SustainaBlue

HEIs stands for Higher Education Institutions

Fisheries Management and Stock Assessment

Module 2: Fisheries and Aquaculture Sustainability

Duration: 1 Hour

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Project: 101129136 — SustainaBlue — ERASMUS-EDU-2023-CBHE

USM UNIVERSITI SAINS MALAYSIA

APEX™

SustainaBlue
HEIs stands for Higher Education Institutions

PROJECT PARTNERS

Malaysia

Universiti Malaysia Terengganu UMT

Universiti Sains Malaysia

APEX

Persatuan Kemajuan Akuakultur Malaysia
Malaysia Aquaculture Development Association

Indonesia

Universitas Indonesia
Veritas, Probitas, Iustitia

ITS Institut Teknologi Sepuluh Nopember

Greece

Πανεπιστήμιο Αιγαίου
University of the Aegean

symplexis

AEGEAN rebreath

Cyprus

University of Cyprus
Oceanography Centre

Center for Social Innovation
www.csicy.com

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.

Project: 101129136 — SustainaBlue — ERASMUS-EDU-2023-CBHE

SustainaBlue
HEIs stands for Higher Education Institutions

Content

Co-funded by
the European Union

The Need for Fisheries Management

SustainaBlue
HEIs stands for Higher Education Institutions

- Fisheries have substantial social and economic importance.
- However, a large proportion of the world's exploited fish stocks are fully exploited, over-exploited, depleted, or in need of recovery, and many are affected by environmental degradation, particularly in the inland and coastal areas.
- New technological developments enhancing the ability of fishers to exploit more living resources more intensively, potentially increasing the severity of the problem

Co-funded by
the European Union

Can fisheries be sustainably harvested?

SustainaBlue
HEIs stands for Higher Education Institutions

Stock Asssessment

Fisheries Management

Technology and Innovation

Co-funded by the European Union

Sustainable Harvesting of Fisheries

SustainaBlue
HEIs stands for Higher Education Institutions

What is stock assessment?

- Stock assessment is a scientific process in which all available data on a fish stock are combined to estimate what the historical trends in abundance are, what the percentage harvested is, and how productive this stock has been.
- Collect and analyze data on fish stocks
- Estimate their current health and population size
- Provide advice on sustainable harvest levels.

Co-funded by
the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

How Scientists Estimate Stocks in Stock Assessments

The Basic Population Dynamics Model

- Nearly all the stock assessment models used in fisheries today are based on some kind of population dynamics model

Example of Calculating Next Year's Population

- The most basic way to predict the size of next year's fish stock is with this formula:

The number of fish alive this year (N1)

– those that die this year (D1)

+ those that are born this year (R1)

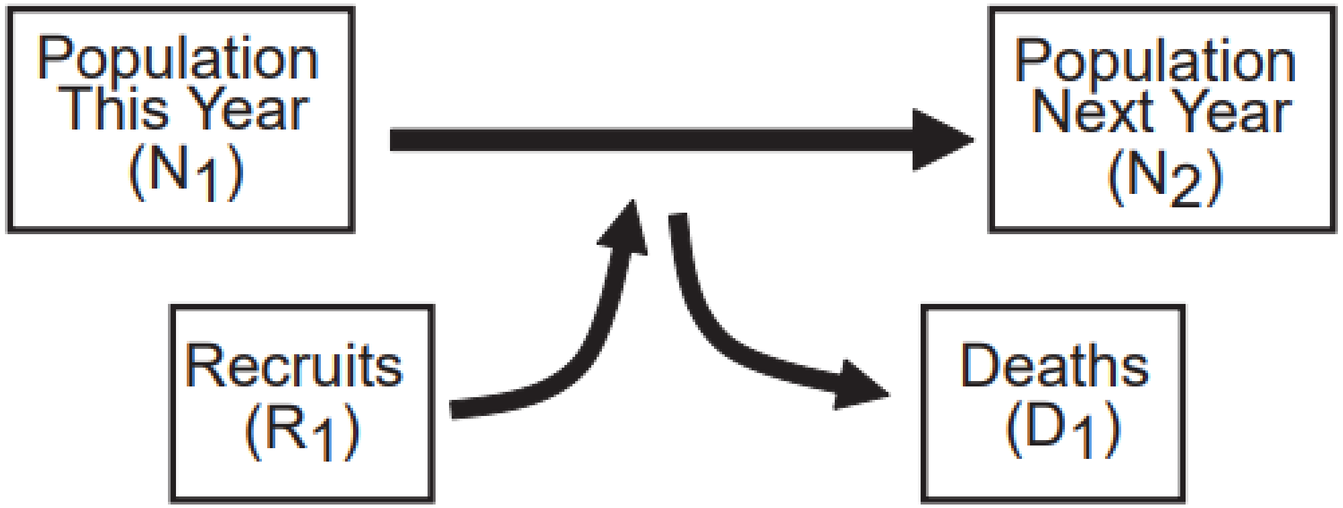
= the number alive next year (N2)

(N2 = N1 - D1 + R1)

Co-funded by the European Union

Source: Cooper, A. (n.d.)

SustainaBlue
HEIs stands for Higher Education Institutions



$$(N2 = N1 - D1 + R1)$$

Source: Cooper, A. (n.d.)

Calculating Next Year's Population

Co-funded by the European Union

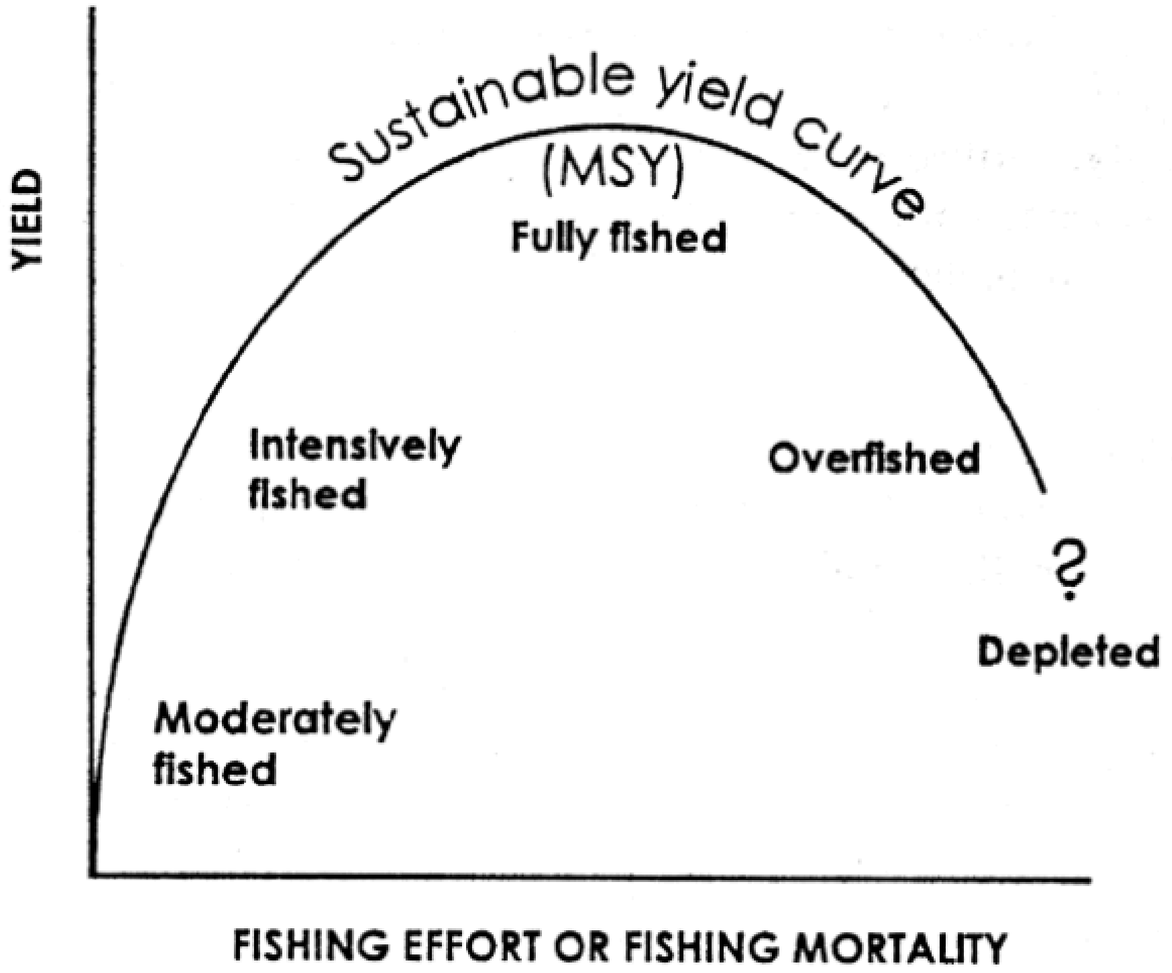
Picture from: https://www.pew.org/~/media/legacy/uploadedfiles/peg/publications/report/AGuidetoFisheriesStockAssessmentpdf.pdf

What is Maximum Sustainable Yield (MSY)?

- It is a harvest strategy widely adopted in global fisheries, including the EU Common Fisheries Policy.
- seeks the largest long-term, predictable catch possible from a stable, 'equilibrium' environment.

"The average catch that can be taken from a stock over the long term without depleting it."

(The Fisheries Secretariat, n.d.)



Source: FAO

Co-funded by the European Union

SustainaBlue

HEIs stands for Higher Education Institutions

Fisheries Management and Management Approaches

Co-funded by
the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

Purposes of Fisheries Management

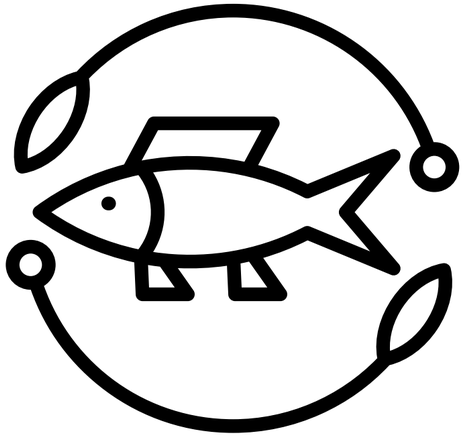
- To avoid biological and economic overfishing.
- To maximize sustainable yield while maintaining fish populations.
- To preserve marine ecosystems by minimizing ecosystem impacts.
- To ensure sustainable food production and economic benefit for communities.
- To regulate harvest pressure and balance ecological and human needs.

Source:(Hilborn & Hilborn, 2012).

Co-funded by
the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

quotas



closed seasons

gear restrictions

Co-funded by the European Union

Fisheries Management tools

SustainaBlue
HEIs stands for Higher Education Institutions

Fisheries Management tools

quotas

- Quotas are limits on how many fish can be caught.
- Implemented as Total Allowable Catch (TAC) divided into Individual Fishing Quotas (IFQs) or Individual Transferrable Quotas (ITQs)
- To end the “race to fish,” increase safety, and ensure sustainable harvests
- **Example**: The Alaska halibut fishery switched to an IFQ system in 1995.

closed seasons

- Specific times of year when fishing is not allowed, often to protect spawning fish
- Reduce fishing pressure during vulnerable life stages
- **Example**: Traditional tools like closed seasons were used in Chile's loco fishery but proved ineffective without stronger enforcement.

gear restrictions

- Limits or bans on certain gear types, such as trawls or gillnets, especially in sensitive habitats
- Protect ecosystems and reduce bycatch.
- **Example:** Restrictions on bottom trawls in sensitive areas and the use of turtle-excluder devices (TEDs)

Co-funded by the European Union

Source:(Hilborn & Hilborn, 2012).

SustainaBlue
HEIs stands for Higher Education Institutions

Management Apporaches

1

Input controls (effort limitation).

- Input controls aim to indirectly manage fishing mortality by limiting how efficiently fishermen can catch fish, for example, by limiting the number and size of fishing vessels. They are easy to implement (because they require less monitoring, i.e., don't have to count all the fish that are caught) and are appropriate for small-scale fisheries (FISHE, 2016).

1

Output controls (catch limits).

- Output controls directly regulate the quantity of fish that are caught
- Harder to enforce than input controls because they require tracking the catch through one or more monitoring and catch accounting methods (FISHE, 2016).

Co-funded by
the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

Management Apporaches

3 Spatial management

- Marine Protected Areas (MPAs) are designated parts of the ocean where human activities are restricted or regulated to safeguard the marine environment. Within MPAs, some zones may be classified as marine reserves or no-take areas, which are fully closed to all forms of fishing and often other extractive activities. These represent the most stringent types of MPAs.

4 Ecosystem-based management(EBFM)

- Ecosystem-based fisheries management is an integrated approach to managing fisheries and marine resources that considers the entire ecosystem surrounding the target species.
- Its main objective is to keep ecosystems healthy, productive, and resilient, ensuring they continue to deliver the benefits and services that people rely on.(NOAA, n.d.)

Co-funded by
the European Union

SustainaBlue

HEIs stands for Higher Education Institutions

The development in Technology and Innovation

Co-funded by the European Union

SustainaBlue

HEIs stands for Higher Education Institutions

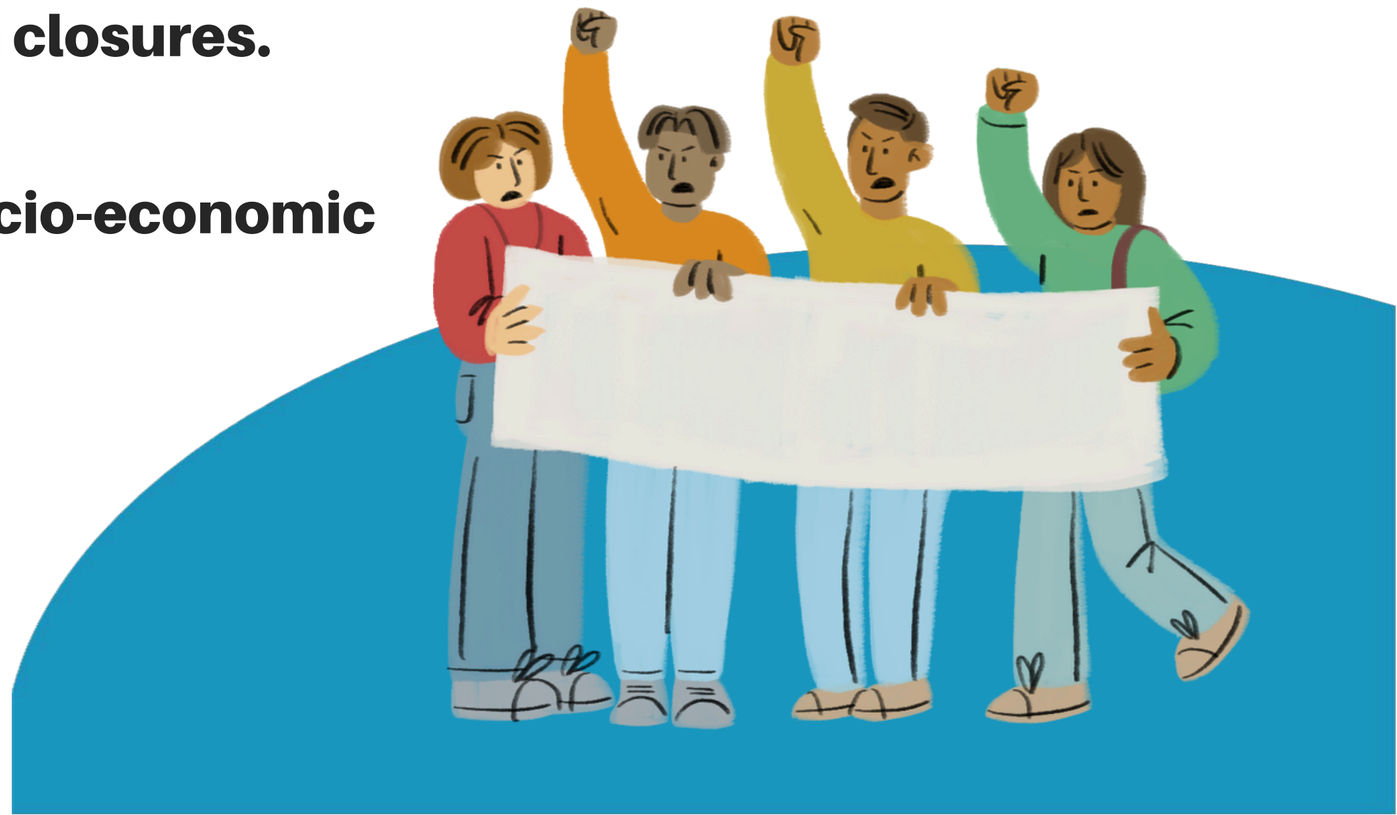
- Use of satellite data, e-logbooks, DNA barcoding
- Mobile apps for small-scale fishers
- Real-time monitoring and participatory data collection.

Co-funded by the European Union

Activity

SustainaBlue
HEIs stands for Higher Education Institutions

- **Use an online or classroom tool to simulate managing a fishery.**
- **Adjust effort, quota, and season closures.**
- **Observe stock response and socio-economic outcomes.**



Co-funded by
the European Union

Summary

SustainaBlue
HEIs stands for Higher Education Institutions

- Effective management ensures resource sustainability.
- Stock assessments guide decisions.
- Technology supports smarter, inclusive fisheries.

Co-funded by
the European Union

Bibliography

1. Hilborn, R., & Hilborn, U. (2012). *Overfishing: What Everyone Needs to Know*. Oxford University Press. (Accessible overview of fisheries problems and management solutions)
2. FAO. (1997). *Fisheries Management*. FAO Technical Guidelines for Responsible Fisheries No. 4. Rome: FAO. (Guidelines on approaches and tools for sustainable fisheries management)
3. The Fisheries Secretariat. (n.d.). Www.fishsec.org. https://www.fishsec.org/management-strategies/msy-objective/
4. Cooper, A. (n.d.). A Guide to Fisheries Stock Assessment From Data to Recommendations. Retrieved July 3, 2025, from https://www.pew.org/~/media/legacy/uploadedfiles/peg/publications/report/AGuidetoFisheriesStockAssessmentpdf.pdf
5. Types of Harvest Control Measures | FISHE. (2016). Edf.org. https://fishe.edf.org/node/99
6. National Oceanic and Atmospheric Administration. (n.d.). Understanding Ecosystem-Based Fisheries Management. https://www.fisheries.noaa.gov/insight/understanding-ecosystem-based-fisheries-management
7.

Co-funded by the European Union

SustainaBlue
HEIs stands for Higher Education Institutions

THANK YOU

ASSOC. PROF. DR MAHADI MOHAMMAD

+6012-472 2912

mahadi@usm.my

Co-funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.
Project: 101129136 — SustainaBlue — ERASMUS-EDU-2023-CBHE