ENERGY use in FISHERIES:

Improving Efficiency and Technological Innovations from a Global Perspective

Special Session:

Energy Consumption and Beyond: Application of Holistic Approaches to Energy Conservation and Innovation in Fishing Operations and Gear Design

Tuesday, November 16, 2010
1:30 - 3:15 p.m. and 3:45 - 5:30 p.m. - Concurrent Sessions
Gear IV: Gear Designs and fishing strategies
that reduce energy costs

Session Organizers
Chris Glass, Northeast Consortium
Steve Eayrs, Gulf of Maine Research Institute

Northeast Consortium

Gulf of Maine Research Institute
Science. Education. Community.

National Oceanic and Atmospheric Administration
NOAA
U.S. Department of Commerce

Welcome

Energy Use in Fisheries Seattle 2010

The “Energy Use in Fisheries” symposium provides a timely and exciting opportunity to review global efforts to conserve energy consumption in commercial fishing operations.

Whilst the goal of energy conservation has important economic implications for fishermen today, a holistic approach that focuses on the key inputs and outputs of fishing activity, has the potential to realize a wide range of environmental and socio-economic benefits.

This session will provide a forum for information exchange on the benefits of applying holistic approaches to problem-solving in fishing operations and fishing gear design. A particular focus will be on the potential for wider benefits, of these approaches, to energy conservation strategies, which may include increased profitability of fishing businesses and reduced impacts on the environment.

The aim of the session is to promote innovative thinking and we hope the discussion will be stimulating and thought provoking.

On behalf of the special session Organizing Committee, we extend a warm welcome to you all and thank you for your many contributions to the symposium.

Chris Glass and Steve Eayrs

Northeast Consortium

The Northeast Consortium was created in 1999 to encourage and fund effective, equal partnerships among commercial fishermen, scientists, and other stakeholders to engage in collaborative research and monitoring projects in the Gulf of Maine and Georges Bank. The Northeast Consortium consists of four research institutions - University of New Hampshire, University of Maine, Massachusetts Institute of Technology, and Woods Hole Oceanographic Institution - working together to foster this initiative.

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Gulf of Maine Research Institute

The Gulf of Maine Research Institute (GMRI) is a new genre of marine research and education institution - neutral, place-based in the Gulf of Maine bioregion, and strategically focused on emerging ecosystem stewardship challenges.

GMRI catalyzes community dialogue, interdisciplinary research, and science literacy to realize the natural and human potential of the Gulf of Maine bioregion. Our goal is to position the Gulf of Maine community to emerge at the forefront of a new era of maritime innovation, embracing creative strategies to harness the oceans' productive capacity while sustaining the bioregion's vitality and character for future generations.

Our scientists partner with fishermen, environmentalists, and state and federal fishery managers to build knowledge of commercial fish species, critical habitats, fishing gear technology, and human behaviors to enable more effective fishery management in the Gulf of Maine. Our education programs engage students with the scientific method and encourage them to learn about Maine's fresh and saltwater ecosystems. Our community programs help to identify emerging challenges and opportunities in New England fisheries and foster a climate of cooperation among a diverse mix of marine stakeholders.

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Energy Consumption and Beyond: Application of Holistic Approaches to Energy Conservation and Innovation in Fishing Operations and Gear Design

Session 1 1:30 - 3:15 p.m.

Paul Winger, Memorial University of Newfoundland, Canada
Energy conservation and gear innovation in Canadian fisheries

Gary Graham, Texas Sea Grant; Texas AgriLife Extension Service, USA
Experience in environmental conservation and profitability of shrimp trawling in the Gulf of Mexico

Steve Eayrs, Gulf of Maine Research Institute, USA
Application of an Environmental Management System: A tool to facilitate structured and systematic efforts to address industry issues and improve profitability

Jennifer Levin, Gulf of Maine Research Institute, USA
Opportunities for fishermen to link environmental stewardship and profitability through clever seafood marketing

Miguel Angel Cisneros Mata, Instituto Nacional de Pesca, Mexico
Achievements in Mexico to link energy conservation and bycatch reduction initiatives

Agenda

Energy Consumption and Beyond: Application of Holistic Approaches to Energy Conservation and Innovation in Fishing Operations and Gear Design

Session 2 3:45 - 5:30 p.m.

Troy Hartley, Virginia Sea Grant, USA
Human dimensions and socio-economic implications associated with changes in fisheries development

Cliff Goudey, Marine Industry Consultant, USA
A need for change in U.S. fisheries

Chris Glass, University of New Hampshire, USA
Modifications to New England trawl gear to reduce seabed impact and fuel consumption

Bob van Marlen, Institute for Marine Resources and Ecosystem Studies The Netherlands
Examples of energy conservation and development of sustainable fishing techniques in Europe

David Sterling, Sterling Trawl Gear Services, Australia
Frameworks for purposefully increasing the energy efficiency and profitability of shrimp trawling in Australia

Panel Discussion:
Future directions for change in the fishing industry

Energy Consumption and Beyond: Application of Holistic Approaches to Energy Conservation and Innovation in Fishing Operations and Gear Design

Presentation Abstracts

Energy conservation and gear innovation in Canadian fisheries

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Abstract

The development of fishing gears for the commercial fishing industry in Canada has changed dramatically over the last few decades. Today's modern designs are more advanced and sophisticated as a result of increasing fuel costs, the need for species- and size-selectivity, stringent bycatch restrictions, and the necessity to minimize impact on the environment. Meeting these challenges has lead to significant improvements in the way new fishing gears are designed and tested.

This presentation will review the gear development cycle used in Canada. The process has evolved to become highly collaborative, involving contribution from industry, government, and academia. The cycle of gear development now involves computer-aided design, numerical simulation, physical modeling, flume tank testing, at-sea comparative fishing experiments, and direct performance observation using underwater cameras, hydroacoustics, and gear-mounted sensors. In many cases, innovative fishing gears are introduced into the fishing fleets, but just as often, even good ideas require further refinement before wide-spread adoption, making the development cycle an endless process.

Extended benefits relating to energy conservation measures in the Southeast shrimp fisheries

Gary L. Graham [1] and Michael G. Haby[2]

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Abstract

Cooperative research by the Texas Sea Grant Program and the Gulf of Mexico shrimp fishery to reduce energy requirements for trawling have resulted in extended benefits from both an environmental and marketing aspect. Some of the fuel conservation efforts have been directed toward testing and demonstration of vented, cambered doors and lighter netting constructed of high density polyethylene. The project has been successful with an average savings of 24% fuel consumption during trawling activities. Although the focus of this work was that of fuel efficiency, other benefits have surfaced which are beginning to provide additional advantages for the shrimp industry.

At the initiation of this project, it was apparent that a potential environmental benefit could be achieved from use of smaller cambered doors. We ascertained that a traditional wooden, flat otter door with a surface area of 2.79 m^2 could be effectively replaced with a cambered door of 1.4 m^2. By doing this, the total length of the door is reduced by a half. Importantly, this decreases bottom contact or the footprint of the door. Also, the angle of attack of cambered doors seems to be less than that of the traditional flat doors utilized in industry which would also project less bottom contact.

Advanced technological netting has also indicated an environmental benefit. When Texas Sea Grant performed the first industry tests on Spectra® netting, it was immediately discovered that less weight was needed on the footrope. In the shrimp fishery, this meant that less loop chain, which makes contact with the seabed, was required on the footrope. Hence, an unintended environmental benefit was achieved. It appears that similar benefits are being acquired from the extended use of other trawls constructed of high technological fibers.

The energy conservation efforts directed by this project have spawned several important pilot programs by various third parties. For example, laws in two states now permit use of the fuel-savings gear. One NGO now offers a pilot program to cover half the cost required to convert to the new trawl gear. An eco-marketing organization that supplies seafood products to retail establishments serving customers committed to supporting sustainable, “environmentally-friendly” production practices has started a pilot effort with select, local producers to market wild, gulf shrimp harvested with the fuel-saving trawl gear and the required environmental gear like TEDs and BRDs. Quoted prices have been much higher than those offered by the traditional market.

Environmental Management System: A systematic approach to problem solving in fishing operations and gear design.

Steve Eayrs
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Abstract

An Environmental Management System (EMS) is a systematic process that enables a group of fishermen to identify, manage and reduce their impact on the physical and working environment. It is a voluntary process that can help the fishermen identify and address their regulatory and non-regulatory responsibilities, and can lead to reduced environmental impact and gains in operating efficiency, product quality and value, and employee safety. In recent years a group of fishermen from Port Clyde, Maine, have been progressively using an EMS approach to tackle a variety of problems affecting their ability to efficiently harvest fresh seafood. To date this approach has been used to improve codend selectivity, seabed impact, and fuel efficiency. This paper describes the EMS approach with these fishermen, including steps to adopt modified fishing gear and innovatively market their seafood.

Opportunities for fishermen to link environmental sterwardship and profitability through clever seafood marketing

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Abstract

From Wal-Mart to your local farmer's market, consumers are increasingly concerned with where their food comes from and in understanding its environmental impact. Fishermen and others from across the country and world are employing strategies to tell their story, including the conservation measures they're employing. Community supported fisheries, supply chain collaboration, and real-time traceability offer opportunities to differentiate products in the marketplace and realize a greater return for the product. Simultaneously, retail chains and restaurants are working with conservation organizations for advice and guidance on where to go for the most responsibly produced products. This presentation will review these opportunities, including case study examples, and how fishermen might take full advantage of them.

Achievements in Mexico to link energy conservation and bycatch reduction initiatives

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Human dimensions and socio-economic implications associated with changes in fisheries development

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A need for change in U.S. fisheries

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Abstract

Due to a combination of factors, marine capture fisheries have reached their peak and many important commercial species are depleted and no longer able to meet the needs of the seafood marketplace. This shortfall has spawned growth in the importance of aquaculture, a sector that is now providing over half of the seafood we eat. Another result of the depleted status of wild stocks has been the adoption of fishing strategies that have been counterproductive from the standpoint of energy efficiency, safety, and stock recovery.

Fisheries and aquaculture are often portrayed as competing industries, when in fact they are two sectors with similar interests on a continuum of seafood production. A re-calibration of these perceptions can result in a fresh approach to the sustainable exploitation of our oceans and enhance the economic viability of both sectors.

This presentation will elaborate on the nexus between fishing and aquaculture and how the capabilities of both sectors can meet the needs of the other. This is particularly evident in offshore fish and shellfish farming where the assets of the fishing industry, often standing idle in a highly overcapitalized state, can be of direct value in the support of farming activities. Similarly, the assets of the fish farming industry can enhance the value of fishing. Equally relevant are the complementary skill sets of participants in these industries. Opportunities for energy efficiency for both sectors will be discussed with specific example of technologies and strategies provided.

A potential benefit of this proposed collaborative approach relates to energy consumption. An examination of fishing practices under the current paradigm reveals dramatic energy and biological inefficiencies. Through a combination of stock enhancement, innovative fishing and offshore farming systems, and rational management strategies, dramatic improvements are possible in levels of domestic seafood production and the economic viability of US seafood-based industries. Further advantages can be realized with the engagement of the offshore renewable energy industry through both the co-siting of offshore facilities and the reduction of the fossil fuel requirements of fishing and aquaculture.

Modifications to New England trawl gear to reduce seabed impact and fuel consumption

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Abstract

Drag induced by a trawl gear is one of the major components of increased fuel consumption in fishing operations. While the economic cost of such operations may comprise only a portion of total fuel costs, any modifications that result in reduced drag associated with trawl gear operation may have significant cost savings and consequent reduction in total carbon footprint. Thinking holistically, there may also be implications for reduced habitat impact, bycatch reduction and potential for higher value product.

Here we report on results of a workshop whose aim was to to demonstrate and document, in a systematic manner, methods to reduce overall drag associated with trawl fishing operations, and to examine consequent reduction in fishing gear impact on the habitat. A scale model of a "standard" east coast bottom trawl was tested and documented by photo, video and measurement, focusing on how changes could be made and how the net performed with each of the successive changes from the trawl door, the sweeps (bridles) the footrope / ground gear and finally the codend. Each component was documented separately so that the contribution of each component of the trawl system as a whole could be assessed individually but also collectively.

This workshop, funded through the Northeast Consortium collaborative research program, sought to evaluate not only those changes resulting in decreased drag and hence reduced fuel consumption, but also, thinking holistically, how collateral effects of trawling may be reduced. Results of this project provide a basis for helping to reduce overall drag, estimating physical disturbance of trawling, providing data for modeling of seabed impact and recommending means to reduce physical impact of trawling.

Examples of energy conservation and development of sustainable fishing techniques in Europe

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Abstract

Innovation has always been part of the research agenda in Europe, in the late 1970s aimed at improving catch and mechanical efficiency of fishing, in later decades aimed at reducing unwanted bycatches and sea bed impact. Examples of national and multi-disciplinary EU-projects are given with major outcomes. A recent development is to finance innovative projects initiated by the fishing industry directly. This has led to higher motivation in the industry and some new remarkable fishing gears being used to a growing extent. Lessons learned are reviewed.

Keywords: fisheries, innovation, energy saving.

Frameworks for purposefully increasing the energy efficiency and profitability of shrimp trawling in Australia

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Abstract
In my work, I attempt to understand the "system" within which I am trying to achieve a purposeful outcome. Looking back, and armed with some modern terminology around the analysis of systems, I see that this tendency is consistent with an ecosystem approach, as described by Kay[1] et. al. , where the term ecosystem is used in its broadest sense and refers to natural as well as human constructs, such as economic systems, or technological systems. According to Kay, the system is defined in terms of :

- Type.
  What perspectives will be used to look at the system? (abiotic, biotic, human cultural ….)
- Scale and Extent (where do things begin and end?)
  What are the boundaries of observation?
  What are the processes, which define the whole?
  What are the boundaries of the ecosystem, the holon of focus?
- Holarchy (what is a part of what?)
  Define the nested holons (nested systems); this defines the contextual relationships

For an ecosystem approach, "holistic" thinking is necessary but not sufficient. The associated "systems thinking" is about the study of objects as wholes, but in two ways. On one hand, it examines an object as being composed of systems; and on the other, it deals with an object as a whole situated in a bigger system (environmental context). Thus, systems thinking is both reductionist and holistic, that is hierarchical.

Without purporting to being particularly adept at applying systems thinking to fisheries matters, I present aspects of my work that nevertheless have systems thinking features. The first fundamental element of systems thinking is the exercise of performing a systems study – identifying the system to be investigated and its important behaviours. I contend that this approach has made possible revolutionary rather than evolutionary ideas in relation to:

- "better" fishing gear and components
- "better" harvest strategies
- Utilisation of waste heat

[1]Kay, J., H. Regier, M. Boyle, and G. Francis. 1999. An Ecosystem Approach for Sustainability: Addressing the Challenge of Complexity, Futures Vol 31, #7, Sept. 1999, 721-742.