

*The Ecosystem Approach to Fisheries in the Mediterranean and Black Seas*  
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## Importance of the Ecosystem Approach to Fisheries in Georgia

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**Summary:** The economic downturn in the 1990s and early 2000s associated with the break-up of the Soviet Union had a negative impact on Georgian fisheries. Both marine and freshwater fisheries and aquaculture suffered considerable decline. The Georgian fishing fleet deteriorated. The role of state institutions in fisheries management weakened and funding of scientific research diminished. Economic and institutional problems had a negative effect on the state of aquatic bio-resources. The excessive and relentless use of living resources, use of illegal fishing gear and degradation of coastal ecosystems led to a considerable reduction in fish stocks, while the number of vulnerable and endangered species increased. Starting from the new millennium the attitude has changed. In 2004-2005 the 15-year plan for the development of the ecosystem approach to fisheries in Georgia was initiated with support from the FAO. A Georgian law on fisheries and aquaculture has been introduced. Discussions on responsible fisheries and an aquaculture code have also started, but are still pending. On the other hand, the fisheries department of the Ministry of Agriculture was abolished and the single fisheries research institute met a similar fate. Fisheries regulation came under the authority of the ministry of environment. There is still a lot to be done in order to establish an ecosystem approach to fisheries in Georgia. First of all, the legislative base must be addressed, including the Georgian law on fisheries, which would consider such issues as long-term sustainable development of fisheries, a responsible code of conduct for fishermen, monitoring and management structures at the national level, allocation of resources and application of scientific approaches in development of fisheries, aquaculture and mariculture.

**Keywords:** ecosystem approach; responsible fishery; hydrobionts; aquaculture; mariculture; fish farms.

### Importancia del enfoque ecosistémico en las pesquerías de Georgia

**Resumen:** La crisis económica de la década de 1990 y principios de 2000 asociada a la caída de la Unión Soviética tuvo un impacto negativo sobre las pesquerías de Georgia. Tanto la pesca de agua dulce como la acuicultura marina sufrieron un importante descenso. La flota pesquera de Georgia se deterioró. Se debilitó el papel de las instituciones estatales en las pesquerías y la financiación de la investigación científica disminuyó considerablemente. Los problemas económicos e institucionales tuvieron un efecto negativo en el estado de los recursos biológicos acuáticos. El uso excesivo de los recursos vivos, el uso de artes de pesca ilegal y la degradación de los ecosistemas costeros, provocó una considerable reducción de las poblaciones de peces, al tiempo que aumentó el número de especies vulnerables y en peligro de extinción. A partir del nuevo milenio la actitud ha cambiado. En el período 2004-2005, con el apoyo de la FAO, se inició el plan de 15 años de duración para el desarrollo del enfoque ecosistémico de la pesca en Georgia. Se introdujo una nueva ley sobre pesca y acuicultura. Sin embargo, las deliberaciones sobre el Código de Conducta para la pesca responsable siguen todavía pendientes. Por otro lado, se eliminó el departamento de pesca del Ministerio de Agricultura y algo similar le ocurrió al instituto de investigación de pesquerías. La regulación de la pesca pasó a manos del Ministerio de Medio Ambiente. Todavía hay mucho por hacer a fin de establecer un enfoque ecosistémico de la pesca en Georgia. En primer lugar, debe aplicarse una base legislativa, e incluir la ley de pesquerías de Georgia en ella. Debe considerarse cuestiones, tales como el desarrollo sostenible a largo plazo de las pesquerías, el Código de Conducta para la Pesca Responsable para los pescadores, vigilancia y estructuras de gestión a nivel nacional, asignación de recursos y aplicación de criterios científicos en el desarrollo de la pesca, acuicultura.

**Palabras clave:** enfoque ecosistémico; pesca responsable; hidrobiontes; acuicultura; maricultura; granjas de pescado.

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## INTRODUCTION

Since the beginning of the new millennium the fisheries sector of Georgia has become a market-oriented, dynamically developing sector of the food industry. In response to increasing demand for fisheries products coastal countries are trying to benefit from their own new opportunities by investing in a contemporary fishing fleet and processing factories. In the late 1980s it became evident that fish resources would not be able to keep pace with rapid and, in most cases, uncontrolled exploitation, immediately requiring the introduction of new methods for fisheries management or an ecosystem approach aimed at conserving biological resources and the state of the environment.

In 2004-2005 a 15-year management plan for the development of the Georgian fishery economy was initiated with support from the FAO, with the aim of creating the basis for an ecosystem approach towards fishery (Van Anrooy et al. 2006). A Georgian law on "Fishery and Aquaculture" was introduced. Furthermore, discussion began on a responsible fishery and aquaculture code and an attempt to establish it was launched.

## MATERIALS AND METHODS

For the evaluation and analysis of the state of marine fishery, fresh water aquaculture and mariculture of Georgia, various types of representative data were collected. For the interpretation and evaluation of the marine fish catch volumes and biological indicators of populations, the methods of Ricker (1979) were applied. For the study of various indicators of the sea and fresh water fish and ichthyologic analysis, the guidebook for fish study by I.P. Pravdin was applied (Pravdin 1966). Fish resources of the lakes were evaluated with the method of A.P. Rijkov (1987).

Hydro-chemical parameters of water basins were assessed with the methods of A.M. Nikonorov (1989). Feeding habits of various fish were studied by the overall methods of Borutskii (1974) and Ivlev (1977). Basic characteristics of fish growth were investigated with the methods of Baranov et al. (1979). Acclimatization of new fish species cultivated in Georgia was implemented by applying the methods of active implantation and gradual radial acclimatization (Karpevich 1975, Rijkov 1987, Ivanov 1988). The salmon species in an industrial economy were evaluated with the methods of Stevenson (1980).

The prospects for evaluating the state of marine aquaculture and its further development were analysed using the support of the FAO Fishery Economy Development Technical Guidebook (Development of Aquaculture, FAO 2010). Contemporary technologies for the development of marine aquaculture were introduced using the method of Sena (2009).

## RESULTS

### State of fisheries in Georgia

The destruction of the economic links after the break-up of the Soviet Union had an impact on the Georgian economy as a whole and on the fisheries sector in particular.

In the beginning of 1980s along the Black Sea coastal waters of Georgia the fishing activity was quite high, for example in 1980 the total catch amounted to 111389 tons (the highest ever) and in 1991 amounted to 60000 tons. For the same period the volume of aquaculture and internal reservoir products comprised 4500-5000 t. At the end of 1980s and during the 1990s Georgian marine and internal water fishing industries (pasture, pond and pool aquaculture) were considerably damaged and went bankrupt. In the second half of 1990s the catch volume has significantly decreased to an average of 2500 tons a year (Khavtasi et al. 2010) (Fig. 1).

As the result of degradation of fish reproduction farms, the fish-breeding industry has switched from an intensive aquaculture into extensive fish-breeding, which has led to a reduction in the profitability of waterbodies and fishfarms. Production of commercial fish in internal waters was reduced from 4000-5000 t to 300-500 t annually.

In turn, the decline of the fishery industry in internal waters and the reduction of fish productivity has had a major impact on marine fisheries, resulting in increasing public demand for marine bio-resources and leading to a serious deterioration of the ecosystem of the sea fishing industry. Presently the level of studies related to assessment of marine fish stocks and designation of fishing quotas has been weakened, and the trend is towards industrial/mass legal fishing with incomplete licensing, leading to a surplus consumption of sea biological resources (mostly involving expensive and rare species). Furthermore, fishing gears and fishing vessels have become outdated and illegal fishing methods have become more widespread, using various mesh-size gill nets, trap nets, screen-type and spider-type nets, seine and purse nets, and prohibited non-standard pelagic and bottom trawls. Along with excessive catch, the cases of abandoned nets and gears have increased, causing uncompensated damage to the ecosystem and especially to ichthyofauna and marine mammals (the harbour porpoise and the common dolphin) (Goradze et al. 2013).

There has been an increase in illegal entrance into the protected areas and uncontrolled fishing for prohibited species with high conservation value, such as *Acipenser sturio* (Linnaeus 1758), *Acipenser gueldenstaedti*, *Acipenser persicus* (V. Marti 1940), *Acipenser stellatus* (Pallas), *Acipenser nudiiventris* (Lovetzky 1828), *Huso huso* (Linnaeus 1758), *Salmo labrax* Pallas, *Psetta*

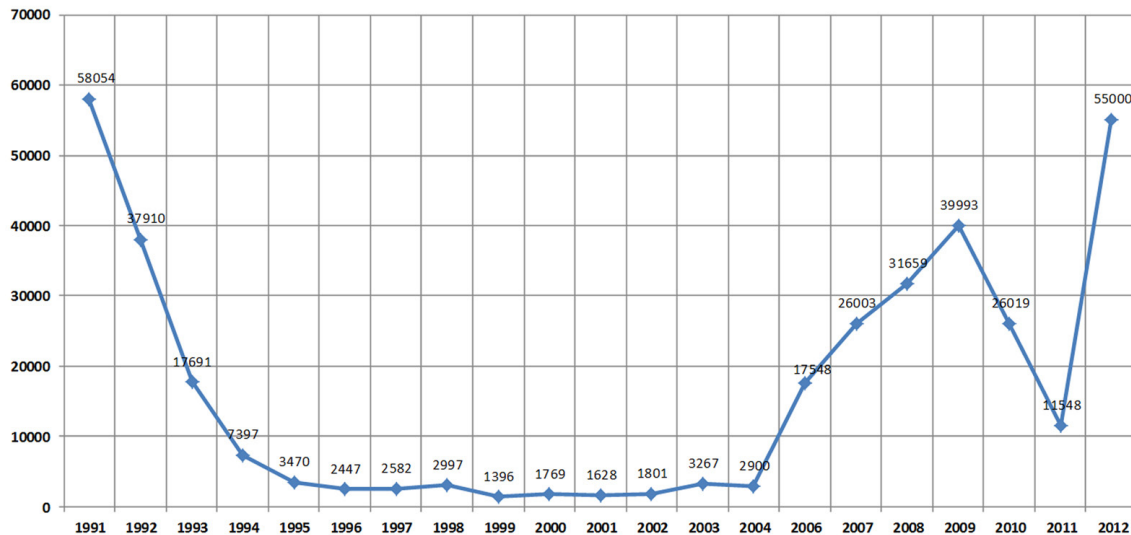


Fig. 1. – Fish catches in Georgia coastal waters.

*maxima maeotica* (Pallas), *Trigla lucerna* L., *Sciaena umbra* L. and *Umbrina cirrosa* L. Catching and selling of sub-adults of these fishes has become quite frequent, as shown by the surveys of local fish markets.

The winter fishing season of 2012-2013 was particularly important, with an unprecedented amount of small-size (3-4 cm) anchovy concentrated along the Georgian Black Sea Coast for wintering and a fairly small amount of commercial size anchovy (5-8 cm). During this season the amount of catch has increased considerably and made up to 55000 tons (Fig. 1), with over half of the catch comprised by the undersize fish. At the same time, massive discard of dead undersize fishes has occurred by a number of fishing vessels, attracting a great number of sea mammals, a large part of which were subsequently by-caught and perished in the nets during further trawling (Goradze et al. 2013).

There are many issues in the Georgian Black Sea coastal zone impacting the state of the environment, including pollution, eutrophication, habitat degradation, depredation, excessive consumption of biological resources, regulation of river streams and construction of hydro-power dams (a new construction boom began in 2012-2013). These factors cause ecological and reproduction isolation of river and sea meta-populations of the Black Sea anadromous fish (*Salmo labrax*, *Acipenser oxyrinchus*, *Acipenser persicus*, *Huso huso*, *Acipenser stellatus*, *Acipenser gueldenstaedtii* and *Acipenser transmontanus*), resulting in a radical reduction of their stock in the whole Black Sea region.

Together with a significant upturn of marine traffic in the Georgian Black Sea waters, the discharge of ballast waters in the sea has increased despite the control measures introduced. This has caused penetration of exotic species in the Black Sea and their biological explosion. For example *Mnemiopsis leidyi* penetrated the Black Sea and underwent a biological explosion in the 1990s, causing serious damage to the Black Sea ecosystem and fishery as a whole (Volovik 2004). The population of *Mnemiopsis leidyi* was recently regulated

with the help of a biological predator *Beroe ovata*, having first occurred in the northeastern part of the Black Sea in September 1999.

During recent years fishery has become a market-oriented, dynamically developing sector of the food industry. In response to ever-increasing demand for fish and other water resources, coastal countries are trying to benefit from their own new opportunities by investing in contemporary fish-catching fleets and processing factories. The same was characteristic of Georgia before the end of 1980s, when it became evident that fish resources would fail to keep pace with rapid and in most cases uncontrolled exploitation, requiring the immediate implementation of an eco-systemic approach towards fishery aimed at protecting biological resources and the environment.

### Fisheries management overview and existing problems

The Ministry of Agriculture of Georgia is traditionally responsible for forming agricultural and national food policy, as well as for the operation of fish and maritime resource production facilities. To strengthen development and management of fisheries, the Department of Fishery was established within the Ministry at the beginning of the millennium. In addition to the Ministry of Agriculture, the Georgian Ministry of Environment Protection and Natural Resources is also involved in the issues related to fishery, surveying fish stocks, distributing fishing quotas, issuing fishing licenses, and controlling the ecological state of fishing and reservoirs. Between 1991 and 2006, the Fisheries Scientific Research Institute was functioning under the Georgian Ministry of Environment Protection and Natural resources. During the period 1931–1991 the institute was part of the Soviet-wide Scientific Institute of Fisheries. During the move to a market economy in 2006 the institute was downsized and reorganized into the Black Sea Monitoring Centre, staffed with a smaller number of specialists.

In order to develop the fishery sector in Georgia, a 15-year Master Plan was drawn up by the Fishery Department of the Georgian Ministry of Agriculture, with technical support from the United Nations Food and Agricultural Organization and immediate participation of the Georgian Marine Ecology and Fishery Research Institute (MEFRI), including a long-term development plan for fresh water aquaculture and marine culture.

Until the late 1980s special and vocational education in the field of fisheries was mainly taught to the citizens of Georgia in Russia (Soviet Union). In the early 1990s the specialities of Water Bio-Resources, Aquaculture and Hydrobiology were introduced at the Shota Rustaveli State University in Batumi, with bachelor's and master's degree programmes. This was rather a successful step forward, but due to the poor management the specialty was closed in the early 2000s. Currently, there is no educational institution with a fisheries specialization in Georgia, which is a considerable limiting factor for fisheries development in the country.

### Development of aquaculture as an important factor in an ecosystem approach to fisheries

Georgia has a coastline more than 315 km long being important for aquaculture, as well as a number of rivers, lakes and reservoirs applicable for fishery with area of ca. 30000 ha and industrial fishponds with ca. 5000 ha area. Intensive development of aquaculture will considerably increase the volume of aquaculture products, helping to satisfy market demands, significantly reducing fishing pressure on marine fishing, and supporting the revival of a marine fishery economy and the rehabilitation of commercial species and sea biodiversity. In the very near future, rapid development of mariculture has a great potential for facilitating the establishment of an ecosystem approach to fisheries and regulation of marine fishery.

The high effectiveness of mariculture and its fast development (5-6% increase per year) is defined by the availability of marine hydrobionts with high nutrient and medical values, as well as the possibility of producing a wide range of food products.

Despite the frequency of storms, the Georgian Black Sea coastline features a number of factors favourable for mariculture. The thermal regime of sea water is one of the best for cultivation of hydrobionts in the Black Sea basin. On the coastline no great change in temperature is observed during the year. Its lowest values of 7°C to 9°C are observed for only one month (February) and the highest temperatures in August. According to multi-year data, the average annual temperature exceeds 16°C, whereas salinity of the sea water ranges between 17.6 and 18.8.

The development of marine culture in Georgia has a solid scientific basis (Goradze and Shavlakadze 1994, Goradze et al. 1996, Goradze and Diasamidze 1997, Goradze and Bagrationi, 1998, Goradze and Komakhidze 1998, Goradze et al. 2011, Goradze et al. 2013). At present the methods and approaches for planning and constructing fish-breeding and marine farms are being developed.

The mussel industry has fairly good prospects in Georgia. For several years a pilot project of artificial growing of mussel (*Mytilus galloprovincialis*) was functioning at a distance of 15 km from the Batumi shore and bio-techniques developed on this basis led to an annual production of 100 to 130 t (Goradze et al. 1996, Goradze and Diasamidze 1997). Furthermore, it will undoubtedly be effective to restore a local population of *Ostrea edulis* by means of artificial reproduction and to start testing the experimental cultivation of the giant Pacific oyster. It has been successfully introduced in the USA, Canada, France, and finally in the Black Sea, in the Russian scientific-experimental complex "Big Utrish" in the vicinity of Anapa (Orlenko and Vijeovski 1995).

Hence, Georgia has great potential and real prospects for the development of marine culture and revival of the marine economy in the very near future, which will greatly support the dynamic development of an eco-systemic approach towards fishery.

### CONCLUSIONS AND RECOMMENDATIONS

As a result of the collapse of the Soviet Union, as well as the break-up of economic links, the fisheries industry in Georgia was completely damaged and has gone bankrupt, having had a serious impact on the state of the Black Sea and surrounding ecosystems. Weakening of the role of the state regulatory system and the ceasing of scientific research activities had a negative impact on the state of the fishery. Nevertheless, the country has great potential for the development of aquaculture and the revival of marine fisheries.

It is necessary to carry out a new fisheries policy in the country, taking into account the measures against excessive fishing and ensuring that fishing is in accordance with availability of fish resources and their sustainability. It is also necessary to develop aquaculture for rehabilitation of commercial species populations. The decisions related to conservation and management of fisheries must be based on the best scientific knowledge.

To implement the aforementioned, the following measures are to be considered:

In the process of development of industrial production, the energy sector and agriculture, to enforce control and reduce to a minimum pollution and degradation of the Black Sea and its ecosystems.

To develop an ecologically sustainable fishery in the long term by prioritizing the selective fishing and application of permitted fishing gear, studying commercial fish stocks on the basis of effective scientific studies and defining catching quotas.

To enforce fishing and trade control, imposing stricter sanctions in cases of violation, and to draw up and publish analytical and methodological instructions for fishing management. Particular attention must be paid to protecting and monitoring species with high conservation value and management of protected areas.

To develop and introduce a responsible fishery code, strengthening research activities in the sea and making an increasing financial and scientific contribu-

tion to the development of fishery and mariculture in order to weaken the pressure of poaching on the marine ecosystem.

To carry out fisheries monitoring and statistical analysis of fishing data in order to develop a genuine database for fishery and information dissemination. To introduce a tracing, certification and accreditation system at all levels of fishery and aquaculture production.

Because scientific research institutes play a particular role in the development and management of the fishery, to initiate a research system of the fishery (including aquaculture) staffed with qualified personnel and equipped with adequate funding in order to draw up a fishery policy and relevant programmes. Unfortunately, there is no scientific research institute authorized to implement strategically important surveys for the country.

To increase fishermen's education, skills and abilities as well as their professional qualification by means of scientific achievements and educational and research programs. To this end, fishery and aquaculture development programmes and plans must be regularly updated. To open fisheries faculties with verified specialities in higher institutions of Eastern and Western Georgia to prepare specialists with higher education in fisheries (bachelor's, master's and doctoral degrees) and vocational education (fish farm personnel).

To draw up a model of public management of fishery in internal and coastal waters, enabling local communities and fishery associations to be involved in decision making process on resource distribution and usage, as well as to directly benefit from the process. It is of great importance to draw up concrete and dynamic plans for maritime and internal waters fishery management, complementing living water resources, an ecosystem approach to fisheries management and sustainable use.

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