community is a key goal.

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M2 goals: minimum needed for pilot

- Estimate historical time series (recruitment, F)
- Provide stock status determination (basic reference points)
- User-friendly way to run model and extract and view output
- Simulation via parameter distributions using TMB and estimation with uncertainty (Hessian)
- Project catch and provide management advice (simple F based projection)

FIMS is a bridge to next generation models.

- Systematic planning and development process to ensure scalability.
  - Community engagement is key

- Separate modules and flexible interfaces.
  - Smooths research – operations pipeline.
  - Reuse parts in MSE, ecosystem, econ models.

- Provides a solid foundation

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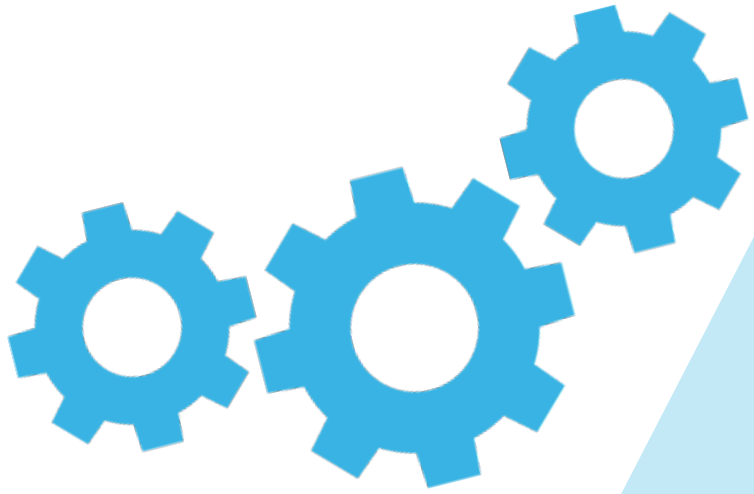
Key Benefits of FIMS

*Helps move toward a more **integrated** and **interdisciplinary** approach to modeling and management.*



Very flexible and simple to use for innovative work.

Scales information from simple (data-limited) to complex (data-rich).

Helps scientists develop integrated models that connect components.

Developed and maintained by the community.

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Thank you!

https://www.fisheries.noaa.gov/national/population-assessments/fisheries-integrated-modeling-system

christine.stawitz@noaa.gov

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