CHARACTERISTICS OF AQUACULTURE PONDS MUD FROM THE PRUT RIVER LOW BASIN

Maria CONTOMAN[1], Luiza FLOREA[1]

[1]The Lower Danube University, Galati
e-mail : mcontoman@ugal.ro

Natural water ecosystems that present a bigger physico-chemical stability as compared to other life eco-systems, is characterized by a high degree of integrality , given by the dynamic equilibrium between the living and the non-living ecosystem components. as a result, they prove a high degree of self-adjustment. But the artificial and the semi-artificial ecosystems used in commercial aquaculture show some characteristics such as: reduced heterogeneity, the decrease of dynamic equilibrium and , as a result, reduced self-adjustment capabilities. The researches performed by the Aquaculture Department of the Lower Danube University of Galatzi aim at establishing water nutrient quantity and mud characteristics in two aquaculture ponds (Sovarca, Vladesti) of the Prut Low Basin. In these researches, both natural and technological factors which determined the nutrient amount in muds have been monitored. The main parameters which characterize the NPK content in muds are: total N (%); phosphorous (ppm); potassium (ppm); pH; humus (%).

Key words: *aquaculture, ecosystem, nutrient*

The process of sedimentogenesis in ponds, pools and lakes consists of organic or mineral precipitate and suspension piling up.

These researches try to establish the degree of nutrient values in fish pond silts in with a view to drawing up a set of technological measures for the reduction of anthropic pressure upon the aquatic ecosystem components.

MATERIALS AND METHODS

The average silt samples have been taken from the fish ponds of Vladesti, Sovarca and Malina farms with a special probe. These samples were studied by the Regional Pedology and Agrochemistry Labs in Galati. Analyses were done for seeing the silt chemical reactions, the amount of humus (organic matter) and nutrient content (N,P,K)in them.

Organic matter was determined through titrimetric method of organic carbon and humus, the Gogoasa modification, the mobile phosphorous through Egner- Riehm-Domingo method, while the accessible potassium through flame emission photometry.

Total nitrogen was determined through Kjeldahl method, ie. the process of wet mineralization of organic compounds with the nitrogen in soil.

RESULTS AND DISCUSSIONS

Fish Ponds Description

The Malina Farm is made up of four fish ponds, three of them being placed between Movileni and Sendreni villages, over a 37 ha area (two ponds for breeding summer 1 young fish and another for breeding summer 2 young fish) in the Siret hydrographic basin. Another , between the slag waste dump of SC ISPAT SIDEX SA and Smardan village with an area of 90 ha for breeding marketable fish in the Malina River bed.

The river Siret is the main water source of the unit and it is also represented, partially, by rainfalls and snowfalls. The farm is also supplied with water from the city's drinking water network. The water's physico-chemical qualities are determined by climatic conditions and supply water quantities. Generally, they have optimum values recommended by specialty sources and admitted by Order 1146 / 2002 for Second Class aquatic ecosystem protection (Report No. 23/22/10. 2004).

The Sovarca Fish Pond Farm is situated in the Suceveni and Oancea territories, Galati County, on the right bank of the River. This unit, with a total surface of 223 ha is managed by SC Singama SRL from Oancea, Galati County.

Water supply and evacuation is achieved mainly gravitationally, the water source being the Prut River through its pumping station SP1 and the reversible flow regulator from E.C.5.

Both filling in and evacuation are done gravitationally and by pumping up with pumps. The pumping station is provided with valves for water direction from and to canals for both reversibility and station close up. In the area where supplying and evacuation pipes cross the Prut banks a series of consolidation and bank protection operations by means of black stone ballasted wattle. The platform on which the station is placed is at an ensured level of 1 %.

The Vladesti Fish Pond is situated on the right bank of the Prut with an area of 323 ha. The unit is managed by SC Zatun SA.

The profile of the unit is that of a complex systematic fish pond and nursery pond. The exploitation cycle is 2years long, while the production is focused on Cyprinus Carpio and other East Asian species, taken from the units that ensure an artificial reproduction of these species.

The feeding canal types are two in number: open and metallic. the main feeding canal has a reversible function. All the ponds have perimeter draining canals.The filling up volume required by this unit is about 5,000 thousand mc.

The water supply is done from the Prut through a pumping station for both water input and output. There are four 350 Brates pumps , out of which two are meant to function reversibly for water evacuation from the unit.

Anyway, before the opening of the Stanca Costesti dam, now the Vladesti unit does no longer benefit from the possibility of having a consistent gravitational

supply during all the periods (contrary to the design documentation). As a result the water supply through pumping has as main effect great rises in costs.

The economic system of the latest years emphasizes the reduction of productive surfaces in comparison with market requirements. So, 40 % of the whole surface is available. The average output on surface unit is of about 1,500 kg/ha for marketable fish and 2,000 kg/ha for young fish material.

The relations between soil and water

Fish production is determined by the way in which the chemical, physical and biological processes that occur in the water, in connection with the fertility level of pond depths or waters.

The mineral substances from the water are being used as food by aquatic plants, but their development depends mainly on the fertility state at the bottom of the pond as a result, special attention must be paid to the chemical and biological conditions in the soil and the water as well. As fish eat, large quantities of nutrients are taken from the water. Optimum conditions of fish productivity are influenced by certain physical, chemical and biological factors of water and soil. In the silts of fish waters there is a strong biochemical dynamism because nutrients are in a permanent chemical change given by bacteria.

Because of the contact between water and silt , a series of changes occur , such as: the water bottom changes its chemical composition as a result of gradual dissolving of nutrients in the water, the reaction becoming more acid , the structure changing continuously.

The finer and richer in colloidal matter the bottom silt is, (which strongly absorb nutrients), the better the soil retains these substances in order to gradually yield them into the water.

During the first production years of a pond, the land deeply influences the quality of water from which it gets large quantities of nutrient matter until it reaches an equilibrium. The next moment is characterized by aquatic flora and fauna development, after microorganism destruction.

The organic matter resulted from plankton death combines with clay particles, sand and limeston, giving birth to detritus with fertilizing properties. The productive layer of a pond is made up of mineralized detritic sediments of organic origin.

Organic matter

In ponds, great quantities of organic matter are formed and they may be grouped under two categories: useful and harmful. The useful ones are represented by zoo and fitoplankton, while the harmful ones, by some organic acids , amines and all decomposition products which are formed on pond bottom , particularly in the absence or insufficiency of oxygen.

In highly aerated waters, both the plankton that goes down and the other organic substances in suspension suffer a process of mineralization, favorable to pisciculture.

In the waters lacking in oxygen, a decay process occurs of all organic matter which is furthermore changed, through microorganisms, into nitrates and sulphides lacking in oxygen, some of which being toxic.

As for the materials that clog fish ponds, they originate from organic matter decomposition processes, from the Prut River alluvia and from fish feeding. The organic matter content in pond silts is shown in *table 1*, with the standard values.

Table 1

Silts Humus Content

Place/ sampling	Farm		
	Vladesti	Sovarca	Malina
Pond Supply/Feeding	3,91	3,86	3,75
Pond Centre	2,54	2,35	1,24
Pond Evacuation	3,42	3,57	4,09

Chemical Composition

The nitrogen in fish pond silts is both of organic and mineral origin. Nitrates are oxidized when they are brought by downpours with lightning, by changing into nitrates of the atmospheric nitrogen fixed in by nitrogen fixing bacteria which develop in the pond bottom silts. Nitrogen is also produced by the protidic nitrogen from organic substances of animal or vegetal origins at the bottom.

This element constitutes one of the most important biogenous factors, ensuring plant evolution. It can't be accumulated as reserve, neither in plants nor in soil because it is easily soluble and as a result it is levigated in depth. Nitrogen washing away from the soilis confirmed by the results of chemical tests of all the samples taken at various points of the fish farm (*table 2*).

Table 2

Silts Nitrogen Content

Place/ sampling	Farm		
	Vladesti	Sovarca	Malina
Pond Supply/Feeding	0,196	0,193	0,188
Pond Centre	0,127	0,118	0,062
Pond Evacuation	0,171	0,179	0,205

The Phosphorous. The rich in limestone pond bottoms fix phosphates in a harly soluble forms particularly if the soil contains a moderate humus quantity. When water acidity and movement conditions allow, phosphorous will turn into assimilable forms. Phosphorous is used by aquatic plants in summer, as important biogenous element. As it is consumed by bacteria and aquatic plants, it is necessary to fertilize ponds with phosphatic fertilizers all through the summer.

There is a strong interaction between phosphorous and nitrogen, the presence of phosphorous helps nitrogen fixing bacteria to accumulate atmospheric nitrogen , gives birth to ammonification and nitrification, helping the process of mineralization of the nitrogen-based organic substances. The chemical tests of silts

from the ponds under analysis show us the presence of moderate quantities of phosphorous , which is explained by the absence of phosphate fertilizer input in the last years (*table 3*).

Table 3

Phosphorous Content in Silts

Place/ sampling	Farm		
	Vladesti	Sovarca	Malina
Pond Supply/Feeding	65,6	77,6	76,6
Pond Centre	39,7	36,1	22,6
Pond Evacuation	96,4	101,5	101,1

Potassium. There is proof that potassic fertilizers influence young fish breeding positively. It is also used by aquatic plants in their process of nutrition, being placed particularly in leaves and stems. The K^+ ion easily penetrates the plants being taken from bicarbonates, phosphates or nitrates soluble in water or in soil solution. In the presence of cations with antagonistic action (Ca^{2+}, Mg^{2+}, Na^+), the potassium salts have favorable action upon aquatic plants and young fish, too.

After the death of aquatic plants potassium reaches the pond bottom representing the nutrient reserve for the next year.

The tests made on the samples from the fish farms show the presence of phosphorus in silts in moderate to high quantities (*table 4*).

Table 4

Potassium Content in Silts

Place/ sampling	Farm		
	Vladesti	Sovarca	Malina
Pond Supply/Feeding	340	260	180
Pond Centre	165	210	120
Pond Evacuation	285	270	265

The soil reaction (the pH) varies according to the nature of the pond bottom, of the assimilation and decomposition of organic matter as well as by rain, snow and high floods.

In a pond with its bottom rich in organic deposits and with a lack in oxygen, decomposition occurs rapidly, followed by a rich development of CO_2 and H_2S.

The chemical reaction of fish pond silts influences the pH from their waters. Fish life is possible in waters with a pH that varies between 5- 8.5, the optimum value being 7.2- 7.8.

The silts analyzed in the fish farms have values between 7.68 and 7.97 which prove that these silts have an adequate pH for optimum fish breeding. When the pH values decrease, it is sure to have decomposition processes on the pond bottom.

The chemical characteristics of silts directly influence both the microflora and microfauna, while these two, in their turn, influence fish production, in general.

Table 5

Soil Reaction

Place/ sampling	Farm		
	Vladesti	Sovarca	Malina
Pond Supply/Feeding	7,68	7,81	7,69
Pond Centre	7,95	7,88	7,97
Pond Evacuation	7,89	7,85	7,88

CONCLUSIONS

1. Fish production is influenced by chemical, physical and biological processes in the water in strict connection with the state of fertility of pond bottom.

2. The organic matter content of silts sampled from fish farm silts show that they have a high fertility with positive influences upon fish production.

3. The nitrogen from the samples show a low to medium level, which is explained by its levigation in depth.

4. Both phosphorous and potassium show average values for the period investigated.

BIBLIOGRAPHY

1. Chirita, C., 1974 – *Ecopedology with Bases of General Pedology*, Ceres Publishing House, Bucharest.
2. Davidescu, D, Davidescu, Velicica, 1981 – *Modern Agrochemistry, The Academy Publishing House*, Bucharest.
3. Davidescu, Velicica, Gabriela, Neata, Ioana, Dima, Roxana, Madjar, 2001 – *The 16 th National Conference for Soil Science, Vol III, pp. 61-67.*
4. Ionescu, A. Jinga, I, Stefanic, Gh, 1985 – *The Use of Organic Waste as Fertilizers*, Ceres Publishing House.
5. Lixandru, Gh, &Colab. – *Agrochemistry*, Didactic and Pedagogical Publishing House, Bucharest.
6. Popovici, Alina, Davidescu, Velicica, Privighetoriţa, C., Ghinescu, P., 1994- *Decolmatage des lacs de barrage par hydromecanisation et utilisation complexe des materiaux extraits*. International Symposium Geological Engineering and Geoenvinronment protection, pag. 93-110, Constanţa, Romania.