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Fisheries Economics and 20 Years with *Marine Resource Economics*: A Citation Analysis

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Abstract *This paper reviews the impact of articles published in the Marine Resource Economics (MRE) and within the field of fisheries economics in general over the period 1954–2004. Specific attention is given to the years 1984–2004, which is the period that MRE has been published. The degree of influence is assessed using citation analysis. I present the most cited papers in MRE, the top ten all time cited fisheries economics papers, and the most cited papers during each decade over the last 30 years. By analysing the trend of recently published papers, I can assess which ones are projected to be most influential.*

Key words Fisheries economics, *Marine Resource Economics*, ISI.

JEL Classification Code Q22.

Introduction

What is a seminal paper? Can we classify publications as essential for the field? These questions are probably dealt with by all ambitious teachers, and any researcher must ask now and then: Am I aware of the relevant literature? Answers can be based on various criteria and most of us with experience in a particular field most often have personal favourites. If seminal and essential are interpreted as most influential, we can use quantitative methods that are nowadays more easily accessed than ever.

The first issue of *Marine Resource Economics (MRE)* was published in 1984 and continued until 1989 with the original publisher. In 1992 publishing rights were attained from the original publisher and publication resumed under the auspices of the non-profit Marine Resources Foundation. The journal has been regularly issued since 1992 and this year's volume is the 21st. It is thus appropriate at this stage to consider some questions about where the field of fisheries economics has taken us over the past several decades and also to examine the role that *MRE* has played in the evolution of the literature. What are the main themes that fisheries economists have addressed? How have those changed and responded to policy questions and important findings from previous work? Where have papers in fisheries economics typically been published and how has this changed with the advent of specialty journals like *MRE*? And, most importantly, what impact have various papers had measured by objective indicators such as citation indices? These are some of the is-

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sues addressed in this paper. The standard approach today for analyzing impacts of particular journal articles is to use a citation index. The index produced by the Institute for Scientific Information (ISI) is easily accessible in electronic versions and is thus the most commonly used measure of citations. This index has been used not only to provide raw rankings of citations, but also to provide rankings of journals and impact factors that reveal how widely particular journals are cited. In addition, citation indices, weighted and unweighted, have been used to rank the productivity and impact of departments or individuals (see *e.g.*, Kalaitzidakis, Mamuneas, and Stengos 2003). Citation analysis has become a common and influential method for assessing the impact of individual researchers, departments, and journals. However, there are limitations related to citation analysis and Costanza *et al.* (2004) list four issues:

- (i) The influence of a publication can go well beyond academia, and citation analysis will not pick up this nonacademic influence.
- (ii) Quantity of citations is not the same as quality. A particular paper might influence only a very few, but those few might be very deeply influenced and might make tremendous further use of the ideas. Some important ideas have lain dormant and “uncited” until they were rediscovered much later.
- (iii) The ISI databases contain only journal articles from a select (albeit large—more than 8,500 journals) group of journals and are, therefore, biased toward the fields that do most of their publishing in the included journals. Most of these are English language journals, and as such there is a bias towards the work of English-speaking scientists. The journals of some fields are underrepresented, and some fields are more focused on books rather than journals as a publication medium. While citations in books are not counted, citations to books or book chapters that occur in articles in included journals are counted. Citations to journals that are not included in the database are also included in the Citation Index.
- (iv) Because of the slowness of the academic review process, it usually takes a year or two for citations to a publication to begin to appear. Citation analysis is, therefore, most useful for publications that are at least a few years old.

Still, with these limitations citation analysis provides a simple, powerful method of assessing the impact of articles and also a whole journal; *i.e.*, *MRE*.

Methods

The first step in a citation analysis is to choose the articles for the study. In case of *MRE*, it was straightforward. All issues were checked and those articles which had 14 citations or more were included. Concerning seminal papers in fisheries economics in general, excellent guidance is provided in the recently edited two volumes, *Fisheries Economics*, by L.G. Anderson (2002). However, I decided to narrow down the scope further; only papers published in economics journals are considered. This is, of course, questionable due to the interdisciplinary nature of the topic and the non-deniable fact that important contributions have been made by Schaefer (1954, 1957) and that many economists have published papers in other journals, most notably the *Journal of the Fisheries Research Board of Canada* (renamed the *Journal of Fisheries and Aquatic Sciences* in 1980). However, this limitation was implemented in order to facilitate the task. In addition to the papers in Anderson’s volumes, I pro-

duced a list of additional articles based on my opinion and with assistance from some senior researchers in the field. I then checked those with number of citations. I also checked some of the well-known books in fisheries economics and natural resources, but decided to focus on articles. Finally, *MRE* has a wider scope than fisheries economics, which is acknowledged in the *MRE* citations table. However, for the rest of the papers the focus is on fisheries economics; *i.e.*, papers on anglers and recreational valuation are not included.

The total number of citations to each paper was estimated using the ISI Web of Knowledge. A cited reference search on each publication in our lists provided the number of times that publication had been cited in the journals monitored by ISI. This option searches the 'Science Citation Index Expanded,' 'Social Science Citation Index,' and 'Arts and Humanities Citation Index' databases. These databases include almost 9,000 journals and more than 25 million articles. It was natural to include all databases given the interdisciplinary nature of fisheries economics. This analysis was carried out between September 9 and 23, 2005. The ISI database covers citations in journals published from 1945 (1955 for the social sciences) to present. Hence, basically all articles were published within the time span (Gordon 1954, preceded with one year), and the number of citations is in fact the total number of citations in all ISI journals over its lifetime. ISI also provides a search option which groups citations by each journal. Such a function can be used to identify which papers are most often cited that appear in a particular journal; *e.g.*, *MRE*. Unfortunately, *MRE* is not fully integrated into the ISI database, and this option could not be used for analyzing it.

Several techniques were applied in order to pick up all citations including those that might be missed with various data entry and coding errors associated with the ISI database. For example, I included preceding and succeeding years and alternative spellings of surnames. Surprisingly few errors seem to occur with a few conspicuous exceptions. Colin Clark's book is referred to with a broad variety of titles, including "pure and applied mathematics," "mathematical bioeconomics," and "the optimal management of renewable resources." This occurs because the first title is the name of the book series and the second and the third are in fact both parts of the long title. Similarly two important papers by the Nobel Prize winner in Economics, Vernon Smith, in *American Economic Review*, 1968, and in the *Journal of Political Economy (JPE)*, 1969, often lead to references of *JPE*, 1968, which were counted as *JPE*, 1969, citations.

Results

The most cited articles published in *MRE* are reported in table 1. Individual transferable quotas (ITQs) obviously form an important area of research reported in *MRE*. Five of the nineteen most cited papers deal with ITQs (Casey *et al.* 1995; Anderson 1994; Arnason 1993; Clark, Major, and Mollett 1988; Lindner, Campbell, and Bevin 1992). Another group of papers relate to the fundamental problem in fisheries, originally described by Gordon (1954), and how to correct for the lack of well-defined property rights by means other than ITQs (Scott 1993; Ruddle, Hviding, and Johannes 1992; Edwards 1994; Parks and Bonifaz 1994). Parks and Bonifaz (1994) study the traditional open-access problem, but for the case of mariculture of shrimp, where mangrove forest is the depleted resource.

The seven articles in italics letters deal with valuation applied to marine recreation. Freeman's (1995) article conveniently provides an overview of research linking water quality and marine recreation. Loomis and Larson (1994) also have a link to bioeconomic modelling in their paper on valuation of increasing grey whale populations.

A third important area of research reported in *MRE* deals with marine reserves where Holland and Brazee (1996) and Hannesson (1998) are two often cited papers. Eales and Wilen (1986) model the determinants of spatial choice by fishers, which clearly has a close link to applied studies on marine reserves, but more generally can be seen as an attempt to model the microeconomic behaviour of fishers. Finally, Andersen and Sutinen (1984) discuss various approaches to handle uncertainty in fisheries. Their paper is the only top twenty cited paper that explicitly deals with uncertainty, which is a bit surprising given the pervasive uncertainties in fisheries.

In general, I would expect older papers to have been more heavily cited than recent publications. One way to compensate for this age effect is to look at the number of citations per unit of time. In the second column of the tables, I report the average number of citations per year, which provides the simplest way of comparing papers occurring at different points of time. In that respect, citations per year are more related to the concept of impact factor. Ranking based on citations per year reinforces the picture of marine reserves being a hot topic, whereas the two marine reserves papers are first and third.¹

Table 2 reports the top ten cited papers. Gordon (1954) is the most cited and has the highest average number of citations per year. Among journals, *JPE* has the top three articles and four out of the top ten. The core journals dominate, while the field journals, *Journal of Law and Economics* and *Journal of Environmental Economics and Management (JEEM)*, contributed with one article each. Almost all of the papers develop theoretical models that are used to derive their results.

MRE began in 1984 and notably all of the top ten papers are older than the journal. To understand whether *MRE* has played a role in publishing well-cited papers, I list the top publications during 1984–2001 in table 3. As this shows, seven of the 25 most cited fisheries economics papers were published in *MRE*, with Holland and Brazee (1996) the second most cited. Seven papers were published in *JEEM*, three in *Land Economics (Land)*, two in the *American Journal of Agricultural Economics (AJAE)*, and two in the *Canadian Journal of Economics*. Single papers appeared in *Rand*, *Econometrica*, *JPE*, and *Applied Economics*. Most interestingly, the most cited fisheries papers are not published in the top core journals anymore, with Berck and Perloff (1984) and Karpoff (1987) the two exceptions from the very beginning of the period. In addition, many of the papers now focus on empirical questions with econometrics as one of the crucial components. A prominent example is Squires (1987a), which is part of his extensive work applying microeconometrics and the theory of the firm and introducing ideas from industrial organization into the analyses of fisheries. Bockstael and Opaluch (1983) is another empirical analysis combining McFadden's (1973) contribution of how to model discrete choice with uncertainty and using these methods to model the choice of target species and location.

In order to reveal some further trends in topics, methods, and journals, I report the most cited papers grouped by decade over the last three decades, starting with 1970–79 in table 4. The most striking feature in table 4 is the influence Colin W. Clark and colleagues have had and still have on fisheries economics. As an applied mathematician, Clark published several influential papers in non-economics journals and including them in the table would bring another 2–3 papers to this list. In addition his book originally published in 1976 and revised in 1990, with almost 1,200 citations, is the most cited work of all contributions to fisheries economics.²

¹ As pointed out by an anonymous reviewer, citations per year can also identify currently popular topics. Another definition of a seminal paper would be a constant, sustained citation trend over a long time, which would exclude a judgement of a paper as being seminal until a long period has passed since the publication.

² Other influential books are Dasgupta and Heal (1979) with 542 citations, Anderson (1976/1986), and Conrad and Clark (1987), which have received 143 and 115 citations, respectively.

Table 1
Top Twenty in *Marine Resource Economics*

Citations	Cit./Year	Title	Author(s)	Year
51	5.7	Marine Reserves for Fisheries Management	Holland and Brazee	1996
33	3.3	The Effects of Individual Vessel Quotas in the British Columbia Halibut Fishery	Casey <i>et al.</i>	1995
33	2.8	Obstacles to Fishery Self-Government	Scott	1993
33	2.1	<i>A Random Utility Model for Sportfishing: Some Preliminary Results for Florida</i>	Bockstael, McConnell, and Strand	1989b
30	2.3	Marine Resources Management in the Context of Customary Tenure	Ruddle, Hviding, and Johannes	1992
26	1.4	An Examination of Fishing Location Choice in the Pink Shrimp Fishery	Eales and Wilen	1986
23	1.4	<i>Taking Stock of Progress with Travel Cost Recreation Demand Methods: Theory and Implementation</i>	Smith	1989
23	1.4	Development and Implementation of New Zealand's ITQ Management System	Clark, Major, and Mollett	1988
23	1.1	Stochastic Bioeconomics: A Review of Basic Methods and Results	Andersen and Sutinen	1984
21	3.0	Marine Reserves: What Would They Accomplish?	Hannesson	1998
18	1.6	An Economic Analysis of Highgrading in ITQ Fisheries Regulation Programs	Anderson	1994
17	1.7	<i>The Benefits of Water Quality Improvements for Marine Recreation: A Review of the Empirical Evidence</i>	Freeman	1995
17	1.5	<i>Total Economic Values of Increasing Gray Whale Populations: Results from a Contingent Valuation Survey of Visitors and Households</i>	Loomis and Larson	1994
17	1.5	Nonsustainable Use of Renewable Resources: Mangrove Deforestation and Mariculture in Ecuador	Parks and Bonifaz	1994
17	1.4	The Icelandic Individual Transferable Quota System: A Descriptive Account	Arnason	1993
17	1.1	<i>Measuring the Benefits of Improvements in Water Quality: The Chesapeake Bay</i>	Bockstael, McConnell, and Strand	1989a
16	1.5	Ownership of Renewable Ocean Resources	Edwards	1994
15	1.2	Rent Generation during the Transition to a Managed Fishery: The Case of the New Zealand ITQ System	Lindner, Campbell, and Bevin	1992
14	0.8	<i>Angler Response to Success in the California Salmon Sportfishery: Evidence and Management Implications</i>	Andrews and Wilen	1988
13	0.6	Behavioral Modeling and Fisheries Management	Opaluch and Bockstael	1984

Note. Citations from ISI Web of Knowledge as of September 20, 2005.

Table 2
Top Ten in Fisheries Economics

Rank	Citations	Cit./Year	Author(s)	Title	Journal	Year
1	749	14.7	Gordon	The Economic Theory of a Common-Property Resource...	<i>JPE</i>	1954
2	233	4.7	Scott	The Fishery: The Objectives of Sole Ownership	<i>JPE</i>	1955
3	190	5.3	Smith	On Models of Commercial Fishing	<i>JPE</i>	1969
4	177	5.1	Cheung	The Structure of a Contract and the Theory of a Non-exclusive Resource	<i>J Law Econ</i>	1970
5	132	3.6	Smith	The Economics of Production from Natural Resources	<i>AER</i>	1968
6	117	4.5	Clark, Clarke, and Munro	The Optimal Exploitation of Renewable Resource Stocks...	<i>Econometrica</i>	1979
7	113	3.5	Clark	Profit Maximization and the Extinction of Animal Species	<i>JPE</i>	1973
8	103	4.1	Levhari and Mirman	The Great Fish War: An Example Using a Dynamic...	<i>Bell</i>	1980
9	101	3.4	Clark and Munro	The Economics of Fishing and Modern Capital Theory...	<i>JEEM</i>	1975
10	95	4.1	Johnson and Libecap	Contracting Problems and Regulation: The Case of the Fishery	<i>AER</i>	1982

Table 3
Top 25 Fisheries Economics Papers Published 1984–2001

Cit.	Cit./Year	Title	Author(s)	Journal	Year
81	4.3	A Critical Review of the Individual Quota as a Device...	Copes	<i>Land</i>	1986
51	5.7	Marine Reserves for Fisheries Management	Holland and Brazee	<i>MRE</i>	1996
43	2.2	The Economics of Fisheries Law Enforcement	Sutinen and Andersen	<i>Land</i>	1985
41	5.1	A Model of Regulated Open Access Resource Use.	Homans and Wilen	<i>JEEM</i>	1997
39	6.5	Bioeconomics of Spatial Exploitation in a Patchy...	Sanchirico and Wilen	<i>JEEM</i>	1999
37	2.1	Public Regulation and the Structure of Production in ...	Squires	<i>Rand</i>	1987b
34	1.5	Discrete Modelling of Supply Response under Uncertainty...	Bockstael and Opaluch	<i>JEEM</i>	1983
33	3.3	The Effects of Individual Vessel Quotas in the British...	Casey <i>et al.</i>	<i>MRE</i>	1995
33	2.8	Obstacles to Fishery Self-Government	Scott	<i>MRE</i>	1993
31	1.7	Suboptimal Controls in Common Resource...	Karpoff	<i>JPE</i>	1987
30	2.3	Marine Resources Management...	Ruddle, Hviding, and Johannes	<i>MRE</i>	1992
29	1.6	Fishing Effort — Its Testing, Specification, and Internal...	Squires	<i>JEEM</i>	1987a
29	1.4	An Open-Access Fishery with Rational Expectations	Berck and Perloff	<i>Econometrica</i>	1984
28	1.9	Entry Restrictions in the Fishery...	Townsend	<i>Land</i>	1990
26	1.4	The Dynamics of an Open Access Fishery	Bjørndal and Conrad	<i>Can J Econ</i>	1987
26	1.4	An Examination of Fishing Location Choice in the...	Eales and Wilen	<i>MRE</i>	1986
26	1.5	The Technology and Management of Multispecies Fisheries	Kirkley and Strand	<i>Appl Econ</i>	1988
25	1.8	Production Quota in Multiproduct Pacific Fisheries	Squires and Kirkley	<i>JEEM</i>	1991
25	1.3	Optimal Governing Instrument Operational Level...	Anderson and Lee	<i>AJAE</i>	1986
24	6.0	A Bioeconomic Model of Marine Reserve Creation	Sanchirico and Wilen	<i>JEEM</i>	2001
24	2.4	Assessing Technical Efficiency in Commercial Fisheries...	Kirkley, Squires, and Strand	<i>AJAE</i>	1995
23	1.6	Estimating the Elasticity of Substitution between...	Campbell	<i>JEEM</i>	1991
23	1.5	Minimum Information Management in Fisheries	Arnason	<i>Can J Econ</i>	1990
23	1.4	Development and Implementation of New Zealand's ITQ...	Clark, Major, and Mollett	<i>MRE</i>	1988
23	1.1	Stochastic Bioeconomics: A Review of Basic Methods...	Andersen and Sutinen	<i>MRE</i>	1984

Table 4
Most Cited Fisheries Economics Papers Published 1970–79

Cit.	Cit./Year	Author	Title	Year	Journal
177	5.1	Cheung	The Structure of a Contract and the Theory of a Non-exclusive Resource	1970	<i>J Law Econ</i>
117	4.5	Clark, Clarke, and Munro	The Optimal Exploitation of Renewable Resource Stocks: Problems of Irreversible Investment	1979	<i>Econometrica</i>
113	3.5	Clark	Profit Maximization and the Extinction of Animal Species	1973	<i>JPE</i>
101	3.4	Clark and Munro	The Economics of Fishing and Modern Capital Theory: A Simplified Approach	1975	<i>JEEM</i>
56	1.8	Brown	An Optimal Program for Managing Common Property Resources with Congestion Externalities	1974	<i>JPE</i>
54	1.6	Bell	Technological Externalities and Common-Property Resources: An Empirical Study of the U.S. Northern Lobster Fishery	1972	<i>JPE</i>
49	1.4	Plourde	A Simple Model of Replenishable Natural Resource Exploitation	1970	<i>AER</i>
49	1.5	Christy	Fisherman Quotas: A Tentative Suggestion for Domestic Management	1973	*
41	1.6	Munro	The Optimal Management of Transboundary Renewable Resources	1979	<i>Can J Econ</i>
37	1.1	Copes	Factor Rents, Sole Ownership and the Optimum Level of Fisheries Exploitation	1972	<i>Man Sch Econ</i>

* Christy's paper is an exception as it was only presented as a working paper from Rhode Island, but is included due to its obvious importance.

The most cited fisheries economics paper published in the 1970s is by Steven Cheung (1970). This is the first paper on contract theory with applications to fisheries, but has notably received little attention in environmental and resource or marine journals thus far.³ Munro (1979) is the first reference where game theory is applied to fisheries economics. In general, in the 1970s the most cited papers were still published in core journals and many in top journals with two exceptions. Clark and Munro's (1975) work appeared in the newly formed specialty journal, *JEEM*, and Christy's (1973) work appeared simply as a manuscript.⁴ According to Wilen (2000), getting ITQs on the agenda as a viable policy instrument is arguably the most important policy achievement made by fisheries economists. The work on ITQs starts with Dales (1968a,b), who suggested transferable emission permits for water-related pollution.⁵ Montgomery (1972) proved the economic efficiency of such instruments,

³ Of 97 detailed records of citations of Cheung, only four are in such journals, while other economics and legal journals often cite Cheung.

⁴ The reason for including Christy is the great importance of Individual Transferable Quotas (ITQs) to the field.

⁵ Crocker (1966) had a similar suggestion for handling air pollution, but it is the book and the paper published by Dales (1968a,b) that has received the recognition, with about 400 citations.

and the 1973 manuscript by Christy suggested a similar arrangement for fisheries. Later on Arnason (1990) proved that ITQs are efficient in a dynamic context given that some reasonable conditions are fulfilled.

Table 5 shows the top ten papers of the 1980s. By this time, it could be seen that the field journals were starting to take preeminence, and an early publication in *MRE* is found on the list. Eales and Wilen (1986) extended the research area initiated by Bockstael and Opaluch (1983) by studying fishers' spatial location choice. Other areas initiated during this decade include the study of crime and punishment in fisheries (Sutinen and Andersen 1985), contract theory with applications to fisheries (Johnson and Libecap 1982),⁶ and the political economy of fisheries regulation (Karpoff 1987).

In table 6 the most cited papers during the 1990–2001 period are reported. By the 1990s the field journals had more or less began to dominate as publishers of fisheries economics papers, with *MRE* established as a journal for well-cited papers in fisheries economics. Holland and Brazee (1996) is the most cited fisheries economics paper from the 1990s and four out of top six were published in *MRE*. The papers are a mixture of pure theoretical ones, those with a unique model which is tested empirically, and pure empirical papers where standard theories are tested or applied to fisheries economics.

Can anything be said about the future? The number of citations per year gives

Table 5
Most Cited Fisheries Economics Papers Published 1980–89

Cit.	Cit./Year	Title	Author(s)	Journal	Year
103	4.1	The Great Fish War: An Example...	Levhari and Mirman	<i>Bell</i>	1980
95	4.1	Contracting Problems and Regulation...	Johnson and Libecap	<i>AER</i>	1982
81	4.3	A Critical Review of the Individual...	Copes	<i>Land</i>	1986
43	2.2	The Economics of Fisheries Law Enforcement	Sutinen and Andersen	<i>Land</i>	1985
37	2.1	Public Regulation and the Structure of...	Squires	<i>Rand</i>	1987b
34	1.5	Discrete Modelling of Supply Response...	Bockstael and Opaluch	<i>JEEM</i>	1983
31	1.7	Suboptimal Controls in Common...	Karpoff	<i>JPE</i>	1987
29	1.6	Fishing Effort — Its Testing, Specification, and Internal...	Squires	<i>JEEM</i>	1987a
29	1.4	An Open-Access Fishery with Rational Expectations	Berck and Perloff	<i>Econometr</i>	1984
26	1.5	The Technology and Management of...	Kirkley and Strand	<i>Appl Econ</i>	1988
26	1.4	The Dynamics of an Open Access Fishery	Bjørndal and Conrad	<i>Can J Econ</i>	1987
26	1.4	An Examination of Fishing Location...	Eales and Wilen	<i>MRE</i>	1986

⁶ As noted earlier, Cheung (1970) is the first paper in this area, but in environmental and resource or marine journals Johnson and Libecap (1982) is the reference often made.

Table 6
Most Cited Fisheries Economics Papers Published 1990–2001

Cit.	Cit./Year	Title	Author(s)	Journal	Year
51	5.7	Marine Reserves for Fisheries Management	Holland and Brazee	<i>MRE</i>	1996
41	5.1	A Model of Regulated Open Access Resource Use	Homans and Wilen	<i>JEEM</i>	1997
39	6.5	Bioeconomics of Spatial Exploitation in a Patchy Environment	Sanchirico and Wilen	<i>JEEM</i>	1999
33	3.3	The Effects of Individual Vessel Quotas in the British Columbia Halibut Fishery	Casey <i>et al.</i>	<i>MRE</i>	1995
33	2.8	Obstacles to Fishery Self-Government	Scott	<i>MRE</i>	1993
30	2.3	Marine Resources Management in the Context of Customary Tenure	Ruddle, Hviding, and Johannes	<i>MRE</i>	1992
28	1.9	Entry Restrictions in the Fishery: A Survey of the Evidence	Townsend	<i>Land</i>	1990
25	1.8	Production Quota in Multiproduct Pacific Fisheries	Squires and Kirkley	<i>JEEM</i>	1991
24	6.0	A Bioeconomic Model of Marine Reserve Creation	Sanchirico and Wilen	<i>JEEM</i>	2001
24	2.4	Assessing Technical Efficiency in Commercial Fisheries: The Mid-Atlantic Sea Scallop Fishery	Kirkley, Squires, and Strand	<i>AJAE</i>	1995

an indication whether a paper is rapidly gaining influence or not. Table 7 shows a ranking based on average citations per year for papers published 1990–2001. The papers are similar to those in table 6, but the order has changed and the important role played by *MRE* as a well-established journal in the field is reinforced. Five of the most highly cited papers appeared in *MRE* and three in *JEEM*, while *AJAE* and *Land* had one each. Hannesson (1998) has entered the list as a new but highly cited paper. It is worth noting that Gordon (1954) has the highest number of average citations per year over all time, but is then followed by the more recent top three papers in table 7. The average number of citations per year is one way to compare papers occurring at different points of time. Can we refine our methods and find a way to predict future importance of a recent paper? Costanza *et al.* (2004) suggest that a foundational paper has the characteristic of an increasing time trend of citations per year over a number of years. An alternative definition suggested by an anonymous reviewer of this paper is that a seminal paper is characterized by a constant, sustained citation trend over a long time.

Figure 1 shows the trend in annual citations over 1998–2004 for the older papers with high average citation rate.⁷ Gordon (1954) clearly shows the characteristics of a foundational paper, while the others seem to have a horizontal

⁷ The extended analysis of citations in ISI is limited in the sense that not all citations reported according to total cites can be retrieved on an annual basis. Hence, some years have a low number of cites, and particularly for older papers it is hard to even come up with a figure for years before 1998, which is the reason for the chosen time period.

Table 7
Citations per Year in Fisheries Economics Papers Published 1990–2001

Cit./Year	Citations	Title	Author(s)	Journal	Year
6.5	39	Bioeconomics of Spatial Exploitation in a Patchy Environment	Sanchirico and Wilen	<i>JEEM</i>	1999
6.0	24	A Bioeconomic Model of Marine Reserve Creation	Sanchirico and Wilen	<i>JEEM</i>	2001
5.7	51	Marine Reserves for Fisheries Management	Holland and Brazee	<i>MRE</i>	1996
5.1	41	A Model of Regulated Open Access Resource Use	Homans and Wilen	<i>JEEM</i>	1997
3.3	33	The Effects of Individual Vessel Quotas in the British Columbia Halibut Fishery	Casey <i>et al.</i>	<i>MRE</i>	1995
3.0	21	Marine Reserves: What Would They Accomplish?	Hannesson	<i>MRE</i>	1998
2.8	33	Obstacles to Fishery Self-Government	Scott	<i>MRE</i>	1993
2.4	24	Assessing Technical Efficiency in Commercial Fisheries — The Mid-Atlantic Sea Scallop Fishery	Kirkley, Squires, and Strand	<i>AJAE</i>	1995
2.3	30	Marine Resources Management in the Context of Customary Tenure	Ruddle, Hviding, and Johannes	<i>MRE</i>	1992
1.9	28	Entry Restrictions in the Fishery: A Survey of the Evidence	Townsend	<i>Land</i>	1990

Note that except for the top four papers in this table, all the top ten papers in table 2 have more citations per year.

trend. In fact, when checking the slope of the five observations for each paper (2005 is excluded for these old papers), it turns out that all are slightly positive except for Scott (1955), which has a horizontal trend. I assume that all fisheries economists agree that Scott (1955) is a seminal paper, which provides a case in favour of the alternative definition of a paper being seminal if it has a constant, sustained citation trend over a long time.

In figure 2 I look at the recently published papers with high numbers of citations per year. All of these papers have positive trend; *i.e.*, I would expect their number of annual citations to increase. Hence, it may be too early to call Holland and Brazee (1996) or Sanchirico and Wilen (1999) seminal papers based on total cites, but given their substantial citation rate per year and the positive trend, they most likely will be regarded as seminal in another five years.

What is the citation rate status of *MRE* compared to other economic journals? *Journal of Citations Report (JCR)* is available in two editions, the Science Edition and the Social Sciences Edition, which cover 1,800 international social sciences journals from the ISI database. In the field of economics, *JCR* ranks 172 journals, but unfortunately it does not rank *MRE*. However, comparing total annual cites of *MRE* in the ISI with other formally ranked journals may give us an idea of *MRE*'s

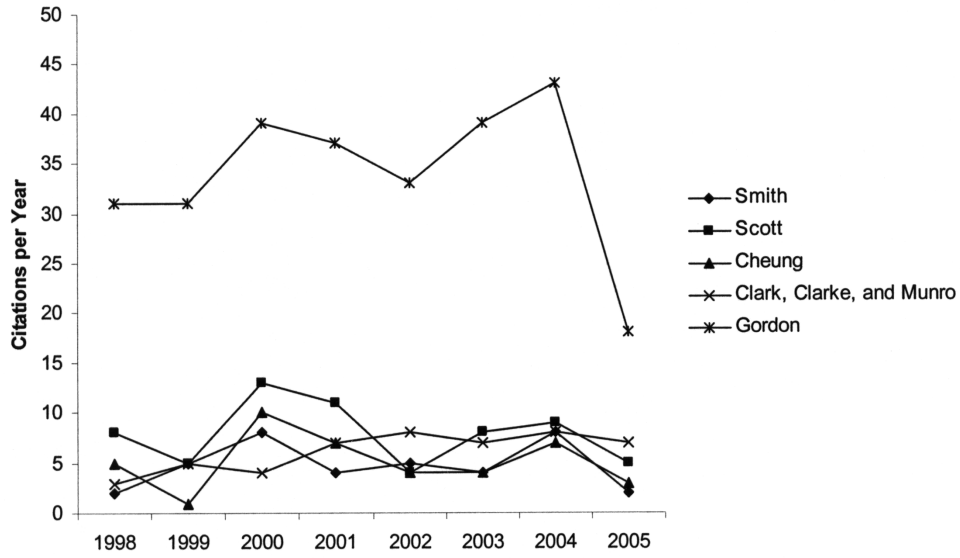


Figure 1. Paper Trend 1954–89

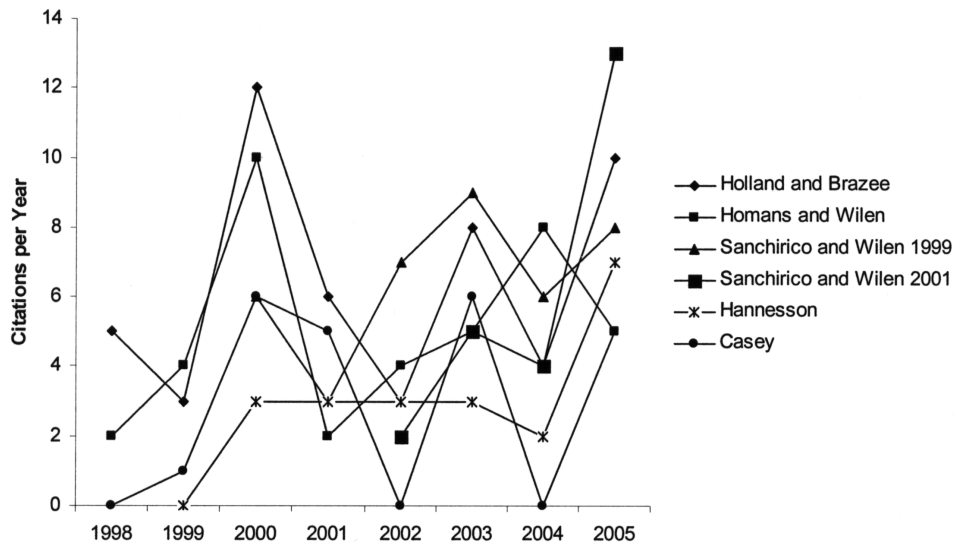


Figure 2. Paper Trend 1990–01

importance. Based on the total number of citations, *MRE* is roughly comparable to the *Australian Journal of Agricultural and Resource Economics* (ranked 156 out of 172) and *Developing Economies* (ranked 157), two journals that are listed in the *JCR*. Based on the citations for each year during 1998–2004, *MRE* would be ranked in between these two journals if it were included in the *JCR*.

Conclusions

The management of marine fisheries has risen to the top of the global agenda. In the Millennium Ecosystem Assessment (2005), launched by U.N. Secretary-General Kofi Annan in June 2001, a short list of key problems starts, “Among the outstanding problems identified by this assessment are the dire state of many of the world’s fish stocks...” (Millennium Ecosystem Assessment 2005, p. 18). The great policy interest of fisheries management is likely to generate funding for research in fisheries economics, but also demand more contributions from the field.

This paper has examined the contributions to fisheries economics during 1954–2001 using citation analysis. This method offers an easily accessible, rich resource for analyzing the impact of various contributions within a field. Total citations and average citations per year are good, but not perfect, indicators of the influence of a particular contribution. An additional method for predicting a future foundational paper is to check for an increasing time trend of citations per year over a number of years. Gordon (1954) is, not surprisingly, the most important paper in the field and meets all the criteria of a foundational paper. Concerning recent trends in fisheries economics, it is clear that the subject of marine reserves is attracting attention beyond standard fisheries economics.

The important papers in fisheries economics were published in top or core journals during 1954–79, but during the 1980s field journals became gradually more important. By the 1990s all important papers were published in field journals. *MRE* has now completed publishing 20 volumes, and the journal seems established in a well-defined area. Of the ten most cited papers in fisheries economics published during 1990–2001, *MRE* had four articles, and if we look at the most cited papers among those published during 1990–2001 the importance of *MRE* is even greater, with half of the top ten publications. Overall, five articles published in *MRE* have received 30 or more citations, which is a substantial amount for a relatively small field.

References

- Andersen, P., and J. Sutinen. 1984. Stochastic Bioeconomics: A Review of Basic Methods and Results. *Marine Resource Economics* 1(2):117–36.
- Anderson L.G. 1977, 1986. *The Economics of Fisheries Management*. Baltimore, MD: Johns Hopkins.
- . 1994. An Economic Analysis of Highgrading in ITQ Fisheries Regulation Programs. *Marine Resource Economics* 9(3):209–26.
- , ed. 2002. *Fisheries Economics: Collected Essays*. Vols. 1 and 2, *International Library of Environmental Economics and Policy*. Aldershot, U.K.; Burlington, VT; and Sydney, Australia: Ashgate.
- Anderson, L.G., and D.R. Lee. 1986. Optimal Governing Instrument, Operation Level, and Enforcement in Natural Resource Regulation: The Case of the Fishery. *American Journal of Agricultural Economics* 68(3):678–90.

- Andrews, E.J., and J. Wilen. 1988. Angler Response to Success in the California Salmon Sportfishery: Evidence and Management Implications. *Marine Resource Economics* 5(2):125–38.
- Arnason, R. 1990. Minimum Information Management in Fisheries. *Canadian Journal of Economics* 23(3):630–53.
- . 1993. The Icelandic Individual Transferable Quota System: A Descriptive Account. *Marine Resource Economics* 8(3):201–18.
- Bell, F.W. 1972. Technological Externalities and Common-Property Resources: An Empirical Study of the U.S. Northern Lobster Fishery. *Journal of Political Economy* 80(1):148–58.
- Berck, P., and J. Perloff. 1984. An Open-Access Fishery with Rational Expectations. *Econometrica* 52(2):489–506.
- Bjorndal, T., and J.M. Conrad. 1987. The Dynamics of an Open Access Fishery. *Canadian Journal of Economics* 20(1):74–85.
- Bockstael, N.E., K.E. McConnell, and I.E. Strand. 1989a. Measuring the Benefits of Improvements in Water Quality: The Chesapeake Bay. *Marine Resource Economics* 6(1):1–18.
- . 1989b. A Random Utility Model for Sportfishing: Some Preliminary Results for Florida. *Marine Resource Economics* 6(3):245–60.
- Bockstael, N.E., and J.J. Opaluch. 1983. Discrete Modelling of Supply Response under Uncertainty: The Case of the Fishery. *Journal of Environmental Economics and Management* 10(2):125–37.
- Brown, G., Jr. 1974. An Optimal Program for Managing Common Property Resources with Congestion Externalities. *Journal of Political Economy* 82(1):163–73.
- Campbell, H.F. 1991. Estimating the Elasticity of Substitution between Restricted and Unrestricted Inputs in a Regulated Fishery: A Probit Approach. *Journal of Environmental Economics and Management* 20(3):262–74.
- Casey, K.E., C.M. Dewees, B.R. Turriss, and J.E. Wilen. 1995. The Effects of Individual Vessel Quotas in the British Columbia Halibut Fishery. *Marine Resource Economics* 10(3):211–30.
- Cheung, S.N.S. 1970. The Structure of a Contract and the Theory of a Non-exclusive Resource. *Journal of Law and Economics* 13(1):49–70.
- Christy, F.T., Jr. 1973. Fisherman Quotas: A Tentative Suggestion for Domestic Management. Occasional Paper 19, Law of Sea Institute, Honolulu, HI.
- Clark, C.W. 1973. Profit Maximization and the Extinction of Animal Species. *Journal of Political Economy* 81(4):950–61.
- . 1976, 1990. *Mathematical Bioeconomics: The Optimal Management of Renewable Resources*. New York, NY: Wiley.
- Clark, C.W., F.H. Clarke, and G.R. Munro. 1979. The Optimal Exploitation of Renewable Resource Stocks: Problems of Irreversible Investment. *Econometrica* 47(1):25–47.
- Clark, I.N., P.J. Major, and N. Mollett. 1988. Development and Implementation of New Zealand's ITQ Management System. *Marine Resource Economics* 5(4):325–49.
- Clark, C.W., and G.R. Munro. 1975. Economics of Fishing and Modern Capital Theory: A Simplified Approach. *Journal of Environmental Economics and Management* 2:92–106.
- Conrad, J., and C.W. Clark. 1987. *Natural Resource Economics*. Cambridge: Cambridge University Press.
- Copes, P. 1986. A Critical Review of the Individual Quota as a Device in Fisheries Management. *Land Economics* 62(3):278–91.

- . 1970. The Backward-Bending Supply Curve of the Fishing Industry. *Scottish Journal of Political Economy* 17(1):69–77.
- . 1972. Factor Rents, Sole Ownership and the Optimum Level of Fisheries Exploitation. *Manchester School of Economic and Social Studies* 40(2):145–63.
- Costanza, R., D. Stern, B. Fisher, L. He, and C. Ma. 2004. Influential Publications in Ecological Economics: A Citation Analysis. *Ecological Economics* 50(3–4):261–92.
- Crocker, T. 1966. Structuring of Atmospheric Pollution Control Systems. *The Economics of Air Pollution*. H. Wolozin, ed. New York, NY: W.W. Norton.
- Dales, J.H. 1968a. Land, Water, and Ownership. *Canadian Journal of Economics* 1(4):791–804.
- . 1968b. *Pollution, Property and Prices*. Toronto, Ontario, Canada: University of Toronto Press.
- Dasgupta, P.S., and G. Heal. 1979. *Economic Theory and Exhaustible Resources*. Cambridge: Cambridge University Press.
- Eales, J., and J. Wilen. 1986. An Examination of Fishing Location Choice in the Pink Shrimp Fishery. *Marine Resource Economics* 2(4):331–51.
- Edwards, S.F. 1994. Ownership of Renewable Ocean Resources. *Marine Resource Economics* 9(3):253–73.
- Freeman, A.M., III. 1995. The Benefits of Water Quality Improvements for Marine Recreation: A Review of the Empirical Evidence. *Marine Resource Economics* 10(4):385–406.
- Gordon, H.S. 1954. The Economic Theory of a Common-Property Resource: The Fishery. *Journal of Political Economy* 62(1954):124–42.
- Hannesson, R. 1998. Marine Reserves: What Would They Accomplish? *Marine Resource Economics* 13(3):159–70.
- Holland, D.S., and R.J. Brazee. 1996. Marine Reserves for Fisheries Management. *Marine Resource Economics* 11(3):157–71.
- Homans, F.R., and J.E. Wilen. 1997. A Model of Regulated Open Access Resource Use. *Journal of Environmental Economics and Management* 32(1):1–21.
- ISI Web of Knowledge <http://portal.isiknowledge.com.ezproxy.ub.gu.se/portal.cgi>
- Johnson, R.N., and G.D. Libecap. 1982. Contracting Problems and Regulation: The Case of the Fishery. *American Economic Review* 72(5):1005–22.
- Kalaitzidakis, P., T.P. Mamuneas, and T. Stengos. 2003. Rankings of Academic Journals and Institutions in Economics. *Journal of the European Economic Association* 1(6):1346–66.
- Karpoff, J.M. 1987. Suboptimal Controls in Common Resource Management: The Case of the Fishery. *Journal of Political Economy* 95(1):179–94.
- Kirkley, J.E., D. Squires, and I.E. Strand. 1995. Assessing Technical Efficiency in Commercial Fisheries: The Mid-Atlantic Sea Scallop Fishery. *American Journal of Agricultural Economics* 77(3):686–97.
- Kirkley, J.E., and I.E. Strand. 1988. The Technology and Management of Multi-species Fisheries. *Applied Economics* 20(10):1279–92.
- Levhari, D., and L.J. Mirman. 1980. The Great Fish War: An Example Using a Dynamic Cournot-Nash Solution. *Bell Journal of Economics* 11(1):322–34.
- Lindner, R.K., H.F. Campbell, and G.F. Bevin. 1992. Rent Generation during the Transition to a Managed Fishery: The Case of the New Zealand ITQ System. *Marine Resource Economics* 7(4):229–48.
- Loomis, J.B., and D.M. Larson. 1994. Total Economic Values of Increasing Gray Whale Populations: Results from a Contingent Valuation Survey of Visitors and Households. *Marine Resource Economics* 9(3):275–86.

- McFadden, D. 1973. Conditional Logit Analysis of Qualitative Choice Behavior. *Frontiers in Econometrics*, P. Zarembka, ed., pp. 105–42. New York, NY: Academic Press.
- Millennium Ecosystem Assessment. 2005. www.millenniumassessment.org/en/index.aspx
- Montgomery, W.D. 1972. Markets in Licenses and Efficient Pollution Control Programs. *Journal of Economic Theory* 5(3):395–418.
- Munro, G.R. 1979. The Optimal Management of Transboundary Renewable Resources. *Canadian Journal of Economics* 12(3):355–76.
- Opaluch, J.J., and N.E. Bockstael. 1984. Behavioral Modeling and Fisheries Management. *Marine Resource Economics* 1(1):105–15.
- Parks, P.J., and M. Bonifaz. 1994. Nonsustainable Use of Renewable Resources: Mangrove Deforestation and Mariculture in Ecuador. *Marine Resource Economics* 9(1):1–18.
- Plourde, C.G. 1970. A Simple Model of Replenishable Natural Resource Exploitation. *American Economic Review* 60(3):518–22.
- Ruddle, K., E. Hviding, and R.E. Johannes. 1992. Marine Resources Management in the Context of Customary Tenure. *Marine Resource Economics* 7(4):249–73.
- Sanchirico, J.N., and J.E. Wilen. 1999. Bioeconomics of Spatial Exploitation in a Patchy Environment. *Journal of Environmental Economics and Management* 37(2):129–50.
- . 2001. A Bioeconomic Model of Marine Reserve Creation. *Journal of Environmental Economics and Management* 42(3):257–76.
- Schaefer, M.B. 1954. Some Aspects of the Dynamics of Populations Important to the Management of Commercial Marine Fisheries. *Bulletin of the Inter-Am. Tropical Tuna Commission* 1:25–56.
- . 1957. Some Considerations of Population Dynamics and Economics in Relation to the Management of Marine Fisheries. *Journal of the Fisheries Research Board of Canada* 14:669–81.
- Scott, A. 1955. The Fishery: The Objectives of Sole Ownership. *Journal of Political Economy* 63:116–24.
- . 1993. Obstacles to Fishery Self-Government. *Marine Resource Economics* 8(3):187–99.
- Smith, V.L. 1968. Economics of Production from Natural Resources. *American Economic Review* 58:409–31.
- . 1969. On Models of Commercial Fishing. *Journal of Political Economy* 77(2):181–98.
- . 1989. Taking Stock of Progress with Travel Cost Recreation Demand Methods: Theory and Implementation. *Marine Resource Economics* 6(4):279–310.
- Squires, D. 1987a. Fishing Effort: Its Testing, Specification, and Internal Structure in Fisheries Economics and Management. *Journal of Environmental Economics and Management* 14(3):268–82.
- . 1987b. Public Regulation and the Structure of Production in Multiproduct Industries: An Application to the New England Otter Trawl Industry. *RAND Journal of Economics* 18(2):232–47.
- Squires, D., and J. Kirkley. 1991. Production Quota in Multiproduct Pacific Fisheries. *Journal of Environmental Economics and Management* 21(2):109–26.
- Sutinen, J.G., and P. Andersen. 1985. The Economics of Fisheries Law Enforcement. *Land Economics* 61(4):387–97.
- Townsend, R.E. 1990. Entry Restrictions in the Fishery: A Survey of the Evidence. *Land Economics* 66(4):359–78.
- Wilen, J.E. 2000. Renewable Resource Economists and Policy: What Differences Have We Made? *Journal of Environmental Economics and Management* 39:306–27.