

FISHING AND ITS IMPACT ON THE LOCAL COMMUNITIES OF THE DANUBE DELTA BIOSPHERE RESERVE

NICOLETA DAMIAN*

Key-words: fishing, impact, local communities, Danube Delta.

Abstract. Declaring the Danube Delta a Biosphere Reserve (Law No. 83/1992) entailed changes in the Delta socio-economic activity, basically to have the local communities and economies adapted to these changes in a coherent manner. One of the major changes was the reorganisation of fishing, since most of the Delta inhabitants are engaged in this activity, as well as in agriculture. Changes in fishing got momentum especially after having this piscicolous resource concessioned, a move that directly affected the population whose fishing-derived incomes dropped; moreover, some rights people had enjoyed before the Reservation came into being and after the catch had to be concessioned. An analysis of the evolution of the fish and fish culture legislation in time, was aimed at a better understanding of this activity and at establishing the best method of exploiting the fish resource by the Danube Delta local communities without disturbing the natural environment; the more so, as the Danube Delta enjoys a Biosphere Reserve status. And last but not least, the local population should be encouraged to practice sustainable fishing by using traditional tools and combine this occupation with alternative activities, such as, tourism, ecological tourism, in particular.

1. INTRODUCTION

Physical-geographical constraints (water-covered areas that limit human settlement, water-imbued soil and vegetation) contribute to restricting human relations, as does the peripheral position, isolation and difficult access (Gâstescu, Știucă, 2008). Geographical constraints also impose a certain distribution of settlements and of socio-economic activities, based mainly on traditional occupations. Since people are not particularly qualified, they are practicing fishing, agriculture and reed harvesting, activities that bring little added value, while other opportunities (e.g. tourism) are not sufficiently well-developed. The socio-economic changes brought about by the economic transition and, moreover, by establishing the Danube Delta Biosphere Reserve, called for the communities and the local economies to better adapt themselves to environmental conditions (Dumitrescu, 2002). After 1992, things changed substantially, most of the Danube Delta population beginning to reorganise fishing, the main income source. The changes experienced in this field, especially after having fishing granted on lease, led to a number of modifications which had a direct impact on fishing-yielded incomes for a large part of the Danube Delta population.

A good management of renewable natural resources is essential for the sustainable development of the Danube Delta and the preservation of traditional economic activities by the local population (Gâstescu, 2009).

The main objective of this paper is to identify and find a unanimously accepted solution to the main problems regarding the fishing activity, problems arising during the concession process, but also after these contracts had finished. The Danube Delta fisherman and the families there are considered to be the most affected, because they are dependent on the fishing resource, the way of exploring and capitalization this resource.

Both the local authorities, and the ARBDD representatives and the local population wish, to continue fishing also in the future, traditional fishing practiced by the locals from generation to

* Senior Researcher, Environment and GIS Department, Institute of Geography, Romanian Academy, 12 Dimitrie Racoviță Str., sector 2, 023993, Bucharest, Romania; nicoleta_damian2002@yahoo.com.

generation, using traditional tools, this activity being practiced according with the Biosphere Reserve status.

2. STUDY AREA

The Danube Delta lies in the east of Romania, basically in the north-east of the Dobrogea Plateau. The main locality, Sulina, is situated in the easternmost point of the country. The Delta is a triangle with the base-side directed to the Black Sea and the point at Pătlăgeanca, where the Danube River divides into two arms (Chilia and Sulina). The Danube Delta represents the largest part (4,150 sq km²) of the synonymous Biosphere Reserve, with 3,150 km² on Romanian territory (cca 84%), and 640 km² on the lefthandside of the Chilia Arm (including its secondary delta) on Ukrainian territory (Geografia României, Vol. 5, p. 577) (Fig. 1). The present settlement system in the area consists of only town – Sulina, and seven communes, that is, 23 settlements in all with a population of over 10,706 inhabitants (2011 Census data).

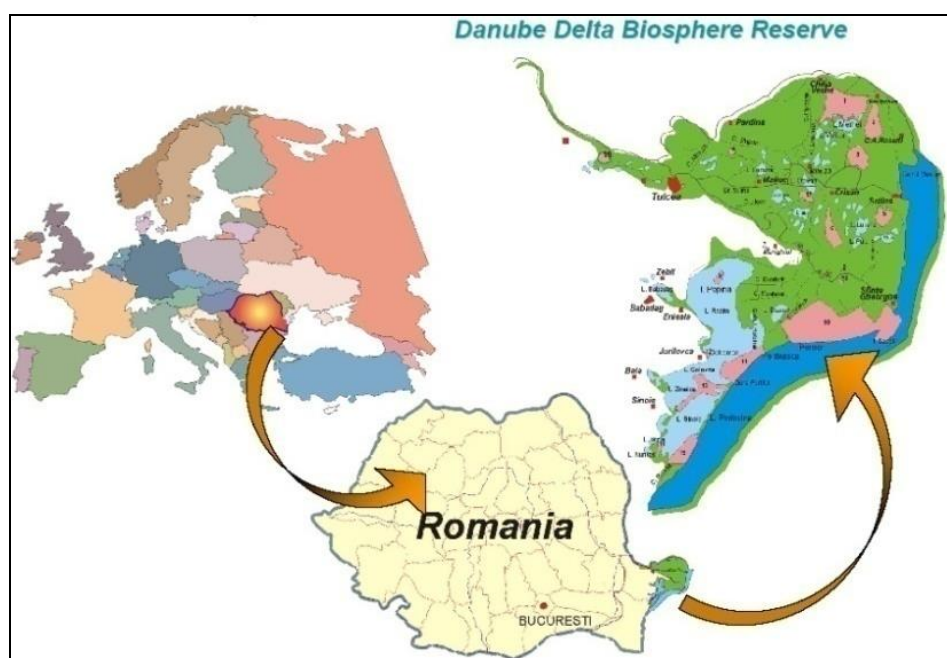


Fig. 1 – Position of the Danube Delta Biosphere Reserve.

Source: <http://www.ddbra.ro/en/danube-delta-biosphere-reserve/danube-delta/location>.

In terms of surface-area, the Danube Delta ranks third in Europe, after the deltas of the Volga (13,000 km²) and the Kuban (4,300 km²) rivers; it holds position 22 on the Globe, and boasts one of the complexmost deltaic biodiversities worldwide.

In 1993, the Danube Delta, and the Razim-Sinoie lagoon complex were declared a Biosphere Reserve (Law No. 82). In view of its importance, the Danube Delta Biosphere Reserve was included on the list of the Biosphere international network, under the Man and Biosphere (MAB) UNESCO Programme, and declared wet zone of international significance, especially as waterbird habitat (Ramsar Convention, September 1991), and listed as World Natural Heritage – UNESCO (December, 1991). The Danube Delta is the only delta in the world to have been declared a Biosphere Reserve for its huge biodiversity: 30 types of ecosystems.

3. MATERIALS AND METHODS

An analysis of the local population's response to activity changes after the Danube Delta was declared a Biosphere Reserve in the 1990s, is based largely on discussions and interviews with the inhabitants of several Danube Delta villages (C.A. Rosetti, Sfiștofca, Crișan, Sfântu Gheorghe, Letea, Mila 23) and Sarichioi at the bounds of the Biosphere Reserve. This several-stage research is connected with the leasing process. Field interviews were conducted particularly in the local fishermen communities, and with the local authorities. The research results were partly included in the World Bank 2005 Global Environmental Facility Project (GEF) (Apostol *et. al.*, 2004, <http://www.gefio.org/sites/default/files/ieo/ieo-documents/lb-case-study-romania.pdf>). The interviews targeted a number of households singled out by income and main occupations (fishing, agriculture and tourism) and were conducted both at the time of granting on lease and subsequently. Discussions focussed on the evolution in time of legislation, beginning with the First Fishing Law, a series of reports and statistical data on the evolution of fish captures and fishing-entailed effects.

4. DISCUSSIONS

4.1. The Human impact on the Delta environment

Insofar as morphohydrography and landscape are concerned, the Danube Delta had evolved in natural conditions until the second half of the 19th century, when the European Danube Commission was set up (1856) and management works to turn the Sulina Channel navigable began. A second impact on the Delta (1903–1960) was caused by scientist Grigore Antipa, who wished to make fisheries more productive. To this end, some channels were enlarged and ten kilometers of new canals were cut to facilitate water circulation between the Danube arms and the Danube lakes (Antipa, 1916, 1930).

The period spanning the years 1960–1970, also called the “reed period”, was a first stage in changing the Delta ecosystems.

The interval between 1970 and 1980, a time of piscicolous and agricultural works, is considered the greatest disaster for the Danube Delta.

From 1980 to 1989, a Programme of Management and Integral Exploitation of the Danube Delta Natural Resources was being implemented. That programme was aimed at turning most of the Danube Delta into agricultural and animal breeding territory and have fish-rearing and forest areas extended. A Decree was issued whereby the Danube Delta and the Razim-Sinoie Lake Complex were divided in six economic enterprises for the exploitation of natural resources, subordinated to the “Danube Delta” Central Company sited in the town of Tulcea (Gâstescu, Știucă, 2008).

As of 1990, having in view the poor economic efficiency, and the disturbed Danube Delta natural regime, management works were stopped and renaturation measures imposed. Thus, in 1994, the Administration of the Danube Delta Biosphere Reserve (DDBRA) in collaboration with experts from the European Bank for Reconstruction and Development, and benefitting from the PHARE Programme financial support, the ecological reconstruction of some of the impaired sites began ([http://www.ddbra.ro/media/master%20plan%20RBDD\(2\).pdf](http://www.ddbra.ro/media/master%20plan%20RBDD(2).pdf)).

All in all, we might say that the effect of human pressure on the Danube Delta was both of conservation (the practice of traditional activities – fishing, animal breeding, and tourism) and damage, (vast management works for agriculture, fish-rearing, reed culture and transports) (Gâstescu, Știucă, 2008).

4.2. The history of fishing in the Danube Delta

As known, fishing is one of the oldest occupations of the Danube Delta population, practiced by more than 50% of the area's inhabitants (<http://www.ddbra.ro/activitati/pescuit>) from times immemorial, people having made use of this resource. At present, the right of commercial fishing have only the

fishermen authorised for it, the locals being allowed to fish for their own consumption provided they have a licence for it; fishing entails all of the Danube Delta Biosphere Reserve resident families.

In Romania, fishing was reorganised by Law No. 192/2001 on fish fund, fishing and fish-breeding, it representing the legal framework for reorganising this sector of activity. The law stipulated the conservation, control and management of fish resources, licencing, introduction of a satellite-based monitoring system, organisation of the fish market, fish inspection, fish-rearing, state intervention in the fish sector, fishing statistics and international accords.

Currently, fishing in Romania is co-ordinated by the National Agency for Fishing and Fish Culture subordinated to the Ministry of Agriculture and Rural Development.

The main national objectives have in view measures to remake the fishing fleet, develop a fish culture, process and sell fish and the products of fish culture, jobs in the fish sector, create and support the social and economic reconstruction of zones which have to cope with difficulties engendered by changes in the fish sector (Strategia Națională a Domeniului Pescăresc 2014–2020, Guvernul României, Departamentul pentru Ape, Păduri și Piscicultură, <http://apepaduri.gov.ro/wp-content/uploads/2014/08/Strategia-Na%C8%9Bional%C4%83-a-Domeniului-Pesc%C4%83resc.pdf>).

In order to get an insight into the development of centuries-old fishing in the Danube Delta, and realise people's discontent with the modifications made to fishing (one of the main occupations) and of introducing the leasing system (deeply detested by fishermen), one should look at the history of fishing and fish culture in the Danube Delta.

Thus, the first fishing law, named *Law of Fishing*, is dated October 10, 1896. That law set only a few principles in matters of fishing, hence the law was short-lived. According to one of its provisions, the right to fish in state waters belonged to the state (Giurăscu, 1969).

In 1929, a new law was passed: *Law for the general administration of State fisheries and improvements in the Danube-flooded region*, which provided for the unification of the three departments, which used to act separately in matters of improvements of floodable zones and water management, into a single body – PARID (National Institute for Co-operation and Administration). This law was a great success due to the ideas promoted by Grigore Antipa, a scientist known for his opposition to the practice of private leasing in the Danube Delta; in his opinion, people granting in lease were tradesmen who appropriated the state's right without giving anything in exchange, while fishermen were paid a very small price for their fish (PARID, Report, 1929).

According to the decree-law, dated November 23, 1939, on the modification of the law of 1896 all the fish caught in Dobrogea's waters, as well as in any other state-owned water in this country, remained state property, or of its sub-units, until sold out. The 1939 decree-law introduced a new act on the right of fishing, obliging fishermen to have, besides the agreement to fishing bill issued by the owner or the leaseholder, also a fishing licence issued by the state (Anastasiiu, 1947). The two documents were very important for the system in which fishing was being organised until 1949. In this way, it was the state who controlled fishing not through the supervision of fishing grounds administrations or leaseholders, but by the fishermen themselves, who were to possess the two personal fishing documents and bring the whole catch to the fishing grounds. Fishing grounds were state-owned, but such private grounds did also exist as well; however, as the 1896 Law came into effect, authorising them implied meeting certain conditions conformably to the regulations in force. Once on the fishing grounds, the fish was weighted by the grounds-master in the presence of the agent from the Administration of the Fisheries, then taken over and carried to the main market of Galați Town (Antipa, 1930).

Decision No. 184/1954 stipulated that the fishing right was granted to specialist fishing enterprises on a contract basis; in this way, only socialist economic organisations had the right of industrial fishing, under a production plan.

A fishing regulation, more comprehensive this time, was found in Law 12/26 July, 1972. According to it, fishing and the fish culture became part of the overcentralised economy, the right to fishing in the Danube Delta and the lagoon zone being reserved only to state enterprises (the "Danube

Delta” Central Enterprise founded in 1970). In consequence of Law No. 15/1990, the units that made up the “Danube Delta” Central Enterprise did no longer remain subordinated to the Ministry of Agriculture and Food Industry, but were passed over to the Prefecture of Tulcea County.

After the dissolution of the “Danube Delta” Central Enterprise, several trading companies were set up, nine of them being engaged in fish-related activities; most of them continued to exist until the leasing process got momentum (it is the case of Ecodelta, Piscicola Chilia Veche, Piscicola Jurilovca, Piscicola Mila 23, Piscicola Murighiol, Piscicola Sfântu Gheorghe, Piscicola Sulina, and Piscicola Tulcea).

Law No. 82/1993 on the establishment of the Danube Delta Biosphere Reserve provided for the leasing of the natural Danube Delta wealth to economic agents.

After 1990, Law 12/1972 was replaced by Law 192/2001 on fish, fishing and fish-aqua-culture. According to this law, fishing is the activity of catching fish and other water-life for commercial, scientific, or recreational/sporting purposes on a licence/fishing permit basis, in places, periods and with legal tools. In 2003 and 2004, a number of modifications and completions followed, and in 2005, Law 113 came into effect, stipulating water resources and fish-aqua-culture. This was the groundwork for establishing the *National Agency for Fishing and Fish-aqua-culture*, a public institution of national interest, with legal person status, currently under the direction of the Ministry of Agriculture and Rural Development. The Agency’s tasks were to elaborate a fishing development strategy, fish-aqua-culture and a fish market in keeping with the Government’s economic policy, management and structural policy of fishing and fish aqua-culture; the Agency is the authority that regulates the specific legal framework of control and inspection. Increasing control activities requires satellite monitoring of fishing crafts.

Law 117/2009 on fishing and fish-aqua-culture stipulated that fish-resources fell under the Administration of the Danube Delta Biosphere Reserve, which took over fish utilisation leasing contracts.

After 1990, three distinct fishing periods in the Danube Delta were recorded:

- 1990–2002, commercial fishing was in the custody of the trading companies that had belonged to the former Danube Delta Central Office, without paying any tax on fishing;
- 2002–2005, access to fishing was a matter of public bidding, the winners being the leasing companies which paid the fishing area due and had to meet certain conditions and specifications; in the meantime, locals were not allowed to practice commercial fishing on behalf of themselves, to do it, one had to be an employee of the respective company;
- since 2005, commercial locals have been allowed to fish on the basis of an individual fishing permit issued by the National Agency for Fish and Fish-aqua-culture through the intermediacy of fishermen’s associations.

A key-moment in the development of fishing was the concessioning of the process of valuating fish resources. Under Law No. 82/1993, modified by Law 454/2001, DDBRA granted fishing by leasing within the Reserve. This move was meant, in principal, to protect the fish resource, entailing licencees to participate in the watch-and-control of poaching and pay for the protection of fish species of high economic value to reproduce; the leasees were obliged to invest in fish processing and depositing, and supply fishermen with protection equipment (file:///D:/pescuit_piscicultura_arbdd/ARBDD%20Tulcea.html).

In order to value fish resources, a number of 25 areas would be designated according to the following criteria: the unitary treatment of some interconnected water ecosystems to facilitate the evaluation of fish stocks from the respective areas; the traditional use of the respective areas by both leasees and the local population.

Leasing would change the fishermen’s status from mere employees whose only task was to fish and deliver the catch, to service-providers. The service providing contracts between user and he/she service provider stipulated the only obligation for the user to pay invoices in terms of the quality and quantity of delivered fish conformable with the bills and invoices issued. In fact, looking at how contracts are drafted and how payments are made, it is obvious that the company had absolute control over the fishermen’s work.

As of 2005, by agreement with the leasees, some of their contracts were annulled, because leasing fish and reed resources contravened to the Danube Delta Statute of Biosphere Reserve. However, the leasees did not fully give up using such contracts, they continuing to be entitled to lease sporting fishing, or open private fish-collecting points. Despite the fact that some leasees had to discontinue further activity, fishermen were still dissatisfied, because they were obliged to deliver the fish to the same fishery stations owned by former leasees, and at a lower price than the market price.

Therefore, we may safely say that leasing restricted fishermen's freedom to fish in certain zones and deliver the catch to the highest bidder, they have to accept the leasee's offer and the price/kg fish. In this way, their revenues were considerably reduced (even halved to what they had been used to getting before leasing). Thus, fishermen lost both the profit and their occupational autonomy (Stahl, Constantin 2004, p. 95).

Traditional commercial fishing is being practiced in several zones of the Biosphere Reserve, fishing methods and tools being specific to each zone (<http://www.ddbra.ro/activitati/pescuit>).

Fishing in the Delta proper goes on the year-round (except for a 60-day prohibition period there, and a 90-day one in the Razim-Sinoie Complex).

In 2006, it was for the first time in Romania when sturgeon fishing was banned for 10 years, a prohibition extended to another five years in 2016, a measure implemented also in other Black Sea limitrophe countries (Bulgaria, Russia, Ukraine, Georgia and Turkey).

4.3. Recreation/sporting fishing

Beside industrial fishing, the Danube Delta is also a place for recreation/sporting fishing provided one gets a permit from Agenția Națională pentru Pescuit și Acvacultură (National Agency for Fishing and Fish Culture) and is practiced in the areas designated by it. Sporting fishing licences are nominal and are issued on request from the sporting fishermen's associations. Fishing is limited to 5 kg. of fish, or to one fish alone if it weights over 5 kg.; one may use no more than two fishing lines, or two lancets with two baited hooks each (Figs. 2, 3, 4, 5).



Fig. 2 – Sporting fishing.



Fig. 3 – Sporting fishing.



Fig. 4 – Recreation fishing.



Fig. 5 – Catch fish.

5. RESULTS

5.1. Changes in fish leasing

Before 1990, when the “Danube Delta” Central Company was operating fishing and working conditions in this sector, as well as the types of employment and payment were inscribed in the Work-Book (Carte de Muncă) and based on it, each employee was paid a fix minimum wage. If the minimum fish quantity was exceeded, payment was of the fisherman’s price, provided the quantity of delivered fish was in excess of the compulsory quota. In winter-time (Decembre–February), it was either reed harvesting, or unemployment which brought minimum wage payment. The fishermen employed received boat and tools, so that damage risks and costs did not devolve on them.

Beginning with the year 1944, private fish collection points started operating, so that fish buying was competition-based. Hence, a certain change in exploitation. The forms of collaboration between fishermen and selling units were distinctively different: some fishermen, employed on a contract-basis, were obliged to deliver the whole catch to the company they worked for, while those who chose to work on their own could deliver the catch to any of the three fishing stations, but they did not benefit from the facilities offered by employers (e.g. medical insurance).

Some other fishermen tried to form family fishing associations, but high taxes made them unprofitable: “it’s not profitable ... many gave it up ... taxes finished them” (35 year-old fisherman). “Piscicola” State Company tried to go on until 1999, having much reduced its activity, and practically ‘disappeared’ (questionnaire-based answers during 2004–2005).

As state monopoly came to an end, any physical person could set up a fishing society and become engaged in fish-trading and employ an unlimited number of fishermen. The employees who were given the employer’s tools, received 15–20% from the value of the wholesale delivered fish, while those who had their own fishing tools received 20–50% of the delivery.

At the time when fish was being leased (2001–2005), fishermen functioned either as employees of the leaseholder societies, or as authorised physical persons (AphP). Most fishermen would acknowledge that it was far better for them when they had been employed by the state and benefitted from fishing tools and wages.

In 2012, the first fish-unloading points (UP) and the first fish-sale centres were established. Unloading points are places where fishing vessels and boats unload the catch, which is registered by authorised fishermen and carried first to fish-sale centres (FSC). These are the only legally official places where authorised traders are making the first fish-sale (Table 1, Fig. 6).

Table 1

Unloading points and first fish-sale centre points

year	Unloading points (UP)	First fish-sale centres (FSC)	UP+FSC
2012	26	–	12
2013	48	32	29
2014	47	38	33
2015	43	39	35
2016	42	40	35
2017	44	42	38

Source: <http://www.ddbra.ro/activitati/pescuit/pd-cpv>.

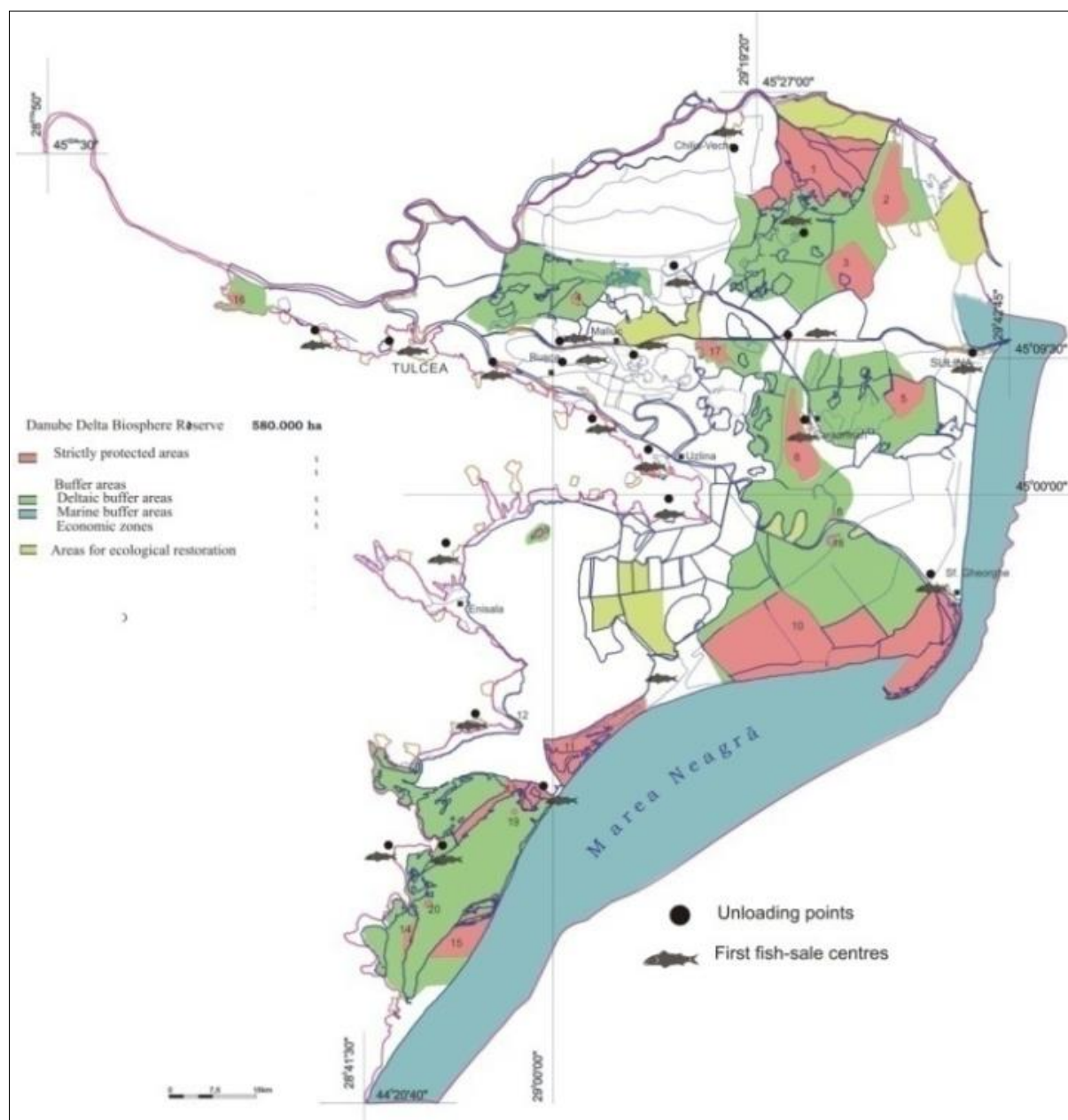


Fig. 6 – Location of the unloading points and first fish-sale centre points.

Source: <http://www.ddbra.ro/media/file/hartadd.pdf>.

The number of active professional fishermen in the DDBR during 1999 and 2017 varied, with a maximum of 1934 people being recorded in 2004 (Fig. 7).

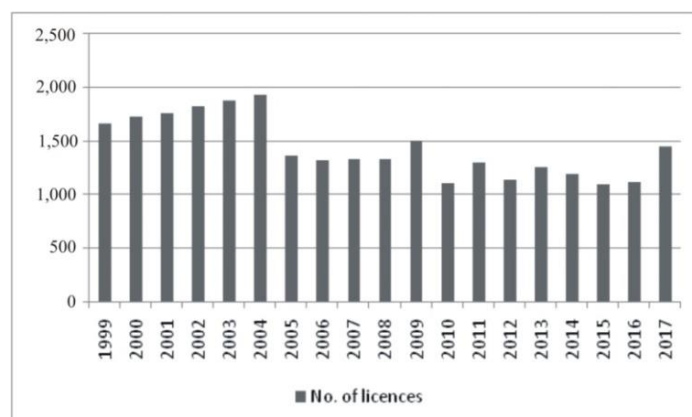


Fig. 7 – Total number of commercial fishing licences (1999-2017).

5.2. Changes in fish price

Among the major modifications brought by licencing was a change of the fish price paid to fishermen. Thus, there were cases when prices fell to half their previous value, the difference resulting from the absence of taxes and duties for fishermen before the leasing system was in place. The lower price of fish reduced the living standard of the fishermen families.

5.3. Changes in the benefits of the Danube Delta local communities

The changes affecting the population were: the quantity of catch/day was limited to 3 kg. for people holding a family fishing licence; fishing water areas allocated to physical persons were at a great distance from their settlements, or in little productive places, making it impossible for tourist boarding-houses to legally obtain the fish they needed.

Apart from the lower price got at the fishing stations, another restriction was the ban on certain legal fishing tools (e.g. the *setci* currently, only “*talianul*” and “*vintirul*”) are permitted for industrial fishing, but these tools are not up to fishermen’s needs.

At present, the number of permitted tools/boat is: 5 *setci*, 7 *ave*, 3 *taliene*, 6 *vintire*, 1 *postrovol*, and one piece of other traditional tools (Figs. 8, 9)



Fig. 8. Traditional tool (*vintir*).



Fig. 9. Traditional tool (*plasa*).

For the Danube Delta people, fishing is both a way of life and a trade handed on from father to son, families making a living from selling the fish they catch.

A positive result of leasing the catch, namely, reduced poaching (that is, fishing in forbidden zones, in restrictive periods and with banned tools) is visible for fishermen, the local community and the authorities.

Before leasing, for fishermen to renew their licences meant receiving a receipt from the DDBR Administration to justify that they had delivered the minimum quota established at 2,500 kg fish/year/fisherman.

5.4. Local economic characteristics

The main occupation of the Danube Delta settlements is fishing (6 months/year), agriculture for local needs and tourism (June-September). There are settlements (e.g. Sfântu Gheorghe) in which the absence of arable land makes agriculture practically inexistent. However, fishing is a source of relatively big revenues compared to the villagers' incomes in Romania. Prior to leasing (2000), a family could earn up to 10,000–15,000 lei/year (out of which some 8,000 came from fishing), these were money exempted from taxation, people having to cover only the losses inherent to fishing.

Fishermen say that it is very difficult to estimate earnings and losses over the year. People here are used to taking risks, working hard and spending much, but ultimately earning does not depend on themselves, "earnings are a matter of luck" (23 year-old fisherman).

After leasing, the fishing-yielded profit would fall significantly, having in view a lower price/kg fish and the taxation of authorised physical fishermen (APF). Fishermen also suffer losses each time a new fishing regulation is issued, imposing modification, or change, of fish tools ("While so far now, I used to fish with a 15-cm net, here is a new law which forbids using fishing nets under 20cm. I must change all my nets, changing rules is a very costly affair for us. No one cares about it ...fishermen have money, they can do it" (34 year-old fisherman).

What is specific about earnings is their seasonal character: fishing brings money especially in springtime; summer is a tourist season (Poruncia 2012, Damian, 2016). People are saving to make provisions for winter. What remains is kept for the next year, when "no one knows if fish will still exist". Only people who still have money even after this last sorting out, afford to invest, usually in buying a house for their children in the neighbouring towns (Tulcea, Constanța and Galați), and more recently making their own village-house more comfortable to offer better conditions to a greater number of tourists. Winter brings no income, and isolated location makes prices soar (Damian, 2013).

5.5. Household incomes

The Delta people rely on fish resources, grazing grounds, agricultural lands and reed to discharge traditional activities, e.g. fishing, animal breeding, the cultivation of land and reed harvesting. Household incomes, based on the exploitation of natural resources, differ with the year (in terms of physical-geographical factors), and each household, depending on the management ability of each family (Rughiniș 2004).

Lands are used for agriculture both by the locals and by the companies that grant on lease. In some of the inner Delta villages, e.g. Mila 23, Crișan and Sfântu Gheorghe, incomes are derived from fishing alone, because agricultural lands are missing, people cultivating only small plots of land in their own gardens.

The Danube Delta Biosphere Reserve inhabitants are allowed a fish quota of 3 kg fish/day. Fishing must be licenced by the Biosphere Reserve Administration, permits being issued annually.

Another household income source is tourism, practiced mostly by settlements like Sulina Town, Sfântu Gheorghe, Mila 23 and Crişan villages, where physico-geographical conditions are particularly favourable for this activity.

People owning tourist boarding-houses enjoy certain physical facilities (cost cuts).

After 1990, people's income sources would change, fish resources steadily depleting, also other activities had to be undertaken, such as the transport of tourist inside the Danube Delta (Damian, 2011).

6. FISH RESOURCES

Fish resources in the Danube Delta populate the 104,571 ha of inland waters. Fish species (about 132) are mostly fresh-water ones, but there are some marine and migratory species as well (Năvodaru, Staraş, 1996).

Important changes of quality and quantity have occurred in the structure of fish species. The size of exploitable fish stocks depends on several factors, such as water regime, reproduction conditions, the quantity of the trophic base, the quality of water, the rate of intense fishing, etc. (Năvodaru, 1996).

After 1972, when several areas were dyked, a direct relationship between water level and fish production used to exist. Subsequently, the balance was shattered and the overall fish catch was ever lower by the year, from 10,000–20,000 t/year in 1960–1970 to 5,000–6,000 t/year over 1984–1996. As of 1993, the human impact on fish species dynamics became ever more aggressive, the total quantity of catches stabilizing at ca. 3,000t/year. The 2011–2012 interval witnessed a fall in estimated captures at 2,385 t and 2,033 t, respectively, with increases in the coming years up to an estimated 4,043 kg in 2017 (Fig. 10).

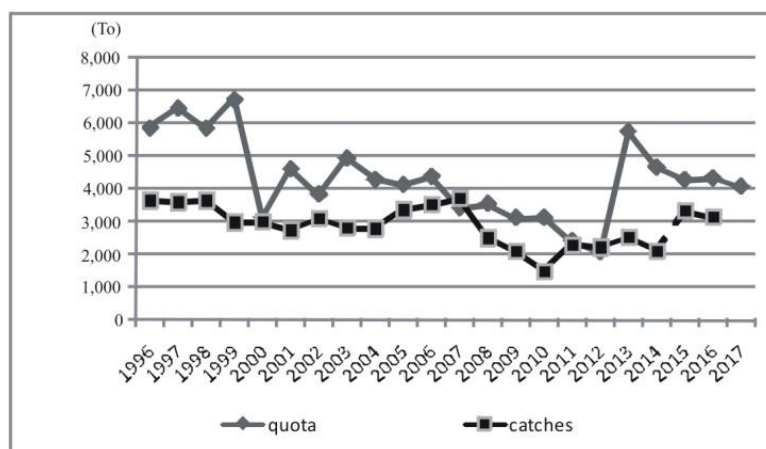


Fig. 10 – The evolution of the fish catch over 1966–2017.

Source of data: <http://www.ddbra.ro/administratia/documente-planuri-strategii-rapoarte/rapoarte-privind-starea-mediului-in-rezervatia-biosferei-delta-dunarii-a744>

6.1. Fishing-triggered conflicts in the Danube Delta

Conflicts in the Danube Delta occur between those interested in obtaining greater profits from the exploitation of the Delta natural resources, especially fish, and people keen on the conservation and protection of the area's natural environment. The main conflicts between them and the representatives of the DDBR Administration, engaged in protecting biodiversity and promoting sustainable development, are connected with limiting access to various Danube Delta resources.

In our study-area, this conflictual situation is less obvious among the local co-inhabiting minorities, or between the young and the old generations; it usually goes on between the locals and the DDBRA, or between the latter and the economic agents.

7. CONCLUSIONS

Summing up, we might say that fishing continues to be one of the traditional occupations in the Danube Delta; what is needed, is to create real conditions for the area's socio-economic development corresponding to the Danube Delta Biosphere economic potential (Damian, Dumitrescu, 2009). Once a Biosphere status was granted, the main traditional activities suffered some changes, a situation arousing discontent among the locals, who had no restrictions in using and valuating the natural resources in their area (Văidianu *et al.*, 2015).

The experience of several countries in valuating the fish resource has shown that central-based control is the most efficient method in overseeing fishing and sales. The former socialist countries were successful in controlling fisheries. In Romania, state control proved beneficial both in the inter-war period and in socialist times, in the mid-1950s, scientist Grigore Antipa was fiercely opposing leasing the fish resource.

Effects are being made to induce people to undertake traditional fishing, but also to find alternative solutions, having in view that, over the past few years, the fish resource has been depleting, as has the number of professional fishermen. One solution among others would be greater involvement of the local population in developing traditional activities and tourism, organised tourism in the main, with the least impact on the natural environment (Hall, 1993). As far as the fishermen themselves are concerned, attempts are being made (in keeping with the Danube Delta Strategy) to reorganise the fish market and provide them with facilities and adequate conditions for practicing fishing.

REFERENCES

- Anastasiu, A. (1947), *Cooperativele de pescuit și pentru valorificarea Deltei Dunărei*, Tipografia Văcăreșcu, București.
- Antipa, Gr. (1916), *Pescăria și pescuitul în România*, Librăriile Socec, București.
- Apostol, Mirela *et al.* (2004), *Romanian Danube Delta Biodiversity Project: Local Benefits Case Study Report*, Global Environment Facility. <http://www.thegef.org/MonitoringandEvaluation/MEOngoingEvaluations/MEOLocalBenefits/meolocalbenefits.html>.
- Bălașa, Ana, Chiriac, D. (1996), *Calitatea vieții populației rurale din Rezervația Biosferei Delta Dunării*, Probleme Economice, Nr. 46, Centrul de Informare și Documentare Economică, București.
- Damian, Nicoleta (2011), *Unemployment and poverty in the Danube Delta settlements, Territorial disparities*, in *Revue Roumaine de Géographie*, Vol. 55, (2), pp. 11–22.
- Damian, Nicoleta (2013), *Mediul geografic și factorii de risc social din Delta Dunării*, Edit. Universitară, București.
- Damian, Nicoleta (2016), *Socio-economic development in the Danube Delta Biosphere Reserve*, in *Revue Roumaine de Géographie*, Vol. 60, (1), pp. 99–107.
- Damian, Nicoleta, Dumitrescu, Bianca (2009), *Sustainable development prospects for the Danube Delta rural communities*, in *Revue Roumaine de Géographie/Romanian Journal of Geography*, Vol. 53, (2), pp. 153–164.
- Dumitrescu, Ana (2003), *The impact of the social and economic policies on the local people of the Danube Delta and the necessary measures*, in *Scientific Annals of the Danube Delta Institute for Research and Development*, IX, pp. 75–83.
- Gâștescu, P. (1993), *The Danube Delta: Geographical characteristics and Ecological Recovery*, *Geojournal*, 29, A International Journal, Kluwer Academic Publishers-Dordrecht, Boston/London.
- Gâștescu, P. (2009) *The Danube Delta Biosphere Reserve. Geography, biodiversity, protection, management*, in *Revue Roumaine de Géographie/Rom. Journ. Geogr.*, 53, 2, pp. 139–152.
- Gâștescu, P., and Știucă, R. (eds.) (2008), *Delta Dunării – Rezervație a Biosferei*, Edit. CD Press, București.
- Giurescu, C.C. (1969), *Istoria pescuitului și a pisciculturii în România*, Edit. Acad. Rep. Pop. Române.
- Hall, D. R. (1993), *Ecotourism in the Danube Delta*, *The Tourist Review*, 48, 3, pp. 11–13.

- Năvodaru, I. (1996), *Exploitation of Alosa pontica in the Danube Delta*, Stock assessment in inland fisheries, Edit. I.G. Cowx, Oxford: Fishing New Books.
- Năvodaru, I., Staraș, M. (1996), *Evolution, research and management of the Danube Delta Biosphere Reserve fisheries*, Scientific Annals of the Danube Delta Institute for Research and Development, **IV** (1), pp. 241–248.
- Poruncia-Ipate, Alina (2012), *Rezervația Biosferei Delta Dunării, Potențial turistic și valorificare*, Edit. Transversal, Târgoviște.
- Rughiniș, Cosima (2004), *Cunoaștere incomodă: Intervenții sociale în comunități defavorizate în România anilor 2000*, Uncomfortable Knowledge, Social Interventions in Marginal Communities in Contemporary Romania, Bucharest: Printech. 160 pages.
- Stahl, P., Henri, C., M., (2004), *Meșteri țărani români*, Edit. București: Tritonic.
- Văidianu, Natașa, Paraschiv Mirela, Saghin Irina, Braghină C. (2015), *Social-ecological consequences of planning and development policies in the Danube Delta Biosphere Reserve*, Romania, Carpathian Journal of Earth and Environmental Sciences, Vol. **10**, No 3, pp. 113–124.
- Văidianu, Natașa (2013b), *Danube Delta Biosphere Reserve. Partnership between people and nature for sustainable development (in Romanian)*, Edit. ARS DOCENDI, Bucharest.
- Văidianu, Natașa, Adamescu, M.C., Wildenberg, M., Tetelea, C. (2014), *Understanding public participation and perceptions of stakeholders for a better management in the Danube Delta Biosphere Reserve (Romania)*, Papageorgiou, E.I. (ed.), *Fuzzy Cognitive Maps for Applied Sciences and Engineering*, Springer, Berlin, pp. 355–374.
- *** (1930), *Darea de seamă pe anul 1929, P.A.R.I.D.*, Administrația Generală a Pescăriilor și Ameliorarea Regiunii Inundabile a Dunării, Edit. Tipografiile Române Unite, București.
- *** (2005), *Geografia României, Vol. V, Câmpia Română, Dunărea, Podișul Dobrogei, Litoralul Românesc al Mării Negre și Platforma Continentală*, Edit. Academiei Române, București.
- *** (2014), *Raport de Diagnostic. Strategia Integrată de Dezvoltare Durabilă pentru Delta Dunării*, Proiect co-finanțat de Fondul European de Dezvoltare Regională prin POAT 2007-2013.
- *** (2014), *Strategia Națională a Domeniului Pescăresc 2014-2020*, Guvernul României, Departamentul pentru Ape, Păduri și Piscicultură, <http://apepaduri.gov.ro/wp-content/uploads/2014/08/Strategia-Na%C8%9Bional%C4%83-a-Domeniului-Pesc%C4%83resc.pdf>.
- Social-ecological consequences of planning and development policies in the Danube Delta Biosphere Reserve, Romania (PDF Download Available)*. Available from: file:///D:/pescuit_piscicultura_arbdd/articol%20natas.html [accessed Oct 18 2017].
- file:///D:/pescuit_piscicultura_arbdd/ARBDD%20Tulcea.html.
- http://www.ddbra.ro/mediatizari/Anexa%201_%20proiect%20HG%20strategia%20Deltei%20Dunarii%20rev1.pdf.
- <http://www.ddbra.ro/activitati/pescuit> [accessed Sept 06 2017].
- [http://www.ddbra.ro/media/master%20plan%20RBDD\(2\).pdf](http://www.ddbra.ro/media/master%20plan%20RBDD(2).pdf). Master Plan – Suport pentru dezvoltarea durabilă a Rezervației Biosferei Delta Dunării – județul Tulcea.
- <http://www.mdr.ro/dezvoltare-regionala/-5882>.
- http://www.mdr.ro/userfiles/espon/dimensiune_teritoriala/reuniune2/materiale05.pdf.
- <http://www.ddbra.ro/administratia/documente-planuri-strategii-rapoarte/rapoarte-privind-starea-mediului-in-rezervatia-biosferei-delta-dunarii-a744>.
- [http://www.ddbra.ro/media/Brosura%20Strategia%20UE%20pentru%20Regiunea%20Dunarii\(2\).pdf](http://www.ddbra.ro/media/Brosura%20Strategia%20UE%20pentru%20Regiunea%20Dunarii(2).pdf) [accessed Feb. 08 2017].
- <http://www.gefio.org/sites/default/files/ieo/ieo-documents/lb-case-study-romania.pdf> [accessed Apr 24 2008].
- <http://www.ddbra.ro/en/danube-delta-biosphere-reserve/danube-delta/location> [accessed Jun 28 2017].
- http://www.bas.ro/rezumat_rughinis.pdf. [accessed Oct. 13 2017].

Received March 5, 2019

