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PRELIMINARY RESULTS OF USING EXTERNAL ATTACHED RADIO-TRANSMITTERS TO TRACK THE MOVEMENTS OF ROMANICHTHYS VALSANICOLA DUMITRESCU, BANARESCU & STOICA, 1957

Adrian Ionaşcu, Nicolae Crăciun

Key words**:** *ecology, telemetrie, endemism, habitat use, home range*

INTRODUCTION

The *asprete,* (Romanichthys valsanicola Dumitrescu, Banarescu & Stoica, 1957) is an extremely endangered species, endemic to a Romanian river: Valsan. Romanichthys valsanicola is the fish genus having the smallest range in Eurasia and was considered by Maitland (1991) the most endangered freshwater fish species in Europe. Once Palearctic the asprete is now a preglaciar relict, which can be found in our days only in the river Valsan. Found in cold, clear, fast-flowing areas, hidden under rocks. Territorial. The asprete is a predator feeding exclusively on aquatic invertebrates: larvae of rheophilic insects, mainly mayflies and stoneflies.

As part of an ongoing study into the behaviour and ecology of asprete, eight radio-tagged asprete were tracked in the River Valsan, a central roumanian stream, from august 2004 to December 2004. Unfortunately two of them had been lost, and one was released, and his tracking was cancelled, due to his small size. The radio-tracking procedures were obstruct during July, August and November because of high rainfall who caused the River Valsan to flood repeatedly, with these floods being of unusual duration and severity.

Day-night alternation represents a major zeitgeber which rules the use of time and space by most teleost fishes (Thorpe, 1978; Helfman, 1986; Boujard & Leatherland, 1992). Depending on species, age, size and environmental conditions fish may use the same habitats all day long both for feeding and resting (e.g. Salmo trutta, Heggens at all, 1993; Ovidio at all., 1998) or different habitats for different activities at different times on the 24 h cycle (Cyprinids, Clough, 1997; Fredrich et all, 1997). Although this is not a rule of thumb, residence and feeding areas, when spatially distinct are frequently connected by functional links: fish exploit a feeding area from a precise resting place (or set of neighbouring resting places), move to another resting place as they select another feeding area and vice-versa (Baras, 1992, 1996, Fredrich et all, 1997). For these reasons, the daily positioning of fish equipped with telemetry devices, coupled with continuous tracking over some 24-h cycles, may give a representative picture of the way fish utilise their environment. For the small fishes like the asprete the small tags used with small batteries impede the tracking for more than 5-6 days.

The asprete was traditionally described as a sedentary species (Banarescu, 1965, 1994). Relatively little is known about space use by asprete in rivers. In this study, radio-tagged asprete were used to obtain more detailed information on the spatial behaviour of this species in river. Initial tracking sessions were designed as a pilot study to determine a tracking protocol. This aimed to determine the number of location records required to describe a stable range, an issue that has rarely been addressed in studies of river fish. Exceptions are (Natsumeda 1998) and Snedden et al. 1999). An optimal sampling interval was also sought. The effects of sampling interval have been considered when radio-tracking river fish (Lucas and Batley 1996; Baras 1998; Ovidio et al. 2000), and autocorrelation between location records has also been considered (Chapman and Mackay 1984).

MATERIALS AND METHODS

Study area

All of the asprete in this study were caught, tagged and released in river Valsan. The River Valsan, situated in the centre of Romania is a typical medium size mountain river. River Valsan is situated in the middle section of Arges River, a tributary of the Danube. Mean channel width vary between 4 and 8 m. The study was conducted in a 1.5 km reach, in the middle section of the River Valsan, 40 km up to the confluence with the River Arges**.**

The bed of the River Valsan where the asprete is present could be described as rocks, gravel and sand from Oligocen and Neogen origin. The bed is constitute also of clay (Eocen Inferior). The sediments is constitute of 54-86% rocks and clay, 14-45,99% gravel and sand and 0,01-0,20% mud. The main river study area had an average width of 6 - 8 metres and had a sinuous course. Depths ranged from 1,5 m in the deepest pools to only a few

centimetres in the shallowest riffles. The average depth is about 15 – 20 cm.

Equipment and tag attachment

Asprete were captured by electrofishing. Details of the asprete subsequently referred to in this paper are shown in Table 1. Asprete were identified using a letter of the alphabet. Asprete were tagged using externally backpack Biotrack micropip AG 337 activity sensing radio-tags (Biotrack Ltd., Wareham, U.K.). These small tags measure 7 (W) x 4 (H) x 13 mm (L) and weight only 0,35g. Each radio-tag transmitted on a unique frequency within the 148 MHz bands allocated to wildlife radio-tags in the E.U. (Kenward 2001). The taggs are attached from the back of the fish with sterilised medical needle and thread . Fish is cross over once under the dorsal fin, according to a method used by Beaumont et all (1996).

All surgical equipment used during the tag implantation procedure had been sterilised. The operator wore sterile gloves throughout the procedure described below; all tagging was carried out on the riverbank. Each asprete was placed in 1:1000 dilution of the anaesthetic quinaldin, until it no longer responded to external stimuli. The fish was then placed onto a plastic operating table. Scales for ageing purposes were removed from an area between the dorsal fin and the lateral line. After full recovery the asprete were released back into the wild at the site of capture.

Operating times ranged from two to three minutes and time to recovery ranged between nine and twenty minutes. Due to the small dimensions the Pip 337 tag has a short battery life so the period in which the animal gets accustomed with the tag was reduce to only one and a half or two days. From our experience in tagging fish and following published accounts data from the first 24-48 hours following a tagging operation was excluded from any analysis.

Between August 2004 and December 2004, the radio-tagged asprete were located using a Sika radio receiver and a five element Yagi antenna.

Data collection

The move and the location of each asprete were recorded using a fixed point as landmark. Fixes were taken on the riverbank. Each fish was monitored for at least one minute, when located.

Fix positions were obtained by approaching the fish as closely as possible, and estimating its position in rapport to the fixes taken on the riverbank. After identifying a fish's position, observers marked the bank at a point perpendicular to its position and measured the distance to the nearest stake. The positions were used to determine the home range (the difference between the furthest upstream and downstream points) of each fish.

Fixes were obtained every two hours in order to build up a picture of both activity patterns and the range of movements of the fish.

During this period we have tagged 8 fish but we have lost three of them, two were lost in august, during a severe flood, the third, the smallest (8,5 cm fork length) seems to be too small for the tagg use, and was released after 1,5 tracking days. After the fish were released there were one or two days of repose, in order to the fish to get accustomed with the tagg. Then tracking took place for three cycles of 24 hours, every two hours. All-day successful tracks took place on the 25th-27 September, 22 Th - 24 Th October, 12 Th -14th November, 10 – 12 Th December.

Table 1. The standard length and age at capture of asprete radio-tagged in the Valsan River

Asprete	Standard length (mm)	Age	Date of capture and tag implantation
A	10,2	3+	20.08.04
B	10,1	3+	20.08.04
C	10,5	3+	22/09/04
D	11	3+	20/10/04
E	10,2	3+	11/11/04
F	8,6	2+	11/11/04
G	10,3	3+	08/12/04
H	10,8	3+	08/12/04

RESULTS AND DISCUSSIONS

Movements

Estimates of fish movement are minimum estimates of displacement. Fish do not move in a straight line (Guy et al. 1994; Rogers and Bergersen 1995), so the more times a fish are located in a day, the more total movement will increase. Better estimates of true movement can therefore be obtained if continuous tracking schedules are employed, or if fish are at least monitored frequently over a 24-h period.

Units of measure of fish movements reflect the precision that was conferred when the data was acquired. For instance, as fish were located numerous times over a seventy-two hour period, we express movement as minimum displacement per hour (MDPH).

During the first period of the study 5 asprete, tagged with radio-transmitters, were successfully located in 190 positional fixes between September 2004 and December 2004. Another two fish tagged were lost, both in August. In order to minimise the stress upon radio-tagged fishes the movement of the radio-tagged fishes were not observed in the first $1_{1/2}$ - 2 days after the implantation of the taggs. Although the fish move also up-stream, the net movement of the radio-tagged fish was in a downstream direction from the point of release.

Tracking data for each fish is shown in Table 2. Generally, the fish seemed to recover in a few hours. All fish moved downwards hundreds of meters in the first hours after release, but some fish move also downstream for long distances during the 72 hours tracking. Fish appeared to spend periods in a restricted area before relocating, always downstream. They never return to areas of previous occupancy, or to the area of release.

Habitat use

Interest in evaluating the habitat used by fish has been a cornerstone of telemetry
projects and one of the primary reasons for doing telemetry study. The overriding question is do fish spend more time in some habitats than would be expected based on the availability of those habitats. When this occurs, this behavior is said to be selective. Animals are presumed to use habitats that confer fitness, so that by studying habitat use, biologists can hope to assess what habitat features may be limiting. By studying where animals allocate their time, one can gain insight into how they meet their requirements for survival.

The fish live hidden almost all of the time under the stones, or on the gravel, and theirs homocromia make them extremely difficult to observe, even in the clear, shallow waters.

Activity patterns

Although the fish descriebed as most of all nocturnal, the analysis of its 24 hours movement patterns shows that the fish move a lot also during the day. The number of the tracked fish is for the moment insufficient to get enough information to drawn clear conclusion. But we have observed that the fish shows a lack of movements in late night and early day.

Home range

Home range is defined as "that area traversed by the individual in its normal activities of food gathering, mating and caring for young" (Burt 1943). The maximal upstream and downstream locations are frequently used to define the home range, often expressing range area as the longitudinal displacement multiplied by mean stream width (Minns 1996; Huber and Kirchhofer 1998). This approach gives a good indication of the overall area available to the fish but may oversimplify the understanding of space use. Rogers and Bergersen 1995 consider movement (MDPH) and home range are highly correlated. The entire home range concept may not be as appropriate for fish as it is for terrestrial mammals (especially those with altricial young). Burt's (1943) original home range concept was developed for mammals as the area used for foraging that surrounded a permanent home site. Fish seem to display more transitory ranges (Winter 1977; Cook and Bergersen 1988; Jones and Rogers 1999). Changes in home range areas appear to occur with changes in forage, water temperature (Savitz et al. 1993), or body size (Minns 1995), rather than intraspecific competition.

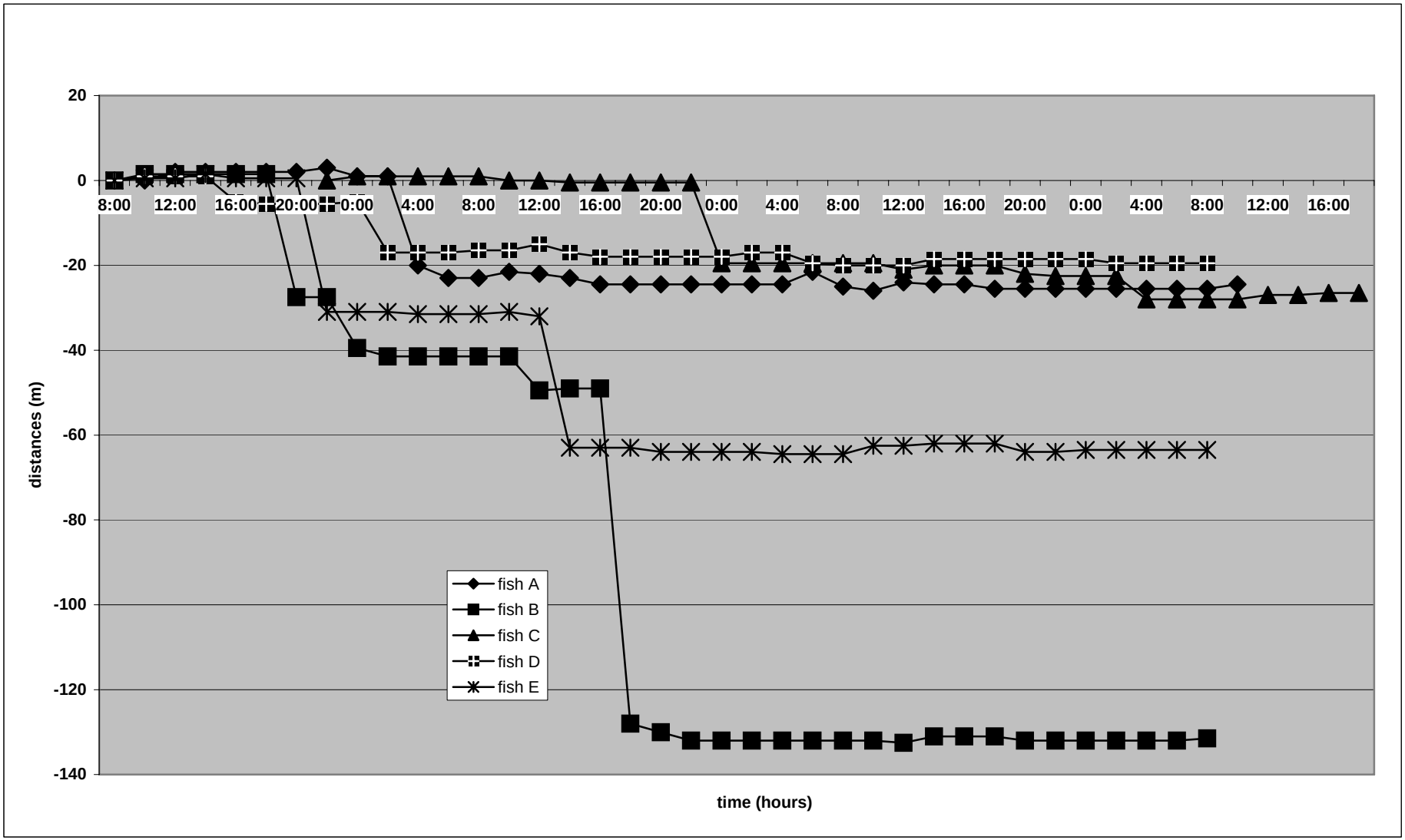
Home ranges still increase in size if a fish decides to relocate to new centers of activity on a regular basis, requiring the investigator to subjectively decide what location data to include in the analysis. I believe this is the case for the aspretes I was radiotracked.

Table 2. Home range and mobility of the five asprete Romanichthys valsanicola radio-tracked in the River Valsan

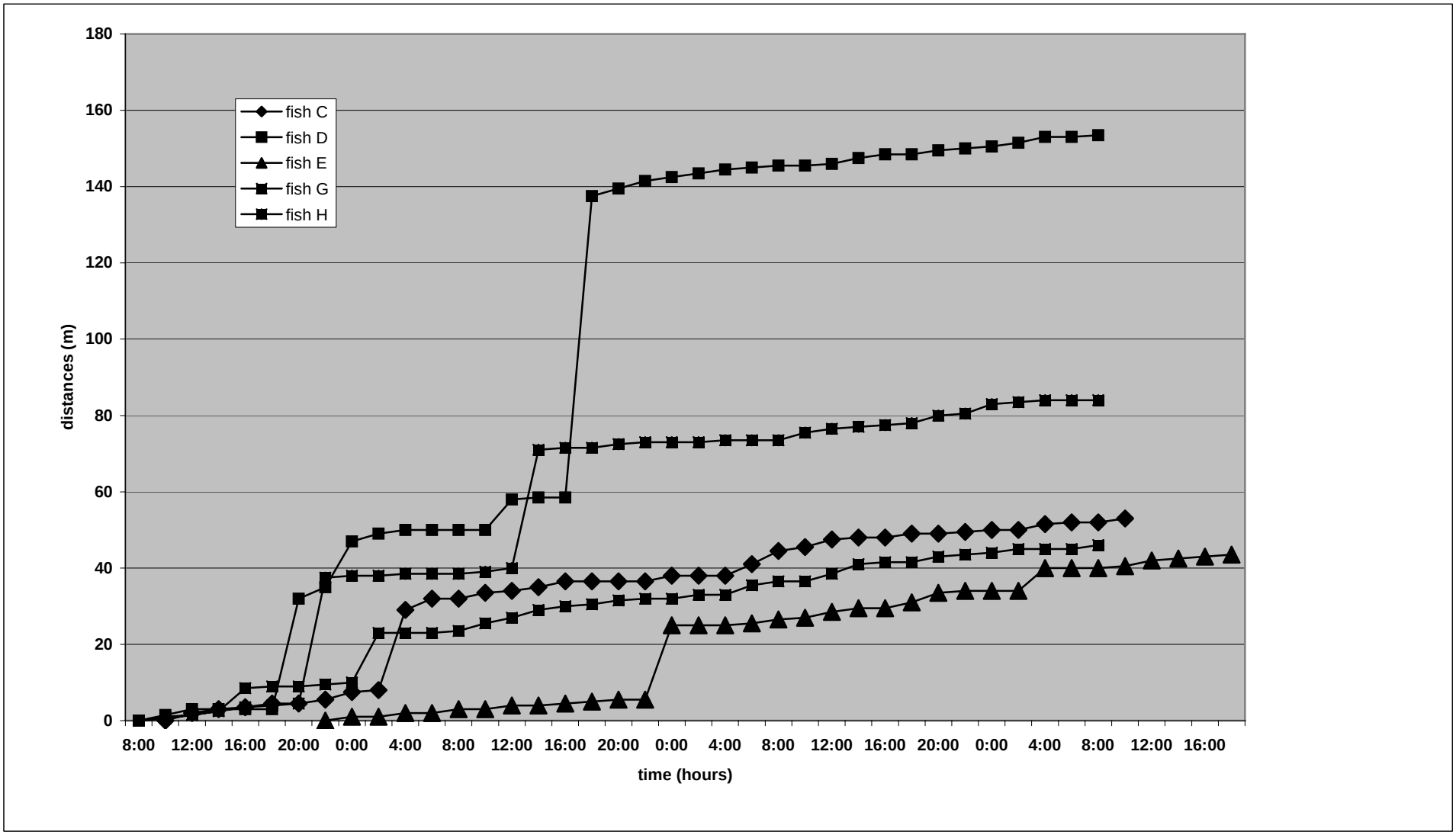
Fish		Home range over 3 days	Distance travelled over 3 days	minimum displacement per hour (MDPH) m/h
n°	FL (mm)	Size (m)	Total (m)	
C	10	28,5	53	0,7361
D	10,5	134	153,5	2,1319
E	8,5	29	43,5	0,6041
G	9,8	21	46	0,6388
H	10,4	65,5	84	1,1666

Distances traveled upstream and downstream in the 72 hours of the tracking protocol (home range)

Time	Distances					Time	Distances				
	Fish C	Fish D	Fish E	Fish G	Fish H		Fish C	Fish D	Fish E	Fish G	Fish H
8:00		0		0	0	2:00	-24.5	-132	-19.5	-17	-64
10:00	0	1.5		1	0.5	4:00	-24.5	-132	-19.5	-17	-64.5
12:00	2	1.5		1	0.5	6:00	-21.5	-132	-19.5	-19.5	-64.5
14:00	2	1.5		1	1.5	8:00	-25	-132	-19.5	-20	-64.5
16:00	2	1.5		-5	0.5	10:00	-26	-132	-19.5	-20	-62.5
18:00	2	1.5		-5.5	0.5	12:00	-24	-132.5	-21	-20	-62.5
20:00	2	-27.5		-5.5	0.5	14:00	-24.5	-131	-20	-18.5	-62
22:00	3	-27.5	0	-5.5	-31	16:00	-24.5	-131	-20	-18.5	-62
0:00	1	-39.5	1	-5	-31	18:00	-25.5	-131	-20	-18.5	-62
2:00	1	-41.5	1	-17	-31	20:00	-25.5	-132	-22	-18.5	-64
4:00	-20	-41.5	1	-17	-31.5	22:00	-25.5	-132	-22.5	-18.5	-64
6:00	-23	-41.5	1	-17	-31.5	0:00	-25.5	-132	-22.5	-18.5	-63.5
8:00	-23	-41.5	1	-16.5	-31.5	2:00	-25.5	-132	-22.5	-19.5	-63.5
10:00	-21.5	-41.5	0	-16.5	-31	4:00	-25.5	-132	-28	-19.5	-63.5
12:00	-22	-49.5	0	-15	-32	6:00	-25.5	-132	-28	-19.5	-63.5
14:00	-23	-49	-0.5	-17	-63	8:00	-25.5	-131.5	-28	-19.5	-63.5
16:00	-24.5	-49	-0.5	-18	-63	10:00	-24.5		-28		
18:00	-24.5	-128	-0.5	-18	-63	12:00			-27		
20:00	-24.5	-130	-0.5	-18	-64	14:00			-27		
22:00	-24.5	-132	-0.5	-18	-64	16:00			-26.5		
0:00	-24.5	-132	-19.5	-18	-64	18:00			-26.5		



Distances traveled upstream and downstream in the 72 hours of the tracking protocol (home range)



Mobility (total distances traveled by the fishes) during the 72 hours of the tracking protocol

Mobility (total distances traveled by the fishes) during the 72 hours of the tracking protocol

Time	Distances					Time	Distances				
	Fish C	Fish D	Fish E	Fish G	Fish H		Fish C	Fish D	Fish E	Fish G	Fish H
8:00		0		0	0	2:00	38	143.5	25	33	73
10:00	0	1.5		1	0.5	4:00	38	144.5	25	33	73.5
12:00	2	3		1.5	1.5	6:00	41	145	25.5	35.5	73.5
14:00	3	3		2.5	2.5	8:00	44.5	145.5	26.5	36.5	73.5
16:00	3.5	3		8.5	3.5	10:00	45.5	145.5	27	36.5	75.5
18:00	4.5	3		9	4	12:00	47.5	146	28.5	38.5	76.5
20:00	4.5	32		9	4.5	14:00	48	147.5	29.5	41	77
22:00	5.5	35	0	9.5	37.5	16:00	48	148.5	29.5	41.5	77.5
0:00	7.5	47	1	10	38	18:00	49	148.5	31	41.5	78
2:00	8	49	1	23	38	20:00	49	149.5	33.5	43	80
4:00	29	50	2	23	38.5	22:00	49.5	150	34	43.5	80.5
6:00	32	50	2	23	38.5	0:00	50	150.5	34	44	83
8:00	32	50	3	23.5	38.5	2:00	50	151.5	34	45	83.5
10:00	33.5	50	3	25.5	39	4:00	51.5	153	40	45	84
12:00	34	58	4	27	40	6:00	52	153	40	45	84
14:00	35	58.5	4	29	71	8:00	52	153.5	40	46	84
16:00	36.5	58.5	4.5	30	71.5	10:00	53		40.5		
18:00	36.5	137.5	5	30.5	71.5	12:00			42		
20:00	36.5	139.5	5.5	31.5	72.5	14:00			42.5		
22:00	36.5	141.5	5.5	32	73	16:00			43		
0:00	38	142.5	25	32	73	18:00			43.5		

Indicators values of water quality in the river Valsan

Data of sampling	20.08.04	22.09.04	20.10.04	11.11.04	08.12.04
Debt (qm * s^{-1})	1,38	0,375	0,763	1,26	1, 14
Water temperature (°C)	17,0	11,0	7,0	4,0	2,0
pH	6,9	7,1	7,4	7,3	7,5
Dissolved Oxygen (mg/l)	8,3	8,5	9,5	10,3	10,8
CBO5	0,5	1,5	1,2	0,8	1,5
CCO-Mn	8,5	5,1	4,3	4,5	4,2
Chloride	10,0	11,0	13,0	16,0	19,0
Sulfate (SO_4)	52	35	64	114	32
Calcium	24,0	35,2	44,1	33,6	43,2
Magnesium	13,3	15,8	7,2	10,8	15,4
Sodium	7,0	6,2	7,2	9,2	9,8
Ammonia	0,0	0,0	0,0	0,0	0,0
Nitrite	0,0	0,0	0,0	0,0	0,0
Nitrate	2,3	2,3	1,3	4,5	5
Suspensions	12,0	8,0	12,0	16,0	8,0
Total hardness	6,4	6,7	7,8	6,8	8
Carbonate hardness	2,8	2,0	3,8	3,6	3,8
Bicarbonate (HCO_3)	79,2	105,3	91,2	115,0	132,4

CONCLUSIONS

This is the first study on the movement of the asprete in his natural environment. The main objective is acquiring information on general movements, home range, and on his behaviour in general. The efforts on the pursuing of fishes are focused on the estimation of home-range of the asprete. We have gained some primary information on the movements of the fish and on the utilisation of the habitat during the 24 hours cycles. From these information we have acquire the distances, periods and the pace of displacements between the succesive locations. We have also calculated a movement hint during a period of time (Kenward, 1992). We have also acquired some information on his fidelity to a site.

The use of radio-telemetry has allowed valuable data to be collected on the habitat usage of asprete during fall and winter. The asprete was traditionally described as a sedentary species and our study confirm this hypothesys.

Adult asprete showed predominantly localised but also width ranging movement throughout the tracking period.

Although we have tried not to scare the fish during the tracking it was obvious that the fish were sensitive to noise generated in the water by the approaching of the operator. The fish generally doesn`t move when the operator is near, but there was some ocassions when the fish was probably afraid by the vicinity of the operator and move short distances.

The analysis of the movement hint suggest that asprete spends the bulk of its time not moving at all, or moving the width of the river, from stone to stone.

The movement hint and activity profiles, commonly shows a variable behaviour with movement extending day and night.

The results presented here reflect the effect of the tagging procedure and the presence of the tag with all the implications that this may have for abnormal behaviour. Certainly the fish moved downward from the tag site after release and observations indicated that movement was wider ranging in the subsequent 2-3 days after which the pattern of behaviour seemed more predictable. The precise effect of the tag however is unknown. In the absence of any other comparative data for Romanichthys valsanicola, this study provides an initial insight into the range and activity patterns of the asprete.

The efforts on the pursuing of fishes will focuse in the future on the localisation of the eventually migrations of the fishes during the pre-spawning and spawning periods and also to the continuing estimation of home-range of the asprete.

REZUMAT

Studiul desfăşurat pe perioada a patru luni a urmărit determinarea comportamentului aspretelui, unul din cei mai rari peşti de apă dulce din fauna Europei. 5 aspreți au fost implantați cu radio-emițători miniaturali şi urmăriți permanent timp de 50-72 ore, în râul Vâlsan, afluent al Argeşului şi singurul refugiu al aspretelui.
Studiul a fost mult îngreunat de ploile repetate şi viiturile care au afectat puternic Vâlsanul în iulie, august şi noiembrie 2004.

S-au marcat şi urmărit 8 peşti, dar din păcate 2 dintre ei au fost pierduți pe durata monitorizării, ca urmare a viiturii din august, iar al treilea a fost eliberat înainte de finalizarea perioadei de urmărire, deoarece s-a dovedit prea mic pentru marcare. S-a folosit echipament de monitorizare de la compania Biotrack (Marea Britanie) : receptor Sika, şi cele mai mici emițătoare disponibile în acest moment pe piața mondială (emițătoare de 0,4 g ce permit marcarea unor peşti de peste 6 g greutate). Pentru a minimiza pe cât posibil stresul marcării peştii protocolul de urmărire a început la 1,5-2 zile după marcare. Datorită dimensiunilor foarte mici ale emițătoarelor şi bateriilor, durata lor de viață este de numai 5-7 zile.

Din analiza rezultatelor a reieşit faptul că, deşi peştii au înotat şi spre amonte, deplasarea lor generală a fost spre aval. Peştii s-au cantonat în general în zone restrânse pentru anumite perioade de timp, după care se mutau mai în aval. Ei nu s-au întors niciodată la locul capturării şi eliberării. Peştii stau camuflați în permanență sub pietre sau pe pietriş iar homocromia lor îi face extrem de greu de observat chiar în apă foarte limpede şi puțin adâncă. Deşi peştele a fost descris ca fiind mai mult nocturn analiza mişcărilor sale pe durata a 24 de ore a arătat că peştele se deplasează în timpul zilei la fel ca noaptea.

Studiul a permis obținerea unor informații primare cu privire la mişcările peştelui şi la utilizarea habitatului pe durata unor cicluri de 24 de ore. Folosind aceste informații am obținut distanțele parcurse, perioadele şi distanța deplasărilor între locații succesive. S-a putut calcula de asemenea indicele de mişcare de-a lungul unei perioade de timp şi ceva informații cu privire la fidelitatea față de un sit. Trebuie precizat că numărul peştilor urmăriți până la această dată nu asigură suficiente informații pentru a se trage concluzii clare.

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AUTHORS` ADDRESS

ADRIAN IONASCU – National Agency for Fishing and Aquaculture, B-dul Carol I No 2-4, sector 3, Bucureşti, e-mail: adrian.ionascu@aventurilapescuit.ro

NICOLAE CRĂCIUN – Faculty of Biology, University of Bucharest, Splaiul Independenței No. 91-95, sector 5, 76201 Bucureşti, e-mail: nicu.craciun@maa.ro