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TASAUL LAKE FISHERIES CHARACTERISTICS AND RESEARCH

Irina Cernisencu[1], Laura Alexandrov[2], Otilia Orac[3], Jürg Bloesch[4], Lucica Tofan[5], Doina Arhire[6], Paris Paris[7]

[1] "Danube Delta" National Institute for Research and Development Tulcea, E-mail: irina@indd.tim.ro
[2] National Institute for Marine Research and Development "Grigore Antipa", Romania, E-mail: laurenta09@gmail.com
[3] "National Agency for Fishing and Aquaculture", Constanta Branch,
[4] Swiss Federal Institute of Aquatic Science and Technology (EAWAG), Dübendorf, Switzerland, and Limnological Research Center, Kastanienbaum: peter.bossard@eawag.ch
[5] University "Ovidius" Constanta, lucica.tofan@gmail.com
[6] SC PESTOM Comp.SRL, Ovidiu, Constanta, pescom_paris@yahoo.com
[7] SC PESCOM SA, Constanta, doina_arhire@yahoo.com

ABSTRACT

Our limnological survey (May 2005 - June 2007) proved the highly eutrophic state of Tasaul Lake: high primary production (80-242 mg Cass/m^2.h), biomass (fresh weight 38 g/l) and chlorophyll *a* (46-383 µg/l), and blooms of Cyanophytes making up to 67-94% of the total algal community (69 species). It is likely that the biota is bottom-up controlled by nutrients (phosphate and nitrate mean concentrations of 0.02 and 1 mg/l, respectively) originating mainly from internal and external loading (the input by Casimcea River, the main tributary was 510 tons TP/year and 29.985 tons TN/year).

Tasaul Lake has been used mainly for aquaculture and fish production. The latter is strongly dependent on stocking and over-exploitation. Historical fish catch records declined drastically in 1994-1995 from 180 to 50 t and later on to 5 t until 2000.

Fish stock in Tasaul Lake was assessed in 2005 for two out of eight species [*Carassius gibelio* (giebel carp) and *Rutilus rutilus* (roach)] from a total of 581 specimens investigated. FAO related methods were applied by using "age-structured" models based on population parameters such as length frequency diagrams and length-weight relations. Biomass in 2005 was 23.6 to for giebel carp and 34.2 to for roach. Since fishing mortality coefficient was greater than natural mortality coefficient, fishery is claimed not to be sustainable (i.e. exploitation). The maximum sustainable yield would be, according to the model based on standard fish catch of 10 to/yr, 10.9 to/yr for giebel carp and 12.2 to/yr for roach.

Apart from reducing nutrient input of Casimcea River by fighting point sources, the conclusion and recommendations towards a more sustainable fishery management in Lake Tasaul are: (1) perform a detailed monitoring of yearly restocking to quantify fishing input; (2) perform a detailed monitoring of fishermen, the number of the gear nets used/day and the CPUE to quantify the fishing effort; (3) perform detailed statistics about net catches and angling, and estimate poaching, to quantify fishing/output.

KEY-WORDS: shallow, coastal lakes, primary production, eutrophication, biodiversity, population model, yield per recruit

AIMS AND BACKGROUND

Tasaul Lake was a coastal basin for fish rearing purposes. Before building the Petromidia-Navodari Plant for oil processing in 1972, the fish catches in Tasaul Lake had about 700-800 tons annual production, mainly based on native cyprinid species (carp, bream, roach etc.) in percent of 70-80%, and pike perch, as dominant voracious species, like it is in the Sinoe Lagoon. The Petrochemical Plant has not significantly polluted the lake, but its construction totally closed the connection between Tasaul Lake and the Black Sea. Since 1980 the lake has been populated systematically with Chinese carps to maintain the ecosystem equilibrium and the fish production. Accommodated carps species preferentially have been developed, comparing with native species. In the past 25 years, Tasaul Lake lost its links with the sea and the Tasaul paramarine-liman characteristics lead to a new oligohaline lake.

Between 1984-1988, the anthropogenic influence started to be visible:

- Between Tasaul and Corbu Lake was built a common channel for the lakes water outflow in the sea through a hydrotechnical works;
- The pumping station permitted a water level balance between the two lakes, avoid level oscillations and maintained a constant content of salts;
- Catches have been based on 80-90% autochthonous carps.

From 1984, Tasaul stabilized it surface at 2,025 ha and 49.5 mil.m^3 water column. Inside the lake, in the area of the Casimcea river, according to its impact, the bottom increased every year with 8-10 cm and lead to the whole lake’s covering with mud; marsh processes have been seen. The most mud stock was intensively grown in the north-western part, due to the water inflow with slow speed. This area has 0.5 m depth in present and is 70% muddy bottom. The main pollution source of this area is the pig complex; it has a waste treatment station, but it never well and totally functioned.

1989 the N/P ratio unbalance induced the microalgae blooms, more than 60%; the microbiological activity increased with 160,000 TGN/ml and the benthos biomass decreased to 18.5 kg/ha in 1989. The fish production reported was 50 tons of small shad.

During 1992-2002 there were registered:

- fish catches have drastically decreased from 199 tons in 1992 to around 20 tons in 1998 with a dominance of Asian cyprinids;
- the small shad is still present in Tasaul Lake, but its migration is no longer possible, as the sea connection is closed;

- the lake's water level is maintained by the Poarta Alba-Midia Navodari channel, even if the real link with it, at water surface, doesn't exist.

The fish stocks evolution clearly reflects the decreasing of fish production from 1992 until 2004 and this has imposed the necessity of fish population improvement and permanent restocking. Some relevant evolution aspects of fish production are presented.

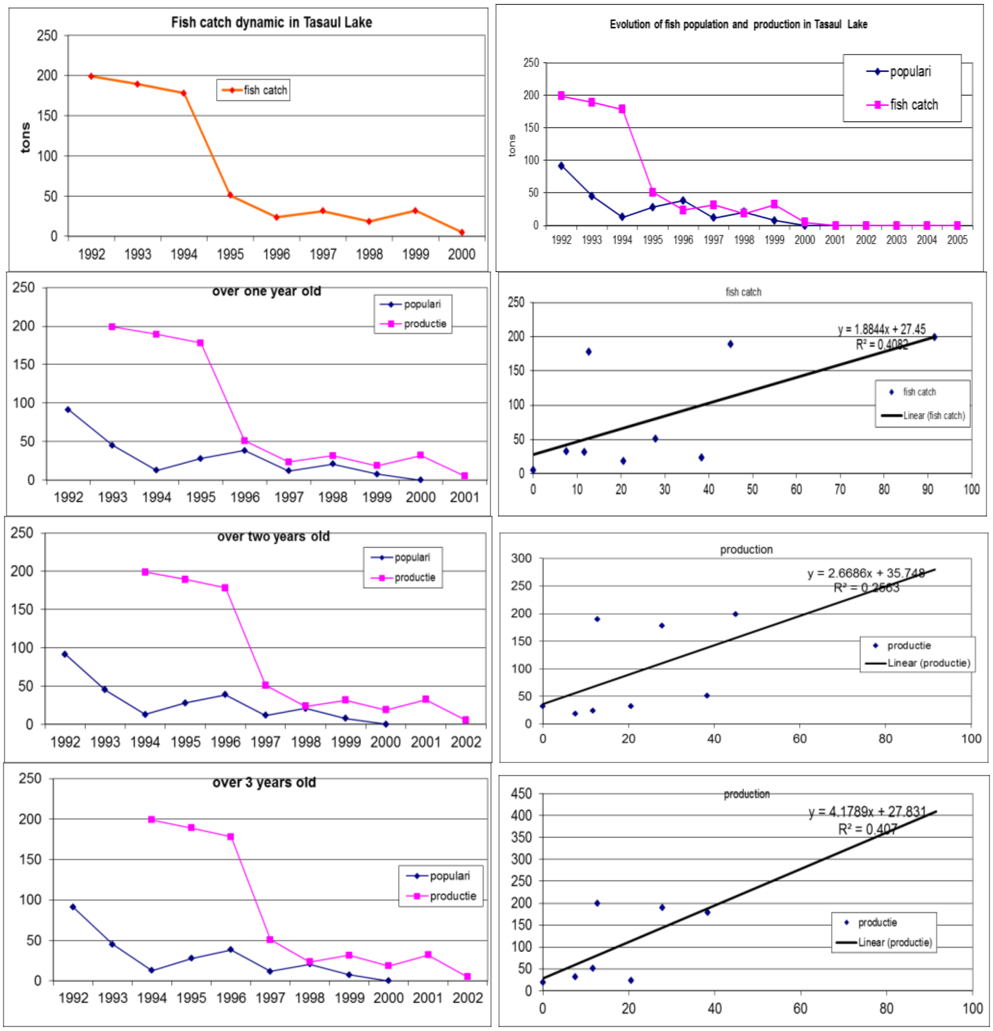


Fig. 1 a-h. Fish catch evolution and restocking, on fish ages (1992-2000)

Fig. 2. a,b,c. Traditional fishing activities in Tasaul Lake

Tasaul Lake belongs to the State Funds Administration. Currently its transfer to the National Company of Fisheries Funds Administration is being prepared.

MATERIAL AND METHODS

In order to elaborate a mathematical theory concerning the Tasaul Lake fish stock assessment a considerable contribution had the studies of Baranov (1977), Ricker (1975), Gulland (1969), Pauly (1983), Jones (1984), Sparre et al., (1989). A fishing strategy based on the evaluation of the fish durable yield is applied in Hungary (Biro, 1990), Russia (Sechin et al., 1991), Poland (Bninska & Leopold, 1990), Greece (Crivelli, 1990), Holland (Jagtman et al., 1990), France (Gerdeaux, 1991) and it was used as example for Tasaul Lake.

DDNI - Tulcea specialists have been usingsince 1984 these methods in their fisheries research for fish stock assessment, elaborated and recommended by FAO. The growth and exploitation fish parameters, the average biomass and the sustainable yield have been estimated in the Razim-Sinoie complex, spreading then evaluations to all Danube Delta lakes.

For the assessment of the fish stock from Tasaul Lake, the analytical model was applied. The analytical model is an “age-structured model” using population’s parameters. This approach assumes to know the length-frequency by fish species. The processing and analyse of the collected samples are made according FAO related publications (Jones, 1984; Sims, 1988; Sparre et al., 1989).

More information is detailed in the paper *History and concepts of sustainable fishery in Tasaul Lake, Romania*, in GeoEcoMarina, about the ESTROM Projects results (Alexandrov et al., 2008).

RESULTS AND DISCUSSION

Fish stocks evaluation in Tasaul Lake

For the assessment of Tasaul Lake fish stocks, there were sampled 581 individuals belonging to eight fish species. The length frequency diagram is presented in Fig. 3 a-f.

In general, the average of the samples has to be around 1,000 individuals, by species, being part of commercial fishing capture, done with active and passive nets. Fish stocks of giebel carp and roach were assessed (Fig. 3 a, b, c.; 4 a,b; 5 a,b; 6 a,b,c).

The coefficient b from the following diagram relation is considered as a measure of the environmental condition offered, being a generalized Fulton index, in which it is taken into account the changes from relation (Pitcher, 1990).

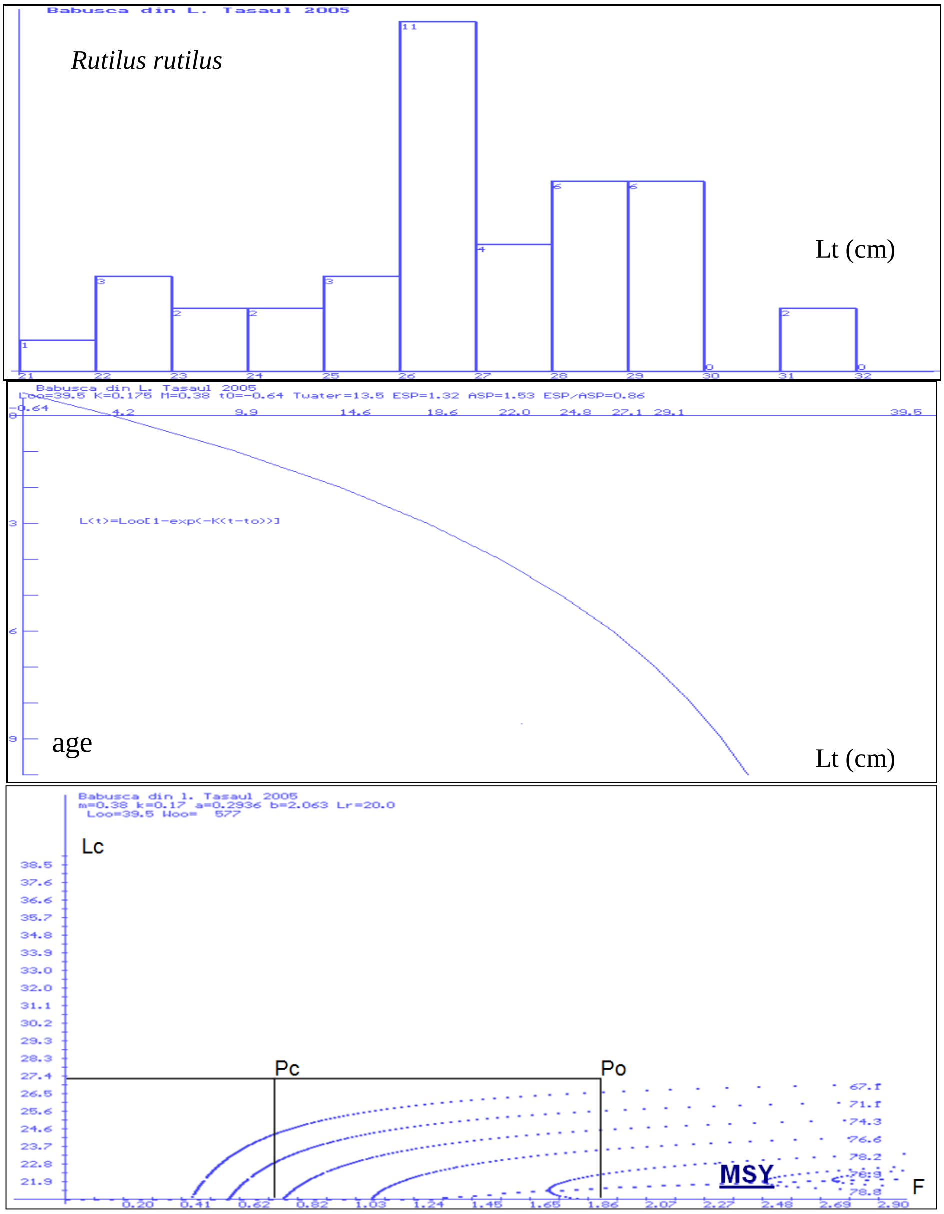


Fig. 3 a,b,c. Length frequency, growth curve and exploitation analysing - Beverton - Holt model - yield/recruit (Y/R) - roach *Rutilus rutilus*, Tasaul Lake, 2005

JONES - virtual population analysis

PBBTS05.PLG — *Rutilus rutilus* - L. Tasaul, 2005

Lg.min-max -cm-	C thds	Xl ind.	N thds	F/Z ind.	F	Z	W gr.	Average thds ind.	Biom (to)	Cant.p (to)
21.0 22.0	0.985	1.062	98.21	0.082	0.03	0.41	150	29.24	4.39	0.15
22.0 23.0	2.956	1.065	86.20	0.227	0.11	0.49	200	26.74	5.35	0.59
23.0 24.0	1.970	1.070	73.17	0.178	0.08	0.46	200	24.11	4.82	0.39
24.0 25.0	1.970	1.074	62.10	0.194	0.09	0.47	225	21.68	4.88	0.44
25.0 26.0	2.956	1.080	51.96	0.291	0.15	0.53	217	19.08	4.13	0.64
26.0 27.0	10.837	1.086	41.81	0.662	0.74	1.12	245	14.66	3.60	2.66
27.0 28.0	4.926	1.094	25.45	0.567	0.49	0.87	280	9.98	2.79	1.38
28.0 29.0	4.926	1.103	16.76	0.661	0.74	1.11	310	6.69	2.07	1.53
29.0 30.0	5.911	1.114	9.31	0.831	1.85	2.23	317	3.19	1.01	1.87
30.0 31.0	0.001	1.127	2.20	0.002	0.00	0.38	338	1.24	0.42	0.00
31.0 32.0	0.985	0.000	1.73	0.570	0.50	0.88	350	1.97	0.69	0.34
--------	38.425								34.2	10.0

L00= 39.5 Lc=27.0 M=0.38 K=0.17

Fmean (N,L>=Lc)= 0.78 Fmean (Average, L>=Lc)= 0.73 F(Y/B(L>=Lc))=0.73

Fig. 4 a. Estimation of fish stock biomass - Jones' length - based cohort analysis
***Rutilus rutilus* – 2005**

x	Fished amount	Biom	Biom(Tc)	Fm	Zm	F/Z=(at 31.0cm)
0.10	2.53	59.07	29.28	0.07	0.44	0.12
0.60	8.35	40.29	12.02	0.43	0.81	0.44
1.00	10.00	34.15	6.99	0.73	1.10	0.57
1.50	10.99	29.92	4.01	1.07	1.45	0.67
2.00	11.53	27.28	2.49	1.37	1.75	0.73
2.50	11.89	25.38	1.62	1.64	2.01	0.77
3.00	12.16	23.88	1.07	1.87	2.24	0.80

MSY= 12.16 corresponding to x=3.00

Fig. 4 b. Analysis of exploitation optimization - Thompson - Bell model

PCRTS05.PLG — *Carassius gibelio* - Tasaul Lake, 2005

Lg.min-max -cm-	C thds	Xl ind.	N thds	F/Z ind.	F	Z	W gr.	Average thds ind.	Biom (to)	Cant.p (to)
19.0 20.0	0.236	1.053	71.11	0.033	0.01	0.45	175	15.73	2.75	0.04
20.0 21.0	0.589	1.056	63.96	0.083	0.04	0.48	190	14.83	2.82	0.11
21.0 22.0	1.178	1.059	56.84	0.162	0.09	0.53	215	13.81	2.97	0.25
22.0 23.0	0.942	1.063	49.59	0.144	0.07	0.51	231	12.74	2.95	0.22
23.0 24.0	2.121	1.067	43.04	0.295	0.18	0.62	270	11.54	3.11	0.57
24.0 25.0	3.888	1.071	35.84	0.471	0.39	0.83	320	9.91	3.18	1.25
25.0 26.0	8.129	1.077	27.59	0.716	1.11	1.55	333	7.32	2.44	2.70
26.0 27.0	6.833	1.083	16.24	0.784	1.60	2.04	367	4.27	1.57	2.51
27.0 28.0	3.181	1.091	7.53	0.772	1.49	1.93	398	2.13	0.85	1.27
28.0 29.0	1.885	1.100	3.41	0.817	1.97	2.41	429	0.96	0.41	0.81
29.0 30.0	0.589	0.000	1.11	0.532	0.50	0.94	458	1.18	0.54	0.27
--------	29.571								23.6	10.0

L00= 39.0 Lc=25.0 M=0.44 K=0.22

Fmean (N,L>=Lc)= 1.35 Fmean (Average, L>=Lc)= 1.30 F(Y/B(L>=Lc))=1.30

Fig. 5.a. Estimation of fish stock biomass - Jones' length - based cohort analysis
***Carassius gibelio*, 2005**

x	Cant.p	Biom	Biom(Tc)	Fm	Zm	F/Z=(la 29.0cm)
0.10	2.89	44.50	25.76	0.11	0.55	0.10
0.60	8.75	27.95	9.76	0.75	1.19	0.41
1.00	10.00	23.57	5.80	1.30	1.74	0.53
1.50	10.60	20.92	3.64	1.94	2.38	0.63
2.00	10.88	19.37	2.55	2.53	2.97	0.69
MSY=	10.88 corespunzator lui x=2.00					

Fig. 5 b. Analysis of exploitation optimization - Thompson - Bell model

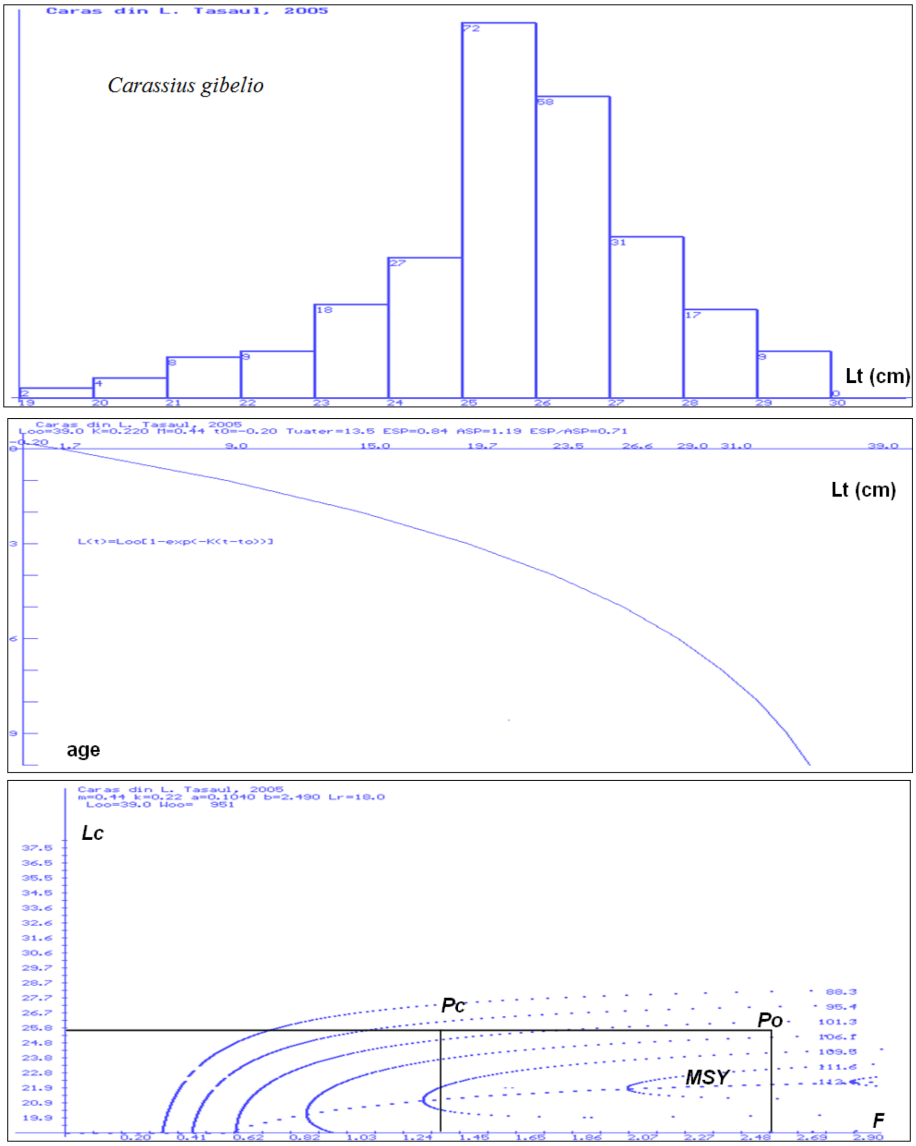
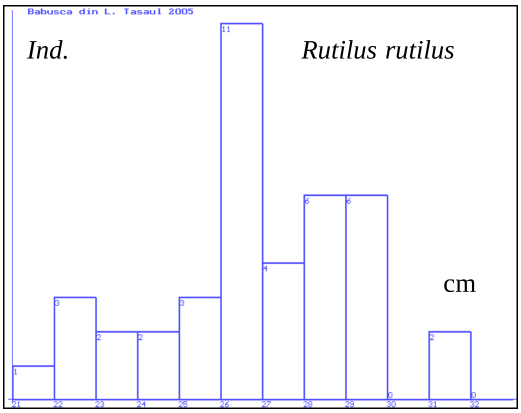


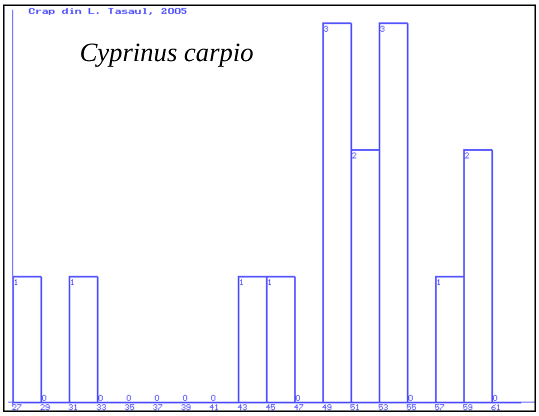
Fig. 6 a,b,c. Length frequency, growth curve and exploitation analysing - Beverton - Holt model - yield/recruit (Y/R) *Carassius gibelio*, Tasaul Lake, 2005

For all sampled species the length-weight relation was calculated, in which a and b coefficients values are variable, changing from a year to another, as a result of the physiological process of the growth, fat, sexual maturity, reflecting specifically adaptation and creating specie-environment unit (Table no. 1, Fig. 7 a-f).

Table 1. Length-weight relation coefficients for commercialized species sampled from Tasaul Lake

Species	Sampled ind.	Lt min. cm	Lt max. cm	Average Lt cm	Average weight (g)	Wt (kg)	$W = aL^b$	
							a	b
Perca fluviatilis	58	22	26.5	24.2	232	13.5	0.02689	2.8425
Rutilus rutilus	39	21.8	31.3	26.7	260	10.2	0.29361	2.06256
Carassius gibelio	251	19,8	30	25	338	84.9	0.10402	2.48958
Cyprinus carpio	12	27.4	60.3	48.5	2292	27.5	0.01155	3.11372
Ctenopharyngodon idella	8	31.6	62.4	50.8	1663	13.3	0.15775	2.34224
Hypophthalmichthys molitrix	195	29.1	86	59	2828	551.5	0.00398	3.26507
Sander lucioperca	5	39.4	43.1	40.7	600	3	0.0475	2.54735
Aristichthys nobilis	13	22	80.3	71.9	4962	64.5	0.0199	2.88483
Total	**581**					**768.4**		





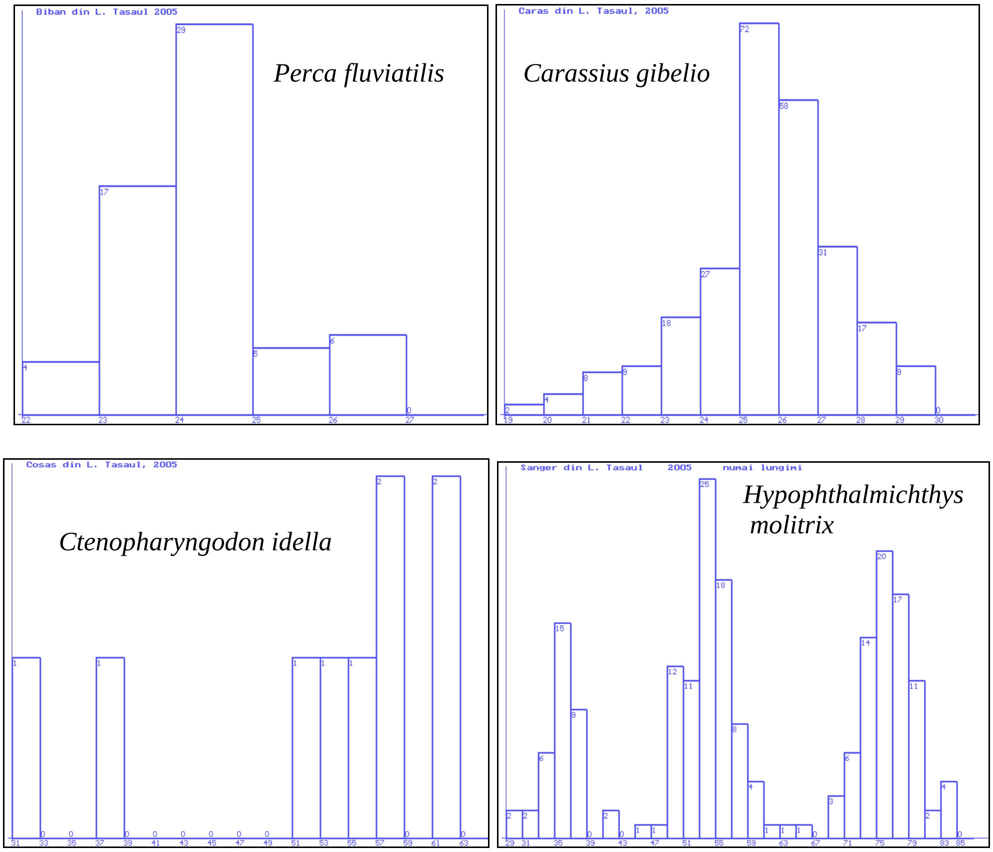


Fig. 7 a, b, c, d, e, f. Length frequency diagram - some species from Tasaul lake - 2005

The growth parameters (Table 2) were estimated using the analysis of frequency with the models " ELEFAN" (Sparre et. al. 1989) included in the ESP packet (Staras et al., 1996).

Tabel 2 Growth and exploitations parameters of *Carassius gibelio and Rutilus rutilus* stocks of Tasaul Lake

Species	L∞	k	t_0	M	Z	F	Lr	Lc
Carassius gibelio	39.0	0.220	-0.20	0.440	1.74	1.30	18	25
Rutilus rutilus	39.5	0.175	-0.64	0.377	1.10	0.73	20	27

Symbols used: Loo - asymptotic length; K curvature parameter; to - initial condition parameter, in years; Lr - recruitment length; Lc - length at which 50% of the fish is retained by gear and 50% escape; M - natural mortality coefficient; F - fishing mortality coefficient; Z - total mortality rate.

Estimation of Fish Stock Biomass

The length cohort analysis is called *Jones' length cohort analysis* (Jones, 1976, and Jones and van Zalinge, 1981, reviewed in Jones, 1984 and Pauly, 1984). As already mentioned, the method is usually applied to "*pseudo cohorts*", i. e. and we assumed a constant parameter (equilibrium) system. In order to simulate an equilibrium condition, it is essential that the data pertain to a relatively long time period, preferably a number of full years.

A length frequency sample collected during a relatively short period is not applicable. The descending slope of a sample has something to do with the variation in individual growth rates. The result of this method is an estimate of average biomass during the lifespan of a cohort, or for all cohorts during a year.

The most applied method for estimating fish stocks and fishing mortality rates is the virtual population analysis (VPA), introduced by Gulland (1965). In the VPA it is assumed that the annual rate of natural mortality of each cohort is known. For any given fishing mortality rate for each cohort, a solution is found which fits with the observed catches at each age, exactly, i.e. VPA, implicitly or explicitly, neglecting measurement errors. One such solution is selected in accordance with auxiliary information.

An example for theestimation of fish stock biomass is presented for giebel carp and roach from Tasaul Lake (3 a,b,c, 4 a,b, 5 a,b, 6 a,b,c,).

Fish population biodiversity of the Tasaul Lake was estimated, for both adults and for early larval stages.

Fig. 8. Photos of fish biodiversity (d,e: *Pseudorasborna parva, Alburnus alburnus, Knipovitschia caucasica, Gasteropteus aculeatus*), early stages evaluation (a,f: *Gobius* sp.), ichtyoplankton collection (b,c)

Fish stocks state estimation and current exploitation. Optimization ways for studied fish species stocks

For both species, the current exploitation state through the current point position (Lc, Fc) on the Y/R diagram was analysed, building with the Beverton-Holt model (Sparre et al., 1989; Ricker, 1958) (4 a,b,c, 5 a,b, 6 a,b, 7 a,b,c,). The state of the fish stocks was analyzed through the positioning of the current point (Pc) with the help of the coordinates which express the length with the selectivity Lc = 0.5 and fishing mortality (F), on the isoplets diagram Y/R, resulted from application of Beverton-Holt model (3 a,b,c, 4 a,b, 5 a,b, 6 a,b,c,). The fishing optimisation was realised by exploitation modeling through changing the fishing mortality and recalculation of the optimum biomass and Maximum Sustainable Yield using analytical methods *Virtual Population Analyse* and Thomson-Bell predictable model (Fig. 3 a,b,c, 4 a,b, 5 a,b, 6 a,b,c). The analysis and optimisation are effectuated for a standard fish catch equal with 10 t (Table 3).

Table 3. Estimation of the exploitation state and optimisation measures

Species/ area		Fc	Lc	Ca	Ba	Fo	Y/ Rc	Y/ Ro	Bo	Co MSY	α
Carassius gibelio	Seine net a=50	1.3	25	10	23.57	2.53	95	101	19.4	10.88	1.088
Rutilus rutilus	Seine net a=50	0.73	27	10	34.15	1.87	60	67	23.88	12.16	1.216

Symbols used: (Fc=current fishing mortality, Lc=length at which 50% of the fish is retained, Ca=Current catch, Ba=current biomass, Fo=optimum fishing mortality, Co / MSY=Maximum Sustainable Yield, Bo= optimum biomass Y/Rc= current Yield per recruit, Y/Ro= optimum Yield per recruit, $\alpha = MSY_{10tone} / 10$)

The formula for sustainable catch is used for the following year evaluation:

$$MSY_{n+1} = \alpha * C_n$$

where α is a coefficient: $\alpha = MSY_{10tons} / 10$;

The giebel carp and the roach samples comprised individuals aged.between 3 -7. The frequency distribution depends by the size of restocking. The dominant age class is 4-5 for the species giebel carp and roach. The fish stocks are under exploitation because of fishing nets, these species being subjected to a bigger fishing intensity.

The administration of the stocks on the durable principles and implementation of the correct strategy depend decisively on the data quality concerning the catch size. Lack of data or unreal records led to the underestimation or overestimation of some parameters with negative results about the current state and the exploitation of the stocks. The improvement of the quality of statistics and effort data is the actual priority for fisheries all over Tasaul Lake. Obviously, the risk of the underestimating the MSY value appears because of the fishing quantity unrecorded, which is higher in recent years. **The level of the resources and of the catches is dependent on the yearly restocking in the actual exploitation regime.**

Fishing effort and size of the commercial catches are absolutely necessary elements in fish stock assessment. The lack of these essential elements and unreliable records led to underestimating or overestimating some parameters.

Fish population restocking in Tasaul Lake

The restocking evaluations have been done under a partnership created between specialists and representatives of NIMRD (ESTROM-TASAUL Project) with a bilateral project of the "Ovidius" University Constanta and University of Wisconsin - USA, involving a large number of students and post-graduates, the National Agency for Fisheries and Aquaculture and SC PESCOM COMPANY SRL.

Tasaul Lake fish re-stocking was done based on all study knowledge regarding the environment and water quality and chemistry, water temperature, the surface of the lake, the natural productivity, water inflow/source of origin, the nature of the lake bottom, vegetation coverage, suitable fish species, possible to grow in the lake, etc. All these have been studied, the main conclusions resulting as follows:

- The causes of the degradation process were the eutrophication and silting/mud off processes. Tasaul Lake, for a long time a fisheries basin, currentlu has no good conditions for natural reproduction because of the lake's depths variability and due to reduced surface of vegetation;
- Rare occurrence and areas of submerged vegetation clumps of reeds do not form a continuous belt, but are stronger present next to the two islands from the middle of the lake and also near the river Casimcea zone, which is the main lake inffluent;
- Fish production is affected because of the nature of the lake's bottom which is covered with
    - fine mud debris, in the mid-eastern side of the lake, more suitable for carp growth,
    - hard bottom or loamy clay in the western side, appreciated by the pike perch for growth,
    - sandy bottom in abundance in the southern-eastern side, where bleak, roach and gobies are met in big number, being the main specifical food for voracious species, like pike perch;
- Chironomidae larvae, Oligochaetae worms, Tubicidae, which are differently spread, are the favorite food of cyprinids (carp, bream, roach), and more developed in the eastern part of the lake and this explains the existence of fish species, dominated by carp rearing and fishing in an area without any supplementary food necessities.

For a good fish population and equilibrium, for avoiding the competition for food, it was concluded that artificial, supplementary food administration was necessary, which was not practiced in the Tasaul Lake; or the repopulation with economic valuable species such as roach, rudd, carp, giebel carp, bream, Asian cyprinids, perch which are purchased from other farms, obtained and transferred from fish nurseries and juvenile rearing station as repopulation material in Tasaul Lake.

Lake Tasaul was populated, in the autumn of 2006, with the following biological material: carp one summer old, mixed Chinese Carps with 40% first summer old and 60% second summer old. The carp is reared for a number of years in accordance with the market preferences. Data were collected from SC PESCOM COMPANY SRL and processed by the National Agency for Fisheries and Aquaculture.

The giebel carp uses to appear in Tasaul Lake from tributaries and is rarely populated by man, but holds the largest production of fish, is the most resistant fish to environment aquatic conditions, using best the lake's natural food, and is most marketable due to consumers' preference and the lower cost.

The fish production of Tasaul Lake main species in the last three years is presented (Fig. 9 a,b,c).

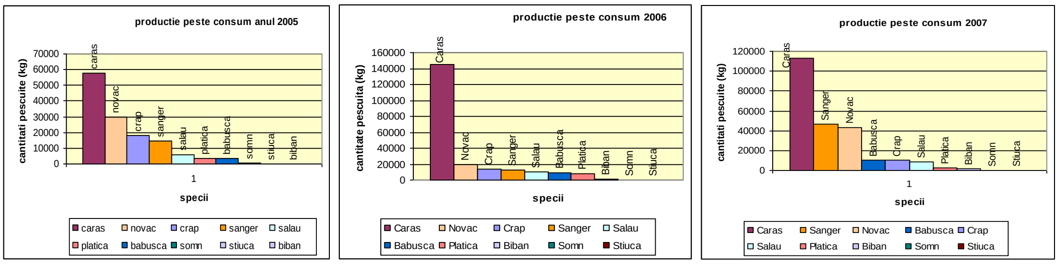


Fig. 9 a, b, c. The fish production of Tasaul Lake in 2005, 2006, 2007; fish quantities - kg per species (Paris Paris/PESCOM Fish Farm: Annual Production Report)

The main remarks of seasonal evolution of fish population in Tasaul Lake are presented. When **winter** temperatures permit, fishing is allowed and catches are dominated only by silver carp, bighead carp and giebel carp.

During **spring,** water temperature rises, vertical circulation is activated and minerals which are concentrated in the superficial layers of the substrate are dissolved in the entire water column, stimulating the plankton development. The unexpected temperature variations produce very large losses and the powerful winds lead to oxygen enrichment of water. It is developed the production of zooplankton which is important for the giebel carp and bighead carp food consumption; the carp growth is met in the next coming period.

Summer accelerates biochemical processes of water; oxygen deficiency and frequencies of morning hypoxia occurs, followed by the presence of fish in the water surface, observed as "pipetting". Mass mortality, which follows, affects the fish production. The carp feeding is stopped at the temperatures above 25°C. Giebel carp is best resistant at the oxygen deficit and this explains its production; the pike perch is the sensitive species.

Autumn is the season when fishing records the intensive production, based on giebel carp and Chinese carps (Fig. 10).

Taking all of these in consideration, it results that fish production in Lake Tasaul is below the natural potential from the trophic point of view (natural food consuming) and needs to be maintained in continuous full balance, by improving the restocking scientific formula, maintaining the water quality (class-for fish), to obtain an annual production of 400-500 tons of high quality fish, according with the market requests. In 2007, the production obtained was 101.7 kg/ha, based on carp production. Fig. 9 reflects this, compared with previous years.

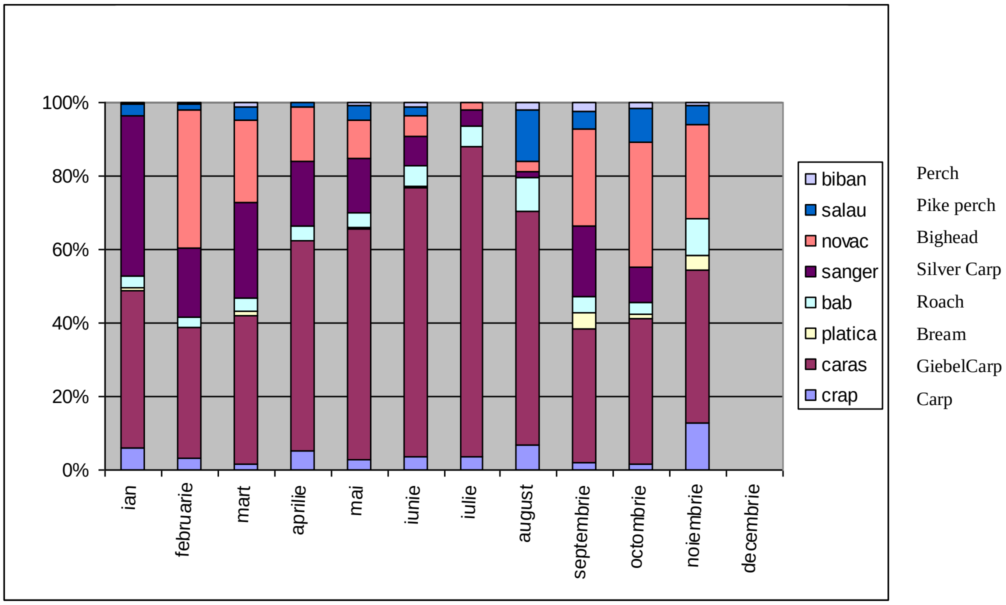


Fig. 10. Fish production by species in 2007
(Paris Paris/PESCOM Fish Farm: Annual Production Report)

Angling, sports, recreational fishing and poaching

- ➢ In Tasaul Lake the recreational, sport fishing and angling are practiced, by using different kinds of rods, under conditions established by the central public authority which is responsible for fisheries and aquaculture (National Agency for Fisheries and Aquaculture) and based on permit cards for each fisherman, approved by NAFA, in accordance with a fishing agreement and regulation of the lake administrator, which is SC PESCOM COMPANY SRL.
- The number of sport fishermen registered in 2007 is shown in the next chart (Fig. 11).
- A prohibition period for all fish species it is established for 60 days starting from the 15t[h] of April, according to Romanian law. The fee for recreational fishing is 20 €/day/person.

- ➢ Fish poaching is another problem that leads to an alarming decline in fish stock. It is an illegal action itself, using illegal means, such as electrical current that affects also juvenile stages of fish, or explosive substances. The lake protection and control by specialized guarding personnel should fight against poaching, robbery, destruction and degradation, including environmental pollution.

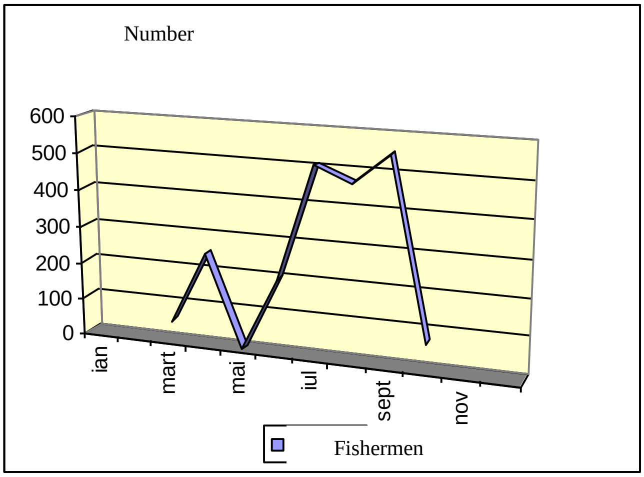


Fig. 11. The fishermen number estimated in 2007 based on recreational fishing statistic (Paris Paris/PESCOM Fish Farm: Annual Production Report)

CONCLUSIONS AND RECOMMENDATION

The recommendations towards the reduction of eutrophication and a more sustainable fishery management in Lake Tasaul are:

- Carrying on the research for ecological reconstruction of the Tasaul Lake for the improvement of the habitat quality and fish communities (including the nutrient input reducing of Casimcea River by and fighting point sources);
- Improving the integrated monitoring (including hydrology, nutrients, primary production etc.) for increasing the fisheries quality data for a better fish stock management;
- Sustainable use of the commercial species through the control of the input (the fishing effort) and output (the fish landed) for species conservation (yearly restocking, detailed statistics about net catches and angling, and estimate poaching.

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