

Low Impact and Fuel Efficient (LIFE) Fishing

Barriers, constraints and opportunities to transition



Petri Suuronen & Frank Chopin

Food and Agriculture Organization of the United Nations FAO

Fishing Operations and Technology Service FIRO

Fishing practices vary widely in their impacts

- Fishing activities impact the environment:
 - removals of target and non-target species
 - direct physical contact with habitats
 - GHG emissions and pollution
 - abandoned, lost or discarded fishing gear
→ “ghost fishing”
- Magnitude of impact:
 - physical characteristics of the gear
 - where, when and how the gear is being operated
 - extent and rate of fishing
- Short-term vs long-term effects!

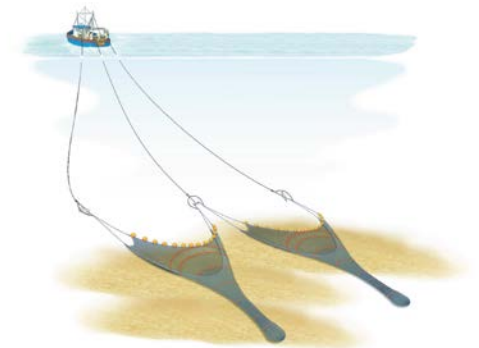
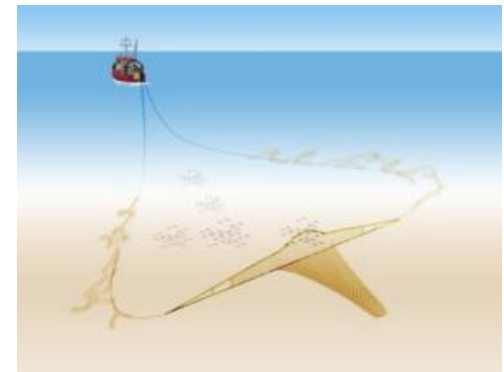
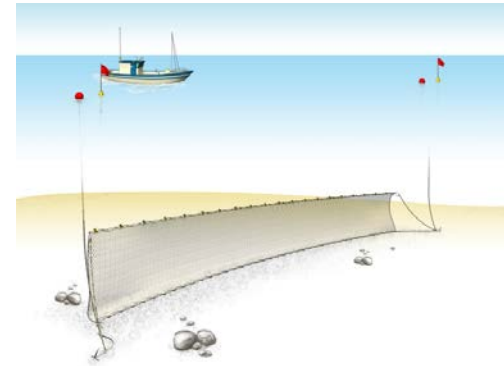


Marine Laboratory, Scotland



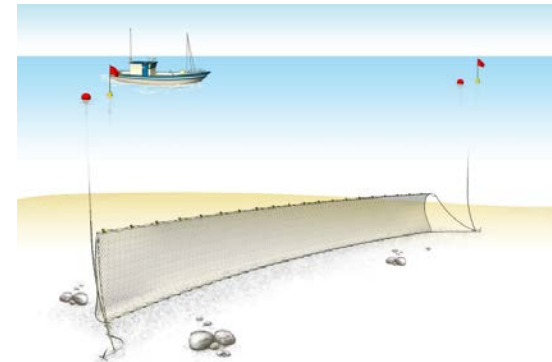
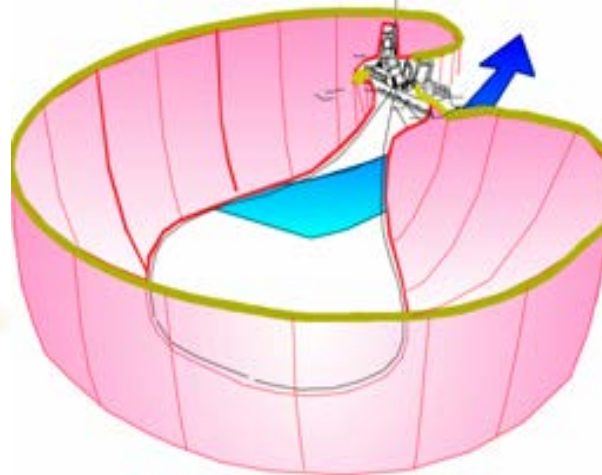
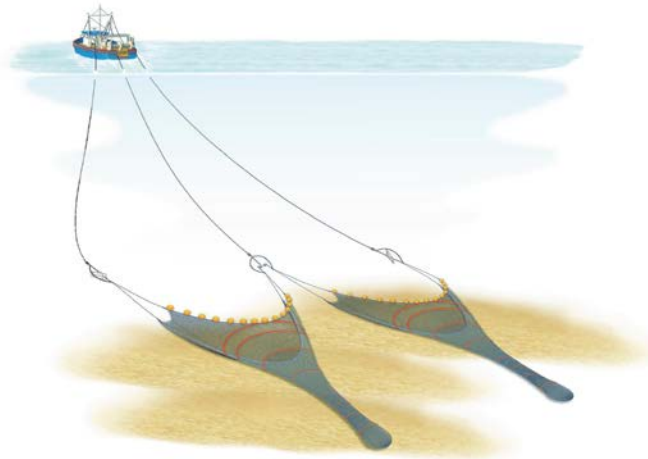
Ranking of fishing gears by impacts

- Gears that rank high for one type of direct environmental impact may have a lower rank for another
- Ranking inevitably includes value judgements (e.g. habitat impacts vs. bycatch impacts)
- Operational choices by fishers can cause similar gears to have different effects
- Nonetheless, the impacts of passive fishing gears are generally considered less severe in comparison to active gears such as demersal trawls, dredges and beam trawls.
- Bottom seines are generally considered less damaging than bottom trawls but more severe than many passive gears.



Fishing gears vary widely in fuel efficiency

Fishing Gear	Litres of fuel per kg of catch
Passive fishing gear	0.1 - 0.4
Bottom seine	0.1 - 0.5
Bottom/shrimp trawls	0.5 - 2.5
Midwater trawl	0.1 - 0.5
Purse seine	0.1 - 0.2



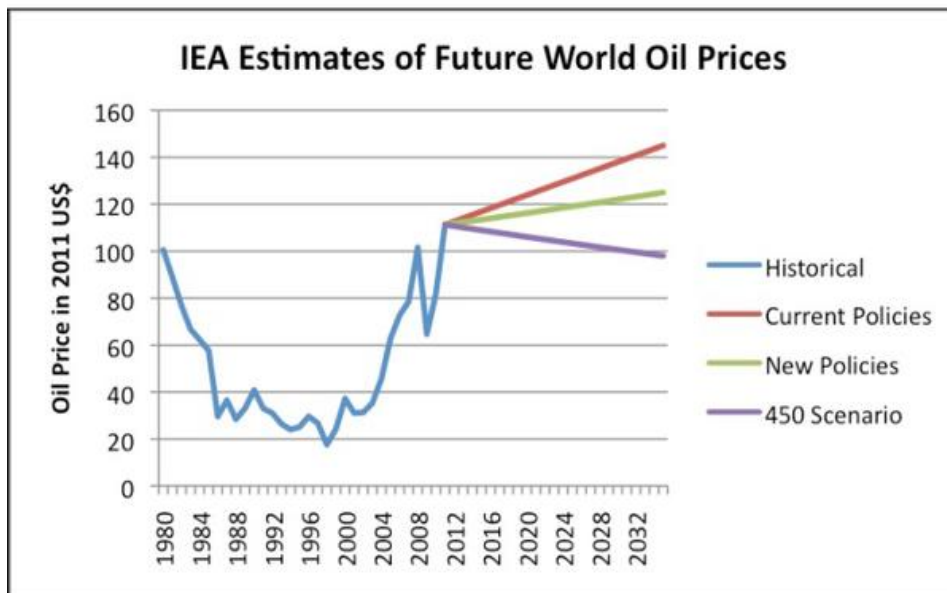
Factors affecting fuel consumption

- fishing gear and mode of operation
 - target species
 - resource availability (abundance and distribution)
 - distance between fishing ground and fishing port
 - fishing depth
 - vessel design, age, condition and operation
 - type and age of engine
 - weather, sea state, fishing ground
 - catch quotas and other regulations
 - skipper decisions
- Globally, about **0.6 litres** of fuel is used per kg fish landed (Tyedmers et al. 2005).
 - Fuel consumption is heavily dependent on the **target species**:
 - crustacean trawl fisheries and beam-trawling of sole & plaice may consume up to 6-7 litres of fuel per kg of catch.
 - Smaller vessels are not necessarily better as regards fuel consumption per unit of catch.



Rising fuel prices a major challenge for many fisheries

- The exposure of fishing sector to rising fuel prices present major challenges for its viability:
 - operating costs are soaring
 - alternative energy sources (*e.g. wind, solar, biodiesel*) no yet practical substitute for many fisheries
- A major challenge on global fish supply



450 Scenario: Presented in the World Energy Outlook which sets out an energy pathway consistent with the goal of limiting the global increase in temperature to **2°C** by limiting concentration of greenhouse gases in the atmosphere to around 450 parts per million of CO₂.

Ranking of gears by carbon emissions

- Global fishing fleet is estimated to generate about 130 million tonnes of CO₂ (*FAO estimate*)
- **It is difficult to rank gears by carbon emissions!**
 - Carbon emission per unit of weight of catch, or
 - Carbon emission per unit value of catch?
- In general, demersal trawl fisheries and offshore longlining have relatively high carbon emissions in terms of emission per unit catch weight.
- Towed gears generally have higher fuel consumptions than passive gears.
- Poorly managed stocks in general lead to higher emissions per unit of catch.



Low Impact and Fuel Efficient (LIFE) Fishing

- Fuel consumption and environmental impacts can be reduced through modifications and changes in operational techniques and gear.
- **Low Impact and Fuel Efficient (LIFE) fishing** refers to fishing gears and practices that ensures fish capture occurs:
 - using the minimal possible amount of fuel
 - with minimal impact on the environment

Gears and practices also have to be efficient, practical and safe!

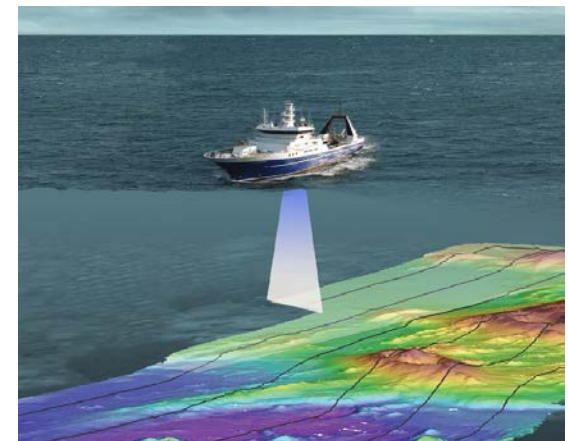
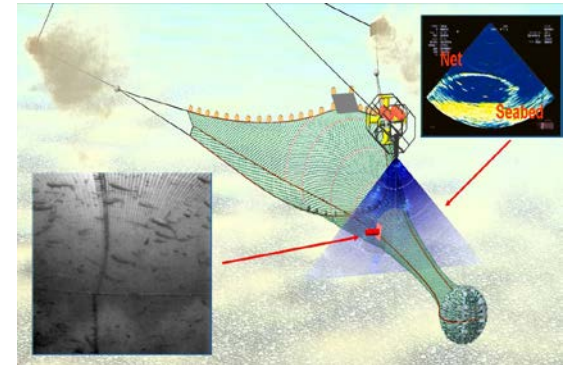
Improving fuel efficiency and reducing impacts

- Win-Win techniques and operational adaptations:
 - Less gear drag / weight => Fuel ↓ Cost ↓
 - Alternative designs => Seabed impacts ↓ Fuel ↓ Cost ↓
 - Selective net => Discards ↓ Labour ↓ Cost ↓ Fuel ↓
- Some of these techniques reduce bycatch and gear drag without marked decrease of the catch of the target species.
 - Fishing industry has recently been very active to adopt fuel saving & best practices.
 - A reduction of the gear drag between 20 to 35% and fuel saving between 20 to 40% has been reported.



Techniques and operational adaptations include:

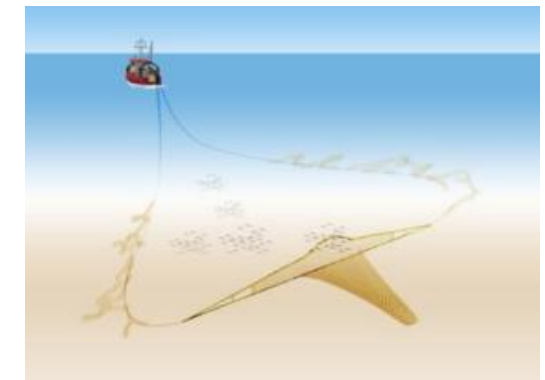
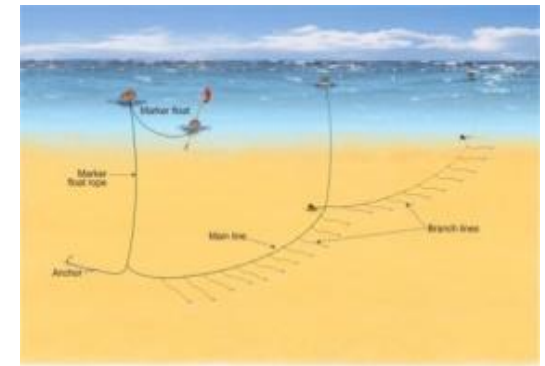
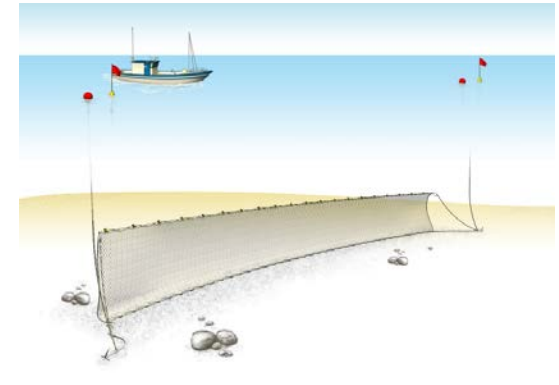
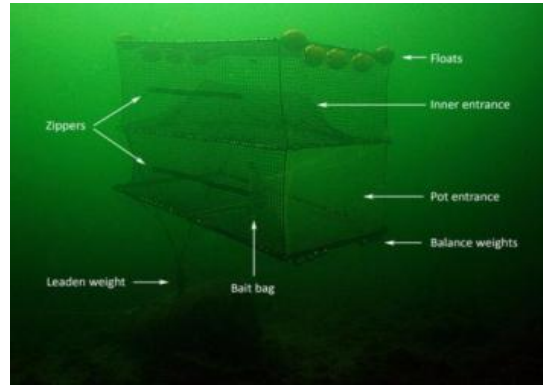
- Alternative designs, materials and rigging
- Adjusting the seabed contact by instrumentation.
- Using acoustic, light, electric pulses and other stimuli to enhance the encounters by target species.
- Using real-time monitoring and control systems in the trawl (acoustic and camera technology).
- Avoid sensitive habitats and minimize fuel with help seabed mapping tools and GPS systems.
- Reducing towing and steaming speed.
- Improving motivation of skipper and crew



Transitioning from high-impact to low-impact practice

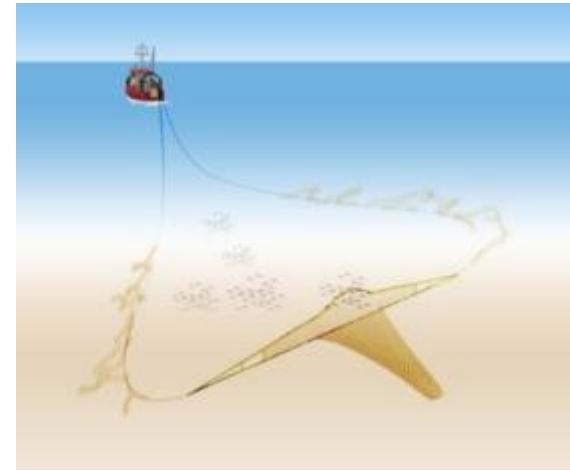
- In some cases, transition to a different fishing gear or practice may be the most potential solution (*in the long run*).
- Not all gears are **interchangeable for same species**.
- Change has high uncertainty and economic risk:
 - Design of existing vessel often a limiting factor.
 - Gears and practices are “tailor-made” to catch specific target species on specific fishing grounds.
 - A new gear type may cause conflicts with the existing gears.
 - passive gears cannot be easily used where towed gears are operated
 - Fishing practices are rooted in tradition and there is often a strong resistance to change.
- Where fish are more abundant, the relative competitiveness of passive fishing gears improves.

Examples of alternative gears and practices



Example 1: Bottom seining

- Bottom seines (e.g. Danish seine):
 - lighter groundrope (than in a bottom trawl)
 - no trawl doors
 - lower hauling speed
 - area swept smaller
 - less pressure (force) on the seabed
 - fuel usage lower.
- Fish caught have higher quality → live-capture possibility.
- Can be restricted by depth, fishing ground, bad weather and strong tide.
- Unwanted catches may be a problem in some seine fishing.



Example 2: Pot fishing

- The advantages of pot fishery include:
 - easy transport
 - low energy use
 - low habitat impact
 - high catch quality
 - live delivery option
 - unwanted catch can often be released alive.
- Unwanted catch can be minimized by using appropriate:
 - baits, mesh sizes, materials
 - size, shape, location and design of entrance and escape openings
- Low capture efficiency for many finfish species – a major barrier!

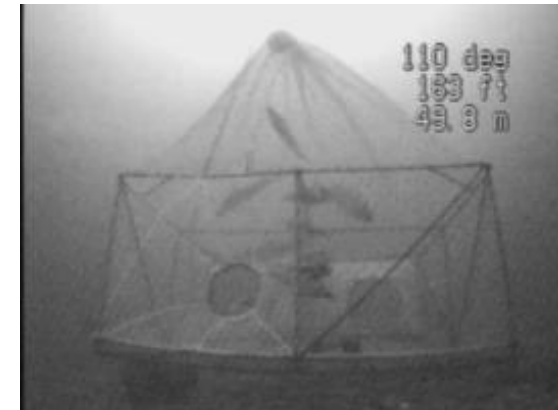


Photo: P. Walsh, FME, Canada

	Advantages	Disadvantages	Priority actions
Pot	<p>Low energy use and low habitat impact</p> <p>Selective (species and size)</p> <p>Flexible and transportable</p> <p>High catch quality, live bycatch</p>	<p>Low capture efficiency for many species</p> <p>Ghost fishing of lost pots</p>	<p>Enhance efficiency for a wider range of species.</p> <p>Alternative baits.</p> <p>De-ghosting technology.</p>
Trap-net	<p><i>More expensive and operation more complex than with pots.</i></p>	<p>Capture depth limited</p> <p>Suitability limited to fewer species</p> <p>Capture of non-target species</p>	<p>Develop practices to prevent the entangling of non-target species.</p>
Gill-net	<p>Low energy use</p> <p>Flexible and easily portable</p> <p>Size selective</p> <p>Relatively cheap to manufacture</p>	<p>Labor intensive</p> <p>Catch quality a concern</p> <p>Capture of non-target species</p> <p>Ghost-fishing of lost nets</p>	<p>Develop practices and technologies that reduce bycatch.</p>
Coastal long-line	<p>Low energy use (<i>depends</i>)</p> <p>Minimal habitat impact</p> <p>Flexible and portable</p> <p>Species selective, good catch quality</p>	<p>Labor intensive, time consuming</p> <p>Bycatch of non-target species</p> <p>Snagging on benthic epifauna</p> <p>Availability and price of bait</p>	<p>Capture of bait may be fuel-consuming.</p> <p>R&D of alternative attractants & hook design.</p>
Bottom seine	<p>Relatively low energy use</p> <p>Reduced sea bed impacts (light gear)</p> <p>Operation on smaller fishing grounds</p> <p>Good catch quality</p>	<p>Operation limited to cleaner grounds and shallower depths.</p> <p>Not effective for non-herded animals such as shrimp.</p>	<p>Operation on rough grounds, in sea currents and in deeper waters.</p> <p>Bycatch reduction tech.</p>
Bottom trawl	<p>Effective</p> <p>Versatile</p>	<p>Seabed impacts, fuel consumption, bycatch, costs, catch quality</p>	<p>A large variety of actions possible to improve this capture method.</p>

Mitigation - The reality

- Fishers reluctant to adopt techniques that may increase costs and workload, and reduce earnings or safety.
 - fishing effectiveness and practicability of new designs are important
 - for capturing certain species trawling may be the only effective solution
 - *there may not be realistic production alternatives available (e.g. shrimp).*
- Profit margins are small in many fisheries – even relatively minor changes may have unpredictable economic consequences.
- Fishermen are often **sceptical** that an alternative gear would work as well as their traditional.
- Fishing sector needs **time** for a change.
- There should be an understanding what impacts are acceptable – there are always some impacts!



Fishermen' perspectives, views and concerns

- What seems logical and desirable from an outsider's perspective does not necessarily seem logical to a fishermen.
- Fishermen generally do not believe that their activities are damaging to the environment.
 - Do not see much reason to change the gear type.
 - Switching gears → one type of environmental impact exchanged for another.
 - Prefer modifying the present gear (*if any*).
- Afraid to leave the market with a shortfall in supply, risking the future trade opportunities.
- Management limitations: Not always possible to change gears.



A change must make sense

- Some type of gears cannot catch as much fish as others for the same amount or work.
 - This is why demersal trawls are so popular
- No two types of fishing gear do exactly the same thing.
 - A change of gear brings with it a need for much broader changes in the whole fishing operation (vessels, fishing grounds, skills, markets, etc)
- Passive and active gears are often incompatible in the same areas – passive gears are frequently damaged by towed gear.
- Passive fishing gears cannot be automated to the same extent as trawling, and cannot cover so much ground in a given time period and effort.
- A switch to passive gear in these type of areas requires some kind of zoning arrangements to avoid gear conflicts.
 - These are achievable!
- Excessive use of any gear type may cause overexploitation and significant ecosystem impacts.

Summary: **Barriers to the transition to LIFE-fishing**

- lack of familiarity with cost-effective and practical alternatives
- availability of adequate substitute technologies
- incompatibility of vessels with alternative gear
- risk of losing marketable catch
- additional work
- concerns with safety at sea by using unfamiliar practices
- high investment costs
- lack of capital
- ineffective technology infrastructure support
- inflexible fisheries management systems
- **“human behaviour barriers”**

There are opportunities in a change

- Cost reduction
 - Waste elimination
 - Product quality improvement (focus on quality rather than quantity)
 - Less pressure by environmental advocacy groups
 - Enhanced reputation
 - Winning new customers and new markets
 - Better motivation among the crew to innovate and further reduce the environmental impacts
 - *they are the one who can provide valuable ideas*
 - Stimulation effects in the local economy (new products etc)
 - Improvement in industry's capacity to deal with the future challenges
- ➔ **From 'reactive mode' to 'proactive mode'**

Incentives

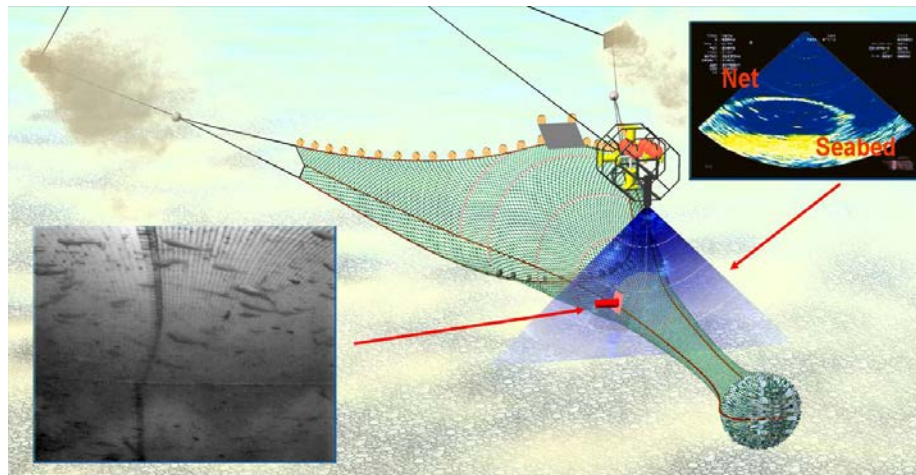
- Management systems should encourage LIFE fisheries:
 - **give fishers a space in which to operate LIFE fishing as efficiently as possible**
 - **allocate quota to LIFE-fishing methods**
 - **give preferential access to specific fishing areas (zoning)**
 - **restore depleted fish stocks (higher CPUE)**
- Outside pressure – “market forces” – may offer strong incentives for a change!
- Increasing fuel prices works in two direction:
 - **provide incentive for fishermen to change**
 - **at the same may prevent fishermen from adapting by cutting their margins to re-invest**
- There are windows for opportunities, though, for instance when fuel prices decline.
- Fuel subsidies work against the development of energy-efficient fishing and may also encourage to build fleet overcapacity.

Conclusions

- Fishing is heavily dependent on fossil fuels and fishing operations have environmental impacts.
- Each fishing gear and practice has advantages and disadvantages.
 - **Optimal solutions vary among fisheries.**
- Successful transition to LIFE fishing depends on:
 - **Developing acceptable technology and creating incentives (find win-win situations)**
 - **Objectives being achievable and realistic – they must make sense**
 - **Adequate training and technical assistance, and encouragement of innovation**
 - **Regulatory regimes that facilitate the recovery of fish stocks**
 - **Making fishers part of the solution**
 - **Finding balance short-term costs vs long-term environmental ambitions**
- The system should reward those who employ best practices – redirect fuel subsidies to encourage development and uptake of LIFE fishing practices.
- Global research and development priorities should be established.

Collaboration

- Close cooperation between key stakeholders is necessary in developing and introducing cost-effective and practical LIFE-fishing technologies.
- Public-private sector initiatives to commercialize economically viable and practical alternatives have to be promoted
- Mechanisms are needed that encourage cooperation among resource users and regulators.



Thank you