## ASSESSMENT OF ECOLOGICAL STATUS OF SOME BULGARIAN RIVERS FROM THE AEGEAN SEA BASIN BASED ON BOTH ENVIRONMENTAL AND FISH PARAMETERS

### Milen VASSILEV, Ivan BOTEV

Institute of Zoology, Bulgarian Academy of Sciences, 1 Tsar Osvoboditel Blvd., Sofia 1000, Bulgaria The present study is a part of the Supplemental Water Quality Survey, which aims the preparation of the typology of surface water bodies based on the European Water Framework Directive (EU-WFD).

The goal of the study was to assess the ecological status of the Bulgarian part of the rivers from the Aegean Sea Basin: Struma/Strimon, Mesta/Nestos and Maritsa/Evros using fish and some environmental parameters. The field survey was carried out in September-October 2006. A total of 36 sites within the watersheds of the three rivers were sampled.



Sampling both for physicschemical parameters and fish species was done synchronous at sites, selected and combined with the actual monitoring sites of the West Aegean Sea River Basin and East Aegean Sea River Basin.

Struma River Basin 8 sites.

Mesta River Basin 3 sites.

Dospat River Basin 1 site.



### **Material and Methods**

Only fish data obtained by electric fishing (single upstream passing) were used. The chosen river length for sampling was 100 m (except for some small or very polluted rivers, where this distance was shorter). The partial sampling method was used in cases when different types of mesohabitats were presented. The collected specimens were identified on-site to species level.





A total of 24 fish species were recorded. Among them, 3 species were selected as indicative for the Bulgarian rivers of the Aegean Sea Basin: Trout (Salmo macedonicus), Maritsa barbel (Barbus cyclolepis) and Chub (Leuciscus macedonicus). The latter two species were most abundant and widespread in the region. As important biological parameters were considered also the presence and abundance of some sensitive (stenobiont) species like Minnow (Phoxinus phoxinus) and Struma loach (Barbatula bureschi), as well as the availability of predatory species (big Chubs, Wels catfish, Pikes, etc.).

The following biological parameters fish diversity, density and biomass, age-size structure, ocular observed health status, abundance of juveniles. The ecological status was expressed as an index ranging from 5 (high ecological status) to 1 (bad ecological status).

## **Quantitative indices**

#### **Trout zone**

#### Indicative species River trout (Salmo macedonicus)

ES	high	good	moderate	poor	bad
ind/ha	>500	100-500	50-100	1-50	no fish
kg/ha	>40	10-40	5-10	1-5	no fish
age(size) groups	>4	2-4	1-2	1 (juveniles)	no fish

#### Carp zone

#### **Total biomass (non trout species)**

ES	high	good	moderate	poor	bad
kg/ha	>290	100-290	50-100	1-50	<1 / no fish

### Age (size) structure of carp indicative species

Maritsa barbel (Barbus cylolepis) and Aegean chub (Leuciscus macedonicus)

ES	high	good	moderate	poor	bad
age(size) groups	4-5	2-4	2	1	single juv./ no fish

#### **Health status**

#### % share of fish with external marks of diseases

ES	high	good	moderate	poor	bad
%	<1	1-5	5-10	10-25	>25

## **Environmental parameters**

The following environmental parameters for assessment of ecological status of sites were used:

- Underwater cavities
- Submerged trees
- Barrages
- Presence or absence of swift current stretches and pools
- Type of substratum
- Flow
  - Maximum width of the river stretch
  - Maximum depth of the river stretch
  - Temperature
  - pH
  - Dissolved oxygen
  - Conductivity
  - Chemical oxygen demand (COD)
  - Biochemical oxygen demand (BOD<sub>5</sub>)
  - Total phosphorus (TP)
  - Total nitrogen (TN)
  - Suspended substances (SS)

#### Principal component analysis was used to summarize the major patterns of variation within some of environmental parameters



The first axis is related to indicators of trophic status (TP, TN) as well as to condition. lt oxygen contrasts the sites with high values of TP, TN, conductivity, COD, BOD5 and with low ones for dissolved oxygen, plotted right the part on of diagram, with the rest of sites, which were with low and average values about TP, TN, COD,  $BOD_5$ , and higher values for dissolved oxygen. Axis 2 is related to pH. temperature and hydrological parameters flow, maximum width and depth.

The major patterns in fish species distribution within each sampled site were determined by Detrended correspondence analysis (DCA).



length The of gradient standard expressed in deviation units of species turnover (5.2 SD) of the first axis denote a good separation of the species along the first axis. This axis was positively correlated with conductivity (r=0.69, p<0.001), TP (r=0.51, p<0.01), BOD<sub>5</sub> (r 0.38, p<0.05), COD (r=0.34, p<0.05) and correlated negatively with dissolved (r=-0.35, oxygen p<0.05). This denote that the first axis is mainly related with the trophic status of the sites sampled.

Legend: Sa.ma. = Salmo macedonicus; Es.lu. = Esox lucius; Al.bi. = Alburnoides bipunctatus; Al.al. = Alburnus alburnus; As.as. = Aspius aspius; Ba.cy. = Barbus cyclolepis; Ca.gi. = Carassius gibelio; Ch.va. = Chondrostoma vardarense; Go.go. = Gobio gobio; Le. ma = Leuciscus macedonicus; Ph.ph. = Phoxinus phoxinus; Ps.pa. = Pseudorasbora parva; Rh.se. = Rhodeus amarus; Ru.ru. = Rutilus rutilus; Vi.me. = Vimba melanops; Ox.bu. = Oxynoemacheilus bureschi; Co.sp. = Cobitis sp.; Co.rh. = Cobitis rhodopensis; Co.st. = Cobitis strumicae; Si.gl. = Silurus glanis; Le.gi. = Lepomis gibbosus; Pe.fl. = Perca fluviatilis; Ne.fl. = Neogobius fluviatilis; Pr.ma. = Proterorhinus marmoratus.

## **Assessment of ES by sites**

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		Indices								
Basin/Site	Species	TB kg/ha	TD ind/ha	TB/TD	Bi kg/ha	Di kg/ha	Bi/Di	% Bi/TB	% Di/TD	
Struma										
<b>S</b> 1	7	185	6800	27.2	31	600	51.7	16.8	8,8	
<b>S</b> 3	7	340	7000	48.6	330	6300	52.4	97.1	90	
S4	6	265	6200	42.7	235	5000	47	88.7	80.6	
S5	6	350	8000	43.8	302	5300	60	86.3	66.2	
<b>S</b> 6	6	231	13200	17.5	193	7100	27.2	83.6	53.8	
S7	4	169	9100	18.6	152	6300	24.1	89.9	69.2	
S8	3	135	2500	54	131	2000	65.5	97	80	
S9	9	263	5400	48.7	252	2500	100.8	95.8	46.3	

	Indices								
Basin/Site	Species	TB kg/ha	TD ind/ha	TB/TD	Bi kg/ha	Di kg/ha	Bi/Di	% Bi/TB	% Di/TI
Mesta									
M3	3	65	1400	46.4	62	1100	56.4	95.4	78.6
M4	2	215	9600	22.4	215	9600	22.4	100	100
M6	5	330	12100	27.3	290	7100	40.8	87.9	58.7
Dospat									
D1	2	5	2100	2.4	1	200	5	20	9.5
Arda									
A1	1	24	100	240	24	100	240	100	100
A3	9	286	16400	17.4	279	10300	27.1	97.6	62.
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		Indices								
	Basin/Site	Species	TB kg/ha	TD ind/ha	TB/TD	Bi kg/ha	Di kg/ha	Bi/Di	% Bi/TB	% Di/TD
1	Tundzha			•		•	•			
111 3	T1	2	55	1600	34.4	55	1500	36.7	99.9	93.8
1	T2	9	300	8100	37	245	5900	41.5	81.7	72.8
	T3	7	252	6900	36.5	209	5300	39.4	82.9	76.1
1	T5	9	145	12000	12.1	67	6200	10.8	46.2	51.7
1	Τ8	11	280	10800	25.9	106	600	176.7	37.9	5.6
15	T10	5	71	5000	14.2	61	3800	16	85.9	76
	T11	13	581	10400	55.9	427	3900	109.5	73.5	37.5

	Indices									
Basin/Site	Species	TB kg/ha	TD ind/ha	TB/TD	Bi kg/ha	Di kg/ha	Bi/Di	% Bi/TB	% Di/TD	
Maritsa										
MA2	4	57	3000	19	54	2000	27	94.7	66.7	
MA4	9	329	10700	30.8	286	3000	95.3	86.9	28	
MA5	6	145	5300	27.4	135	3700	36.5	93.1	69.8	
MA8	8	250	27000	9.3	12	1200	10	4.8	4.4	
MA9	2	140	5300	26.4	140	5300	26,4	100	100	
MA10	9	134	9900	13.5	41	2100	19.5	30.6	21.2	
MA11	6	37	3300	11.2	35	1400	25	94.6	42.4	
MA12	10	363	11400	31.8	357	7500	47.6	98.5	65.8	
MA14	10	144	12100	11.9	99	5300	18.7	68.8	43.8	
MA15	10	353	8000	44.1	206	3700	55.7	58.4	46.2	
MA17	1	2	400	5	0	0	0	0	0	
MA18	7	60	6400	9.4	48	1900	25.3	80	29.7	
MA19	4	40	2600	15.4	0	0	0	0	0	
MA22	12	346	11000	31.4	117	2100	55.7	33.8	19.1	
MA23	8	142	6900	20.6	97	2400	40.4	68.3	34.8	

