

# Site selection and carrying capacities for inland and coastal aquaculture

FAO/Institute of Aquaculture, University of Stirling, Expert Workshop  
6–8 December 2010  
Stirling, the United Kingdom of Great Britain and Northern Ireland



Cover photo: Seabream cages, Izmir Bay, Turkey (courtesy of Ozgur Altan)

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Edited by

**Lindsay G. Ross**

**Trevor C. Telfer**

**Lynne Falconer**

Institute of Aquaculture, University of Stirling

Stirling, the United Kingdom of Great Britain and Northern Ireland

and

**Doris Soto**

**José Aguilar-Manjarrez**

Aquaculture Branch

FAO Fisheries and Aquaculture Department

Rome, Italy

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# Preparation of this document

This publication is the proceedings of the Food and Agriculture Organization of the United Nations (FAO) Expert Workshop on Site Selection and Carrying Capacities for Inland and Coastal Aquaculture convened at the Institute of Aquaculture, University of Stirling, the United Kingdom of Great Britain and Northern Ireland, from 6–8 December 2010.

The workshop was attended by 20 internationally renowned experts from 13 countries (the Arab Republic of Egypt, Canada, the Federative Republic of Brazil, the Hellenic Republic, the Kingdom of Norway, the People's Republic of China, the Portuguese Republic, the Republic of Chile, the Republic of Ghana, the Republic of South Africa, the United Kingdom of Great Britain and Northern Ireland, the United Mexican States and the United States of America), representing the private sector, industry, academia, government, research organizations and FAO.

The workshop was jointly organized by the Sustainable Aquaculture Group, Institute of Aquaculture, University of Stirling, and the Aquaculture Branch of the FAO Fisheries and Aquaculture Department through a collaboration agreement.

The main purpose of this document is to provide guidance to developing countries on the process of aquaculture site selection and carrying capacity to improve the sustainability of aquaculture.

This technical workshop constitutes the first of a series of workshops and activities addressing different issues to help implement the ecosystem approach to aquaculture (EAA). The intended audience for this publication consists of professionals in the fisheries sector at managerial and technical levels in government service, in international organizations and in the aquaculture industry.

The workshop report and the first global review entitled “Carrying capacities and site selection within the ecosystem approach to aquaculture” have been edited by FAO. However, all the other reviews have been reproduced as submitted.

# Abstract

An FAO-sponsored Expert Workshop on Site Selection and Carrying Capacities for Inland and Coastal Aquaculture was held at the Institute of Aquaculture, University of Stirling, the United Kingdom of Great Britain and Northern Ireland, in December 2010. The workshop was attended by 20 internationally recognized experts, including two staff members of FAO, and covered a number of relevant core topics and represented aquaculture in different regions of the world. Expertise within the group included the academic, regulatory and consultative sectors of the industry, giving a wide perspective of views on the core topics.

Seven global reviews and ten regional reviews on site selection and carrying capacity encompassing inland aquaculture and coastal aquaculture were presented and discussed at the workshop. Supplementary inputs were provided by the experts who were unable to attend the workshop for the reviews on “Environmental Impact, Site Selection and Carrying Capacity Estimation for Small-scale Aquaculture in Asia” and “Guidelines for Aquaculture Site Selection and Carrying Capacity for Inland and Coastal Aquaculture in Mid- and Northern Europe”.

Definitions of carrying capacity appropriate for different types of aquaculture were discussed and agreed based upon four categories: physical, production, ecological and social.

The range and capability of modelling tools, including spatial tools, available for addressing these capacities were discussed. The prioritization and sequence for addressing site selection and the different categories of carrying capacity were considered in detail in terms of both regional or national priorities and site-specific considerations.

Two major outcomes have been developed from the workshop: (i) a comprehensive record of the workshop proceedings (this document), which includes global and regional reviews and a summary of major findings and recommendations; and (ii) a set of guidelines for addressing site selection and carrying capacity in the context of the framework of the ecosystem approach to aquaculture (EAA), including summaries of the key findings and recommendations for aquaculture site selection and carrying capacity with an EAA perspective. Recommendations were made for promotion of these concepts and approaches by FAO.

This publication is organized in two parts. One part contains the workshop report and the first global review entitled “Carrying capacities and site selection within the ecosystem approach to aquaculture”, while the second part is the full document. The latter part is available on a CD-ROM accompanying the printed part of this publication.

**Ross, L.G., Telfer, T.C., Falconer, L., Soto, D. & Aguilar-Manjarrez, J., eds. 2013.** *Site selection and carrying capacities for inland and coastal aquaculture*. FAO/Institute of Aquaculture, University of Stirling, Expert Workshop, 6–8 December 2010. Stirling, the United Kingdom of Great Britain and Northern Ireland. FAO Fisheries and Aquaculture Proceedings No. 21. Rome, FAO. 46 pp.

Includes a CD-ROM containing the full document (282 pp.).

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# Abbreviations and acronyms

<b>ADZ</b>	Aquaculture Development Zone
<b>ALSC</b>	Aquaculture Livelihoods Service Center
<b>APP</b>	average physical product
<b>AQCESS</b>	Aquaculture and Coastal Economic and Social Sustainability (EU-funded research project)
<b>ASEAN</b>	Association of Southeast Asian Nations
<b>ASFA</b>	Aquatic Sciences and Fisheries Abstracts
<b>ASSETS</b>	Assessment of Estuarine Trophic Status
<b>AZA</b>	Allocated Zones for Aquaculture
<b>AZE</b>	Allowable Zone of Effects
<b>BIOFAQs</b>	BioFiltration and Aquaculture: an Evaluation of Substrate Deployment Performance with Mariculture Developments (EU-funded research project)
<b>BMP</b>	best management practice
<b>BOD</b>	biological oxygen demand
<b>BP</b>	biosafety protocol
<b>BQE</b>	biological quality element
<b>CBD</b>	Convention on Biological Diversity
<b>CC</b>	carrying capacity
<b>CCRF</b>	Code of Conduct for Responsible Fisheries
<b>CEAA</b>	Canadian Environmental Assessment Act
<b>CFP</b>	Common Fisheries Policy
<b>CITES</b>	Convention on International Trade in Endangered Species of Wild Fauna and Flora
<b>CNPq</b>	Brazilian National Research Council
<b>COC</b>	code of conduct
<b>COPAS</b>	Centro de Investigación Oceanográfica en el Pacífico Sur-Oriental
<b>CRIS</b>	British Columbia Coastal Resource Information System
<b>CZM</b>	coastal zone management
<b>DEAT</b>	Department of Environmental Affairs and Tourism (the Republic of South Africa)
<b>DFID</b>	Department for International Development (United Kingdom of Great Britain and Northern Ireland)
<b>DFO</b>	Department of Fisheries and Oceans (Canada)
<b>DO</b>	dissolved oxygen
<b>DPSIR</b>	Driver-Pressure-State-Impact-Response
<b>DTZ</b>	Dibah Triangle Zone (the Arab Republic of Egypt)
<b>E2K</b>	EcoWin2000
<b>EAA</b>	ecosystem approach to aquaculture
<b>ECASA</b>	Ecosystem Approach for Sustainable Aquaculture (EU FP6 project)
<b>EEZ</b>	exclusive economic zone
<b>EIA</b>	environmental impact assessment
<b>EMP</b>	environmental monitoring programme
<b>EPA</b>	Environmental Protection Agency
<b>EQS</b>	environmental quality standards
<b>EU</b>	European Union
<b>FAO</b>	Food and Agriculture Organization of the United Nations

<b>FCR</b>	food conversion rate
<b>GAFRD</b>	General Authority for Fish Resources Development (the Arab Republic of Egypt)
<b>GAP</b>	good aquaculture practice
<b>GDP</b>	gross domestic product
<b>GEcS</b>	Good Ecological Status
<b>GEoS</b>	Good Environmental Status
<b>GFCM</b>	General Fisheries Commission for the Mediterranean
<b>GHG</b>	greenhouse gas
<b>GIS</b>	geographic information system
<b>GISFish</b>	Global Gateway to Geographical Information Systems, remote sensing and mapping for fisheries and aquaculture
<b>HAB</b>	harmful algal bloom
<b>HACCP</b>	Hazard Analysis and Critical Control Point (system)
<b>HELCOM</b>	Helsinki Commission: Baltic Marine Environment Protection Commission
<b>HR</b>	human resources
<b>IAAS</b>	integrated agriculture–aquaculture systems
<b>IBSFC</b>	International Baltic Sea Fishery Convention
<b>ICES</b>	International Council for the Exploration of the Sea
<b>ICZM</b>	integrated coastal zone management
<b>IFAS</b>	integrated fisheries–aquaculture systems
<b>IMAP</b>	integrated management of aquaculture plans
<b>IMTA</b>	integrated multitrophic aquaculture
<b>IPAS</b>	integrated peri-urban aquaculture system
<b>ISEX</b>	inland sea of the xth region (the Republic of Chile)
<b>IUCN</b>	International Union for Conservation of Nature
<b>KZN</b>	KwaZulu-Natal Province of the Republic of South Africa
<b>LCA</b>	life cycle analysis
<b>LDCS</b>	least-developed countries
<b>LGU</b>	local government unit
<b>LIFDCs</b>	low-income food-deficit countries
<b>LRDW</b>	Land and Resource Data Warehouse (British Columbia)
<b>MedVeg</b>	Effects of Nutrient Release from Mediterranean Fish Farms on Benthic Vegetation in Coastal Ecosystems (EU-funded project)
<b>MERAMED</b>	Development of Monitoring Guidelines and Modelling Tools for Environmental Effects from Mediterranean Aquaculture (EU-funded project)
<b>MMT</b>	million metric tonnes
<b>MOLO</b>	MOm–LOkalisering (Norwegian)
<b>MOM</b>	Modelling–Ongrowing fish farms–Monitoring (model)
<b>MOU</b>	memorandum of understanding
<b>MPA</b>	Ministério da Pesca e Aquicultura (the Federative Republic of Brazil)
<b>MPA</b>	marine protected area
<b>MPEDA</b>	Marine Products Export Development Authority (the Republic of India)
<b>MPP</b>	marginal physical product
<b>MSFD</b>	Marine Strategy Framework Directive
<b>MTA</b>	multitrophic aquaculture
<b>MTB</b>	maximum permitted biomass
<b>NACA</b>	Network of Aquaculture Centres in Asia-Pacific
<b>NAFO</b>	Northwest Atlantic Fisheries Organization
<b>NASCO</b>	North Atlantic Salmon Conservation Organization
<b>NEAFC</b>	North East Atlantic Fisheries Commission
<b>NELHA</b>	Natural Energy Laboratory of Hawaii Authority

<b>NGO</b>	non-governmental organization
<b>NIFES</b>	National Institute of Nutrition and Seafood Research (the Kingdom of Norway)
<b>NIMBY</b>	not in my backyard
<b>NIMTO</b>	not in my term in office
<b>NPDES</b>	National Pollutant Discharge Elimination System
<b>NWPA</b>	Navigable Waters Protection Act (Canada)
<b>OM</b>	organic matter
<b>OSPAR</b>	Oslo-Paris Convention
<b>PLDM</b>	Local Plans for Mariculture Development (the Federative Republic of Brazil)
<b>PPP</b>	polluter pays principle
<b>PRA</b>	participative rural appraisal
<b>QD</b>	quality descriptors
<b>QQT</b>	quality, quantity and time
<b>RAMA</b>	Aquaculture Environmental Regulation (the Republic of Chile)
<b>REPLA</b>	Aquatic Pest Regulation (the Republic of Chile)
<b>RESA</b>	Aquaculture Sanitary Regulation (the Republic of Chile)
<b>ROV</b>	remotely operated vehicle
<b>RTD</b>	Research and Technology Development
<b>SAMI</b>	Synthesis of Aquaculture and Marine Ecosystems Interactions
<b>SCI</b>	Shellfish Capability Index
<b>SDSS</b>	spatial decision support system
<b>SEA</b>	strategic environmental assessment
<b>SEAFDEC</b>	Southeast Asian Fisheries Development Center
<b>SEPA</b>	Scottish Environmental Protection Agency
<b>SHoCMed</b>	Siting and Holding Capacity in the Mediterranean
<b>SME</b>	small and medium enterprises
<b>SMME</b>	small, medium and microenterprises
<b>SPEAR</b>	Sustainable Options for People, Catchment and Aquatic Resources
<b>SPF</b>	specific pathogen free (shrimp)
<b>SPICOSA</b>	Science and Policy Integration for Coastal System Assessment
<b>SSA</b>	Sub-Saharan Africa
<b>TEK</b>	traditional ecological knowledge
<b>TPP</b>	total physical product
<b>UNCED</b>	United Nations Conference on Environment and Development
<b>USACE</b>	United States Army Corps of Engineers
<b>WFD</b>	Water Framework Directives
<b>WGSC</b>	Working Group on Site Selection and Carrying Capacity
<b>WHO</b>	World Health Organization
<b>WWF</b>	World Wildlife Fund for Nature