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Is grey literature ever used? Using citation analysis to measure the impact of GESAMP, an international marine scientific advisory body

Abstract: Citation analysis was used to measure the impact of GESAMP, the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection, which since 1969 has published reports for the United Nations and seven of its agencies. Web of Science was used to search for citations to 114 publications, of which 15 are journal articles or books. Citations to grey literature can be difficult to locate and interpret, but two thirds of the 1436 citations, in 1178 citing papers, are to grey literature items. The distribution of citations and self-citation are examined. Journal versions were cited more than corresponding reports. Core journals for GESAMP citations include seven environmental science journals and a social science journal. This paper confirms that citation searching can successfully measure the impact of organizations producing grey literature. Such publications can be very influential, diffusing widely from their source.

Résumé: L'analyse des citations a été utilisée pour mesurer l'impact du GESAMP, groupe mixte d'experts chargé d'étudier les aspects scientifiques de la protection de l'environnement marin et qui publie depuis 1969 des rapports pour les Nations Unies et pour sept de ces organismes. Le *Web of Science* a été utilisé pour rechercher des citations dans 114 parutions parmi lesquels 15 sont des articles de journaux ou des livres. Les citations touchant la littérature grise peuvent être difficiles à repérer et interpréter, mais les deux tiers des 1436 citations, des 1178 articles les citant, proviennent de la littérature grise. La distribution des citations et l'auto-citation sont examinées plus en détail. Les versions tirées des journaux sont davantage citées que les versions provenant des compte-rendus correspondants. Le principal noyau de journaux des citations du GESAMP inclut sept journaux des sciences de l'environnement et un journal des sciences sociales. Cette communication confirme que la recherche de citations peut mesurer avec succès l'impact des organisations produisant la littérature grise. De telles parutions peuvent avoir une très grande influence, grâce à la diffusion à partir de leur source.

[This paper is the winner of the Student to CAIS/ACSI 2003 Award, given to the best abstract submitted by a student and accepted for presentation at the conference. The full text of this paper is also published in volume 27, number 3 (2002/2003) of the *Canadian Journal of Information and Library Science / La revue canadienne des sciences de l'information et de bibliothéconomie.*]

1. INTRODUCTION

Although citation indexing was developed primarily to provide an alternative method of information retrieval, citation analysis has also been adopted to measure the impact of individuals, journals, and even countries. In addition, citation analysis has been used to measure the impact of university departments (e.g., Kim & Kim, 2000) and other organizations (e.g., Redman, Willett, Allen & Taylor, 2001), but such studies have focussed on organizations for

which the main published output is found in the journal literature. This paper reports on a citation study of GESAMP, an organization which produces primarily grey literature.

The Fourth International Conference on Grey Literature (GL '99) defined grey literature as “that which is produced on all levels of government, academics, business and industry in print and electronic formats, but which is not controlled by commercial publishers” (New York Academy of Medicine, 2003). It has also been defined as “literature which is not readily available through normal book selling channels, and therefore difficult to identify and obtain” (Auger, 1998, 3). A significant portion of the primary scientific and technical literature consists of items in this genre (Warnick, 2001). Technology and the growth of the Internet have made it easier for individuals and groups to publish their own material, and for others to access it, leading to considerable growth (Farace, 1997).

Citation studies involving grey literature are not common. Some have taken a body of journal literature in a particular field and examined the citations to grey literature items contained in it (e.g., Alberani & Pietrangeli, 1995). At least one organizational citation study (of several academic departments) has included citations to grey literature as well as to books and journals (Seng & Willett, 1995). Brown (2001) has studied citations in a small group of physics and astronomy journals to e-prints from the Los Alamos e-print archive. No other studies have been found which start with a complex body of primarily grey literature and attempt to locate all citations to it.

This paper describes GESAMP and its publications, outlines the process of locating and clarifying citations to them, discusses the distribution of citations, and relates that to the self-citation of reports by the authors. Citation of any GESAMP publication by anyone associated with the organization is also briefly discussed, and core journals for the citations are identified. While locating citations to grey literature is challenging, this study reveals that some items are widely used, although similar items published in journals receive more citations than the grey literature versions.

2. GESAMP

GESAMP is an international marine scientific advisory group. A note in each of its recent reports explains that it “is an advisory body consisting of specialized experts nominated by the Sponsoring Agencies (IMO, FAO, UNESCO-IOC, WMO, WHO, IAEA, UN, UNEP). Its principal task is to provide scientific advice concerning the prevention, reduction and control of the degradation of the marine environment to the Sponsoring Agencies.” GESAMP had an important role in the preparation for the United Nations Conference on Environment and Development (UNCED), and in particular its Agenda 21, adopted at the conference held in Rio de Janeiro in June 1992. Its history is summarized on its website (Sekimizu, 1999), in two agency publications (Pravdic, 1981; Windom, 1991), and a recent paper (Wells, Duce & Huber, 2002).

As sponsors were added and GESAMP's role expanded, its acronym has remained unchanged, but its official name has changed six times, from *Joint IMCO/FAO/UNESCO/WMO/WHO Group*

of Experts on the Scientific Aspects of Marine Pollution in 1969, to IMO/FAO/UNESCO-IOC/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) since 1993. GESAMP is managed by an administrative secretary from the International Maritime Organization (IMO), and a technical secretary from each agency. Member scientists meet annually, and observers from other organizations sometimes attend. Between sessions additional experts participate with GESAMP members in the working groups that address specific questions. Draft reports receive extensive, though not anonymous, peer review by external reviewers and by GESAMP members. Before publication, reports must be approved at an annual session of GESAMP.

In May 2000, the agencies “agreed to carry out an independent and in-depth evaluation of the achievements of GESAMP, its impact, scope, membership, working methods and future role” (*Joint Group of Experts on Scientific Aspects of Marine Environmental Protection holds thirty-first session*, 2001). This citation study was undertaken independently to contribute to this process; a preliminary report supported the evaluation committee’s positive recommendation to the 2001 GESAMP meeting in New York.

2.1 GESAMP Publications

GESAMP’s publications are summarized in Table 1. Its main published output is its *Reports and Studies* series, which includes reports of its annual sessions since 1975, and forty-eight thematic reports on topics studied by working groups. These publications are listed on GESAMP’s website (*GESAMP publications*, 2002), where the full text of fifteen reports is available. Each report is published by the agency that hosted the session or primarily sponsored the working group. Other publications, identified by document numbers, include the reports of

Type of Content	Type of Publication	Items	Items Cited	Citations	% Total Citations
Session reports	GESAMP <i>Reports and Studies</i>	25	10	23	1.6%
	early sessions - documents	6	5	21	1.5%
	other series	1	0		
Histories		2	2	11	0.8%
Thematic reports	GESAMP <i>Reports and Studies</i>	48	44	668	46.5%
	supplements to session reports	2	2	12	0.8%
	identical versions, other series	14	9	137	9.5%
	only published in another series	1	1	11	0.8%
	drafts of reports (# items not determined)			20	1.4%

	other working documents (# items not determined)			25	1.7%
<i>Sub-total</i>	<i>grey literature</i>	99	73	928	64.6%
Session reports	journal articles & books	7	3	10	0.7%
Thematic reports	journal articles & books	8	8	498	34.7%
<i>Sub-total</i>	<i>journal articles & books</i>	15	11	508	35.4%
	TOTAL	114	84	1436	100%

Table 1: Types of GESAMP publications and citations, to July 28, 2002.

the first six sessions, various report drafts and other working documents. Annexes to the reports of the sessions, and two early supplements, contain reports from the working groups. All reports are published in English, but some have been translated into French, Spanish and Russian, and one into Chinese.

The sponsoring agencies have republished some reports in other series. Fifteen have been identified to date. One report appeared in IAEA's *Technical Reports* series (# 263), and another as *FAO Fisheries Report* # 102. Thirteen reports were republished in the United Nations Environment Programme (UNEP)'s *Regional Seas Reports and Studies* series (*Regional Seas Reports and Studies publication list*, 2003). The *Technical Annexes to the Report on the State of the Marine Environment* were published only in that series.

Within grey literature, technical reports in numbered series are quite a light shade of grey (easy to identify and locate). However, these reports show many features typical of the genre, since the agencies have not made bibliographic control a priority. There are many inconsistencies in the form of the organization's name, the name of the report series, and the titles of the reports, within and among reports. ISSNs and ISBNs appear irregularly, and two lack publication dates. Having eight publishers for a single report series is unusual, and can cause confusion; two reports were published as # 11, though later lists call one # 12. These features make the reports difficult to catalogue and difficult to locate, and make it less likely that people will use them.

Journal articles and books that correspond to several of GESAMP's reports have been published. For the first twenty years, five brief summaries of reports of sessions have been identified, most from searches for articles mentioning GESAMP. In the 1990s, GESAMP members made an effort to publish their work as books and journal articles, expecting that formally published work, often in shorter form, would receive more notice and use than would technical reports. Six journal articles and two books were identified with the help of Dr. Peter Wells, Environment Canada and past chairman of GESAMP. A viewpoint article, *Oceans at Risk*, was published as an annex to the report of the 28th session, and published in two journals.

3. METHODOLOGY

Citations to GESAMP's publications were located using the Web of Science interface to the Science, Social Sciences and Arts and Humanities Citation Indexes, produced by the Institute for Scientific Information (ISI). To maximize retrieval of citations to GESAMP's publications, searches were made as general as possible, while keeping the retrieved cited reference lists manageable. Citations to the books and journal articles were found using standard citation searching procedures, but wild cards were used to locate citations with non-standard journal abbreviations or incorrect author initials.

Locating citations to grey literature items is much more complex than finding citations to journal articles, as they are not recorded in the citation indexes in a standard way (Table 2). An initial search for articles about GESAMP allowed examination of the format of their citations to GESAMP publications. The subsequent search process was iterative, searching either the *cited work* or *cited author* field, and examining the results for new variations to use in searches of the other field. Other citations in the retrieved papers also led to new strategies. Table 3 contains a partial list of search strings. The full list includes entries based on the name of the organization, its sponsoring agencies, the report series titles, report numbers, titles of individual reports and the names of some people given individual credit. The *cited year* field was not searched, since the targets included publications produced over more than thirty years, and dates were often inaccurate. No explicit attempt was made to locate citations to items

<i>Cited author (18 characters)</i>	<i>Cited work (20 characters)</i>	<i>Volume</i>	<i>Page</i>	<i>Cited year</i>
*GESAM	REP STUD	39		1990
*GESAMP	39 GESAMP IMO UNEP		111	1990
*GESAMP	GESAMP IMOFAOTJNESCO			1990
*GESAMP	IMO FAO UNESCO WMO W			1990
*GESAMP IMO FAO UN	STAT MAR ENV			1990
*GROUP EXP SCI ASP	UNEP REG SEAS REP ST	115		1990
*IMO	STAT MAR ENV UNEP RE	115		1990
*IMO FAO UNESCO WM	UN ENV PROGR REG SEA	115		1990
*JOINT GROUP EXP S	39 REP STUD			1990
*UNEP	115 REG SEAS REP STU		33	1990
	GESAMP39 REP			1990
	GSAMP REPORTS STUDIE	39		1990
	REPORTS STUDIES GESA	39		1990
	STATE MARINE ENV			1992
	UNEP115 REG SEAS REP			1990

Table 2: Examples of actual Web of Science cited reference strings.

Citations are to *The State of the Marine Environment*, published as GESAMP Reports and Studies # 39, UNEP Regional Seas Reports and Studies # 115, and as a book (GESAMP, 1991).

<i>Basic search string</i>	<i>Related searches for fields beginning with any digit, or any letter</i>	
GESAMP*	n*GESAMP*	(n=0-9, A-Z)
G* REP* STUD*	n*G* REP* STUD*	(n=0-9)
GR* EX* SC*	n*GR* EX* SC*	(n=0-9)
IMCO*FAO*	n*IMCO*	(n=0-9)
IMCO* REP*		
IMO*FAO*	n* IMO*	(n=0-9) (space avoids "2 Timothy" etc.)
IMO* REP*		
J* GR* EX*	n*J* GR* EX*	(n=0-9)
REP STUD*	(Separating this search from the next keeps the hits more manageable.)	
REPORTS STUDIES*	n*REP* STUD*	(n=0-9)
UN REP* ST*	n*UN REP* ST*	(n=0-9)
UNEP* REG*	n*UNEP*	(n=0-9)
UNESCO* REP* ST*	n*UNESCO* REP* ST*	(n=0-9)
UNEP* REP* ST*	n*UNEP* REP* ST*	(n=0-9)
WHO* REP* ST*	n*WHO* REP* ST*	(n=0-9)
WMO* REP* ST*	n*WMO* REP* ST*	(n=0-9)

Table 3: Partial list of Web of Science *cited work* search strings.

Citations are to GESAMP *Reports and Studies*, based on GESAMP, agency names, and the series title. The wild card character (*), representing any number of characters, including zero, cannot be used at the beginning of a string. "n*GESAMP* (n=0-9, A-Z)" means "0*GESAMP or 1*GESAMP or 2*GESAMP or . . . or Z*GESAMP" published in languages other than English, but, since the GESAMP acronym is used in all four official languages, a few citations to French documents were located.

Search results were exported from Web of Science to ProCite bibliographic management software, and duplicate records were deleted. The cited references to GESAMP publications were compared with GESAMP's publication list. Some inconsistent citations were assigned to the most likely report, but over 250 papers were examined to see which GESAMP item or version was being cited, or to verify that the citation was indeed to a GESAMP publication. If the full citation was also ambiguous, the report title was assumed to be the most accurate part. Two articles were printed twice in separate issues of the journals; citations in them were counted only once. In eight cases, it was impossible to be sure which version of *The State of the Marine Environment* was being cited; the citations were distributed among its three versions. When a report has been reprinted with identical content, citing authors may mention both versions in a single citation; only the first version mentioned has been counted. In 26 cases, papers cite both a report and its non-identical book or journal version. If citations to documents were not recognizable as report drafts, or as annexes in reports of sessions, they were counted as "other working documents." A code for each cited item was entered in the *keywords* field of the corresponding ProCite record.

To allow further analysis of the citations, the ProCite record identifier, author names, journal title, publication date, and cited reference codes for each citing article were exported to a Microsoft Access database. Information taken from the reports and the histories, about GESAMP publications, sessions, working groups, and the roles of 690 people connected to GESAMP, was also entered. To identify all citing papers with an author connected to GESAMP at or before the time the paper was published, the names of authors and the publication years of the citing papers

were compared with the names of people connected to GESAMP, and the year that they first had a connection. If the publication year was greater than or equal to the year in which the person was first associated with GESAMP, the surnames matched, and either the first initial or all initials of the GESAMP person matched the author initials available from Web of Science, it was considered that the citing paper had an author with GESAMP connections. Since middle initials are not always available for GESAMP people, but are often found on publications, another query displayed pairs of names for which the year condition was met and the surnames matched, so that other likely matches could be made.

4. RESULTS & DISCUSSION

4.1 Searching for Grey Literature Citations

Citations to grey literature items are entered in ISI's citation indexes in many ways (Table 2). An ISI tutorial (Institute for Scientific Information, 2002) explains that report citations have the corporate author name in the *cited author* field, beginning with an asterix. However, many records omit a corporate author. The tutorial also explains that the *cited work* field for a corporate report contains the title, while, for a government report, it contains the report number, often fused to the organizational acronym. Both of these formats are found for GESAMP reports (Table 2), but sometimes the series title is treated like a journal name. Others start with some form of the organization name, followed by a report number and series title. *Cited author* records for GESAMP publications compress the organization name, or the name of the agency which published the report, in many ways. The most productive searches were those for *GESAMP** in *cited author* or *cited work*; together they retrieved about two thirds of the grey literature citations. To maximize retrieval, many varied searches were done (Table 3); some produced no relevant results. Web of Science's flexible wild card features make it preferable to the Dialog interface to the citation indexes for a study of this sort.

Errors compound the difficulty of retrieving relevant citations. Some errors occur in the reference lists in journal articles, where report numbers and publication dates are particularly prone to error, but any part of a citation may be incorrect. Errors may also occur as the cited reference strings are created. Web of Science's hyperlinks between citing and cited articles are created automatically, but cited reference records are created manually for citations to items not in the database and for those containing errors or non-standard journal abbreviations (personal communication, Lynn Sonk, November 20, 2002). The searches and verifications found occasional evidence of human fallibility: interchanged digits, misspelled acronyms, data in the wrong fields, similar sequential references conflated into one, and missing references.

4.2 Distribution of Citations

From data available in Web of Science up to July 28, 2002, 1178 papers, containing 1436 citations to GESAMP publications, were identified. Most papers (88.2%) contain a single relevant citation, but three contain more than a dozen each. Citations were found to 84 of the 114 identified publications, and to many working documents and report drafts. Table 1 summarizes

the distribution of citations among publication types. Two thirds of the citations (64.6%) are to grey literature items, while the remaining third (35.4%) are to journals or books.

The earliest citing papers date from 1971, not long after GESAMP's first session in 1969. The distribution of citations per year (Figure 1) increases with the number of GESAMP documents published (Figure 2), but the rapid increase in citations in the 1990s also reflects the efforts of GESAMP's scientists to publish their work in the open literature, coupled with the general increase in the number of journal articles published annually.

Citations are unevenly distributed among the reports and their versions. As expected, the reports and articles describing GESAMP's annual sessions received few citations (54, 3.8%), (Table 1). However, the report of the first session received 17 citations (10 to document GESAMP I/11, and 7 to the related journal article (Joint IMCO/FAO/UNESCO/WMO Group of Experts on the Scientific Aspects of Marine Pollution, 1969)). While verifying some of these, it was noted that they refer to GESAMP's definition of marine pollution, developed at the session. Many are likely to be "copy-cat" citations, since that report is not widely available, and the definition appears in each of GESAMP's reports.

The grey literature versions of thematic reports received 873 citations (60.8%), while the book and journal versions received 498 citations (34.7%) (Table 1). The ten most highly cited reports (including citations to all versions) are listed in Table 4. They account for one sixth (19, 16.7%) of the identified publications, two thirds (968, 67.4%) of the total citations, and three quarters (879, 76.2%) of the citing papers. The list includes the six reports that Dr. Wells expected would receive large numbers of citations, but other, unexpected ones received more citations than some of those. Three thematic reports received no citations to any version. This is not surprising for a report published in 2001, but it is more remarkable that the others, published in 1984 and 1989, have not attracted any notice in the scientific literature.

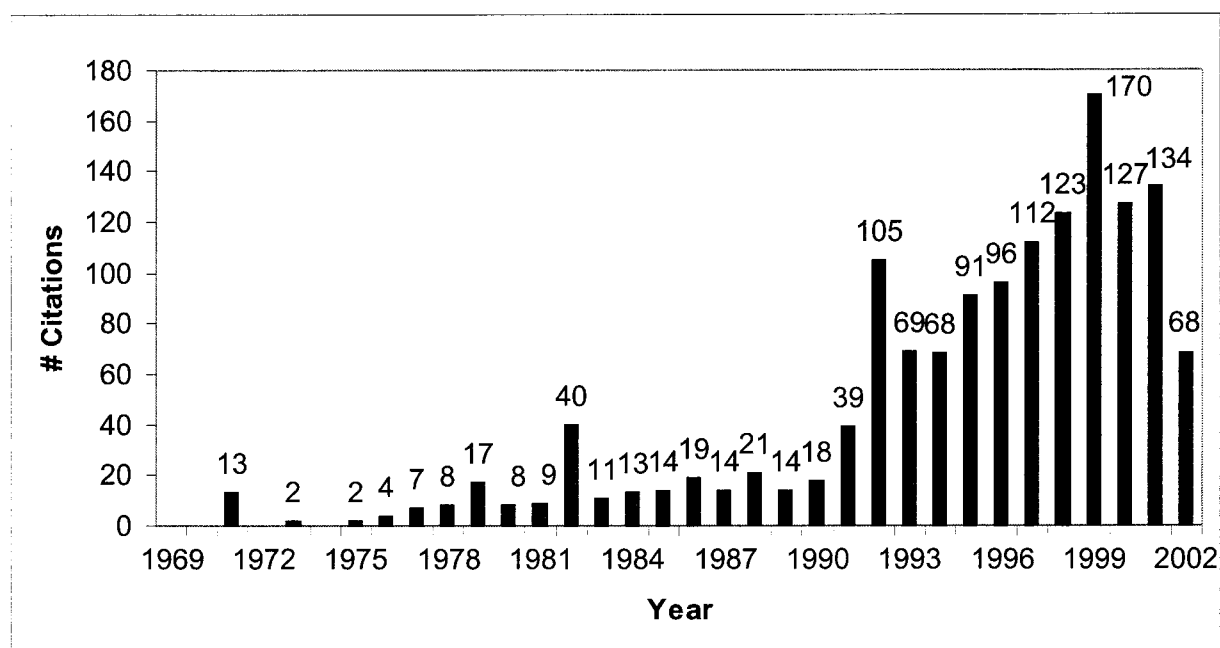


Figure 1: Frequency of citations to GESAMP publications, to July 28, 2002.

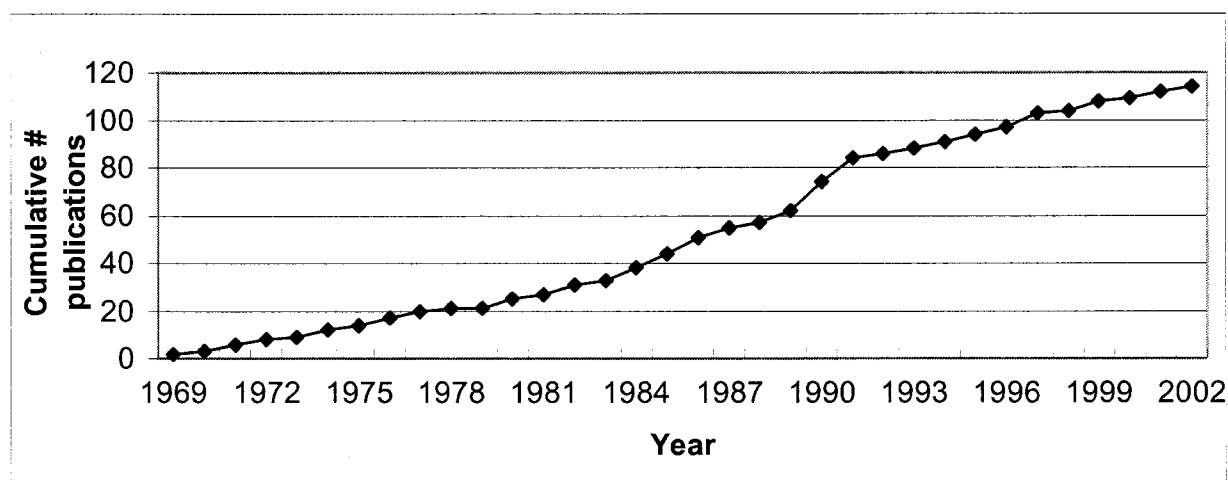


Figure 2: Cumulative number of items published by GESAMP.

Examination of the relative numbers of citations to the versions of individual reports (Table 4) shows that, as expected, journal articles receive more citations than do the corresponding report versions. The most highly cited single item, with 324 citations (22.6% of the total) is a journal article (Duce et al., 1991). It received four fifths of the citations to *The Atmospheric Input of Trace Species to the World Ocean*. However, the book version of *The State of the Marine Environment* (GESAMP, 1991) received only one sixth of the citations to its three versions. One other book (Liss & Duce, 1997) is related to a GESAMP report (# 59); the three corresponding chapters received 12 citations, while the report received 13. (The other 13 chapters of the book, written by people who contributed to the report, received 59 citations which were not included in this study.) Publishing GESAMP's work as journal articles, rather than in book form, may attract more notice among people who publish in journals.

Report Title, Versions* and Publication Dates	# Citations to Each Version*				Total Citations	Citing Papers
	A	B	C	D		
<i>The Atmospheric Input of Trace Species to the World Ocean</i> A: # 38 (1989), B: # 119 (1990), C: Duce et al. (1991)	76	3	324	7	410	394
<i>The State of the Marine Environment</i> A: # 39 (1990), B: #115 (1990), C: GESAMP (1991) **	54	85	26		165	164
<i>Technical Annexes to the Report on the State of the Marine Environment</i> B: # 114 (1990), C: Fowler (1990)		11	67		78	78
<i>Land/Sea Boundary Flux of Contaminants: Contributions from Rivers</i> A: # 32 (1987)	56			4	60	60
<i>The Review of the Health of the Oceans</i> A: # 15 (1982), B: # 16 (1982)	20	27			47	47
<i>Impact of Oil on the Marine Environment</i> A: # 6 (1977)	44				44	44
<i>Review of Potentially Harmful Substances: Arsenic, Mercury and Selenium ***</i> A: # 28 (1986), B: # 92 (1988)	36	7			43	43
<i>Impact of Oil and Related Chemicals on the Marine Environment</i> A: # 50 (1993)	39			3	42	42
<i>Global Strategies for Marine Environmental Protection</i> A: # 45 (1991), C: Gray et al. (1991)	15		27		42	39
<i>Marine Biodiversity: Patterns, Threats and Conservation Needs</i> A: # 62 (1997), C: Gray (1997) **	3		34		37	37

Table 4: Ten most frequently cited GESAMP publications, to July 28, 2002.

*Versions: A: GESAMP Reports and Studies B: UNEP Regional Seas Reports and Studies
C: journal article or book D: report draft

** Content of the book or article is identical to that of the report.

*** Title of Regional Seas # 92 : *Arsenic, Mercury and Selenium in the Marine Environment*

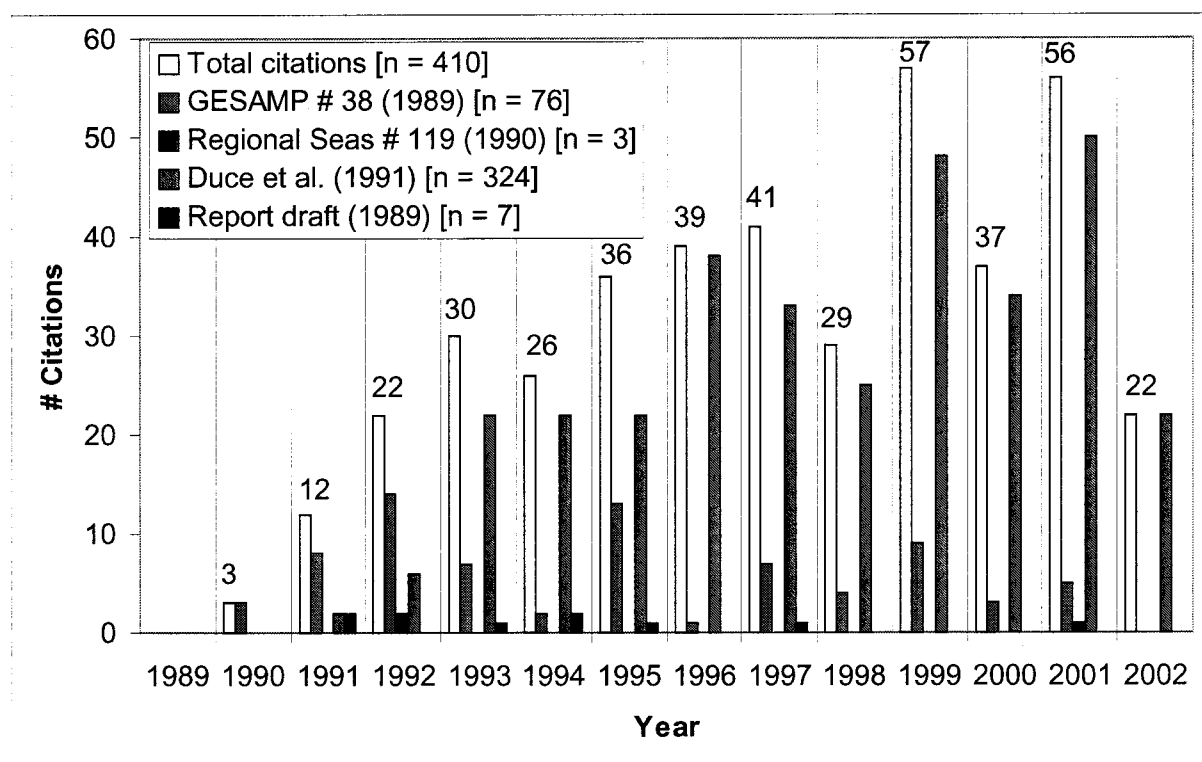


Figure 3: Frequency of citations to *The Atmospheric Input of Trace Species to the World Ocean*, the most highly cited report (Table 4), to July 28, 2002.

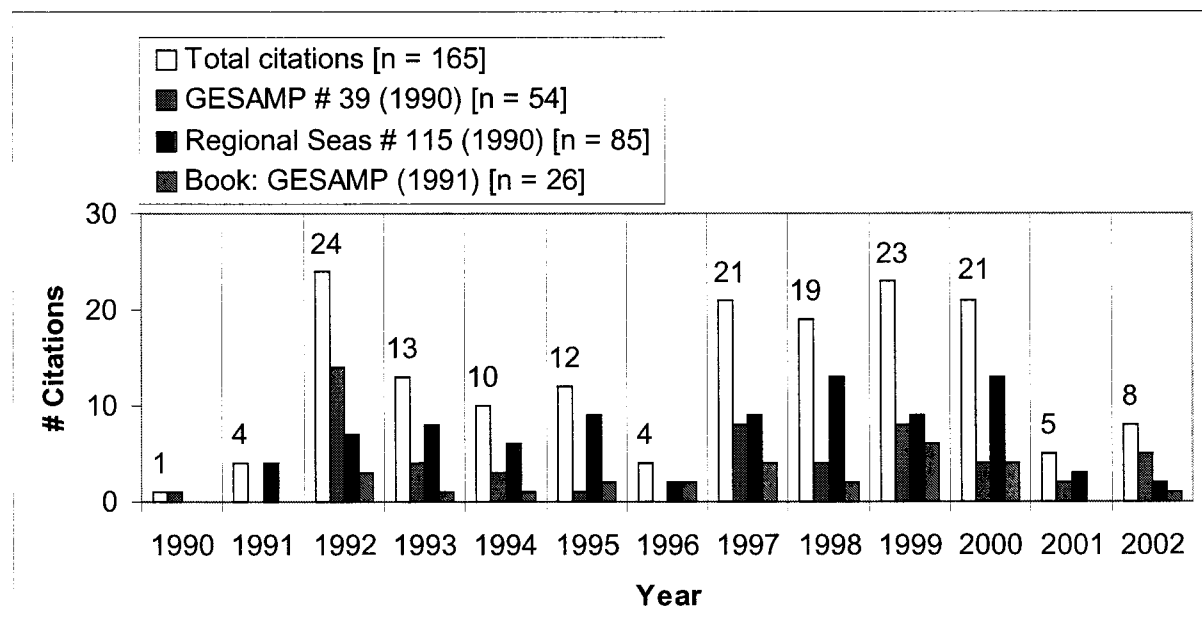


Figure 4: Frequency of citations to *The State of the Marine Environment*, the second most highly cited report (Table 4), to July 28, 2002.

Figure 3 shows the distribution over time of citations to the various versions of the most highly cited report. Citations have shown a generally increasing trend for more than a decade since the report's publication. The report versions received at least one citation each year from 1990 to 2001. By 1993 the journal version (Duce et al., 1991) was receiving the majority of the citations, and has held that position ever since. This paper has received a remarkable number of citations compared to other environmental science papers. ISI's Essential Science Indicators sets citation thresholds for "most cited papers" published since 1992 in various disciplines. The threshold for a paper published in 1992 in the *Environment/Ecology* category is 101 citations (Institute for Scientific Information, 2003). Citations to Duce et al. (1991) are triple the threshold.

Figure 4 shows the corresponding data for the second most highly cited report. The peak year is 1992, with 24 citations, but the years from 1997 to 2000 have almost as many. Citations are much more evenly distributed among the three versions than are those in Figure 3, though the Regional Seas version has the most citations overall. If all 165 citations were to a journal article, it too would exceed the "most cited paper" threshold in the Essential Science Indicators *Environment/Ecology* category.

4.3 Self-citation of Individual Reports

Citation studies of the work of individuals usually note, and sometimes eliminate, papers in which the person's own work is cited. The working group members who prepared the thematic reports are usually listed in them, and it is informative to examine their self-citations. Twenty-two people contributed to the most highly cited report (Table 4, # 38), and its journal article version (Duce et al., 1991). Working group members wrote, or co-authored, 62 (15.7%) of the 394 citing papers, containing 67 citations (16.3%). Two individuals are responsible for 32 of the self-citations, with 17 papers each. All but five members of the working group cite this report at least once. Five papers (four of which were published in 1990 - 1992) cite just the GESAMP report, 52 cite just Duce et al. (1991), and five cite both. The working group members' preference for recommending the journal article makes sense, since it is easier for readers to locate. This may explain why the journal article is cited so often, relative to the reports.

Twenty-one people contributed to the second report in Table 4, but only five of them cite it, in 12 papers, representing 7.3% of the 165 citations to this report. Three papers cite GESAMP *Reports and Studies* # 39, while nine cite UNEP *Regional Seas* # 115. These working group members have not been as prolific in citing their report as were the authors of # 38, but their citation practices may provide an explanation for the overall distribution of citations to the versions of this report. Their preference for the *Regional Seas* version, and neglect of the book, is mirrored in the citation totals. Other authors sometimes mention two or three versions when they cite this report; these have been counted as single citations in this study, unless the citations are distinct.

4.4 Self-citation Within GESAMP

In a citation study of an organization, citation of work published by others in the same organization may be noted. Measuring self-citation for an organization such as GESAMP is very complicated, as many people have had various roles in the organization since 1969, and as most publications have many contributors. Less than a third of the citing papers (363, 30.8%) were

found to have at least one author with GESAMP connections, at or before the time the paper was published. The list of people connected to GESAMP contains 690 names, including observers who attended GESAMP sessions and the reviewers of six reports; 146 (21.2%) of them have been linked to citing papers. The matching process may have made links between citing authors and different people with GESAMP connections who have the same surname and initials, but this is likely to be a small problem.

The information available indicates that more than two thirds of the citing papers were written by people who had not had a direct connection with GESAMP when the paper was published. Awareness of GESAMP's publications has diffused widely beyond the (fairly large) group of people who would be most aware of the scope and quality of GESAMP's work. While it is likely that many authors do not actually read the items they cite (Simkin & Roychowdhury, 2002), they at least accept GESAMP's publications as authoritative sources. Many of the papers examined while verifying the citations refer to a GESAMP report in a general introductory statement that some aspect of marine pollution is a problem, but others quote facts and figures.

4.5 Disciplines Represented by the Citing Journals

GESAMP has always been an interdisciplinary group, with members who apply various of the basic sciences to the problems of marine pollution and marine environmental protection. While the majority of papers citing GESAMP's publications are likely to be found in environmental science journals, it is interesting to examine the range of disciplines represented by the journals containing the citing papers. The core journals for citations of GESAMP's publications may be determined by ranking the 298 citing journals by the number of citations they contain, and selecting those which together contain one third of the total citations. (Some matching was done between current and former names of journals, to combine the citation totals under the current name.) The eight core journals for GESAMP's publications are listed in Table 5. It is fitting that the top journal is one called *Marine Pollution Bulletin*. Seven of the eight are diverse environmental science journals, but one, *Marine Policy*, is a social science journal. Journals containing fewer citations represent fields such as fisheries, aquaculture, toxicology and occupational health.

<i>Core Journals</i>	<i># citations</i> <i>(n = 1436)</i>	<i># citing papers</i> <i>(n = 1178)</i>
Marine Pollution Bulletin	185	135
Science of the Total Environment	56	37
Marine Chemistry	46	39
Marine Policy	42	22
Journal of Geophysical Research – Atmospheres	40	40
Atmospheric Environment	39	38
Ocean & Coastal Management	38	19
Marine Ecology – Progress Series	31	30
Total for core journals	477 (33.2%)	360 (30.5%)

Table 5: Core journals for citations to GESAMP publications.

5. CONCLUSIONS

This work has shown that, despite the limitations imposed by its condensed citation format and errors in coding of citations, it is possible to use Web of Science to locate citations to the publications of an organization, such as GESAMP, which publishes mostly grey literature. Identifying all the target publications is complicated because bibliographic control is poor, and some may be republished in other report series with little documentation of the fact. Since grey literature citations are coded in diverse ways in the citation indexes, the searcher must be prepared to explore the indexes, and to develop new strategies as the search progresses. Interpreting the citations is also challenging, and requires a good understanding of the organization's publications, as well as a good library for verification of ambiguous citations.

The results show that many of GESAMP's publications are widely cited in the journal literature. Some of GESAMP's reports have received a significant number of citations for more than a decade after publication. There is some self-citation of reports by the working group members who prepared them. For each of the two most highly cited reports, the version which its authors cite most often, and thereby recommended to readers, is the version which was most cited overall. While there is also intra-organization citation by other people connected to GESAMP, over two thirds of the citing papers have no author with any direct connection to GESAMP. Citations are found in journals from a wide variety of disciplines. Although the core journals for the citations are concentrated in environmental science fields, they include the social sciences journal *Marine Policy*. The quality of GESAMP's work is highlighted by noting that the two most cited reports exceed ISI's citation threshold for "most highly cited" *Environment/Ecology* papers.

Studying citations to GESAMP's publications in the journal literature gives a measure of the attention they have received, but it is certainly not the complete picture. Even though many strategies have been used, relevant citations have almost certainly been missed in Web of Science, and other citations exist in journals not indexed there. GESAMP's work is also cited in other technical reports, in policy documents, and in both technical and popular books. Those citations are also important, but locating them systematically would be very time consuming.

This study has served its purpose of demonstrating to the GESAMP evaluation committee that GESAMP's publications do have a positive impact, and it contributed to the committee's positive recommendation for GESAMP's continued existence. In a broader context, it also shows that grey literature publications can be long-lived and influential, deserving of much more respect than is often accorded to the genre.

ACKNOWLEDGEMENTS

Many people assisted with this project. Dr. Bertrum MacDonald, School of Library and Information Studies, Dalhousie University, and Dr. Peter Wells, Environment Canada and past chair of GESAMP, supervised the project. Dr. Elaine Toms, Faculty of Information Studies, University of Toronto, provided suggestions for the data analysis. Staff of the libraries at Dalhousie University and the Bedford Institute Oceanography helped locate documents and

clarify citations. Rhonda Miller and Emily MacKenzie assisted with data entry of information about people associated with GESAMP. John Cordes provided much support and encouragement. Partial support from the International Maritime Organization is gratefully acknowledged. Information about creating the citation databases came from a tour of the ISI production facility during the ASIS&T annual meeting, Philadelphia, November 2002.

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