Summary Report
Inter-Disciplinary Workshop on the Management, Economics, and Biology of Transferable Effort Rights-Based Management

Sept. 17-20, 2012
University of the Basque Country
Bilbao, Spain

Purpose

Effort rights-based fisheries management programs are an important, albeit less widely used, form of rights-based management than the more widely employed transferable catch quotas for groups or individuals (ITQs).[1] All forms of rights-based management reorient the economic incentives motivating fisher behavior from the perverse race to fish to incentives that more closely align the private behavior of fishers with desired economic-ecological objectives of harvests satisfying a sustainable yield target and sustainable economic benefits, although some rights may be more effective than others. Although limited (vessel) access is a popular form of effort management, this workshop focused upon some measure of time or gear (particularly pots and traps) as effort.

Effort rights-based management programs represent a major step forward from open access and limited entry by providing a more completely structured right with stronger exclusive use of the right by individual firms, vessels, or groups. Effort rights based management programs set an annual Total Allowable Effort (TAE) for the fishery, typically denominated in nominal units of effort such as days at sea or number of sets of gear, although units of gear, such as numbers of hooks or traps, are also employed. When the TAE is allocated to individuals and explicit transferability of effort rights is allowed between individuals flexibility and economic efficiency increases. Effort can be area-denominated (as in the Faroe Islands) to preclude local stock depletion or to protect sensitive areas, resulting in economic gains through more spatially efficient allocation of effort. Effort can be further allocated across species and/or gear combinations to realize efficiency gains by reducing unwanted bycatch or from separating different methods of fishing or different groups, such as small and large-scale fishers.

Effort forms of rights-based management have received considerably less attention in the literature than transferable catch quota approaches, and the intent of the workshop was to close this gap. The workshop surveyed the practice and discussed issues associated with transferable effort rights-based management and effort management in general.

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[1] Other forms of rights-based management include sector allocations of catch rights and voluntary agreements, license limitation, area and territorial use rights, and common property.

The inter-disciplinary workshop included economists, population biologists, political economists, and fisheries managers who provided inter-disciplinary background papers and presentations. The discussion and conclusions, presented below, were grouped by five categories: (1) Characteristics of the fishery – number of gears and species plus the biological starting point (overfishing, overfished), initial economic conditions (capacity, profitability, etc.); (2) Biology – (i) biology of the species and its ecosystem and (ii) data availability and uncertainty and (iii) issues in population assessments and determining a Total Allowable Catch (TAC) and Total Allowable Effort; (3) Economics – (i) law and economics of property rights, (ii) microeconomics of effort and catch controls, and (iii) economic incentives; (4) Costs of monitoring, compliance, enforcement, population assessment, data collection, and other management and governance costs; (5) Political economy and governance – the politics and feasibility of reaching and sustaining agreement on rights-based management and subsequent management of the fishery, which would take into consideration past management, objectives of management and the distribution of the costs and benefits among the actual and potential participants.

The workshop focused on comparing the advantages and disadvantages of effort rights-based management to those associated with catch rights-based management according to the five broad categories discussed immediately above, and evaluating trade-offs according to different specific factors (discussed below) and under what specific conditions. Although clear conditions may exist favoring one approach over another, the workshop participants recognized that various circumstances may favor a different approach, and development of a framework to evaluate conditions and trade-offs was the key outcome of the meeting.

The workshop recognized that fisheries management by catch or effort property rights simultaneously requires estimation of, and management under, a TAC or TAE, but that fisheries might simply be managed by TACs or TAEs without catch or effort property rights. Hence, the workshop necessarily discussed catch and effort management as general approaches, and rights-based management can in this sense be viewed as special cases of these two approaches. Nonetheless, catch or effort management sans property rights was not the workshop's focus.

The specific attributes evaluated for both TAC and accompanying rights-based management (RBM) and TAE and accompanying RBM were:

- Fishery
- Biology
- Type of Fleet (Vessel, gear, multiple sectors)
- Data Availability/Uncertainty
- Past Management (Path Dependency)
- Biological Starting Point (Overfishing, overfished)
- Economic-Management Starting Point (Capacity, profitability, employment, initial TAE/TAC)
- MCS (Monitoring, Control, and Surveillance) & Enforcement (Cost and means)

- Market and Industry Structure (Concentration, product and input markets, distribution of income, monopoly/monopsony/market power)
- Political Economy and Governance (governmental and non-governmental institutions with stake in process, income distribution)
- Individual vs. Group Rights
- Social Considerations (Employment, community impacts)
- Production Process (Dynamic inefficiency, incentives)
- Structure of Property Rights
- Objective of Management System (fishing mortality, rents, social, RBM)

Main Results

Both effort and catch rights-based management have strengths and weaknesses and have potential to be applied in different circumstances as well as in conjunction with one another through hybrid programs. In both cases, individuals or groups can hold the rights.[2] The choice between catch and effort approaches to managing a fishery is likely to be determined on a case-by-case basis. The workshop results are intended to guide informed choices between catch and effort rights-based management systems and to evaluate the trade-offs involved.

The balance of this main results section is organized as follows. The microeconomics of the vessel's harvesting process, economic incentives, and law and economics of property rights is discussed first. The discussion focuses next on the biology of species, data availability, and issues arising in assessing stocks, TACs, and TAEs. The discussion then contrasts TAE management with TAC management regardless of whether catch or effort is subject to property rights. The discussion next briefly discusses the role of area management. The discussion then considers the costs of MCS, enforcement, stock assessments and how these affect the overall economic efficiency of catch or effort rights-based management. The results conclude with discussion of several other related issues that arise.

Catch rights programs are largely preferred from the perspective of the microeconomics of the vessel's production process and the law and economics of property rights due to the superior incentives that are created and that lead to economic efficiency, minimizing capacity, and matching catches with TACs. Effort rights are weaker than catch rights, since effort is less clearly defined and is an input. Broadly put, catch rights approaches establish incentives to minimize costs and effort use at the individual vessel level, and effort rights approaches establish incentives to expand unregulated dimensions of effort to maximize catch and revenues. Effort rights-based management creates incentives to expand input use by expanding along unregulated dimensions of effort through input substitution, input utilization (fishing time), and investment augmenting the capital stock, although comparable incentives exist to

[2] Transferability is explicit with individual rights and often through markets, and transferability with groups can be made between groups or occurs solely within the group.

expand catches of unregulated species or to discard under catch quotas.[3] Technical change expands effective effort and fishing mortality, compounding the difficulties of effort management, where technical change can be implemented through investment that augments the capital stock (embodied) or disembodied through learning by doing. In contrast, incentives to minimize costs under catch approaches lead to shedding of effort as vessels attempt to minimize costs. An effort program may require limits on vessel size and other forms of capital stock (e.g. gear) to limit substitution of unregulated for regulated inputs plus accommodate replacement of old by new vessels or gear and other upgrades and transfers of effort rights across gear types. An effort program limiting time (e.g. days) restricts capital utilization. Supplementary restrictions on gear types used, vessel numbers for each gear type, and real-time seasonal and area closures may also be required to maintain fishing mortality levels and species mixes. Over time, restrictions on one or more dimensions of effort can induce a long-run response through technical change.

Given the objective of controlling fishing mortality (the aim in all but a handful of reasonably well managed industrial fisheries), the aim is to keep the stock at a productive level. Effort management then directly relates to fishing mortality, whereas catch management less directly relates to fishing mortality.

Both effort and catch based quotas require the estimation of Total Allowable Catch (TAC) or Total Allowable Effort (TAE), so that issues arising with estimation of biomass and TACs or TAEs and management by TAC or TAE are an important consideration in the choice between the two rights-based management approaches. As we shall see, catch rights-based management under a TAC requires an estimate of the absolute level of biomass, while effort rights-based management under a TAE requires an estimate of the catchability coefficient . These differences can be illustrated by the simple equation that relates catch (C) to effort (E) and biomass (B) through the catchability coefficient (q):

$$C = qEB.$$

Where fishing mortality (F) is equal to the product of q and E (in this case F is used as an exploitation rate rather than an instantaneous fishing mortality to simplify the illustration).

Take a hypothetical case where the catch quota is set using the fishing mortality corresponding to maximum sustainable yield (Fmsy) such that C=Fmsy*B. In this case both Fmsy and B need to be determined. These are generally estimated using a stock assessment model. Estimates of both TAC and TAE require estimation of Fmsy,[4] [5] and

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[3] Incentives to catch the same fish arise under effort management as long as catches of the species (which now would not necessarily be called bycatch per se) are profitable.

[4] Fmsy is determined from the assumptions about the population (e.g. form of the growth and stock-recruitment curves) and fishery (e.g. form of the selectivity curves) dynamics and the pre-determined or estimated parameters (e.g. natural mortality, growth, stock-recruitment, selectivity) and is typically independent of absolute abundance.

therefore the difference between the two approaches lies in the accuracy of estimating the absolute level of biomass B versus the catchability coefficient q. In reality, both B and q are known with uncertainty.

The absolute level of abundance B (the "scaling" of the stock assessment model) is notoriously difficult in many assessments.[6] Biomass estimates are a function of all the model assumptions and data, but are generally driven by the influence catch has on abundance indices and how many old fish are in the catch. In contrast, an effort quota based on Fmsy is calculated as E=Fmsy/q, and when applied to the stock automatically takes the true B into account resulting in the C. The evaluation of effort-based quotas can be implemented by estimating F/Fmsy in a stock assessment model, which may be more robust to the scaling issue.

Difficulties arise in estimation of biomass and TACs. The catchability coefficient q may change over time randomly (e.g. due to environmental influences) or systematically (e.g. due to improvements in technology) or both. Failing to account for improvements in technology will cause the fishing mortality to increase over time. Catch may be a nonlinear function of effort or biomass, $C=qE^aB^b$, and may stay high even if the biomass declines because the fishery can find schools of fish ($b<1$). Competition among effort may cause increased effort to not produce the same proportional increase in catch ($a<1$).

There are several other reasons why a stock assessment may not be accurate:

1. Estimation uncertainty (low sample size, not the right data)
2. Process uncertainty (e.g. recent recruitment)
3. Model misspecification (fixed parameter values or model structure)
4. Biased data (i.e. under-reported catch)
5. Programming/logic errors

The above factors can introduce bias or variance into the biomass and hence TAC estimates. If the variance is accurately estimated, it can be taken into consideration when setting the quota. However, some of the sources of variance are often ignored (e.g. when influential parameters such as natural mortality are pre-specified). In addition, there are errors in implementing the catch or effort quotas. For example, catch may be miss-reported or vessels could add additional catching capacity.

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[5] It may not be necessary to accurately estimate Fmsy for use in management. For many species the stock recruitment relationship is weak (steepness of the Beverton-Holt stock-recruitment relationship is high and recruitment is independent of stock size). This means that the yield curve is similar to the yield-per-recruit (YPR) curve. It is well established that the YPR curve is flat for many species and fishing at a rate somewhat less than (or greater than) Fmsy will produce similar equilibrium yields. However, dynamic yields may be very different

[6] Absolute levels of biomass are more difficult to estimate than depletion relative to some target level, i.e. relative changes.

Effort management may be more effective at managing fishing mortality when there is: (1) a clear and direct link between effort and fishing mortality through minimal uncertainty or stochastic variation in q, and TAE may be more effective by directly acting on F whereas changing TAC may not correspondingly change F; (2) high annual recruitment variation leading to stochastic variation in the fish stock B; (3) considerable unavailability or low quality of data that relatively affects estimation of B more than q; and (4) uncertainty in the estimates of biomass B and TAC exceeds uncertainty in the estimates of the catchability coefficient q and TAE.

TAC and catch rights-based management can be favored when there are a high number of age classes and/or low recruitment variability in the fishery, since stochastic variation and uncertainty and annual changes in the biomass is minimized. In this case, the biomass and hence TAC are comparatively stable and there is substantially reduced uncertainty in stock assessments. TAC and catch rights-based management are also favored when there is more uncertainty in q or the catch-effort relationship. TAC and catch quota management may also be favored (all other factors held constant) when quotas are transferable across disparate gear types, thereby reducing the problems of standardizing effort and finding a stable unit of account for effort.

Effort management defaults to a constant mortality rate. In the case of constant effort quotas, as the biomass fluctuates the catch realized from the effort will also change. Hence, when the abundance declines or increases, the catch will correspondingly decline or increase. However, in the case of constant catch quotas, as the biomass declines (perhaps due to an environmentally reduced series of recruitment) fishing mortality will increase, which is not desirable since it may result in a highly depleted stock. Thus, the within-the-period self-correcting mechanism of the effort quota management reduces the risks of under-utilization and over-exploitation.[7] Some form of control rule, which may involve estimating the abundance, is needed to modify the catch to avoid endangering the stock in the catch quota approach. There may be delays in implementing the new catch quota. These conclusions are strengthened the weaker, or the more variable, is the stock-recruitment relationship and stochastic variations in the stock size relative to the harvest-effort relationship and stochastic variations in q.

In sum, catch or effort rights-based management is likely to be settled on a fishery-by-fishery basis, with a clear nod to effort-based approaches in complex

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[7] Shepherd [2003, p. 1 states, "Under an effort control system it is no longer necessary to predict the fishable stock size accurately every year to fix a TAC, as the level of fishing mortality is restrained directly, irrespective of the continual fluctuations of stock size, by controlling the level of fishing effort, which need only be adjusted occasionally and progressively in order to achieve medium-term management objectives. The landings would of course continue to vary with the natural fluctuations of stock size, but this would occur automatically and they would not need to be predicted in advance." Shepherd, JG. Fishing effort control: Could it work under the Common Fisheries Policy? *Fisheries Research* 63(2): 149-153, 2003.

multispecies fisheries in developing countries (especially with complex tropical multispecies ecosystems) where TAC-based management is more difficult and expensive, stock assessments are difficult; data are largely unavailable or of low quality; and uncertainty over biomass estimates is paramount. Effort management is widely applied in pot and trap fisheries, where the link between effort (number of pots and soak time) and mortality is direct, managing pots and traps is more cost-effective, and incentives are clear to fishers given the importance of territoriality where fishers deploy their pots and traps. There may also often be elements of fisher territoriality in these fisheries, which favors effort management, since pots and traps and the target species readily lend themselves to this approach. Effort management also has advantages in fisheries with highly variable stock-recruitment and subsequent high stochastic variation and uncertainty in resource stock, such as shrimp and squid and perhaps some small pelagic species. Effort management is also applied when escapement is important such as salmon, and as with salmon where the river of origin is important and effort can be targeted to specific rivers and regions but catch at sea is difficult to directly relate to the river of origin.

Although time-area closures or area management can contribute to both catch and effort rights-based management, they may be especially important in effort management because there are not any direct controls upon catches. Area management can be important to separate gear types and vessel classes and to protect species for both catch and effort management, but may be even more so in effort rights-based management.

There may be fisheries where catch quota management may be preferred on biological and economic efficiency grounds, yielding the greatest economic net benefits compared to controlling fishing mortality at the desired level. But, the overall costs of MCS, enforcement, data collection, stock assessments, and other governance may be sufficiently high so that net economic benefits are lower than what they would be under effort management. When overall net benefits from catch rights-based management are lower than effort rights-based management, effort rights-based management may then be preferred on broad economic efficiency grounds.

There may be fisheries in which either effort or catch quota management is suitable on the basis of biology, economic efficiency, and management costs, but the political economy of reaching and sustaining agreement among participants and governance of the fishery favor the alternative rights-based management approach. Governance is likely to be easier and less expensive in effort rights-based management, since there are generally fewer detailed restrictions.

Catch quotas lead to discards of the target species while effort quotas do not, with the latter having less direct control over catch and fishing mortality rates on individual species. Shepherd [2003, p. 2] states, "…in adopting effort control we would be accepting that fine-tuning the management of individual stocks in a fishery is impossible, and that effective but broad-brush control would be preferable to the apparent (but actually ineffective) precision management using TACs and quotas."

The critical issues for other fisheries outside of MCS, enforcement, and stock assessment costs and political economy may be: 1) a standardized and agreed measure

for the relationship between fishing effort and fishing mortality, reflecting the two principal sources of uncertainty including technical change, [8] and for effort itself; 2) the greater difficulty of effort systems to inherently address overcapacity growing through investment, input substitution, increased input utilization (fishing time), and increasingly productive capital and effort due to technical change; 3) discards of target species under catch quotas; and, 4) the feasibility of fine-tuning the management of individual stocks in a fishery and the validity that effective but broad-brush control could be preferable to the apparent precision management using TACs and quotas.

Bycatch of protected species such as sea turtles, birds, and sharks are likely to be independent of either system. Maintaining an underlying license limitation scheme can safeguard against pressures to expand the TAE or TAC. The above discussion does not address broader concerns of ecosystem management.

Hybrid systems of catch quota rights-based management have emerged that are complemented by effort restrictions. The workshop recognized that a single policy instrument, such as catch quotas may be insufficient to address all policy concerns.

The workshop recognized that both individual and group effort or catch rights can achieve target fishing mortality, can improve economic efficiency, and can have associated issues of political economy and governance. The workshop did not further pursue that choice of one approach or the other.

Presentations

The presentations were grouped together to first provide overview and concepts of fisheries management, economics, population assessment, and ecology and then were followed by case studies.

1. Overview and Survey – Dale Squires

2. Is There a Case for Effort Control? - Rögnvaldur Hannesson

3. Effort Versus Quota Control When Stocks Cannot be Targeted – Rögnvaldur Hannesson

4. Microeconomics and Effort Management – Niels Vestergaard

5. On Fisheries and Property Rights – Ikerne del Valle

[8] (1) unexpected realizations in terms of the stock size such that the TAC is set at too high or too low a level and (2) unexpected realizations in terms of the catch-effort relationship such that the TAE is set at an inappropriate level.

6. Management Strategy Evaluation – Douglas Butterworth

7. Population Assessment, Data Availability, and Uncertainty – Ana Parma

8. Developing Country Perspective – Shaufique Sidique

9. Effort Control through the Vessel Day Scheme (VDS): Rights-based Management in the Western and Central Pacific Ocean Tuna Fishery – Elizabeth Havice

10. Effort Based Rights: Falkland Islands *Loligo* Squid Fishery – Vishwanie Maharaj

11. Fisheries in the Faroe Islands – Hans Ellefson

12. The Effort Control Program in the Northeast United States Groundfish Fishery – Eric Thunberg

13. Management of Demersal Fisheries in the Faroese Fishing Zone – Kjartan Hoydal

14. Effort Allocation and the Hawaii Longline Shallow-set (Swordfish) Certificate Program – Raymond Clarke

15. Tradable Traps in the Northeast U.S. American Lobster Fishery – Eric Thunberg

Participants

1. **Allen, Robin**. Fisheries management and population biology. Scientific Advisory Committee, International Seafood Sustainability Foundation and Former Director Inter-American Tropical Tuna Commission. New Zealand.

2. **Andersen, Peder**. Fisheries economics. Professor of Economics, University of Copenhagen and former Director of the Council of Economic Advisors, Government of Denmark.

3. **Astorkiza, Kepa**. Fisheries economics. Professor of Economics, University of the Basque Country, Bilbao, Spain.

4. **Butterworth, Douglas**. Population biology. Professor of Mathematics, University of Cape Town, South Africa.

5. **Clarke, Raymond**. Fisheries management. Pacific Island Regional Office, National Marine Fisheries Service, Honolulu, Hawaii.

6. **Ellefson, Hans**. Fisheries economics. Government of Faroe Islands and Ph.D. student, University of Southern Denmark.

7. **Guillotreau, Patrice**. Fisheries economics. Professor of Economics, University of Nantes, France.

8. **Hampton, John**. Population biology. Secretariat of the Pacific Community, Noumea, New Caledonia.

9. **Hannesson, Rögnvaldur**. Fisheries economics. Professor of Economics, Norwegian School of Economics and Business Administration, Bergen, Norway.

10. **Havice, Elizabeth**. Political economy of natural resource use. Assistant Professor, Department of Geography, University of North Carolina, Chapel Hill.

11. **Helvey, Mark**. Fisheries management. Southwest Regional Office, National Marine Fisheries Service, Long Beach, California.

12. **Herrick, Samuel, Jr.** Fisheries economics. Industry Economist, Southwest Fisheries Science Center, National Marine Fisheries Service, La Jolla, California.

13. **Hoydal, Kjartan**. Fisheries management and population biology. Former Director of Fisheries, Government of Faroe Islands and Former Director of NEAFAC.

14. **Maharaj, Vishwanie**. Fisheries economics. Senior Program Economist, World Wildlife Fund-Fisheries, Washington, D.C.

15. **Mosqueira, Iago**. Population biology. Scientific Committee International Seafood Sustainability Foundation and European Union.

16. **del Valle, Ikerne**. Fisheries economics. Professor of Economics, University of the Basque Country, Bilbao, Spain.

17. **Prieto-Bowen, Ivan**. Fisheries economics and management. Consultant and former Under-Secretary of Fisheries, Government of Ecuador.

18. **Sidique, Shaufique Fahimi**. Fisheries economics. Assistant Professor of Economics, Universiti Putra, Malaysia.

19. **Parma, Ana**. Population biology. Professor of Biology, University of

20. **Squires, Dale**. Fisheries economics. Scientific Advisory Committee, International Seafood Sustainability Foundation and Senior Scientist, National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, California.

21. **Steinsham, Stein Ivar**. Fisheries economics. Professor of Economics, Norwegian School of Economics and Business Administration, Bergen, Norway.

22. **Thunberg, Eric**. Fisheries economics. Economic and Social Analysis Division, Office of Science and Technology, National Marine Fisheries Service, Silver Springs, Maryland.

23. **Gonzalo, Caballero**. Fisheries economics. Professor of Economics, University of Vigo, Spain.

24. **Vestergaard, Niels**. Fisheries economics. Professor of Economics, University of Southern Denmark, Esberg, Denmark.

25. **Metzner, Rebecca**. Fisheries management. Food and Agriculture Organization of the United Nations, Rome.

Background Papers

Institutional Change and Fishing Sector in Spain: The Governance of the Spanish 300 Fleet on the Gran Sol Fishing Grounds by Gonzalo Caballero, María Dolores Garza and Manuel Varela

On Fisheries and Property Rights by Ikerne del Valle and Kepa Astorkiza

Is There a Case for Effort Control by Rögnvaldur Hannesson

Effort Management in the Danish Fishery for Blue Mussels by Peder Andersen, Hans Frost, and Niels Vestergaard

Effort Versus Quota Control When Stocks Cannot be Targeted by Rögnvaldur Hannesson

Input Based Rights Based Management: The Falkland Islands Loligo Squid Fishery by Viswanie Maharaj.

The Effort Control Program in the Northeast United States Groundfish Fishery by Eric Thunberg and Min-Yang Lee

Effort Control through the Vessel Day Scheme: Rights-based Management in the Western and Central Pacific Ocean Tuna Fishery by Elizabeth Havice

Hawaii Pelagic Longline Fishery and Sea Turtle Bycatch – The Use of Set Certificates as an Allocation Solution by Raymond Clarke, Paul Dalzell, and Walter Ikehara

Effort Rights Based Management by Dale Squires, Mark Maunder, Samuel Herrick, Jr., Mark Helvey, and Raymond Clarke

Management of Demersal Fisheries in the Faroese Fishing Zone, FFZ by Kjartan Hoydal

Rights-Based Fisheries Management in a Developing Country: A Case Study of Malaysia by Shaufique F. Sidique, Kusairi Mohd Noh, and Kuperan Visnawathan

Agenda

Inter-Disciplinary Workshop on the Management, Economics, and Biology of Transferable Effort Rights-Based Management

Bilbao (Spain) 17-20 September 2012

Final

<u>Sponsored by:</u> US National Marine Fisheries Service, International Seafood Sustainability Foundation, Nordic Council of Ministers, Research Council of Norway, University of the Basque Country

VENUE:

Faculty of Economics and Business (SARRIKO)
www.ekonomia-enpresa-zientziak.ehu.es/p242-home/es
Basoko Etxea. Ganbara Meeting Room.
Avda. Lehendakari Agirre 83,
48015 Bilbao (Spain)

SARRIKO Economics & Business School. Main Entrance.

SARRIKO Campus Area

Basoko Etxea Meeting Room (SARRIKO)

Chairs: Peder Anderson and Ikerne del Valle

Purpose: Evaluate transferable effort programs as form of rights-based management to assess strengths and weaknesses, most appropriate fisheries in which to apply, implications and consequences when apply, trade-offs when apply to different fisheries, design features for optimum performance

Steering Committee: Peder Andersen, University of Copenhagen, Røgnvaldur Hannesson, Norwegian School of Economics and Management, Sam Herrick and Dale Squires, National Marine Fisheries Service La Jolla, Niels Vestergaard, University of Southern Denmark, Ikerne del Valle, University of the Basque Country, Mark Maunder, Inter-American Tropical Tuna Commission, Victor Restrepo, International Seafood Sustainability Foundation

Expected Outcomes: (1) journal paper (e.g. *Fish and Fisheries*), (2) FAO Fisheries Technical Paper. Each presentation will form a chapter in FAO Fisheries Technical Paper and synthesis paper from meeting forms another chapter and (after some changes) journal paper.

Rapporteur: Squires, Helvey

Day 1: 17th September, Monday

9:45 Introductions, purpose, key issues, etc.- Peder Anderson and Ikerne del Valle

9:45 Overview and survey – Dale Squires

10:30 coffee

11:00 Is There a Case for Effort Control? - Røgnvaldur Hannesson
Effort Versus Quota Control When Stocks Cannot be Targeted – Hannesson
Discussant (Squires and Hannesson papers): Vestergaard
12:30 Microeconomics of Effort and Output Controls – Vestergaard
Discussant: Squires/Hannesson

13:00-14:00 lunch

14:00-14:45 Property Rights - del Valle
Discussant – Peder Anderson
14:45-15:45 Management Strategy Evaluation - Doug Butterworth
Discussant: Ana Parma

15:45 Coffee

16:15-17:15 Developing country perspective – Shaufique Fahmi
Discussant: Ivan Prieto
17:15 Overview and wrap-up for day and what's up for next day

Day 2: 18th September, Tuesday

9:00 Falklands/Malvinas Squid – Vishwanie Maharaj
Discussant: Sam Herrick
9:45 New England Groundfish – Eric Thunberg
Discussant: Mark Helvey

10:30 Coffee

11:15 Effort and output controls – Ana Parma and Doug Butterworth

13:00-14:30 lunch

14:30-15:15 Faeroe Islands – Hans Ellefson
Discussant: Rognvaldur Hannesson
15:15-16:00 Faeroe Islands – Kjartan Hoydal
Discussant: Stein Ivar Steinshamn

16:00 Coffee

16:30-17:15 Hawaii Pelagic Longline Fishery and Sea Turtle Bycatch – Ray Clarke

Discussant: Mark Helvey
17:15 Summary, Themes to Discuss, Begin Discussion
18:00 Wrap-up

Day 3: 19th September, Wednesday

9:00 Spanish 300 fleet – Gonzalo Caballero
Discussion includes EU use of both ITQs and effort controls
Discussant: ikerne del Valle
Discussant: Patrice Guillotreau

9:50-10:50 PNA Vessel Day Scheme – Elizabeth Havice
Discussant: John Hampton (implications for assessments)
Discussant: Rognvaldur Hannesson (economics)

10:50 Coffee

11:20 New England pot and trap – Eric Thunberg
Discussant: Vishwanie Maharaj
12:10 Danish case study – Peder Andersen
Discussant: Stein Ivar Steinshamn

13:00 lunch

Day 4: 20th September, Thursday

9:00 Discussion and wrap-up – Peder Andersen
Rapporteur – Squires

10:30-11:00 Coffee

13:00 lunch