fish610.5 Trade-offs

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1 Ecological Trade-offs

1.1 Learning Objectives

1.1.1 Details

Learning Objectives 1

- Explain the trade-offs which are associated with discarding and discard regulations
- Explain the ecological trade-offs which occur within and between sectors
- Explain the bio-economic trade-offs
- Explain how EAFM addresses these trade-offs

1.2 Balancing Production and Conservation

- Types of trade-offs
- Major Bio-economic trade-offs

1.2.1 Details

One of the key aspects of EAFM planning is balancing conflicting interests. For example, within any fishery, it is important to balance production needs with conservation needs. Thus, one of the building blocks of all EAFM plans is to ensure sustainable fisheries while maintaining ecosystem function. To do this, social, economic, and biologic needs need to be considered and simultaneously evaluated. In other words, within EAFM planning the impact of a particular management decision must be simultaneously evaluated from a social, economic, and biologic perspective.

For ease, in this tutorial we will explore these trade-offs from a biologic, economic, and social perspective respectively. Thus, in this lecture, we will look at biologic and bio-economic trade-offs.

Major Trade-offs

Biologic trade-offs can be separated into two major categories: 1) sector conflicts and 2) bio-economic conflicts. Sector conflict trade-offs address the conflicting interests between the fishery itself and the impacts on, or from, other sectors such as agriculture, aquaculture, other fisheries, tourism, etc. While bio-economic trade-offs deal with ecosystem and economic impacts of different management actions.

The subsequent slides will go into depth on these two types of trade-offs.

1.3 Trade-offs Associated with Discards

- Bycatch and discards
- Biologic issues
- Economic issues
- How EAFM address the trade-offs

1.3.1 Details

By-catch and Discards

A common topic of conflict for both sector and bio-economic trade-offs is by-catch and discards.

Definition 1: By-catch

The portion of catch which is unintentionally taken while fishing for another species.

Definition 2: Discard

'The proportion of total organic material of animal origin in the catch which is thrown away or dumped at sea, for whatever reason.' FAO fisheries glossary

Remember, discards are the by-catch which are landed and subsequently thrown overboard.

Generally speaking, the conflict surrounding discards deals with the ecological impact of discarding compared to the economic impact of not discarding.

Ecological Impacts

As seen in the 'Ecosystem Impacts of Discards' lecture, the ecosystem impacts of discarding are largely associated with fish mortality. Specifically, discarding tends to have fairly high rates of fish mortality. The high mortality rates have been found to significantly alter energy flow within a system via top-down and bottom-up trophic cascades. Specifically, if the discarded species is a predator then top-down cascades can result whereas when prey species are discarded bottom-up cascades can ensue. These interactions can result from discarding non-target species as well as discarding juveniles of the target species.

Economic Impacts

The economic impacts of discarding are largely felt by the commercial fishery. For example, economic loss can be accrued by a vessel through the:

- purchase of new, more selective gear
- lower market value of non-target species compared to target species
- selling of juveniles to alternative markets rather than human market
- counting of illegal species towards quota of target species

More information on the economic impact of discards can be found in the 'Economic Impacts of Discards' lecture.

Addressing the Trade-off

The trade-off between the economic cost of discard bans and the ecological benefit is dealt with directly within EAFM [Staples et al., 2014]. Specifically, the management decisions associated with discards and the cost mitigation methods are to be discussed in stakeholder holder meetings and then incorporated within EAFM plans.

Several different approaches have been used to minimize the cost to fishermen including:

- expanding alternative markets
- making it legal to use landed biological material as pot bait
- expanding quotas to compensate for formally discarded material
- allowing fish with high discard survival rates to be discarded
- providing larger quotas to vessel with lower discard rates

1.4 Sector Trade-offs

- What are sector conflicts
- Within sector conflicts
- Between sector conflicts
- Addressing conflicts within EAFM

1.4.1 Details

Sector conflicts, or trade-offs, deal with the impact of fishing on individuals other than competitors. Thus, sector conflicts can occur between fisheries, i.e. one fishery negatively impacts another fishery, or between a fishery and a non-fishery, i.e. a fishery and eco-tourism. The proximal cause of many of these issues are economical in nature; however, ultimately, they are ecological in nature. Therefore, the trade-offs made to combat these issues will be addressed from an ecosystem perspective.

Within Sector Trade-offs

As previously noted, within sector trade-offs are the trade-offs made between fishermen. The fishermen, however, are not fishing the same fishery; rather, one fishery is negatively impacting another. The conflict may be a result of

- incidental take (one fishery accidentally catching non-target species of commercial value, i.e. the target for another fishery)

- habitat damage (one fishery causing habitat damage which negatively affects the target species of another fishery)
- trophic cascades (discards from one fishery causing a trophic cascade which negatively impacts another fishery)

The above list is by no means exhaustive.

Between Sector Trade-offs

Between sector trade-offs occur between a fishery and an industry other than fishing. In this situation the conflict can result from the fishery negatively impacting the other industry or vice versa, i.e. an industry other than fishing negatively impacting a fishery. Examples of industries which be impacted by or impact the fishery include:

Industry	Potential Conflict	Example
Agriculture	Agricultural subsidies	Subsidizing agriculture can deflate the cost of meat making it more economical to eat meat than fish
Municipalities	Urban run-off	Run-off, such as road salt, altering water chemistry, i.e. fish habitat
Tourism	Aesthetics	Observing a fishing vessel harvesting a whale while on a whale watching tour
Off-shore Mining	Habitat destruction	Drilling for oil damaging the sea floor, i.e. fish habitat
Aquaculture	Uncontrolled development	New development harming habitat

Addressing Conflicts within EAFM

Sector related conflicts are largely addressed via stakeholder meetings. One of the key goals of stakeholder workshops are to identify potential conflicts, determine ways to minimize these conflicts, and then create resolutions. In order to accomplish this, it is important that all involved parties be present

at the workshops and that the workshops have a 'safe environment' in which everyone is comfortable stating their concerns Staples et al. [2014].

1.5 Bio-economic Trade-offs

- What are the bio-economic conflicts
- How are bio-economic conflicts addressed within EAFM

1.5.1 Details

Bio-economic conflicts

Bio-economic conflicts address the trade-off between maximizing profits, i.e. harvests, and maintaining a healthy, functioning ecosystem. In these situations, the question is really...'when does fishing negatively impact the ecosystem, i.e. at what level or with what equipment?'.

1.6 Bio-economic Trade-offs and EAFM

Within EAFM the ultimate goal is to maintain long-term sustainable fisheries and healthy, functioning ecosystems. By achieving this goal, and in turn balancing this trade-off, one ultimately ensures that profits are maximized over the long-term.

To address this trade-off within EAFM Maravelias et al. [2014] suggests using stochastic simulation and computational statistics to determine the economic and ecological impacts of different management strategies. Within these bio-economic models, stocks should be quantified across time under different scenarios in order to fully evaluate the risks. This information should then be relayed to stakeholders to maintain transparency. Similarly, stakeholders should be used as an information source during this process, i.e. acquire employment as well as production data.

1.7 Incorporating Ecological Trade-offs into EAFM

- Role of stakeholders
- Bio-economic models

1.7.1 Details

A key component of EAFM planning is to balance conservation and sustainable use of the fisheries. This balance must be sustainable for the fishery and maintain ecosystem function. Thus, trade-offs between ecological, economic, and social objectives need to be addressed within each FMU, fisheries management unit. In order to balance the conflicting needs long-term planning which involves short-term economic and social support must be accomplished.

Stakeholder Incorporation

One way to increase societal support is to incorporate stakeholders in conflict resolution. Staples et al. [2014] recommends incorporating stakeholders into planning and resolution discussions as well as using their knowledge to fill information gaps in management models.

Stakeholder workshops are suggested as a way to identify current and potential conflicts within and across sectors. Once an issue is identified, Staples et al. [2014] recommends involving a small group of influential people from all sides of the issue. These individuals can then be used as spokespersons for their respective sector. Through these negotiations, potential resolutions should be identified which can be relayed to managers and policymakers.

Stakeholder workshops can also be used to acquire information which can be incorporated into bio-economic models. Specifically, the proposed management resolutions should be incorporated into statistical models to ensure fishery and ecosystem sustainability. To obtain the most accurate projections, stakeholders can be used to provide tactical data such as employment rates, wages, profits, etc. Utilizing stakeholders as data sources also increases stakeholder buy-in and transparency which in turn increases accountability.

Bio-economic Models

To truly evaluate the trade-off between production and ecosystem health Gascuel [2012] recommends running ecosystem and bio-economic models simultaneously. Gascuel [2012] has identified 7 economic and 6 ecosystem indicators which can be used to properly evaluate these tradeoffs.

Economic Indicators	Ecosystem Indicators
Employment (FTE)	Energy consumption/ton landed
Wage per FTE	F* sustainability
Subsidies	B* sustainability
Income	Partial F
Gross Value Added	Food Web Impact Index(PPR)
Operating Cash-flow	Seafloor Impact Index
Profits/losses	

These indicators can then be placed into a bio-economic model to obtain a sustainability index for the fishery.

2 Economic Trade-offs

2.1 Learning Objectives

2.1.1 Details

Learning Objectives 2

- Explain the economic trade-offs associated with an EAFM framework in regards to revenue
- Explain how EAFM resolves these trade-offs

2.2 Decreased Revenue vs. Increased Financial Resources

- How EAFM may reduce income to fisherman
- How EAFM may increase revenue to fisherman

2.2.1 Details

Revenue Losses

Incorporating ecosystem concerns into fisheries management will likely result in new regulations which impose extra costs to fishermen. For example, discard bans are often associated with the need to purchase new gear and increased regulatory costs, some of which are imposed on the fishermen.

Other ways incorporating ecological considerations into fisheries management may result in revenue losses include:

- purchasing of new gear
  - to increase selectivity (as previously discussed)
  - to decrease habitat destruction
  - to reduce by-catch
- filling quota with non-target individuals
  - alternative markets don't pay as much
  - increased processing time
- increased surveillance
  - more on-board observers
  - more observational equipment requirements (cameras, etc.)

Financial Resources

Although incorporating ecosystem concerns into management decisions may increase fishermen's costs, EAFM tries to counterbalance these by including ways to offset these costs. For example, the increased sustainability of the fishery may open up new funding opportunities from conservation organizations. Similarly, increased cooperation among stakeholders, policy-makers, and managers could mean increased communication about funding opportunities. The increased communication can also result in decreased costs by coordinating efforts, especially in relation to monitoring and regulation.

Financial benefits can also be a result of long-term planning. Specifically, part of EAFM is to maintain long-term budgetary planning. Similarly, long-term fisheries management means more consistent and reliable landings from year to year.

A third financial benefit of EAFM is incentives. As discussed in the discards tutorial, one option within EAFM is to provide financial incentives to fishermen which consistently have low discard rates.

3 Societal Trade-offs

3.1 Learning Objectives

3.1.1 Details

Learning Objectives 3

- Explain the trade-offs associated with fishing scale within an EAFM framework
- Explain how EAFM resolves these issues

3.2 Large vs. Small Scale Fisheries

- What are small scale/artisanal fisheries and how are they different from large scale fisheries
- The ecosystem impacts of small scale fisheries relative to large scale fisheries
- What is the conflict between large-scale and small-scale fisheries
- How is this conflict resolved within EAFM

3.2.1 Details

Small-scale Fisheries

Unfortunately, there is not an internationally recognized definition for small-scale or artisanal fisheries. That is, the definition changes depending on context

- where the fishery originates from a caste, community, or tribe
- what type of gear they use, variety of gear is used, and how that gear differentiates them from other fisheries in the area, i.e. large scale fisheries
- where the fishery occurs and how long it has been around

The above pieces of information are considered when determining whether or not a fishery is "small-scale". However, the below definition can be used to summarize the type of fishing done by these fisheries.

Definition 3: Small-scale/Artisanal Fisheries

'Small-scale fisheries refer to the smallest viable fishing units with downward or lateral compatibility in fishing gear operation.'Mathew [2003]

Generally speaking, small scale fisheries are fisheries with relatively limited gear that fish from either on-shore or from a small boat. Typically, these fisheries are multi-species fisheries and use relatively selective gear such as hook and line.

These fisheries also differentiate themselves from large-scale fisheries in their regulations. In fact, the 1995 FAO Code of Conduct for Responsible Fisheries, specifically identified small-scale fisheries as an important economic contributor and stated that they should be protected [Mathew, 2003]. One of their main "protections" is to provide them with access to their traditional fishing grounds. Specifically, artisanal fisheries have priority over historical grounds.

Environmental Impact of Small-scale Fisheries

Another major difference between large-scale and small-scale fisheries are their environmental impacts. Typically speaking, large-scale fisheries impose much greater environmental harm than small-scale fisheries. This difference, has largely been attributed to the type of gear used. The gear used by artisanal fisheries tend to be more selective and cause less habitat damage than large-scale fisheries.

Conflicts Between Large and Small-scale Fisheries

There are several issues which arise between large-scale and small-scale fisheries including:

- Commercial fleets imposing on artisanal fishing grounds (traditional fisheries have first priority to historical fishing grounds)
- ITQs (individual transferable quotas) have been seen as a benefit to large-scale fisheries at the cost of small-scale fisheries

However, as technological advances become more affordable the areas for which artisanal fisheries fish becomes larger and their gear becomes more advanced. As a result, artisanal fisheries have now been found fishing within international waters and using the same gear as commercial fisheries.

Incorporating Conflict into EAFM

The conflict between these groups is largely addressed via stakeholder involvement. Specifically, both large-scale and small-scale fisheries should have representatives present at stakeholder workshops. During which time, the representatives can voice their concerns and work to appropriate resolutions Staples et al. [2014]. It is vitally important that these resolutions be incorporated into long-term management plans

4 Further Reading

4.1 Further Reading

4.1.1 Details

A large portion of the material found within this tutorial was adapted from Staples et al. [2014]. However, Staples et al. [2014] went into more depth on many of the subjects covered, thus, for further information or detail please refer to their EAFM manual.

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