

76



GESAMP

Joint Group of Experts on the
Scientific Aspects of Marine
Environmental Protection

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REPORTS AND STUDIES

ASSESSMENT AND COMMUNICATION OF ENVIRONMENTAL RISKS IN COASTAL AQUACULTURE



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ENVIRONMENTAL RISKS
IN COASTAL AQUACULTURE**

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2008

REPORTS AND STUDIES

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ABSTRACT

This GESAMP study focuses on environmental risk assessment and communication in coastal aquaculture. To support effectively an open and transparent approach to sustainable resource use, risk assessment and communication must be able to fit within a broader social, economic and environmental decision-making framework. The communication aspects become paramount in enabling sustainable development in that type of decision-making environment. In today's environmentally conscientious societies, no activity is truly sustainable without social licence. Scientific knowledge has to be developed, presented and communicated in a manner that fully acknowledges the extent and limits of our ability to predict the consequence of development. This applies at all scales, from development of a single aquaculture farm site to the development of a number of sites that may have a cumulative effect that cannot be predicted on the basis of the activities at a single site, and to the initiation of an entirely new industry.

This publication presents a set of objectives, goals, methodologies and a checklist for assessment and communication of environmental risks which may be

associated with coastal aquaculture. It is structured to improve risk communication and to ensure that risk assessment is a scientific exercise in predicting environmental change. Suggestions are given on how socio-economic values can be used with environmental risk assessment in open and transparent decision-making for questions of resource allocation. In addition, the risk assessment methodologies are designed to present a clear picture of the role of uncertainty in prediction error. This approach to risk assessment also helps target mitigation and research efforts to ensure knowledge of the causes and effects of environmental interactions of coastal aquaculture.

A set of six case studies is also presented to illustrate the use of the environmental risk assessment methodologies in coastal aquaculture. These examples of environmental interactions span a range of cultured species from fin fish to molluscs and shrimp. The type of effects studied includes effects on carrying capacity, phytoplankton, kelp, benthic fauna, the genome of wild fishes and salinisation of soils.

Key words: coastal aquaculture, environmental risk, assessment, communication, risk analysis, GESAMP.

PREPARATION OF THIS STUDY

The Thirty-first session of GESAMP in 2001 charged GESAMP Working Group on Environmental Impacts of Coastal Aquaculture (WG31) with the task of producing a review report and guidelines for environmental risk assessment of coastal aquaculture, aimed at promoting harmonisation and consistency in the treatment of risk and uncertainty, and improved risk communication. In 2002 FAO invited the preparation of a discussion paper on environmental risk assessment and communication in coastal aquaculture (Hambrey and Southall, 2002¹). In 2003 this discussion paper was distributed by the FAO Technical Secretary of GESAMP to some 70 experts in the field of environmental risk assessment and coastal aquaculture with a view to inviting comments, suggestions, and contributions to this document. A scoping and planning meeting of a core group of GESAMP WG 31 was held in Rome from 1 to 3 December 2003. Under the chairmanship of Mr E. Black (2005-2007) drafts of sections of this study and six case studies

were prepared by members of WG31, and discussed during the GESAMP WG31 workshop (held in Rome from 20 to 24 November 2006). This GESAMP WG31 workshop was attended by C. Bacher, E. Black (Chair of WG31), K. Black, I. Davies, J. Hambrey, R. Petrell, M. Reantaso, H. Rosenthal, D. Soto, S.K.Teng, K.Yin and U. Barg (Technical Secretary of WG31). Following the Rome workshop, the advanced draft of the study report was circulated by F. Haag (GESAMP Officer) to several experts for peer review. The advanced draft study report and the peer reviewers' comments were presented to the Thirty-fourth Session of GESAMP, held in Paris from 7 to 11 May 2007. WG31 revised the study report based on comments contributed by the peer reviewers and GESAMP. On 8 October 2007 GESAMP approved the revised study report for publication. The work of GESAMP WG 31 was sponsored by FAO's Aquaculture Management and Conservation Service. The Secretariat was provided by FAO.

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following experts peer-reviewed drafts of the present GESAMP study report and its case studies: K. Astles, M. Baumann, J. Borg, W.J. Fletcher, L. Massaut, D.J. Morrisey, M.C. Nandeesh, M. Phillips, M. Saroglia, P. Shin, F. Simard, F. Suplicy and T. Telfer. A. Brebner and S. Heath formatted and edited the final texts. S. Borghesi finalized layout, graphic design and formatting of the report. FAO acknowledges with appreciation the work and contributions by above experts and by Members of GESAMP.

¹Hambrey, J. and T. Southall (2002). Environmental risk assessment and communication in coastal aquaculture: A background and discussion paper for GESAMP Working Group 31 on Environmental Impacts of Coastal Aquaculture (71 p.).

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Members of GESAMP Working Group 31 on Environmental Impacts of Coastal Aquaculture

Cedric BACHER (2)
Institut français de recherche pour l'exploitation de la mer IFREMER
29280 Plouzané, France
Tel.(33) 298224215
E-mail: Cedric.Bacher@ifremer.fr;
cbacher@ifremer.fr

Edward BLACK (1 ; 2)
Chair of GESAMP Working Group 31
Aquaculture Science Branch
Fisheries and Ocean Canada
12th Floor, 200 Kent Street
Ottawa, Ontario, Canada, K1A 0E6
Tel. (613) 9900272
E-mail: BlackE@DFO-MPO.GC.CA

Kenneth D. BLACK (2)
The Scottish Association for Marine Science
Dunstaffnage Marine Laboratory, Oban, Argyll
Scotland, PA37 1QA, United Kingdom
Tel. (44) 1631559259;
E-mail: kenny.black@sams.ac.uk

Kenneth M. BROOKS (1)
644 Old Eglemount Road.
Port Townsend, WA 98368
United States of America
Tel. (360) 732-4464
E-mail: brooks@olympus.net

Ian DAVIES (1 ; 2)
Fisheries Research Services Marine Laboratory
375 Victoria Road. Aberdeen AB111 9DB,
United Kingdom
Tel. (44) 1224876544
E-mail: daviesim@marlab.ac.uk

John HAMBREY (1 ; 2)
Crancil Brae House.
Strathpeffer; Ross-shire IV14 9AW;
United Kingdom
Tel. (44) 1997420086
E-mail: john@hambreyconsulting.co.uk

Royann Jean PETRELL (2)
University of British Columbia
2360 East Mall Vancouver
British Columbia, Canada V6T 1Z3
Tel. (604) 8223475
E-mail: petrell@interchange.ubc.ca

Harald ROSENTHAL (1 ; 2)
Schifferstrasse 48. 21629 Neu Wulmstorf,
Germany
Tel. (49) 40-7006514
E-mail: haro.train@t-online.de

TENG Seng-Keh (2)
Block 4, Toh Yi Drive, 09-211,
Singapore 590004
Tel. (65) 64622547
E-mail: tkwy@cyberway.com.sg; skteng@gmail.com

YIN Kedong (2)
Department of Biology, Hong Kong University of Science
and Technology, Clear Water Bay, Kowloon
China, Hong Kong Special Administrative Region
Tel. (852) 23587329
E-mail: kyin@ust.hk

FAO staff attending GESAMP WG31 meetings
in 2003 (1) and 2006 (2)

Melba REANTASO (2)
FAO Fisheries and Aquaculture Department
Viale delle Terme di Caracalla. Rome,
Italy
Tel: (39) 06-57054843
E-mail: melba.reantaso@fao.org

Doris SOTO (2)
FAO Fisheries and Aquaculture Department
Viale delle Terme di Caracalla. Rome,
Italy
Tel: (39) 06-57056149
E-mail: doris.soto@fao.org

Uwe BARG (1 ; 2)
Technical Secretary of GESAMP Working Group 31
FAO Technical Secretary of GESAMP
FAO Fisheries and Aquaculture Department
Viale delle Terme di Caracalla. Rome,
Italy
Tel: (39) 06-57053454
Email: uwe.barg@fao.org

(1) *Attended GESAMP WG31 Scoping & Planning Meeting, 1-3 December 2003*

(2) *Attended GESAMP WG31 Workshop, 20-24 November 2006*

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EXECUTIVE SUMMARY

Aquaculture is an increasingly prominent feature of our coastal environments. Seafood production from capture fisheries has ceased to increase significantly, while demand for their products increases each year. In an effort to fill that demand, aquaculture production has shown marked annual growth. In many areas much of that increase has come from coastal aquaculture activities. However, this adds to the pressures on space, natural resources and environmental services in coastal areas, and potentially to conflicts between different stakeholders and activities in the coastal zone.

The public is demanding a greater role in the management of coastal resources. Many jurisdictions are seeking to use participatory management schemes that include the public and other stakeholders in the processes that lead to decisions on aquaculture (and other) developments. All activities in coastal areas interact with the environment. Coastal aquaculture is no exception, and a wide range of environmental risks associated with coastal aquaculture developments have been described in scientific and other fora, with varying accuracy in their reflection of reality. Reliable assessment of the significance of these risks should provide a sound basis for decisions regarding new developments, mitigation actions, and research needs. However, this must be done in the face of uncertainty in predicting the environmental response to stresses (hazards).

Risk assessments must also communicate risk and uncertainty information to managers and the public in a fashion that meets the information needs of all stakeholder groups and managers at the same time. Scientists must provide information that meets with the requirements of managers for environmental risk management, and of the public and other stakeholders, to enable them to develop.

GESAMP Working Group on Environmental Impacts of Coastal Aquaculture in collaboration with experts of the International Council for the Exploration of the Sea's Working Group on Environmental Interactions of Mariculture has developed an integrated risk assessment/communication protocol that fits within a risk analysis structure for resource management. This report presents a model of ecological risk analysis for coastal aquaculture and guidelines for its application which:

- Is structured to fit into a broader decision making environment which combines social and economic values with science-based predictions of environmental changes and effects;
- Is pre-adapted to enhance the role of risk communication and risk management in the context of transparency;
- Can operate in an open and transparent manner to incorporate information supplied by scientists from government, academia, industry, and stakeholder organisations, and the public;

- Recognises that many of the environmental changes associated with aquaculture activities can also arise from other coastal activities such as industrial and urban development, tourism, agriculture, fishing and stock enhancement; and,
- Clarifies how uncertainty relates to the precautionary principle and affects decision-making.

The document emphasises the role of communication in decision-making, and the need to create risk assessments that meet the needs of, and be acceptable to, stakeholders as well as scientists. The protocol clearly indicates which elements of the decision-making process are derived from social/economic considerations, and where environmental science should provide critical information.

The most common causes of environmental concern from coastal aquaculture are nutrient release, habitat change and loss, effects on wild fish and shellfish populations, chemical pollution, and secondary effects on other production systems. Many of the interactions with the environment are subtle and cumulative, they can be highly dispersed in space and time, and often the magnitude and probability of environmental changes can be unclear. The risk assessment and analysis protocol presented includes processes to identify areas where knowledge is lacking, handles uncertainty (The Precautionary Approach) in an objective and constructive way, and provides an agreeable basis for discussion. The objectives of the risk assessment and analysis protocol presented include the separation of scientific analysis from valuation, transparency, consistency in assessment, non-discrimination, proportionality in risk management measures, monitoring linked into a review and action cycle, all of which are undertaken within the paradigm on sustainable use of coastal resources.

The risk analysis protocol applied to coastal aquaculture includes four main components: hazard identification, risk assessment, risk management and risk communication. The first three are sequential, and are carried out within a comprehensive risk communication strategy.

The risk assessment component is a major focus of this document and is considered in four subcomponents: release assessment, exposure assessment, consequence assessment, and risk estimation. It is recommended that the risk assessment is structured through a logic model that explicitly sets out the steps that lead from the hazard arising from a coastal aquaculture development to the undesirable outcome (endpoint) that is the target of the risk analysis.

The proposed risk analysis protocol is discussed in relation to other procedures established to aid

decision-making on resource use and sustainable development in coastal waters. Particular strengths of this approach are: the inclusion of uncertainty as part of the documentation; the assessment of probability and the uncertainty of the occurrence of each step in the chain of events (logic model) that leads to a change in the environment; and, the potential for a structured risk analysis to be incorporated into existing regulatory processes and contribute a robust and flexible framework for discussions between stakeholders and regulators. The protocol has been developed to work within a participatory management scheme that includes stakeholders and the public. It also helps clarify where research or regulatory approaches best control either the level of anticipated environmental change, or the accuracy of the prediction.

The application of the proposed risk analysis protocol to coastal aquaculture is discussed in some detail, and reference is made to typical sets of environmental concerns arising from aquaculture development proposals. The need for clarity at all stages of the risk assessment process is emphasised, and clarity is identified as an important factor for assisting in the resolution of differences and the handling of uncertainty. Mechanisms are described for combining the outcomes of analyses of several pairs of hazards and undesirable outcomes, as are often raised in relation to coastal aquaculture development.

A common difficulty in decision-making is determining when proposed mitigation measures are sufficient. Mitigation can be used to reduce

the severity or uncertainty of an effect. Zero environmental change is unattainable, therefore what constitutes an acceptable degree of change in relation to the anticipated benefits needs to be defined. These are not scientific decisions. They are societal decisions, perhaps political decisions. In order to ensure that the risk analysis can be objective, the valuation process, establishing what is acceptable and what is not, should be carried out at a very early stage in the risk analysis process.

All the processes of risk assessment should be carried out within the framework of risk communication. In some areas, decisions on coastal aquaculture development can be extremely contentious and have in the past led to extreme responses, ranging from encouragement of very rapid exploitation to moratoria on further developments. Advice is offered on the use of experienced facilitators and communicators in avoiding or resolving potential and actual conflicts between stakeholders and other interested parties.

The assessment protocol is applied to a series of case studies covering some of the common causes of concern expressed in relation to coastal aquaculture. These include the effects of the release of dissolved and particulate nutrients on primary production and seabed communities, the potential effects of coastal aquaculture on other local exploitable resources (reductions in sea weed communities, and in the carrying capacity for farmed shellfish), and wider-scale potential consequences of the escapes of farmed stocks for wild populations, and soil salinisation in coastal zones.