

Aquacultures' Contribution at Sustainable Development of Island Regions

Chatziefstathiou Michael ^{1,3*} and Spilanis Ioannis ²

¹ University of Aegean, Department of Environment, Environmental Policy and Management, Alkaiou 1, GR-81100, Mitilini. E-mail: mhatzi@env.aegean.gr

² University of Aegean, Department of Environment, Laboratory for Local and Island's Development, University Hill (Xenia building), GR-81100, Mitilini. E-mail: gspi@aegean.gr

³ Interscientific Institute of European Studies, Analyses and Planning (INIESAP), Koumoundourou 37, GR-10437, Athens. E-mail: diemas@mail.gr

Abstract

The islands in spite of their wide diversity, are all confronted to a greater or lesser extent with similar problems: isolation and remoteness, limited natural and human resources, difficulties in terms of competitiveness and economic development, and fragile environments. Work in island regions involves consideration of potentials and constraints in the various aspects of development, e.g. in the Mediterranean region, tourism is the largest industry, but its uncontrolled development and thoughtless use of nature has taken a toll of this region's resources and resource base.

At the same time, the world's increasing demand for seafood can only be met through aquaculture and it is expected to dominate global fish supplies by 2030, with less than half the fish consumed coming from capture fisheries. In the last 20 years, in response to increased fishing pressure on wild fish stocks and to technology development there has been rapid growth in fish farming. This growth has been accompanied by increasing public concern about equity in the planning and allocation of waters for aquaculture, and about the potential of the industry to cause environmental and visual pollution, and navigation conflicts.

As aquaculture is a relatively new primary industry attempting to compete for resources against established industries and uses, it is probable that controversy will accompany many new proposals. The public perception is that marine farming excludes other beneficial uses including conservation, recreational uses including fishing, and commercial fishing.

Having as a goal the sustainable development of the island regions we must have in mind that sustainability has three basic sectors: the environment, the society and the economy. Small islands required a special agro-ecological approach in the pursuit of sustainable development. Agriculture, fisheries and forestry were for centuries the main source of livelihood for the population of the islands and their sustainable management remains crucial for the future.

The objective of an aquaculture development plan for island regions is to provide a sound basis for developing a new aquaculture industry in the islands, while at the same time conserving the unique environment of the islands for present and future generations, and minimising conflict between aquaculture and existing and future users of the islands.

Keywords: aquaculture, sustainable development, island regions, islands, conflicts

Συμβολή των Υδατοκαλλιεργειών στην Βιώσιμη Ανάπτυξη των Νησιωτικών Περιοχών

Χατζηευσταθίου Μιχαήλ^{1,3*} και Σπιλάνης Ιωάννης²

¹ Πανεπιστήμιο Αιγαίου, Τμήμα Περιβάλλοντος, Περιβαλλοντική Πολιτική και Διαχείριση, Αλκαίου 1, ΤΚ 81100, Μυτιλήνη. E-mail: mhatzi@env.aegean.gr

² Πανεπιστήμιο Αιγαίου, Τμήμα Περιβάλλοντος, Εργαστήριο Τοπικής και Νησιωτικής Ανάπτυξης, Λόφος Πανεπιστημίου (Κτίριο Ξενία), ΤΚ 81100, Μυτιλήνη. E-mail: gsri@aegean.gr

³ Διεπιστημονικό Ινστιτούτο Ευρωπαϊκών Μελετών Αναλύσεων & Σχεδιασμού (ΔΙΕΜΑΣ). diemas@mail.gr

Περίληψη

Τα νησιά παρά την μεγάλη ποικιλία τους, αντιμετωπίζουν σε μεγαλύτερη ή μικτότερη έκταση παρόμοια προβλήματα: είναι απομονωμένα και απομακρυσμένα, έχουν περιορισμένους φυσικούς και ανθρώπινους πόρους, εμφανίζουν δυσκολίες σε επίπεδο ανταγωνιστικότητας και οικονομικής ανάπτυξης και έχουν ευαίσθητα περιβάλλοντα. Οι εργασίες σε νησιωτικές περιοχές απαιτούν προεργασία και σκέψη αναφορικά με τις δυνατότητες και περιορισμούς των διαφόρων αναπτυξιακών δράσεων, π.χ. στην περιοχή της Μεσογείου ο τουρισμός είναι η μεγαλύτερη βιομηχανία, όμως η ανεξέλεγκτη ανάπτυξη του και η αλόγιστη χρήση της φύσης έχει οδηγήσει σε υποβάθμιση του συνόλου πόρων της ευρύτερης περιοχής.

Ταυτόχρονα οι παγκόσμια αυξανόμενες απαιτήσεις για πιο πολλά θαλασσινά αλιεύματα μπορούν να αντιμετωπιστούν μόνο μέσα από τις υδατοκαλλιέργειες, οι οποίες αναμένεται να κυριαρχήσουν στον παγκόσμιο εφοδιασμό μέχρι το 2030, χρονιά που λιγότερα από τα μισά αλιεύματα που θα καταναλώνονται θα προέρχονται από την συλλεκτική αλιεία. Τα τελευταία 20 χρόνια λόγω της αυξανόμενης αλιευτικής πίεσης στους άγριους ιχθυοπληθυσμούς και της τεχνολογικής προόδου αναπτύχθηκε γρήγορα και η ιχθυοκαλλιέργεια. Αυτό συνοδεύτηκε από μία αυξημένη ανησυχία του κοινού σχετικά με τον σχεδιασμό για την χρήση των υδάτων στις υδατοκαλλιέργειες και την πιθανότητα να προκληθούν περιβαλλοντική και «οπτική» ρύπανση, εμπόδια στην ναυτιλία, καθώς και άλλες συγκρούσεις παράκτιων χρήσεων.

Εξαιτίας του ότι οι υδατοκαλλιέργειες είναι μία σχετικά νέα βιομηχανία του πρωτογενή τομέα που προσπαθεί να ανταγωνιστεί για τους ίδιους πόρους με εδραιωμένες βιομηχανίες και χρήσεις, οδηγούμαστε στο γεγονός κάθε νέα πρόταση να αντιμετωπίζεται με σκεπτικισμό. Η άποψη που διαμορφώθηκε στο κοινό είναι ότι οι θαλάσσιες καλλιέργειες αποκλείουν άλλες χρήσεις, και περιλαμβάνουν σε αυτές την προστασία του περιβάλλοντος, τις δραστηριότητες αναψυχής όπως το ψάρεμα, και την επαγγελματική αλιεία.

Έχοντας ως στόχο την βιώσιμη ανάπτυξη των νησιωτικών περιοχών πρέπει να θυμόμαστε ότι η αειφορία έχει τρεις βασικούς τομείς: το περιβάλλον, την κοινωνία και την οικονομία. Τα μικρά νησιά χρειάζονται ειδική αγρο-οικολογική προσέγγιση στην αναζήτηση της βιώσιμης ανάπτυξης τους. Η γεωργία, αλιεία και δασοπονία ήταν για αιώνες οι κύριες πηγές εφοδίων του πληθυσμού των νησιών και η βιώσιμη διαχείριση τους παραμένει βασική για το μέλλον. Ο σκοπός ενός ολοκληρωμένου σχεδίου για την ανάπτυξη ιχθυοκαλλιεργειών στις νησιωτικές περιοχές είναι να παρέχει μία καλά μελετημένη πρόταση ανάπτυξης των υδατοκαλλιεργειών, ενώ παράλληλα θα φροντίζει για την διατήρηση του μοναδικού περιβάλλοντος τους για τις παρούσες και μελλοντικές γενεές και παράλληλα θα ελαχιστοποιεί τις συγκρούσεις μεταξύ των υδατοκαλλιεργειών και των υφισταμένων και μελλοντικών χρηστών των νησιών.

Introduction

Everybody is agreed: an island is a territory surrounded by water. According to the European Union (EuroStat, "Portrait of the islands"), an island is a territory surrounded by water:

1. inhabited by more than 50 permanent people,
2. not linked to the mainland by a permanent device (bridge, tunnel...),
3. distant by at least 1 Km from the mainland,
4. with no capital of an EU member state

The islands of the European Union, in spite of their wide diversity, are all confronted to a greater or lesser extent with the same problems: isolation and remoteness, limited natural and human resources, difficulties in terms of competitiveness and economic development, fragile environments (Eurisles, 2002).

However, that's as far as the consensus goes and the problems start as soon as we try to understand and compare the island regions between them and something even more difficult to understand their difference from the mainland, even from the coastal areas.

At the same time, against the background of a growing world population, static levels of wild capture fisheries, an increasing recognition of seafood as part of a healthy diet and growing affluence among the populations of some key export markets, further development of the aquaculture industry, mainly towards the production of premium species, represents an enormous opportunity for islands (Frankic et al., 2001).

Starting from the hypothesis that further economic development of island regions is needed (Eurisles, 2000), that their sustainable management remains crucial for their future (Eurisles, 2002), and that one way to do that is to continue develop marine aquaculture to the islands among other activities (European Environmental Agency, 2002), we will try to present the major issues and dilemmas arising today from this use and try to examine how aquaculture can contribute to sustainable development of island regions, having in mind similar problems and the technical and managerial solutions applied in different regions (Australian Ministry of Agriculture, Forestry and Fisheries, 2000).

Sustainable Development and Island Regions

Sustainability refers to the ability of a society, ecosystem, or any such on-going system to continue functioning into the indefinite future without being forced into decline through exhaustion or overloading of key resources on which that system depends. In general, the concept of sustainable development is simple and important, but translating it into specific standards or criteria is difficult, often subjective and misused. Sustainability has three basic sectors: the environment, the society and the economy (Chatziefstathiou et al., 2002).

The term "**sustainable development**" implies the informed, conscientious management of the natural resources that are exploited or utilized by humans so that these resources may be capable of exploitation over time. Sustainable development has undergone numerous definitions, the first of which was formulated in the 1987 Brundtland report, i.e. "sustainable development is a mode of development that meets the needs of current generations without compromising the capacity of future generations to meet theirs".

Whatever the various definitions, they are translated into practice in "development that respects the environment enabling harmonious economic and social progress". The inclusion of the environment in development policies is a constant in most of these definitions.

The sustainable development of island regions calls for sustainable management that implies both the taking into account of environmental components in human activities such as aquaculture and fishing, agriculture, transports, industry, tourism and leisure-activities, etc., **and** management of coastal resources, ecosystems, water quality and so forth (UNEP, 2002).

Small islands required a special agro-ecological approach in the pursuit of sustainable development (Brooks, 2002). Agriculture, fisheries and forestry have provided for centuries the main source of livelihood for the population of the islands. Their sustainable management remains crucial for the future. Work in small islands involves consideration of potentials and constraints in the various aspects of development, including:

- Economic issues: narrow resource base, isolation from major markets, vulnerability to volatile international markets, erosion of preferential trade arrangements, high external debt, high level of foreign aid and remittances, net food importing countries, difficulties in conforming to sanitary regulations, importance of tourism and dominance of public sector.
- Ecological issues: rich marine and terrestrial biodiversity, vulnerability to natural hazards, harsh competition for scarce natural resources, particularly fresh water, degradation of coastal habitats, loss of traditional agricultural systems and over-exploitation of forest and coastal resources.
- Social issues: high population growth and mobility, limited variety of dietary intakes and nutritional problems, institutional "brain drain", scarcity of skilled manpower and weak institutional capacities.

Considering increasing human population pressure, changing socio-economic structures, fluctuating environmental conditions and on-going exploitation of natural resources, coastal areas and island regions need an integrated, interdisciplinary management strategy founded on principles that will enable long-term sustainable development.

Technical solutions to most problems in the environment do exist (Chatziefstathiou et al., 1997). Unfortunately science and technology are often pushed aside from short-term social or economic considerations, having a few good examples (e.g., ecotourism is an area in which there is a commonality of social, economic, scientific and technical considerations).

In the Mediterranean region, tourism is the largest industry. Uncontrolled development and thoughtless use of nature has taken a toll of this region's resources and resource base. In this same area the degraded coastal zone is the focus of many international conventions and organizations trying to find solutions to the problems created by mass tourism. The disenchanted tourist is moving toward pristine islands to capture what use to be on the main land. It is matter of time until tourism ruins the pristine islands.

Ecotourism strategies should be established and supported within the context of natural resources limitations and socio-cultural constraints. A region's cultural heritage and natural resources should define the tourist carrying capacity of the region. The management objective is to develop "limits on acceptable change" to assess stress in both the natural and the social and economic environment (Frankic et al., 1996).

Analysing the Island Phenomenon

Data concerning the exact situation of the island regions and in particular the nature, extent and evolution of their problems, is often incomplete, out of date or insufficient. Problems of size, remoteness, status and isolation crop up immediately and these problems need to be analysed using conceptual tools (Eurisles, 1997). Conceptually, the diagnosis is known:

- scarce resources leading to rarity and lack of diversification,
- small local market leading to exposure to the outside,
- single-production exports,
- natural risks whose consequences are aggravated by size factors,
- lack of economies of scale for both the private sector and public infrastructures,
- the perverse effects of monopolies and reduced competition,
- the disadvantage of dispersion for the archipelagos.

It is very difficult to measure island specificities linked to the rarity of their natural resources, their ecological fragility, transport overcosts, and degree of dependence on market economy. Certain comparative advantages have enabled islands to develop certain social or economic mechanisms favourable to their populations. Islands governed by a complex and fluctuating set of interactions, the specific characteristics of the islands arise from a set of factors, and the "island phenomenon" is defined by a combination of these factors. Insularity may not in itself be the determining factor in explaining the economic development (Eurisles, 1997).

Island space has characteristics which are proper to it and which affect the economic development of the island regions. Effects of size, dependence and distance imply different consequences, as do historical periods or economic systems, but, overall, there are specific island characteristics, which determine the type of economic development of a territory.

One fact which always holds true is that the islands are **smaller** than the mainland areas. While this seems to be stating the obvious, it nevertheless leads to a very simple first level of reasoning. Because of its endemism to the islands, smallness implies **rarity**.

While this rarity manifests itself in various ways, it is measured mainly by the scarcity and paucity of resources (raw materials, infrastructures, human potentialities, etc.). In order to **manage these rare resources**, the island economies adopt a specific management system. This is based on the **need to have access to a major network of exchange with the outside**. From colonialism to today's trade deficits, this phenomenon is a constant factor of the economic history of all the island economies.

Rarity and openness to the outside are factors that lead to a high degree of dependence, due to a single-product export activity and a high level of imports. This dependence, which is due to the weakness of the domestic economy and the dominant role of external trade, is significantly aggravated if, in addition, **the island is remote and located far from markets**.

An evaluation of the costs of insularity is essential to understanding the economy of an island. Successful operation of an economic system depends on the degree of control and capacities to adjust, which develop in the process of sharing-out resources. The effectiveness of this process depends on the degree of initiative and consistency of private investors, suitability and extent of government intervention, transparency of the market and on the level of information on economic realities and on its use to facilitate economic forecasts.

The foreseeable consequences of the reduction in public spending (on which they depend to a large extent), the threats to their single-sector activities (agriculture, fisheries, tourism, etc.) or their demographic (young/old) or territorial (coast/inland) imbalances, place them in a very unfavourable situation with regard to the major European milestones, e.g. the “hard” euro, the EU enlargement, etc (Eurisles, 2002).

Definition of Aquaculture

The Food and Agricultural Organisation (FAO) of the United Nations defines aquaculture as: *Farming of aquatic organisms including fish, molluscs, crustaceans and plants, with some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators etc. Farming also implies individual or corporate ownership of the stock being cultivated.*

Fish farming typically involves the enclosure of fish in a secure system under conditions in which they can thrive (Klaoudatos et al., 1995). Aquaculture is usually dependent on natural ecosystems (Klaoudatos et al., 1997). It can impact freshwater supplies, modify coastal habitats, compete with the commercial wild catch, or through escape, introduce non-indigenous organisms and disease to new environments (Frankic et al., 2003).

Aquaculture is a diverse industry where success for each individual company, each sector and the industry as a whole is dependent on a multitude of inter-related factors that are constantly changing (European Commission, 2002). Successful aquaculture development involves a breadth of activities, mainly in the coastal zone, spanning areas such as engineering, environmental management, land and marine planning, transport, education, marketing and research and development (Stead et al., 2002).

It is generally recognised that most known commercial fish species are at or near full exploitation and internationally many have exceeded the maximum sustainable yield and are already at or beyond the point of commercial extinction (Chatziefstathiou et al., 2002). The world’s increasing demand for seafood can only be met through aquaculture and it is expected to dominate global fish supplies by 2030, with less than half the fish consumed coming from capture fisheries (Friends of Europe, 2003).

General facts related to aquaculture activities

- Aquaculture is a global, inevitable and a fast growing industry.
- Part of our past and present history, and its needed in our future.
- There are environmental, social, and economic problems.
- ‘Use conflicts’ are everyday scenarios in the coastal areas.
- Growing consumer demand for environmentally responsible products (e.g., the Marine Fisheries Conservation Programme, ecolabeling, ISO 14000, EMAS, etc).
- Continuing development of indicators for environmental, social and economic aspects of aquaculture activities, to monitor and evaluate impacts and sustainability of its nature.
- Globalisation is an inevitable developmental process, but in order for each country to become part of this process in a sustainable manner, it first has to become self-sustaining.
- Aquaculture on islands is a great example of how to become sustainable and show how not to. They represent ‘small globes’ and show how the process of globalisation and self-sustainability can be implemented.

Targeting Sustainable Development of Island Regions

During recent years there has been considerable progress in both the acceptance of the need to manage the way in which humans interact with the environment, and the tools available to achieve such management. This trend is exemplified in the increasing promotion the “ecosystem approach”, where controls are applied human activities and the demands we make upon the environment, as opposed to managing ecological processes (Grant et al., 1997).

Ecosystems, although frequently described as "fragile" have remarkable powers of resiliency. As long as basic processes are not irretrievably damaged, ecosystems will continue to recycle and distribute energy, sustaining the resources upon which we rely. A healthy functioning ecosystem not only sustains itself, it can also sustain local human communities, economies and industry. The delivery of an ecosystem approach can be broadly divided into six steps:

- Vision and environmental goal-setting
- Integrating policy
- Assessment
- Decision-making and spatial planning
- Delivery tools
- Strategy for delivery, including monitoring, enforcement, etc

The sustainability analysis then calls for the consensual setting of a "band of equilibrium" for the key indicators making it possible to judge the sustainability of the present situation in the region in question and to determine what is desirable and what is unacceptable. The projection of these indicators, based on the prospective of the studied system, then makes it possible to judge the future sustainability and thus the region's sustainable development level.

To have the desirable sustainable development level in island regions, it is better to have not a single-production and to base the islands' development on a more multidisciplinary approach, promoting the parallel deployment of different activities, like agriculture, tourism & leisure, and fisheries (UNEP, 2002). In this approach aquaculture can contribute by:

- Increase household food supply and improve nutrition.
- Increase household economy through diversification of income and food sources.
- Strengthen marginal economies by increasing employment and reducing food prices.
- Improve water resource and nutrient management at household or community levels.
- Preserve aquatic biodiversity through re-stocking, and recovering of protected species.
- Reduce pressure on fishery resources if done sustainably.
- Improving / enhancing habitats.
- Stimulates research and technology development.
- Increase education and environmental awareness.

Key to achieving a successful ecosystem approach in island regions is the development of appropriate management systems and structures in combination with integrated marine policies (Chatziefstathiou, 2000). Amongst the assessment tools available for use in order to achieve ecosystem management is Strategic Environmental Assessment (SEA) that can be defined as formalised, systematic and comprehensive process of evaluating the environmental impacts of a policy, plan or programme and its alternatives, including preparation of a written report on the findings of the evaluation, and using the findings in publicly accountable decision making (European Commission, 1999; European Commission, 2001).

Conclusions and Recommendations

Our main goal is to define the major problems from aquaculture (Klaoudatos et al., 1996), to examine if aquaculture really contributes to sustainable development of island regions and to propose a simple and easy to use tool for choosing the best available aquaculture type for each island's sustainable development. For this reason we will try to develop a matrix of suitable indicators as a tool to estimate the contribution of aquaculture, and compare different islands and level of development that can be applied to each one, taking in mind the economic, social and environmental aspects of aquaculture and the limitations derived from the island status. After that a case study will be followed, based on this series of indicators.

This tool we hope that can help to facilitate decision-making processes for spatial planning, incorporating socio-economic and ecological / environmental assessment elements. Perhaps in facilitating spatial planning decisions its combined use with SEA and EIA will help to determine appropriate and inappropriate sites for projects in areas considered suitable for development, and promote the sustainable development of the islands.

Ecosystem approach, indicators matrix, and Strategic Environmental Assessment have a key role to play in establishing those areas that may be environmentally sensitive or vulnerable to a variety of activities. Depending on the type of preferred development needed, areas may be identified as sensitive or vulnerable for reasons other than their environmental characteristics. For instance a particular area may be important for fishing, aquaculture or tourism.

In the context of the preceding analysis of the current position of global, national and local aquaculture industry, a vision for the aquaculture industry in the islands could:

- Implement site selection and operation management practices based on the principles of ecologically sustainable development
- Work with local and indigenous communities to consider the social concerns and impact of aquaculture projects
- Ensure site selection processes consider the needs of all stakeholders but result in only economically viable sites being approved
- Develop into an industry serving local and international markets
- Commit to supplying only safe, high quality seafood to local and international markets
- Become professional and united with a global scope utilising the latest technologies and systems enabling members to earn a sustainable economic return on their investment
- Commit to an ongoing coordinated and collaborative research and development program aimed at continuous improvement in productivity and the development of environmentally sustainable technologies
- Continue to be characterised by a combination of small and large enterprises across multiple sectors bound by a joint commitment to build a clean, safe, sustainable and profitable industry supported by all inhabitants.

Aquaculture is a relatively new primary industry attempting to compete for resources against established industries and uses and probably controversy will accompany the new proposals. The introduction of transparent planning, community consultation, reporting and objection processes, which meet public expectations on matters of public interest, will permit these discussions to be conducted in an atmosphere of trust (Fisheries Western Australia, 1997).

References

- Australian Ministry of Agriculture, Forestry and Fisheries, 2000.** Aquaculture Plan for the Houtman Abrolhos Islands. Fisheries Western Australia, Fisheries Management Paper No. 137. April 2000
- Brooks K.M., 2002.** Assessing the Risks: A comparison between the environmental impacts of aquaculture and traditional agriculture. Northern Aquaculture, January 2002.
- Chatziefstathiou M., 2000.** Environmental Management Systems (EMS) and Marine Aquaculture. 6th Panhellenic Symposium of Oceanography & Fishery, Chios, May 2000
- Chatziefstathiou M., Charalambous A., Makris G. and Kargioti I., 2002.** Sustainable development: Is the use of fish meal in aquaculture compatible with the effort for sustainable management of Marine Biological Resources? 11th Panhellenic Congress of Ichthyologists, Preveza, Greece, April, 2003
- Chatziefstathiou, M. and Nerantzis, E., 1997.** Sustainable Development: From Theory to Practice. Use of industrial waste as an alternative raw material: Protein substitution of fish feeds with industrial wine distilleries wastes. 2nd Congress on Protection & Sustainable Development of Amvrakikos Gulf, Arta 1997.
- Eurisles, 1997.** Statistical Indicators of Regional Disparities Caused by Insularity and Ultra-Peripherality. European Islands System of Links and Exchanges (Eurisles). Ed. Eurisles, 10/1997
- Eurisles, 2000.** What Status for Europe Island's?. European Islands System of Links and Exchanges (Eurisles). Edition l'Harmattan. ISBN: 2-7384-9250-9. 05/2000
- Eurisles, 2002.** Off the coast of Europe. European construction and the problem of the islands. European Islands System of Links and Exchanges (Eurisles). Study undertaken by Eurisles on the Initiative of the Islands Commission of CPMR. 2002
- European Commission, 1999.** Strategic Environmental Assessment. Existing Methodology. Directorate General for Environment, Nuclear Safety and Civil protection (DGXI). Prepared by DHV Environment and Infrastructure BV under a research contract. 1999.
- European Commission, 2001.** Directive 01/42/EC on Application of Strategic Environmental Assessment (SEA).
- European Commission, 2002.** Aquaculture in the European Union. EU, GD Fisheries, Leaflet No. KL-43-02-147-4Q-P
- European Environment Agency, 2002.** An indicator-based approach to assessing the environmental performance of European marine fisheries and aquaculture. Scoping study. EEA Technical report 87. Copenhagen, 2002
- Fisheries Western Australia, 1997.** Marine farm planning and consultation processes in Western Australia. FWA, Fisheries discussion paper No. 102. August 1997
- Frankic A. and Hershner C. 2001.** Seafood recipes: balancing aquaculture development with coastal planning. In: International workshop on 'Aquaculture and Its Role in Integrated Coastal Zone Management'. European Aquaculture Society, 19–21 April, Oostende, Belgium
- Frankic A. and Hershner C. 2003.** Sustainable aquaculture: developing the promise of aquaculture. Aquaculture International 517–530, 2003
- Frankic A. and Lynch M. 1996.** ECOSTAR, A Program For Identifying Ecotourism Activities That Support Sustainable Development In Coastal Regions. World Ecotourism Conference in Honolulu, June 1996
- Friends of Europe, 2003.** Is fish-farming a long-term answer to the fisheries crisis? FoE, The European Trialogue, Summary of Debates. February 3, 2003
- Grant W.E. and Thompson P.B., 1997.** Integrated ecological models: simulation of socio-cultural constraints on ecological dynamics. Ecological Modelling 100 (1997) 43 – 59
- Klaoudatos S., Conides A and Chatziefstathiou M., 1997.** Study of the coastal and marine ecosystem of Kalloni gulf, Lesvos Island, NE Aegean Sea and organisation of a permanent remote sensing system for environmental monitoring. Final Report. Greek National Centre for Marine Research, Institute of Marine Biological Resources, Aquaculture Department
- Klaoudatos, S., Conides, A. and Chatziefstathiou, M., 1995.** Assessment of the Impact of the floating cage culture systems on the Marine Environment. 3rd Panhellenic Convention on Environmental Protection, August 1996, Chania, Greece
- Klaoudatos, S., Conides, A. and Chatziefstathiou, M., 1996.** Environmental Impact Assessment (E.I.A.) studies in floating cage culture systems in Greece. «Littoral '96» 3rd International Conference of the European Coastal Association for Science & Technology, Portsmouth, England, 16 - 19 September 1996
- Stead S.M., Burnell G. and Gouletquer P., 2002.** Aquaculture and its role in Integrated Coastal Zone Management. Aquaculture International 10: 447–468, 2002
- UNEP, MAP, 2002.** Indicators for Sustainable Development in the Mediterranean Coastal Regions. Plan Bleu, Final report. Plan Bleu pour l'Environnement et le Développement en Méditerranée. Regional Activity Centre. Sophia Antipolis, December 2002