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DESCRIPTION AND ECOLOGY OF SOME EARLY LIFE STAGES OF FISHES IN THE RIVER SINNAMARY (FRENCH GUIANA, SOUTH AMERICA)

Dominique PONTON and Sylvie MÉRIGOUX

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Brno 2001

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PONTON, D & MÉRIGOUX, S., 2001: Description and ecology of some early stages of stages of fishes in the River Sinnamary (French Guiana, South America). *Folia Zool., 50(Monogr. 1): 116 pp.*

Abstract

This work presents a series of drawings as well as different criteria describing the early life stages and juveniles of some fish species from the River Sinnamary. The material originates from studies that began at the end of 1992 and provide some insight into the ecology of these stages. For each of the 64 different taxa, from 52 genera, 21 families and 5 orders, we describe, for individuals of different sizes, the general body and head shapes, the fins development and the pigmentation pattern and illustrate them with drawings. For most of these taxa, we also provide information about their spatial and temporal occurrence, the habitats in which they were caught and their diet.

Key words: neotropics, larval and juvenile fish, taxonomy, distribution, food, habitat, Characiformes, Hemiodontidae, Curimatidae, Anostomidae, Erythrinidae, Lebiasinidae, Characidae, Siluriformes, Doradidae, Auchenipteridae, Pimelodidae, Cetopsidae, Asprenidae, Trichomycteridae, Callichthyidae, Gymnotiformes, Sternopygidae, Hypopomidae, Gymnotidae, Cyprinodontiformes, Rivulidae, Poeciliidae, Perciformes, Nandidae, Cichlidae, Eleotridae

Contents

Introduction

South America is famous for the richness of its fish communities (Lowe-McConnell 1987) but identification of fish species remains a problem because of the scarcity of identification manuals. Several species are even barely discriminable as adults and some ecological studies have been published using partially false identifications (Vari & Weitzman 1990). In this context, it is understandable that only few descriptions of the young stages of neotropical fish exist for Characiformes (Balon & Frank 1958, Oldani 1977, 1979a, 1979b, 1983a, Araujo-Lima 1985, 1990, 1991, Araujo-Lima et al. 1993, Cordiviola de Yuan & Campana 1993), Siluriformes (Chacon 1975, Godinho et al. 1978, Oldani 1983b, Kossowski & Madrid 1991, Mol 1996), Gymnotiformes (Kirschbaum & Schugardt 1995), or Cichlidae (Pena et al. 1988, Prokeš et al. 1987). The identification of young specimens usually requires to draw extensive series of specimens of variable sizes for which different meristic characters are recorded (Nakatani et al. 1997, Powles & Markle 1984) but only few scientific programmes presently allow to invest the needed time and money for this type of work.

French Guiana, a 90000 km² overseas department of France, possesses an important network of rivers and streams that harbour more than 400 freshwater and brackish species of fish (Planquette et al. 1996). When Electricité de France obtained the mandate to construct a dam on the River Sinnamary, French laws obliged the company to fund studies aimed at documenting the impact of the dam on water quality (Richard et al. 1997), aquatic flora (Vaquer et al. 1997), aquatic fauna (Horeau et al. 1997, 1998), and especially fishes (Tito de Morais & Lauzanne 1994, Mérona & Tito de Morais 1997, Tito de Morais & Raffray 1999).

Studies on early life stages of fish in the River Sinnamary began only at the end of 1992, and provided information on taxon-habitat relationships (Ponton & Copp 1997, Mérigoux & Ponton 1999, Mérigoux et al. 1999), on changes in morphology and diet during ontogeny (Mérigoux & Ponton 1998, Ponton & Mérigoux 2000), on biological traits – habitats relationships (Mérigoux et al. 2001), and on the impact of Petit-Saut dam after its doors closed in January 1994 (Ponton & Vauchel 1998, Ponton et al. 2000, Ponton 2001). All the young fishes caught for these studies were identified with the help of series of drawings and different criteria that have improved over time.

In this context, the present work has thus two main aims: 1) to present drawings and criteria used for identifying the young stages of more than 60 fish taxa of the River Sinnamary, its tributaries and associated flooded areas; and 2) to provide insight into the ecology of these young stages, their temporal and spatial occurrence, their habitats and their diet.

Study Area

The River Sinnamary is the fifth largest river of French Guiana with a length of approximately 260 km (Fig. 1) and can be classified as a medium-sized river sensu Dynesius & Nilsson (1994). Its drainage basin covers ca. 6565 km² and receives annual precipitation averaging 3000 mm (for a description of the entire river system see Boujard 1992 and Tito de Morais et al. 1995). Its lower course, downstream from the rapids where the Petit-Saut dam has been built, meanders through an old flat coastal plain

dominated by palms *Mauritia flexuosa* and *Euterpe oleracea* as well as 'Moutouchis' *Pterocarpus officinalis*. Water levels are under the influence of tide that elevates regularly the river's fresh waters. These tidal movements cause the flow to recede into the tributaries when River Sinnamary water levels are low. Upstream from the reservoir, four forest types are associated with the river and its tributaries (Granville 1979): terra firme arborescent assemblage, permanent swamp forest rich in monocotyledons, flooded forests dominated by Pteridophytes and palm swamps (for a complete list of plant species associated with the River Sinnamary see Tito de Morais et al. 1995).

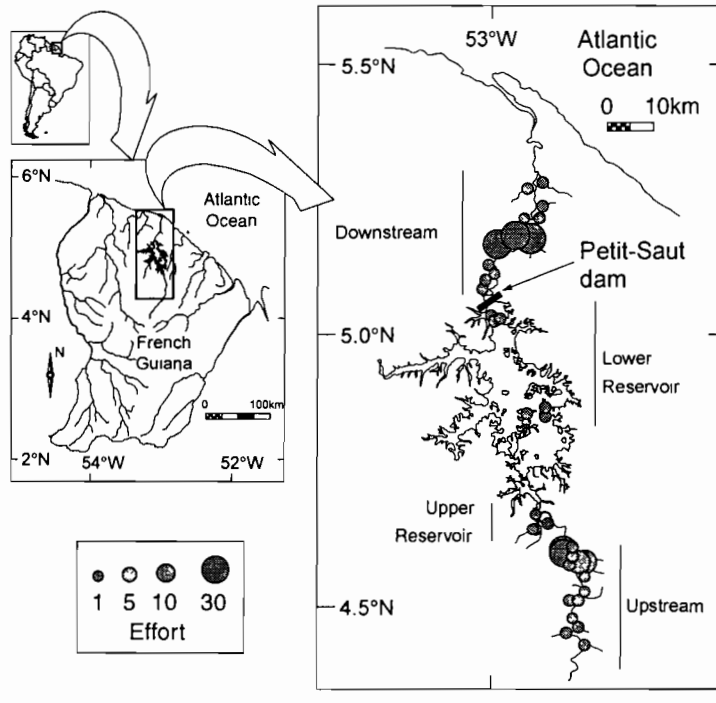


Fig. 1. Map of the River Sinnamary (French Guiana, South America), the reservoir at Petit-Saut as it appears when full. The diameters of the circles are proportional to the number of samples (effort) performed with rotenone at each site.

The mean annual discharge of the River Sinnamary is 230 $m^3 \cdot s^{-1}$ and its flow regime is under the dependence of the temporal succession of a short rainy season from mid-December to mid-February, a small dry season from mid-February to mid-March, a long rainy season from mid-March to mid-July and a dry season from mid-July to mid-December (Fig. 2). Unlike large tropical rivers in which flooding is highly predictable (Bayley 1988), small tropical rivers of the Guiana shield exhibit extreme short-term variability in discharge (Covich 1988, Oubotter & Mol 1993) linked to local rainy events as well as important year to year variations (Ponton in press).

In 1988, Electricité de France (EDF) started to build a dam (total length = 750 m, maximum height = 44 m) at Petit-Saut rapids, the first set of rapids moving upstream (Fig. 1). This dam was intended to have the capacity to generate 111 MW when releasing 430 $m^3 \cdot sec^{-1}$ from its four generators. Impoundment was completed in mid-1995 and this dam is presently providing about 80 % of the electricity consumed in French Guiana.

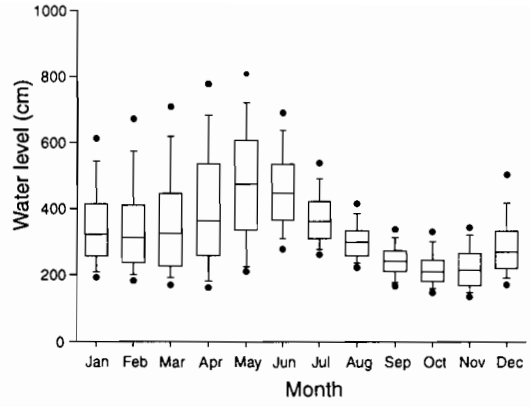


Fig. 2. Monthly water level (in cm) at Petit-Saut dam from a series of 26 years of daily minimum water level (Ponton, in press) Lower and upper limits of boxes represent 25th and 75th percentiles, respectively, horizontal bar inside boxes the median, whiskers the 10th and 90th percentiles and black dots the 5th and 95th percentiles

Material and Methods

Sampling techniques and habitat description

Descriptions of young fish were based on samples obtained with rotenone as well as different kind of traps and dip nets employed between 1992 and 1993 and with light traps used in 1993 and 1994 mostly downstream from the dam . The spatial distributions, temporal occurrences, characteristics of habitats and diet presented here come only from the samples obtained by the use of rotenone in different tributaries of the River Sinnamary and their associated flooding areas downstream from the dam, upstream from the reservoir, as well as in the littoral zone of the reservoir (Fig. 1, Table 1). Sampling took place where this technique had been found to be the most efficient for sampling young fish, i.e. at the sites with maximum depth < 1.5 m and water velocity < 20 cm·sec^{-1} (Mérigoux et al. 1999). Indeed, in deeper sites an efficient retrieval of sunken fish is difficult and greater water velocities require the use of important quantities of toxicant, which could potentially have disastrous effects on downstream fishes. At each site of approximately 50 m^2, water temperature, pH, oxygen and conductivity were first measured with an ICM 51000 multiparameter before any disturbance. Then, the extents of the sampling sites were delimited by stop nets (1 mm mesh) carefully set on the bottom in order to avoid the escape of fishes. Three successive doses of a 6.6 % emulsifiable solution of rotenone were mixed in the water with final concentration never exceeding 3 mg·l^{-1}. This gradual increase in rotenone concentration allowed the progressive collection of the least resistant (mostly small Characiformes), then the moderately resistant (mostly Siluriformes) and finally the most resistant juvenile fish (mostly Gymnotiformes) at the water surface before they died and sank to the bottom. At each sampling site, the fish were collected by a minimum of four persons equipped with 1 mm mesh dip nets. All specimens were immediately preserved in 90 % alcohol for allowing future genetic studies on the specimen deposited in different museums of natural history (Table 2). The fish not surfacing after rotenone application were retrieved by stirring the water in crevices and under trunks, removing woody debris and carefully checking for dead fish in leaf litter (total duration of sampling: 1-2 hours). No attempt was made to detoxify rotenone outside the sampling area

Table 1. Number of rotenone samples per month from 1993 to 1996 in the different sections of the River Sinnamary

Year / Section	Month											
	Jan.	Feb.	Mar	Apr	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec
1993												
Downstream							10					
1994												
Downstream								10				
Lower reservoir								6	1			
Upper reservoir									3			
Upstream									10			
1995												
Downstream	7		10		10	10	10	10			10	
Lower reservoir								6				
Upper reservoir								4				
Upstream			10		10	10	10	9	1	10		
1996												
Downstream	6	5	10		10		10	10		10		
Lower reservoir								6				
Upper reservoir								4				
Upstream	10		10	10		10		10		10		
Total	23	5	40	10	30	30	40	75	15	30	10	0

with potassium permanganate because: 1) sampling volume was always small compared to surrounding waters; 2) most fish species outside of the sampling site were found to detect and avoid rotenone; 3) clay, largely represented in our sampling site, is known to reduce rapidly the toxicity of rotenone (Gilderhus 1982); and 4) above 23 °C, the half life of this toxicant is less than one day.

After fish sampling, the surface of the area sampled was measured, the percentages of leaf cover and woody debris, branches or tree trunks on bottom and the percentages of mud or sand as substrate were visually estimated in 1993 and 1994 (Ponton & Copp 1997), or calculated from the information recorded at each point of a 1x1m grid covering the entire area in 1995 and 1996 (Mérigoux et al. 1999).

Fish identification

In the laboratory, the larger specimens were sorted and identified using keys for adults by Géry (1977), Le Bail et al. (1984), Rojas-Beltran (1984) and Kullander & Nijssen (1989). Identifications were later confirmed, and fish species names sometimes modified, following Planquette et al. (1996), Keith et al. (2000), and Le Bail et al. (2000). Younger specimens were identified by tracing back morphological (pigmentation, relative positions of the fins, etc.) and morphometric characters (body shape, number of rays on the anal fin, etc.) from the largest to the smallest fish (Powles & Markle 1984, Nakatani et al. 1997). In aquaria, we only raised young stages of *Krobia* aff. *guianensis* sp1 from fertilised eggs of known parents. For all taxa, series of specimens of variable size were drawn by using a binocular microscope equipped with a *camera lucida*. As much more information is required to identify young than adult fish (Powles & Markle 1984), we did not attempt to summarise our information in keys. Taxa were classified by order and family as proposed by Nelson (1984).

Table 2. Taxa presented in this study, corresponding page and figures, total number of early life stages and juveniles caught with rotenone (Ntot), and reference numbers of the specimens deposited in the National Museum of Natural History in Paris, France (MNHN) and the Museum of Natural History in Geneva, Switzerland (MHNG). Numbers may correspond to several specimens of a same size range.

Taxon	Page	Figures	Ntot	MNHN	MHNG
Hemiodopsis quadrimaculatus (Pellegrin, 1908)	14	3, 4	454	2001-231 2001-232 2001-233 2001-234	2615.69 2615.70 2615.71
Parodon guianensis Géry, 1959	17	5, 6	192	2001-235 2001-236	2615.72 2615.73
Curimatidae spp	17	7, 8	5977	2001-237 2001-238	2615.74 2615.75
Chilodus zunevei Puyo, 1945	20	9, 10	45	2001-239 2001-240	2615.76 2615.77
Cyphocharax helleri Steindachner, 1910	22	11, 12	82	2001-241 2001-242	2615.78 2615.79
Anostomus brevior Géry, 1960	23	13, 14	11	2001-243 2001-244	2615.80
Leporinus spp. [*L. friderici*, *L. gossei* and *L. granti*]	23	15, 17	80	2001-245 2001-246 2001-247 2001-248	2615.81 2615.82 2615.83 2615.84
Leporinus friderici (Bloch, 1794)	23	16	22	2001-253	2615.85
Leporinus gossei Géry, Planquette et Le Bail, 1991	23	16	20	2001-252	
Leporinus granti Eigenmann, 1912	23	16	40	2001-251	2615.86
Leporinus despaxi Puyo, 1943	26	16	69	2001-249 2001-250	2615.87 2615.88
Leporinus maculatus Steindachner, 1910	26	16	1	2001-254	
Erythrinus erythrinus (Schneider, 1801)	27	18, 19	22	2001-255 2001-256 2001-257 2001-258	2615.89 2615.90 2615.91 2615.92
Hoplerythrinus unitaeniatus (Spix, 1829)	27	18, 20	22	2001-259	2615.93
Hoplias spp. [*H. aimara* and *H. malabaricus*]	28	21, 22, 23	2269	2001-260	2615.94
Hoplias aimara (Valenciennes, 1840)	28	21, 24	135	2001-261 2001-262	2615.95 2615.96
Hoplias malabaricus (Bloch, 1794)	28	22, 25	505	2001-263 2001-264	2615.97 2615.98
Copella carsevennensis (Regan, 1912)	32	26, 27	550	2001-265 2001-266 2001-267 2001-268	2615.99 2615.100 2616.01 2616.02

Table 2. continued

Taxon	Page	Figures	Ntot	MNHN	MHNG
Pyrrhulina filamentosa Valenciennes in Cuvier, 1846	34	28, 29	1076	2001-269 2001-270 2001-271 2001-272 2001-273 2001-274	2615.03 2615 04 2615.05 2615 06 2615.07
Characidium fasciadorsale Fowler, 1914	35	30, 31	491	2001-280 2001-281 2001-282	2616.12 2616.13 2616.14
Melanocharacidium cf. *blennioides* (Eigenmann, 1909)	37	32, 33	91	2001-283	2616.15
Microcharacidium eleotrioides (Géry, 1960)	39	34, 35	242	2001-284 2001-285	2616.16 2616.17
Acestrorhynchus spp. [*A falcatus* and *A microlepis*]	41	36, 37	191	2001-286 2001-287 2001-288 2001-289	2616 18 2616 19 2616.20 2616.21
Charax pauciradiatus Günther, 1864	42	38, 39	36	2001-291 2001-292	2616.23
Pristella maxillaris (Ulrey, 1894)	44	40, 41	3226	2001-293 2001-294 2001-295 2001-296 2001-297	2616.24 2616.25 2616 26 2616.27 2616.28
Pseudopristella simulata Géry, 1960	44	40, 42	4456	2001-298 2001-299 2001-300 2001-301	2616.29 2616 30 2616.31 2616.32
Myleus spp. [*M rhomboidalis* and *M. ternetzi*]	45	43	0	2001-302	
Myleus rhomboidalis (Cuvier, 1818)	45	43		2001-303	
Myleus ternetzi (Norman, 1929)	45	43			
Poptella brevispina Reis, 1989	48	44, 45, 49	623	2001-304 2001-305 2001-306	2616.33 2616.34 2616.35
Astyanax bimaculatus (Linnaeus, 1758)	50	46, 47, 49	536	2001-307 2001-308	2616.36 2616.37
Jubiaba cf. *keithi* (Géry, Planquette et Le Bail, 1996)	51	48, 49, 50	1249	2001-309 2001-310 2001-311 2001-312 2001-313 2001-314 2001-315	2616.38 2616 39 2616.40 2616.41 2616.42 2616.43 2616.44
Jubiaba meunieri (Géry, Planquette et Le Bail, 1996)	52	51, 52	22	2001-316	2616.45

Table 2. continued

Taxon	Page	Figures	Ntot	MNHN	MHNG
Bryconops spp [*B. affinis* (Günther, 1864), *B caudomaculatus* (Günther, 1869) and *B. melanurus* (Bloch, 1795)]	55	53, 54	828	2001-317 2001-318 2001-319 2001-320 2001-321 2001-322 2001-323	2616.46 2616.47 2616.48 2616.49 2616.50 2616.51 2616.52
Hemigrammus ocellifer (Steindachner, 1882)	56	55, 56, 69	2007	2001-326 2001-327 2001-328 2001-329 2001-330	2616 54 2616.55 2616.56 2616.57 2616.58
Hyphessobrycon aff. *sovichthys* Schultz, 1944	59	57, 58	62	2001-331 2001-332 2001-333	2616.59 2616 60 2616.61
Moenkhausia chrysargyrea (Günther, 1864)	60	59, 60	1581	2001-334 2001-335 2001-336 2001-337 2001-338 2001-339 2001-340 2001-341 2001-342	2616.62 2616.63 2616.64 2616 65 2616 66 2616.67 2616.68 2616.69 2616.70 2616.71
Moenkhausia collettii (Steindachner, 1882)	60	61, 62	5896	2001-343 2001-344 2001-345	2616.72 2616.73 2616.74
Moenkhausia georgiae Géry, 1966	63	63, 64	19	2001-346	2616.75
Moenkhausia hemigrammoides Géry, 1966	65	65, 66	1631	2001-347 2001-348 2001-349 2001-350	2616.76 2616.77 2616.78 2616 79
Hemigrammus unilineatus (Gill, 1858)	65	65, 67	324	2001-351 2001-352 2001-353	2616.80 2616.81 2616.82
Moenkhausia oligolepis (Günther, 1864)	67	68, 69, 70	3838	2001-354 2001-355 2001-356 2001-357	2616 83 2616.84 2616 85 2616.86
Moenkhausia surinamensis Géry, 1966	68	71, 72	71	2001-358 2001-359 2001-360	2616.87 2616.88 2616.89
Phenacogaster aff. *megalostictus* Eigenmann, 1909	70	73, 74	2421	2001-362 2001-363 2001-364 2001-365 2001-366	2616.91 2616.92 2616.93 2616.94

Table 2. continued

Taxon	Page	Figures	Ntot	MNHN	MHNG
Piabucus dentatus (Köhlreuter, 1761)	73	75, 76	39	2001-367	
Doras carinatus (Linnaeus, 1766)	75	77	1		
Parauchenipterus galeatus (Linnaeus, 1766)	76	78, 79	6	2001-368 2001-369	2616.95 2616.96
Tatia aff. *intermedia* (Steindachner, 1876)	76	80, 81	491	2001-370 2001-371 2001-372	2616.97 2616.98 2616.99 2616.100
Pimelodella spp. [*P. cristata* and *P. geryi*]	79	82, 83	177	2001-373	2617.01
Pimelodella cristata (Müller et Troschel, 1848)	79			2001-374 2001-375	2617.02 2617.03
Pseudopimelodus raninus (Val. in Cuvier et Valenciennes, 1840)	80	84, 85	151	2001-376 2001-377 2001-378	2617.04 2617.05 2617.06
Rhamdia quelen (Quoy et Gaimard, 1824)	81	86, 87	13	2001-379	2617.07
Helogenes marmoratus (Günther, 1863)	85	88, 89	19	2001-380 2001-381	2617.08 2617.09
Dysichthys coracoideus (Cope, 1874)	85	90, 91	46	2001-382 2001-383	2617.10 2617.11
Ituglanis amazonicus (Steindachner, 1882)	85	92, 93	105	2001-384 2001-385 2001-386 2001-387	2617.12 2617.13 2617.14
Callichthys callichthys (Linnaeus, 1758)	87	94, 95	27	2001-388 2001-389 2001-390	2617.16 2617.17
Megalechis thoracata (Valenciennes, 1840)	90	96, 97	38	2001-391 2001-392	2617.18 2617.19
Sternopygus macrurus (Bloch et Schneider, 1801)	92	98, 99	106	2001-395 2001-396 2001-397 2001-398	2617.22 2617.23 2617.24 2617.25
Brachyhypopomus beebei (Schultz, 1944)	94	100, 101	306	2001-399 2001-400 2001-401 2001-402	2617.26 2617.27 2617.28 2617.29
Hypopomus artedi (Kaup, 1856)	96	102, 103	124	2001-403 2001-404 2001-405 2001-406 2001-407	2617.30 2617.31 2617.32 2617.33 2617.34

Table 2. continued

Taxon	Page	Figures	Ntot	MNHN	MHNG
Gymnotus spp. [*G. anguillaris* and *G. carapo*]	97	104, 106	896	2001-408 2001-409	2617.35 2617 36
Gymnotus anguillaris Hoedeman, 1962	97	104, 105		2001-410 2001-411 2001-412 2001-413 2001-414 2001-415	2617.37 2617.38 2617.39 2617.40 2617.41 2617.42
Gymnotus carapo Linnaeus, 1758	97	104, 105		2001-416 2001-417 2001-418 2001-419 2001-420	2617.43 2617 44 2617.45 2617 46 2617.47
Rivulus agilae Hoedeman, 1954	99	107, 108	375	2001-421 2001-422 2001-423	2617.48 2617.49 2617.50
Rivulus xiphidius Huber, 1979	100	109, 110	670	2001-424 2001-425 2001-426	2617.51 2617 52 2617 53
Micropoecilia spp. [*M bifurca* (Eigenmann, 1909), *M. parae* (Eigenmann, 1894), and *M* cf. *picta* (Regan, 1913)]	101	111, 112	171	2001-428	2617.55
Polycentrus punctatus (Linnaeus, 1758)	102	113, 114	115	2001-430 2001-431 2001-432	2617.57 2617.58 2617.59
Cleithracara maronii (Steindachner, 1882)	104	113, 115	168	2001-433 2001-434 2001-435	2617.60 2617.61 2617.62
Nannacara spp. [*N. anomala* Regan, 1905 and *N. aureocephalus* Allgayer, 1983]	106	113, 116	1181	2001-436 2001-437 2001-438 2001-439 2001-440	2617.63 2617.64 2617.65 2617 66
Crenicichla saxatilis (Linnaeus, 1758)	107	117, 118	2082	2001-441 2001-442	2617.67 2617.68
Krobia aff. *guianensis* sp.1 (Regan, 1905)	107	119, 120, 121	5702	2001-443 2001-444 2001-445 2001-446 2001-447 2001-448 2001-449 2001-450	2617.69 2617 70 2617 71 2617 72 2617.73 2617.74 2617.75 2617 76
Eleotris pisonis (Gmelin, 1789)	110	122, 123	5240	2001-454 2001-455 2001-456	2617.80 2617.81 2617 82
Dormitator maculatus (Bloch, 1790)	111	122, 124	21	2001-457	

We separated non-adults and adults of each species according to limits of size used by Mérigoux & Ponton (1998), which were based on the observed minimum sizes at first maturity of females. All lengths correspond to standard length (SL) measured from the tip of the snout to the tip of the notochord or the base of the C-fin when the notochord is flexed. Following Mérigoux & Ponton (1998) and Ponton et al. (2000), non-adults were categorised based on SL into early life stages (about 4.0 to 15.0–20.0 mm, depending on species), young juveniles (about 15.0–20.0 to 30.0–50.0 mm) and older juveniles (> 30.0–50.0 mm to the minimum size at first maturity). Our descriptions of the general shape of the body, head size and eye size (Table 3) correspond to the broad categories used by Leis & Carson-Ewart (2000).

Table 3. Broad categories used to describe the general shape of the body, head size, and eye size. With SL: standard length, BD. body depth, HL: head length, and ED: eye diameter (after Leis & Carson-Ewart 2000, modified)

General shape of the body	BD in % of SL
Very elongate	<10
Elongate	10-20
Moderate	20-40
Deep	40-70
Very deep	>70
Head Size	HL in % of SL
Small	<20
Moderate	20-33
Large	>33
Eye dimater	ED in % of HL
Small	<25
Moderate	25-33
Large	>33

Data analysis

For each taxon, we first calculated the number of individuals per m^2 at each sampling site. For each size class, we determined the occurrence of individuals each month and the minimum and maximum values of temperature (Te in °C), pH, conductivity (Cd in $\mu S \cdot cm^{-1}$), oxygen (Ox in $mg \cdot l^{-1}$), percentage of leaf cover (%L) and woody debris, branches or tree trunks (%W) on bottom and percentage of mud (%M) or sand (%S) as substrate, for all the sites where individuals were present. Stomach contents analyses were based on individuals caught in 1995 and 1996 downstream from the dam and upstream from the reservoir (Mérigoux & Ponton 1998). Diet items of ten randomly chosen individuals of each size class were assigned to ten categories: fish (Fi), molluscs (mainly snails, Mo), large crustaceans (shrimps, Lc), micro-crustaceans (Copepoda, Cladocera and Ostracoda, Mc), terrestrial insects (Ti), insect larvae (Il), hydracarians (Hy), rotifers (Ro), miscellaneous vegetative debris (Mi) and substrate (Su). The relative volumes of each category were estimated following the method of Sheldon & Meffe (1993). For each fish, the most abundant food category was assigned rank 1, the second most abundant rank 2 and so on. For each individual, ranks of food categories were then converted into percentages by a modified version of the MacArthur broken stick model (Magurran 1988). This model gives the

expected percentage N_i of each food category i when eaten randomly and simultaneously by a fish by:

$$N_i = \frac{100}{S} \sum_{n=i} \frac{1}{n}$$

with S = total number of food categories and N_i = rank number of food category.

Thus, a fish feeding on two food categories will have 100/2(1/1+1/2)=75 assigned to category ranked 1 and 100/2(1/2)=25 to category ranked 2. Identically, an individual feeding on three different categories will have 1100/18, 500/18 and 200/18 assigned for categories ranked 1, 2 and 3 respectively. We finally calculated the mean N_i calculated for all the individuals of each size class.

Results and Discussion

In total we caught and identified young stages of 64 different taxa from 52 genera, 21 families and five orders. This represents about a half of 126 freshwater fish species listed in the River Sinnamary (Tito de Morais & Lauzanne 1994).

A. CHARACIFORMES

1. Hemiodontidae

Four species of Hemiodontidae are present in the River Sinnamary (Tito de Morais & Lauzanne 1994) but we never caught young stages of *Bivibranchia bimaculata* Vari, 1985 nor those of *Hemiodus* aff. *unimaculatus*.

Hemiodopsis quadrimaculatus (Pellegrin, 1908)

Early life stages of *H. quadrimaculatus* present an elongated cylindrical body, a triangular head of moderate size and a pointing snout (Fig. 3a). The round eyes are moderately large, and the mouth barely reaches to the eye. The straight gut reaches > 80 % of body length. At that stage, only the rays of the C- and D-fin are present. Finfold remnants are also still present ventrally anterior to the anus. The D- and V-fins are set medianly relative to SL and the adipose fin is already present. Pigmentation on the body consists of one double dorsal and one single mediolateral line of melanophores starting at the anterior margin of the D-fin, and one ventral row of melanophores. These rows highly contrast with the whitish aspect of the rest of the body. From 18.0–19.0 mm on, the body slightly deepens, the eyes and the mouth become smaller relative to head size and the A-fin rays are present (Fig. 3b). Three of the four characteristic vertical black dark bands begin to appear laterally behind the P-fins, at the posterior margin of the dorsal final and the anterior margin of the A-fin. Once the fourth bar appears, it resembles a triangular spot on the caudal peduncle. From 24.0 mm on, *H. quadrimaculatus* juveniles possess most of the morphological characteristics of the adults (Fig. 3c) but their pigmentation lacks the two black bars on the C-fin.

Small *H. quadrimaculatus* should not be confounded with small *Bryconops* spp. (Fig. 53) or small *Piabucus dentatus* (Fig. 75), which present a more rounded snout and a shorter gut. They should neither be misidentified as small *Parodon guianensis* (Fig. 5), which are much more pigmented. When they are larger, young *H. quadrimaculatus* are easily identified by their pattern of pigmentation and their short A-fin (I 9).

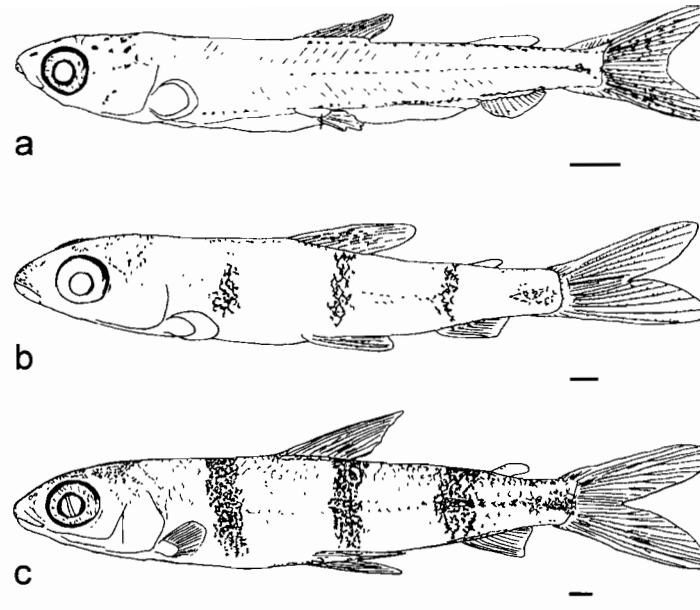


Fig. 3. *Hemiodopsis quadrimaculatus* a) 10.7 mm, b) 19 0 mm and c) 24.0 mm. Black horizontal bars represent 1 mm.

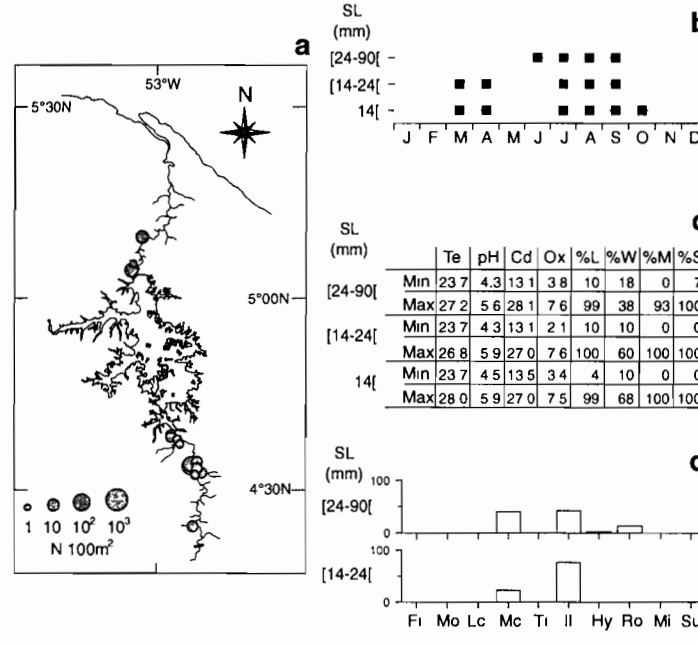


Fig. 4. *Hemiodopsis quadrimaculatus* a) spatial distribution (all individuals) with densities (N.100 m^{-2}) proportional to the size of circles, b) temporal occurrence, c) habitat characteristics (Te: temperature in °C, Cd: conductivity in µS.cm^{-1}, Ox: oxygen in mg l^{-1}, %L: percentage of leaf cover, %W: percentage of woody debris, branches or tree trunks, %M: percentage of mud as substrate, %S: percentage of sand as substrate) for early life stages <14 mm, young juveniles 14 to 24 mm, and old juveniles 24 to 90 mm, and d) relative importance of various dietary items (Fi: fish, Mo: molluscs, Lc: large crustaceans (shrimps), Mc: micro-crustaceans (Copepoda, Cladocera and Ostracoda), Ti: terrestrial insects, Il: insect larvae, Hy hydracarians, Ro rotifers, Mi. miscellaneous vegetative debris and Su substrate) for early life stages and young juveniles only.

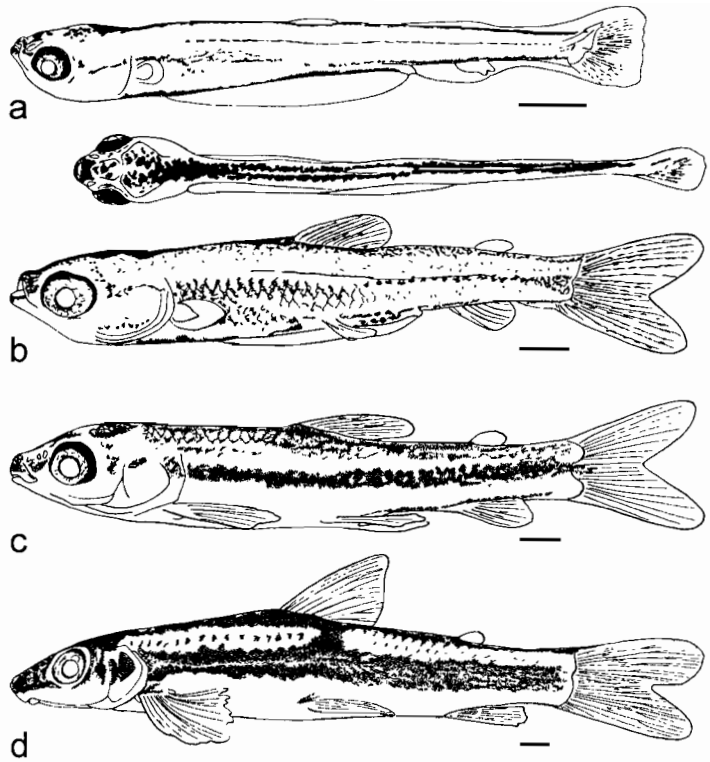
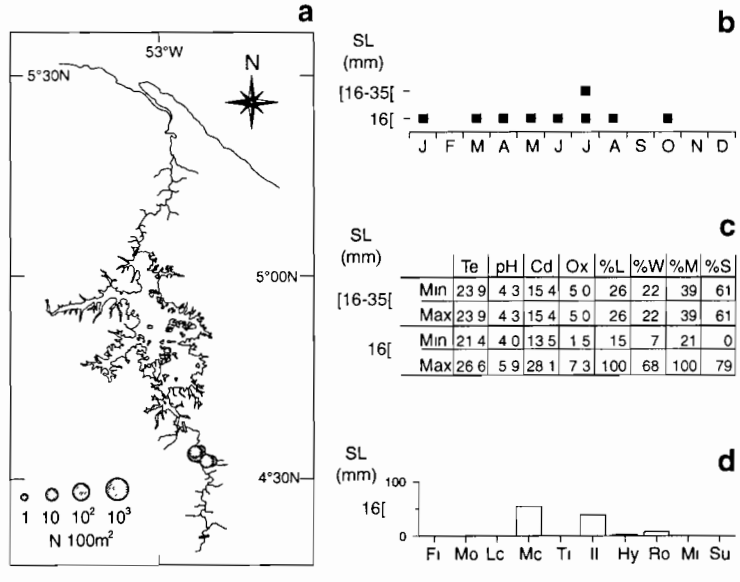


Fig. 5. *Parodon guianensis* a) 8 5 mm lateral and dorsal view, b) 11 5 mm, c) 15 0 mm and d) 43 0 mm. Horizontal bars represent 1 mm



		Te	pH	Cd	Ox	%L	%W	%M	%S
[16-35[	Min	23 9	4 3	15 4	5 0	26	22	39	61
	Max	23 9	4 3	15 4	5 0	26	22	39	61
16[	Min	21 4	4 0	13 5	1 5	15	7	21	0
	Max	26 6	5 9	28 1	7 3	100	68	100	79

Fig. 6. *Parodon guianensis* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics for early life stages <16 mm and young juveniles 16 to 35 mm and d) relative importance of various dietary items for early life stages only Habitat and prey codes in Fig 4

Young *H. quadrimaculatus* were caught near the dam in the downstream section, in the upper reaches of the reservoir and in the upstream section (Fig. 4a). They occurred in our samples only in March-April and from June to October (Fig. 4b) in a very large range of habitats (Fig. 4c). At 14.0–24.0 mm, young fish mostly ate insect larvae but included more small sized prey in their diet as they grew (Fig. 4d).

Parodon guianensis Géry, 1959

At 8.5–9.0 mm *P. guianensis* early life stages present an elongate to very elongate, laterally compressed, body (Fig. 5a). The head is ovate and small to moderate, the snout is pointed, the oblique mouth reaches to the anterior edge of the eyes, which are of moderate size and obliquely elongate. The straight gut reaches 60 % of body length. The C-fin presents incipient rays when only the anlagen of the D- and A-fin can be observed. The uniformly white body highly contrasts with the dorsal double row of melanophores, the ventral series of large melanophores, and the thin mediolateral line. At 11.0 mm, the body deepens and becomes more cylindrical, the head is moderately large, the snout is still pointing and the obliquely elongate eyes remain of moderate size (Fig. 5b). At that SL, all fin rays are present except those of P-fin but remnant of the finfold can be observed ventrally. D- and V-fins are positioned at mid-body oppositely from each other. From that SL onward, the pigmentation intensifies dorsally and laterally. Ventrally, a large band of melanophores persists behind the head. From 15.0 mm on, the mouth is terminal, the eyes become somewhat round, and all fins are completed (Fig. 5c). The lateral band of melanophores is enlarged, the dorsal surface of the entire body is dark and a characteristic band of melanophores bisects the eye and extends onto the snout. At 40.0 mm, *P. guianensis* juveniles looks like adults with the characteristic shape of the body deepened at D-fin level, the triangular head, the pointing snout, the obliquely elongate eyes and the inferior position of the mouth (Fig. 5d). Pigmentation is also characteristic of adults except for fins, which remain unpigmented.

P. guianensis early life stages have a more pointed snout and a longer gut than *Bryconops* spp. (Fig. 53) or small *P. dentatus* (Fig. 75). *P. guianensis* juveniles are easily identified by their pigmentation pattern and their short A-fin (I 7).

Young *P. guianensis* were only caught upstream from the reservoir (Fig. 6a). Individuals <16.0 mm were observed in our samples from January to October (Fig. 6b) in habitats where the substrate consisted in clay and/or mud (Fig. 6c). The diet of the youngest *P. guianensis* comprised mainly micro-crustaceans and insect larvae (Fig. 6d).

2. Curimatidae

There are four species of curimatids in the River Sinnamary (Tito de Morais & Lauzanne 1994) but we were only able to identify young *Chilodus zunevei* and *Cyphocharax helleri* to species level. The group we addressed as Curimatidae spp. thus comprises the progeny of *Curimata cyprinoides* (Linnaeus, 1758) and *Cyphocharax* sp. (gr. *spilurus*).

Curimatidae spp.

Early life stages of Curimatidae spp. cannot be confounded with the progeny of other Characiformes. Their body is moderately elongated and cylindrical, the ovate head is large, the snout rounded, the terminal mouth does not reach to the anterior edge of the small eyes (Fig. 7a). The gut represents more than two third of SL. The body is scattered with evenly

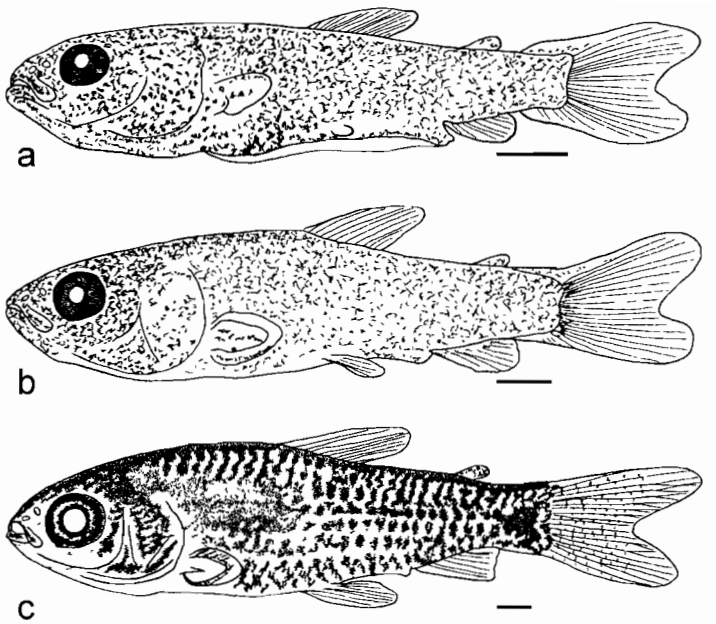


Fig. 7. Curimatidae spp. a) 7.5 mm, b) 9.0 mm and c) 15 5 mm Horizontal bars represent 1 mm

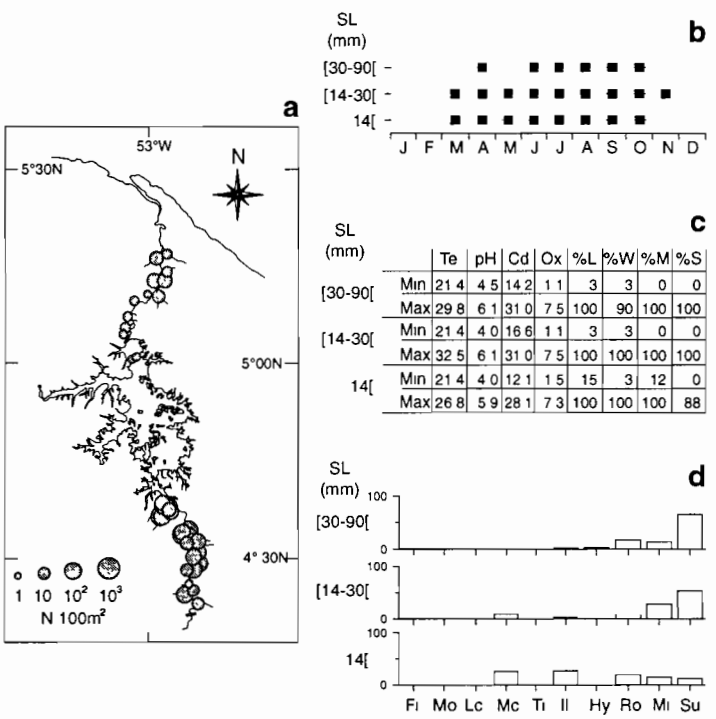


Fig. 8. Curimatidae spp. a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics and d) relative importance of various dietary items for early life stages <14 mm, young juveniles 14 to 30 mm, and old juveniles 30 to 90 mm Habitat and prey codes in Fig 4

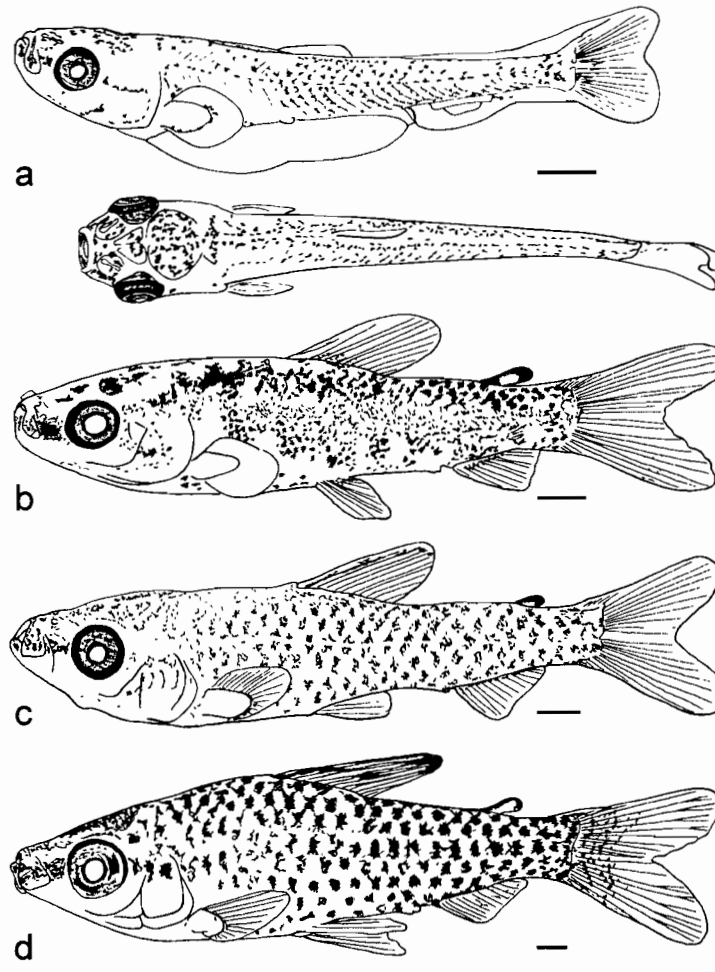


Fig. 9. *Chilodus zunevei* a) 10.0 mm lateral and dorsal view, b) 12.0 mm, c) 14.0 mm and d) 19.0 mm. Horizontal bars represent 1 mm.

spaced melanophores that give a brownish aspect to individuals when fixed in alcohol. The adipose fin is also pigmented. From 8.5–9.0 mm the body becomes deeper, the head remains large and the V-fins develop (Fig. 7b). The body is always heavily and homogeneously pigmented. At 15.0–16.0 mm, the body shape of Curimatidae spp. begins to look like that of adult (Fig. 7c). All fins are completed except the pectorals. Pigmentation patterns vary from individual to individual, certainly accordingly to the species they belong to.

We caught early life stages of Curimatidae spp. in all three sampled sections of the River Sinnamary except in the central part of the reservoir (Fig. 8a) from March to November (Fig. 8b). We found them in a wide range of habitats except those 100 % covered by sand that appeared to be avoided by individuals <14.0 mm (Fig. 8c). Curimatidae spp. <14.0 mm preyed upon micro-crustaceans, insect larvae, rotifers, miscellaneous vegetative debris and substrate when larger individuals included an increasing proportion of substrate in their diet (Fig. 8d).

At 9.5–10.0 mm, early life stages of *C. zunevei* have an elongated body, an ovate head of moderate size, a blunt snout, a small oblique almost vertical mouth and small round eyes (Fig. 9a). The gut can reach up to 70 % of SL. The rays of the C-fin are present, the finfold remains and is especially large ventrally. Anlagen of the A- and D-fin are observed. Rows of melanophores enhance the pattern of myomeres (n = 31 – 32) on each side of the body. Two dark spots can be observed on the C-fin base and a band of melanophores is present from the snout to the operculum. From 11.0 mm on, the body deepens and the head becomes markedly triangular (Fig. 9b). At that SL, all fins but P-ones present rays. The entire body darkens with regularly spaced dark spots on the dorso-lateral surface of the body and clusters of melanophores on its ventro-lateral surface. The horizontal band of melanophores anteriorly to the eye is large, and the adipose fin becomes deep black except its unpigmented centre. All fins are mostly unpigmented except some melanophores at the base of the D-, C-, A- and V- fins. At 14.0 mm, the body and head shapes are similar but the rays of the P-fins are completed and regularly spaced clusters of melanophores cover most of the body (Fig. 9c). A thin line of melanophores remains on the A-fin base and along the first ray of the D-fin. At 19.0 mm, juveniles present the characteristic diamond body shape and the pattern of melanophores of the adult (Fig. 9d).

Young *C. zunevei* were mostly caught in the upper reaches of the reservoir and upstream from Petit-Saut Lake, but some individuals were also caught immediately downstream from the dam (Fig. 10a). Early life stages were caught only in March and from June to August

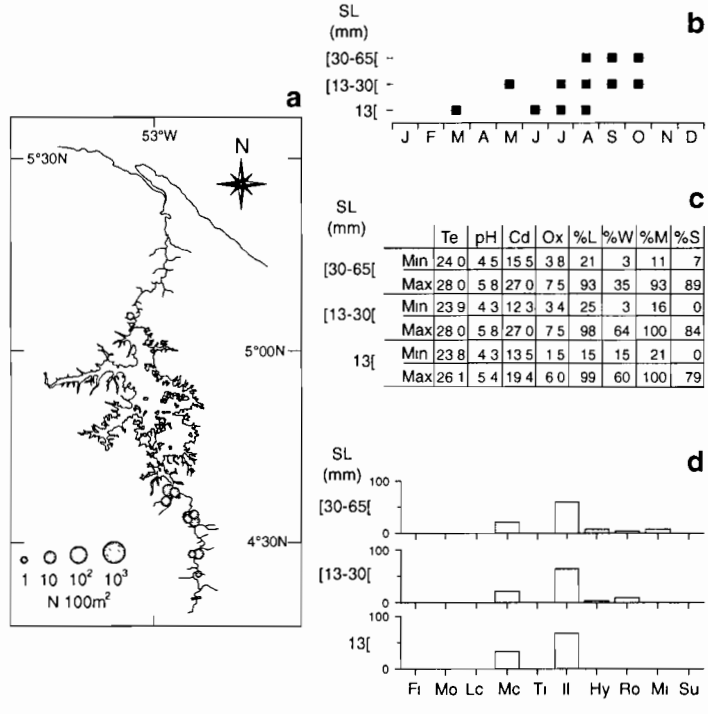


Fig. 10. *Chilodus zunevei* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <13 mm, young juveniles 13 to 30 mm, and old juveniles 30 to 65 mm Habitat and prey codes in Fig 4

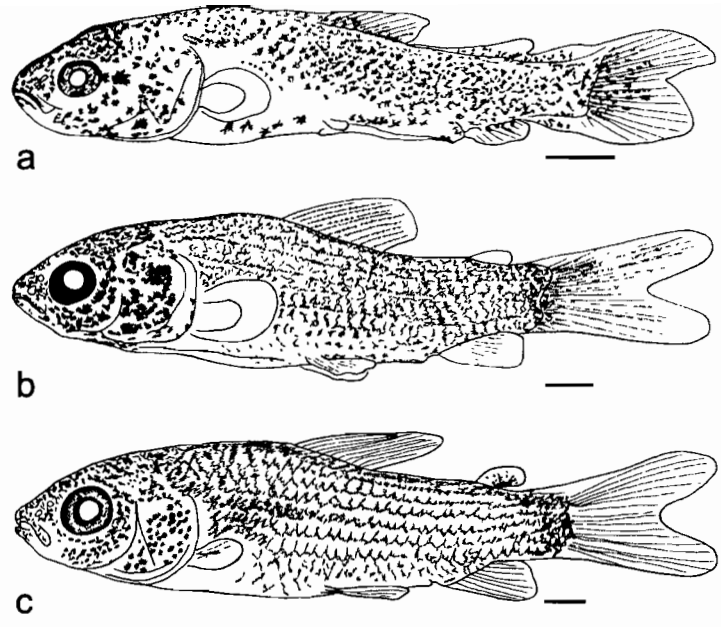


Fig. 11. *Cyphocharax helleri* a) 8 5 mm, b) 11.5 mm and c) 13 5 mm Horizontal bars represent 1 mm

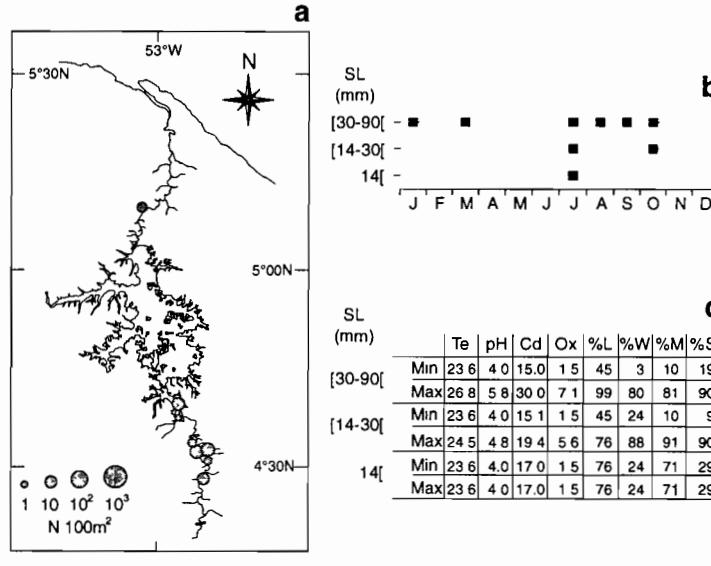


Fig. 12. *Cyphocharax helleri* a) spatial distribution (all individuals) and b) temporal occurrence, and c) habitat characteristics for early life stages <14 mm, young juveniles 14 to 30 mm, and old juveniles 30 to 90 mm Habitat codes in Fig. 4.

(Fig. 10b). Juveniles >13.0 mm were never caught in deoxygenated waters and all stages appear to avoid any habitat entirely covered with sand (Fig. 10c). Whatever the SL range considered, young *C. zunevei* mainly preyed upon insect larvae and micro-crustaceans (Fig. 10d).

Cyphocharax helleri Steindachner, 1910

The smallest *C. helleri* we caught was 8.5 mm. At that SL early life stages present an elongate to moderately-elongate cylindrical body, a triangular head of moderate size, a blunt snout, a small terminal mouth that does not reach to the anterior margin of the eye, and small round eyes (Fig. 11a). The gut represents 60 to 70 % of SL. The fin rays of the C-, D- and A-fin begin to appear, whereas V-fins are only present as buds. The head and the body, especially in its dorso-lateral part, are heavily pigmented with large scattered melanophores. The snout and the dorsal surface of the brain appear very dark. D-, C- and A-fin present numerous melanophores at their base that align more or less along the rays. At 11.0–11.5 mm, the body increases in depth at the level of the D-fin and the head is more evidently triangular (Fig. 11b). All fins except the pectoral ones are complete. Pigmentation intensifies with growth. The melanophores are organised laterally in longitudinal lines that cover the entire body and are crossed by oblique shorter ones. The head takes on a very dark aspect with the coalescence of its melanophores. On the tip of the caudal peduncle and the base of the C-fin, the melanophores become denser and begin to form the vertical bar characteristic of adults. At 13.0–14.0 mm, *C. helleri* present the body shape, the longitudinal zigzag pattern of melanophores and the vertical black bar on the extremity of the caudal peduncle that characterise the adult.

Young *C. helleri* were mostly caught in the upper reaches of the reservoir and upstream from Petit-Saut Lake but some individuals were also caught immediately downstream from the dam (Fig. 12a). Early life stages <14.0 mm were caught at only one occasion in July and older juveniles >30.0 mm were observed from January to October (Fig. 12b). Young *C. helleri* were observed in a large range of habitats but appeared to avoid those entirely covered with sand, mud or litter (Fig. 12c).

3. Anostomidae

Tito de Morais & Lauzanne (1994) listed seven species of Anostomidae in the River Sinnamary, six of them belonging to the genus *Leporinus*, but we never caught the young stages of *L. fasciatus* (Bloch, 1794).

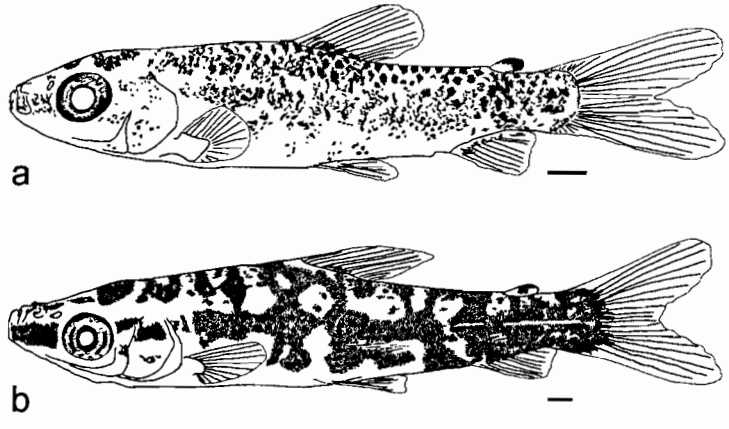
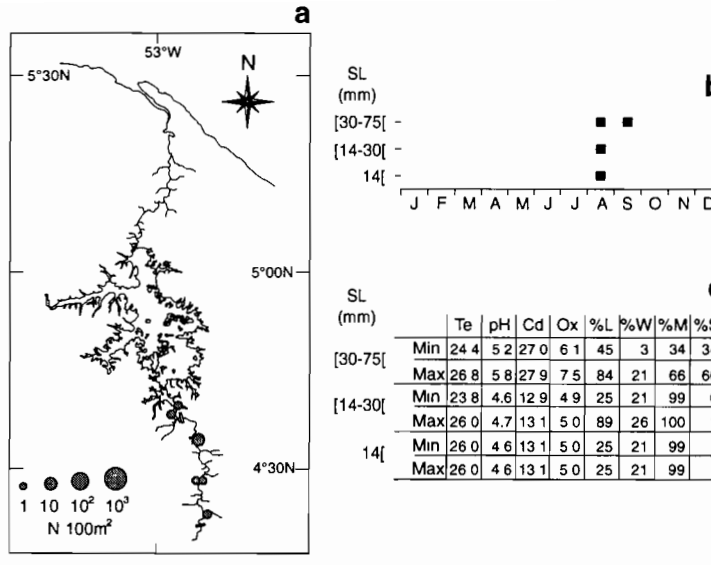


Fig. 13. *Anostomus brevior* a) 14.5 mm and b) 23.0 mm Horizontal bars represent 1 mm.



SL (mm)		Te	pH	Cd	Ox	%L	%W	%M	%S
[30-75[	Min	24 4	5 2	27 0	6 1	45	3	34	34
	Max	26 8	5 8	27 9	7 5	84	21	66	66
[14-30[	Min	23 8	4.6	12 9	4 9	25	21	99	0
	Max	26 0	4.7	13 1	5 0	89	26	100	1
14[	Min	26 0	4 6	13 1	5 0	25	21	99	1
	Max	26 0	4 6	13 1	5 0	25	21	99	1

Fig. 14. *Anostomus brevior* a) spatial distribution (all individuals), b) temporal occurrence, and c) habitat characteristics for early life stages <14 mm, young juveniles 14 to 30 mm, and old juveniles 30 to 75 mm Habitat codes in Fig. 4.

Anostomus brevior Géry, 1960

At 14.0–14.5 mm *A. brevior* young juveniles present an elongate cylindrical body, a triangular head of moderate size, a small oblique mouth, round eyes of moderate size and rays on every fin (Fig. 13a). Pigmentation includes blotches of melanophores more or less regularly spaced on the dorso-lateral surface of the body, patches on the fore- and hindbrain and a more diffuse large band of melanophores from the tip of the snout to the end of the caudal peduncle. All fins are unpigmented except the base of D-, C- and A-one and the extremity of the adipose one. At 23.0 mm, *A. brevior* juveniles look like young adults (Fig. 13b).

We caught the young *A. brevior* upstream from the reservoir (Fig. 14a) at the beginning of the dry season only (Fig. 14b), mostly in habitats with a high proportion of mud and/or clay (Fig. 14c). The number of individuals caught was too low to study their diet.

Leporinus spp. [*L. friderici* (Bloch, 1794), *L. gossei* Géry, Planquette et Le Bail, 1991 and *L. granti* Eigenmann, 1912]

Young *L. friderici* (Bloch, 1794), *L. gossei* Géry, Planquette et Le Bail, 1991 and *L. granti* Eigenmann, 1912 are difficult to discriminate, we thus grouped them at the genus level.

At 9.5 mm early life stages of *Leporinus* spp. present an elongate body, a triangular head of moderate size, a small oblique mouth and small round eyes (Fig. 15a). The gut is deep in its half anterior part and resembles a straight tube in its posterior section. At that SL, the finfold is large and continuous ventrally from the cleithrum to the anus. Dorsally it is still present as remnants on the caudal peduncle. Most of the rays of the C-fin are present, while those of the D-fin are just starting to form. Incipient rays of the A-fin are also observed. Pigmentation consists in very dark patches that highly contrast with the white colour of the body. A horizontal black band of melanophores is present on the snout at the eye level.

Another conspicuous curved black band encompasses the A- and C-fin. The latter appears to join the adipose fin, which has a very dark extremity. The remaining pigmentation consists of V-shaped blotches of melanophores on the body which density varies from individual to individuals, and scattered melanophores on the hindbrain and the operculum.

At 15.0 –17.0 mm, the body shape is moderately elongate, the triangular head represents one third of SL (Fig. 15b). The oblique mouth is very small, reaching to half the distance between the tip of the snout and the anterior edge of the round eyes of moderate size. All the fin rays are present. The pattern of pigmentation varies from individuals and consists in a scattering of melanophores on the entire body that become denser along up to seven more conspicuous vertical bands. These bands are denser on the dorso-lateral surface of the body and the central one extends across the D- and V-fins. The horizontal black band of pigments remains on the snout, the extremity of the A-fin remains unpigmented and one patch of melanophores becomes conspicuous at the base of the C-fin.

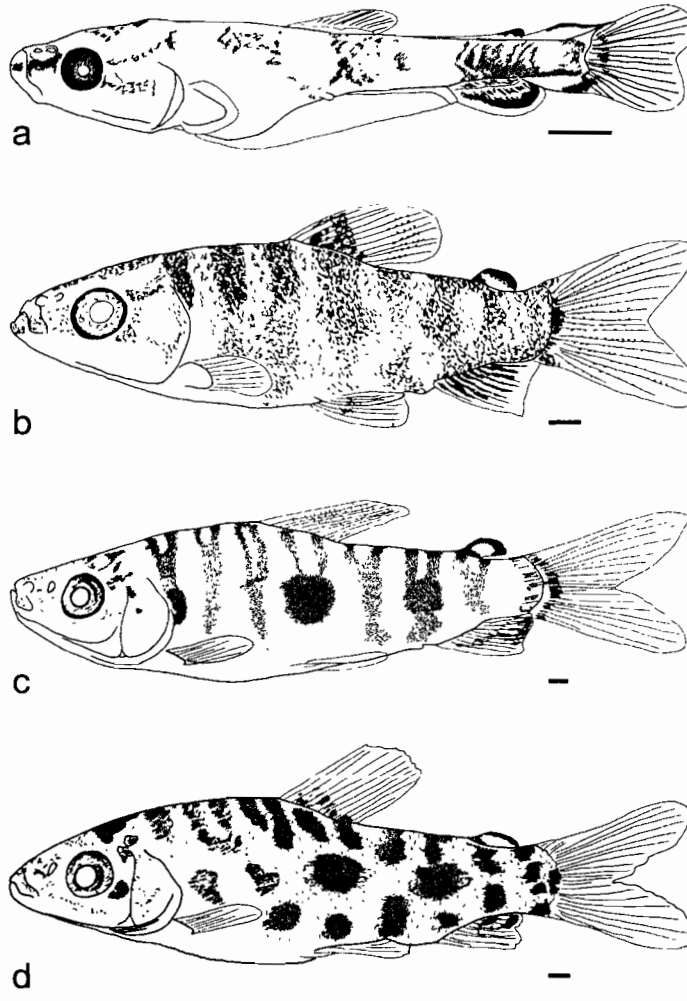


Fig. 15. Early life stage of *Leporinus* spp. a) 9 5 mm, b) 17.0 mm, c) 27 0 mm tentatively identified as *Leporinus friderici* or *L. gossei* and d) 26 0 mm tentatively identified as *L. granti* Black horizontal bars represents 1 mm.

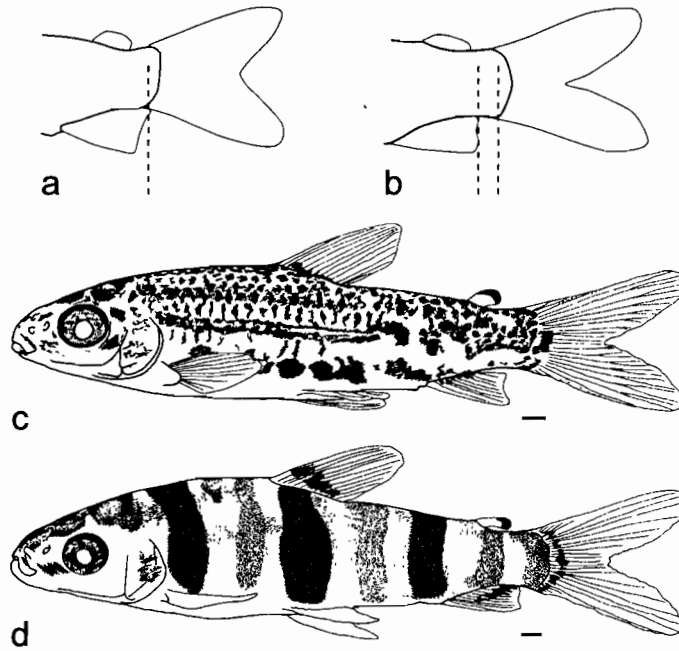


Fig. 16. Relative positions of the A- and C-fin of a) young *L. friderici/L. gossei* and b) young *L. granti*. The last ray of the A-fin reaches the anterior limit of the C-fin in *L. friderici/L. gossei* and extends only mid-distance of the caudal peduncle in *L. granti*. Young stages of c) *L. despaxi* 22.0 mm and d) *L. maculatus* 26.0 mm. Horizontal bars represent 1 mm.

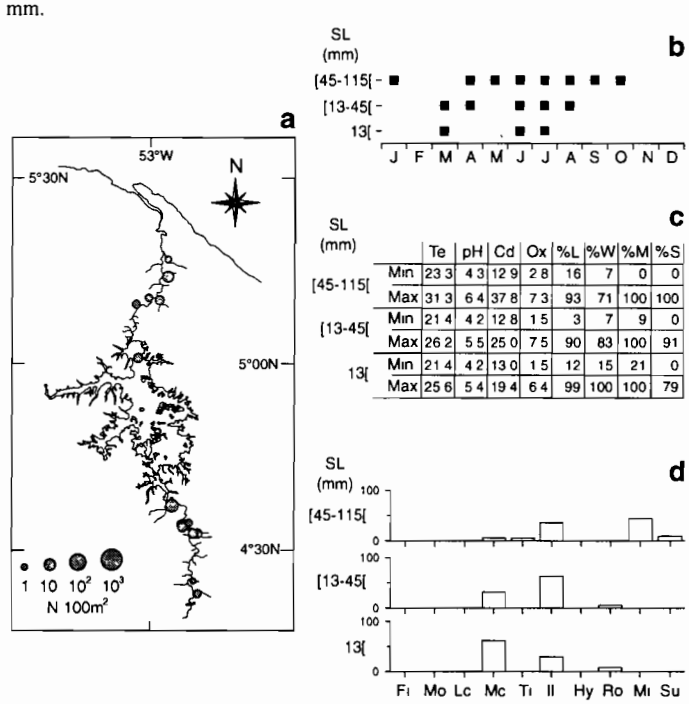


Fig. 17. *Leporinus* spp. a) spatial distribution (all individuals), b) temporal occurrence, and c) habitat characteristics for early life stages <13 mm, young juveniles 13 to 45 mm, and old juveniles 45 to 115 mm. Habitat codes in Fig. 4.

At 26.0–27.0 mm, *L. friderici* or *L. gossei* (Fig. 15c) and *L. granti* (Fig. 15d) juveniles begin to present the pattern of pigmentation of the adults. Three large dark spots on the flanks of *L. friderici/L. gossei* juveniles contrast with less dense vertical bands of pigments, whereas the pigmentation pattern of *L. granti* juveniles consist in patches of equal density. These patterns can vary importantly from specimen to specimen.

We suggest to use the length of the last ray of the A-fin for distinguishing *L. friderici/ L. gossei* and *L. granti* juveniles: it reaches to the anterior limit of the C-fin in *L. friderici/ L. gossei* (Fig. 16a) and extends only mid-distance of the caudal peduncle in *L. granti* (Fig. 16b). The distinction with *L. despaxi* Puyo, 1943 (Fig. 16c) and *L. maculatus* Steindachner 1910 (Fig. 16d) can be easily made for young juveniles >15.0 mm from the pattern of their pigmentation.

Young *Leporinus* spp. were caught in all the sampled sections except in the central part of the reservoir (Fig. 17a). Early life stages <13.0 mm were observed only in March and June-July (Fig. 17b) and seemed to prefer habitats with high proportions of leaf cover, woody debris and mud (Fig. 17c). During their ontogeny, the diet of young *Leporinus* spp.

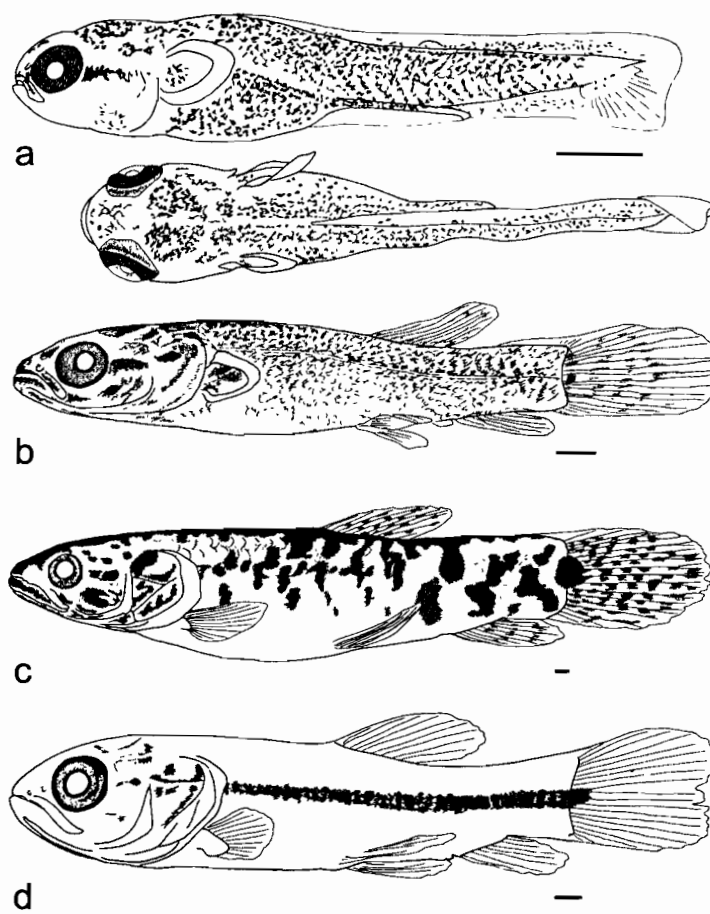


Fig. 18. *Erythrinus erythrinus* a) 7.5 mm lateral and dorsal view, b) 14.0 mm and c) 38.0 mm, and d) *Hoplerythrinus unitaeniatus* 21.0 mm. Horizontal bars represent 1 mm

switched from mainly micro-crustaceans to insect larvae, and finally to insect larvae and miscellaneous debris (Fig. 17d).

4. Erythrinidae

Erythrinus erythrinus (Schneider, 1801) and *Hoplerythrinus unitaeniatus* (Spix, 1829)

At 7.5 mm, the notochord *E. erythrinus* early life stages is not flexed, the moderately compressed body is elongate, the ovate head is small, the snout is convex, the upper maxilla

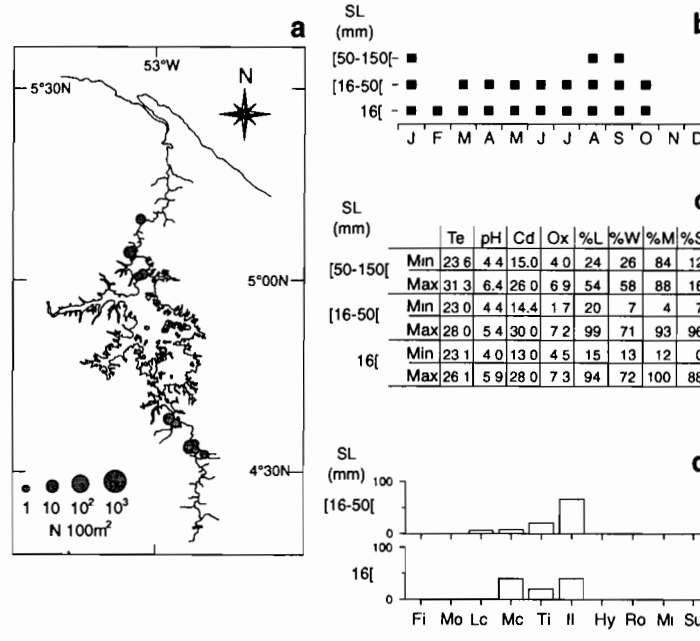


Fig. 19. *Erythrinus erythrinus* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics for early life stages <16 mm, young juveniles 16 to 50 mm, and old juveniles 50 to 150 mm and d) relative importance of various dietary items for early life stages and young juveniles only. Habitat and prey codes in Fig 4.

reaches to the anterior edge of the pupil, the obliquely elongate eyes are of moderate size (Fig. 18a). The anterior half of the gut presents a clear triangular shape whereas the posterior part is straight. A continuous finfold surrounds the body in which incipient rays of the C-fin and anlagen of the D-fin can be observed. Melanophores are scattered on the entire body except the caudal tip. On the body, melanophores enhance the geometry of the myomeres. Melanophores also cover the nape, the dorsal and ventro-lateral surfaces of the head where they coalesce in a conspicuous horizontal black line that bisects the eyes and extends onto the snout. Sprinklings of tiny melanophores are also present on the finfold posteriorly to the anus and dorsally.

At 14.0–15.0 mm, the body of young *E. erythrinus* is less compressed but remains elongate, the ovate head becomes large with a convex snout, the mouth reaches to the anterior edge of the pupil, but the eyes remain elongate (Fig. 18b). At that SL, the rays of all fins except pectoral ones are present. The scattered melanophores on the body tend to coalesce into larger patches dorsally, anterior to the D-fin, and on the dorsal surface of the head. Dark patches cover the tip of the snout, the upper and lower jaws and the operculum.

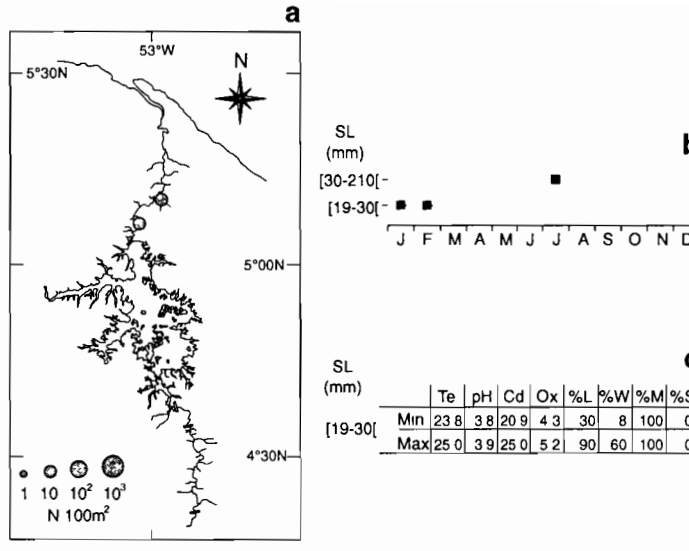


Fig. 20. *Hoplerythrinus unitaeniatus* a) spatial distribution (all individuals), b) temporal occurrence for young juveniles 19 to 30 mm and old juveniles 30 to 210 mm and c) habitat characteristics for young juveniles only Habitat codes in Fig 4

A- and V-fins are unpigmented whereas some pigments are present on the D-fin, especially at its base. Melanophores on the C-fin align in curved vertical lines and the characteristic black spot at its mid-base can be observed.

At 25.0–30.0 mm, *E. erythrinus* juveniles look like young adults (Fig. 18c) and can be easily distinguished from young *Hoplerythrinus unitaeniatus* (Spix, 1829), which present a deeper body, a larger more rounded head and a virtually unpigmented body with the exception of a horizontal black line that extends from the operculum to the base of the middle rays of the C-fin (Fig. 18d).

We caught young *E. erythrinus* in all the sampled sections except in the central part of the reservoir (Fig. 19a). Early life stages were caught from January to October (Fig. 19b). Young *E. erythrinus* were caught in a large range of habitats, but older individuals appear to avoid habitats covered mostly by sand (Fig. 19c). Individuals <16.0 mm ingested mostly micro-crustaceans and insect larvae and switched almost exclusively to the later when larger (Fig. 19d).

Young *H. unitaeniatus* (N=22) were caught only downstream to the dam (Fig. 20a), but too infrequently for us to detect any consistent pattern in their temporal occurrence (Fig. 20b). Most of the young were caught in habitats where the bottom was covered with mud and presented large amounts of leaves (Fig. 20c). Specimens were not caught in sufficient number to detect reliable pattern in their diet.

Hoplias aimara (Valenciennes, 1840) and *H. malabaricus* (Bloch, 1794)

Identification of early life stages of *H. aimara* and *H. malabaricus* is problematic and we grouped individuals <20.0 mm at the genus level for studying their ecology (e.g. Mérigoux & Ponton 1999, Ponton et al. 2000). However, we will tentatively describe the early life stages of both species separately here keeping in mind that differences for some individuals are not always so clear-cut.

At 10.0–11.0 mm early life stages of *H. aimara* present an elongate laterally compressed body, an ovate head of moderate size, a terminal mouth that reaches to the anterior edge of the pupil, large horizontally elongate eyes (Fig. 21a). The gut reaches 70 % of SL. At that size, remnants of the finfold are still observable with thickenings that correspond to the future D-and A-fins whereas the rays of the C-fin are already developed. The body of young *H. aimara* is lightly and homogeneously pigmented, the snout and the dorsal surface of the head appearing dark. At 13.0–14.0 mm, the body is deeper, the head is still large and the snout pointed, the size of the eyes becomes moderate relatively to head size but they are clearly smaller vertically than horizontally (Fig. 21b). At that SL, the rays of all fins except the pectoral ones are present. Melanophores form numerous dark patches over the entire body surface, on the dorsal surface of the head, and on the operculum. Melanophores on the D-, C- and V-fins align along the rays but remain only near the base of the A-fin. From 25.0 mm onwards, *H. aimara* juveniles look like young adults with a characteristic triangular head, relatively large elongated eyes, which are positioned quite dorsally, and patches of pigmentation that vary greatly between individuals (Fig. 21c).

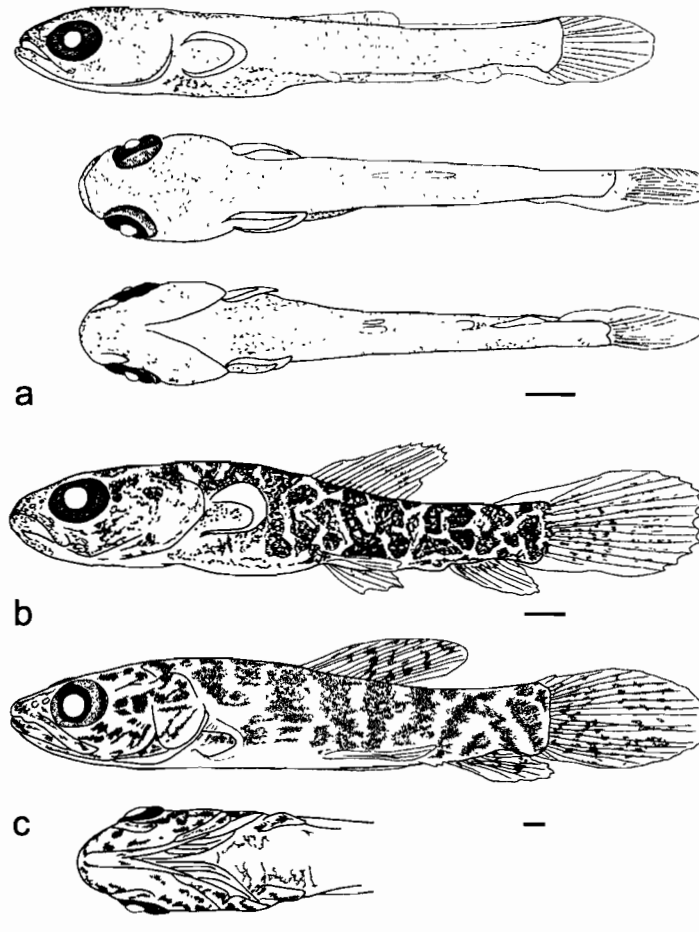


Fig. 21. *Hoplias aimara* a) 11.0 mm lateral, dorsal and ventral view, b) 13.0 mm and c) 25.0 mm with ventral view of the head. Horizontal bars represent 1 mm.

At 9.0–10.0 mm, early life stages of *H. malabaricus* present an elongate laterally compressed body, an squarish head of moderate size, a terminal mouth that reaches to the pupil, a short snout, and round eyes of moderate size (Fig. 22a). The gut represents 65 % of SL. At that SL, the finfold is still present with incipient rays of the future D-fin and only the anlagen of the A-fin. Only the rays of the C-fin have started to develop. The pigmentation is light with clusters of melanophores over the entire body, the gut, the snout and the dorsal surface of the head. At 13.0–14.0 mm, the posterior part of the body increases in depth, the head is still large, the snout more roundish, the size of the eyes becomes small relatively to head size, but their shape is clearly round (Fig. 22b). In that size range, the rays of all fins except the pectoral ones are present. Melanophores form light brownish patches scattered over the entire body surface, of the dorsal surface of the head and on the operculum. Melanophores on the D-, C- and V-fins align along the rays but remain near the base of the A-fin only. From 25.0 mm onwards, *H. malabaricus* young juveniles look like adults with a characteristic rounded snout, relatively small round eyes and a conspicuous dark line that extends from the operculum to the C-fin and contrasts with the brown colour of the body (Fig. 22c).

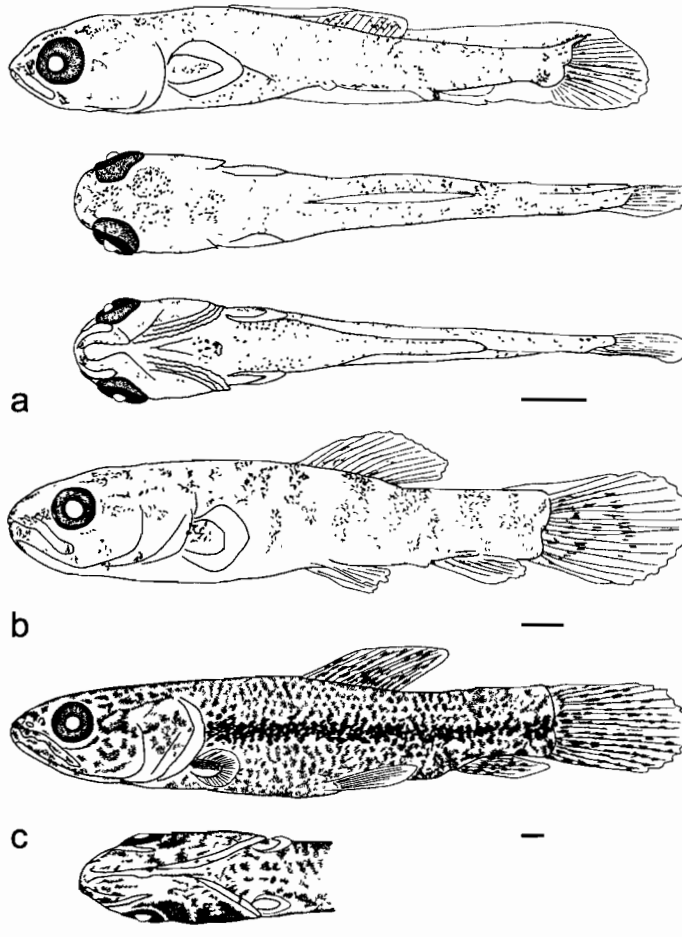


Fig. 22. *Hoplias malabaricus* a) 9 0 mm lateral, dorsal and ventral view, b) 13 0 mm and c) 25 0 mm with ventral view of the head. Horizontal bars represent 1 mm.

Early life stages of *H. aimara* and *H. malabaricus* can be tentatively distinguished from the shape of their eyes (horizontally elongate *vs.* round, respectively) and their patterns of pigmentation (homogeneous *vs.* patchy, respectively). When their SL exceeds 20.0 mm, the young juveniles of the two species can be confidently distinguished by the shape and position of the eyes, the shape of the snout and the pattern of pigmentation. In older

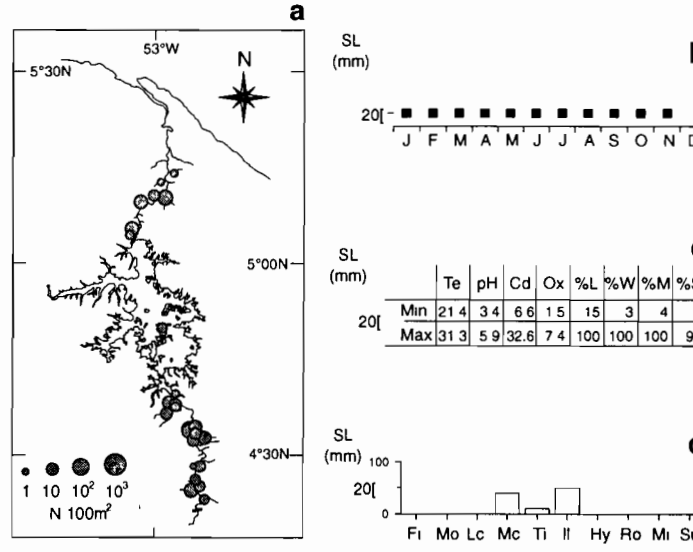


Fig. 23. *Hoplias* spp. a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics and d) relative importance of various dietary items for early life stages <20 mm. Habitat and prey codes in Fig. 4.

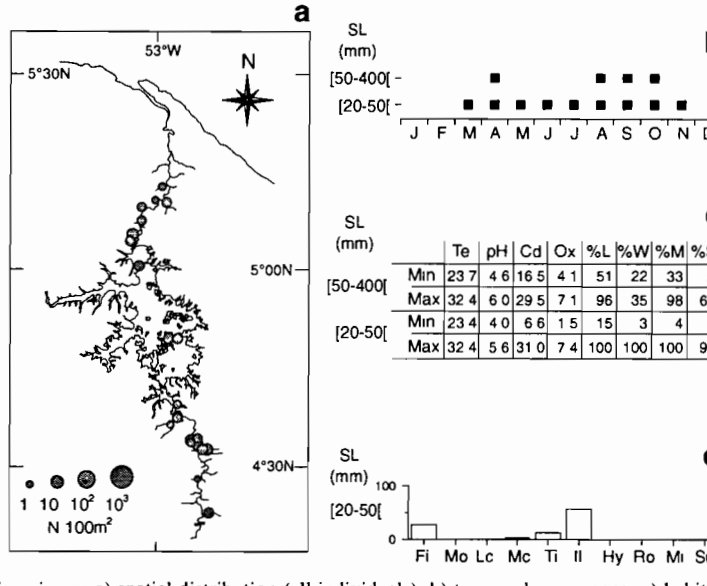


Fig. 24. *Hoplias aimara* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics for young juveniles 20 to 50 mm, and old juveniles 50 to 400 mm and d) relative importance of various dietary items for young juveniles only. Habitat and prey codes in Fig. 4.

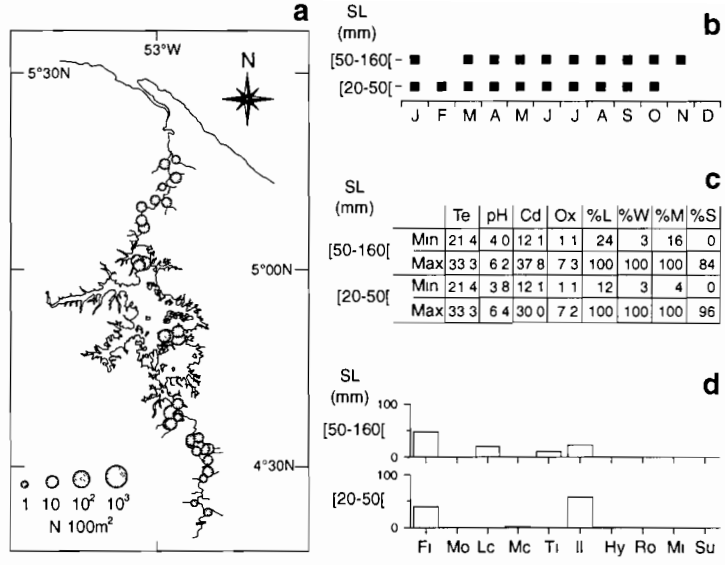


Fig. 25. *Hoplias malabaricus* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for young juveniles 20 to 50 mm and old juveniles 50 to 160 mm Habitat and prey codes in Fig 4.

juveniles, the shape of the lower jaw, when observed ventrally, can help discriminate *H. aimara* (Fig. 21c) from *H. malabaricus* (Fig. 22c).

Young *Hoplias* spp., *H. aimara* and *H. malabaricus* were caught almost everywhere in the River Sinnamary (Figs. 23a, 24a and 25a respectively). Early life stages and young juveniles were present year-round in our catches (Figs. 23b, 24b and 25b). They were observed in a large range of habitats except those covered entirely with sand (Figs. 23c, 24c and 25c). *Hoplias* <20.0 mm ingest mostly micro-crustaceans and insect larvae (Fig. 23d), whereas larger specimens switch to insect larvae and fishes (Figs. 24d and 25d), with larger *H. malabaricus* also preying on large crustaceans and terrestrial insects.

5. Lebiasinidae

Copella carsevennensis (Regan, 1912)

At 6.5–7.0 mm, the moderately compressed body of *C. carsevennensis* is elongated, the ovate head is of moderate size, the snout is rounded, the small oblique mouth does not reach to the eye and the round eyes are large (Fig. 26a). The gut reaches 50 % of SL. At that SL, the notochord is curved into an S-shape and forms a characteristic long curved needle-like appendicle when only remnants of the finfold are present ventrally and around the C-fin. Young *C. carsevennensis* are heavily pigmented, especially on the dorsal surface of their head and body and the melanophores are almost aligned along the myomeres. The gut is lightly pigmented, the melanophores being mostly on its ventral surface.

At 9.0–10.0 mm, the body deepens but the head remains of moderate size and the eyes remain round and large (Fig. 26b). At that SL, the rays of all fins except the pectoral ones are present and the needle-like appendicle is proportionally shorter, not exceeding the length of the

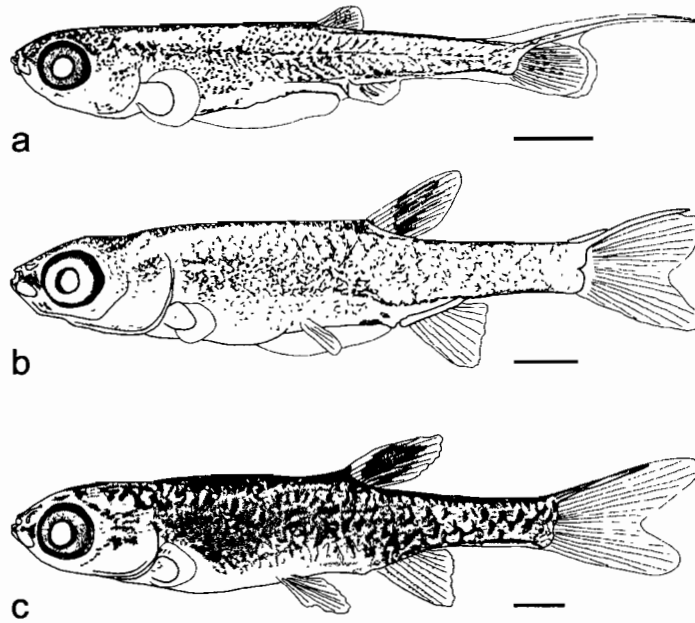


Fig. 26. *Copella carsevennensis* a) 6.5 mm, b) 9 0 mm and c) 10.5 mm. Horizontal bars represent 1 mm

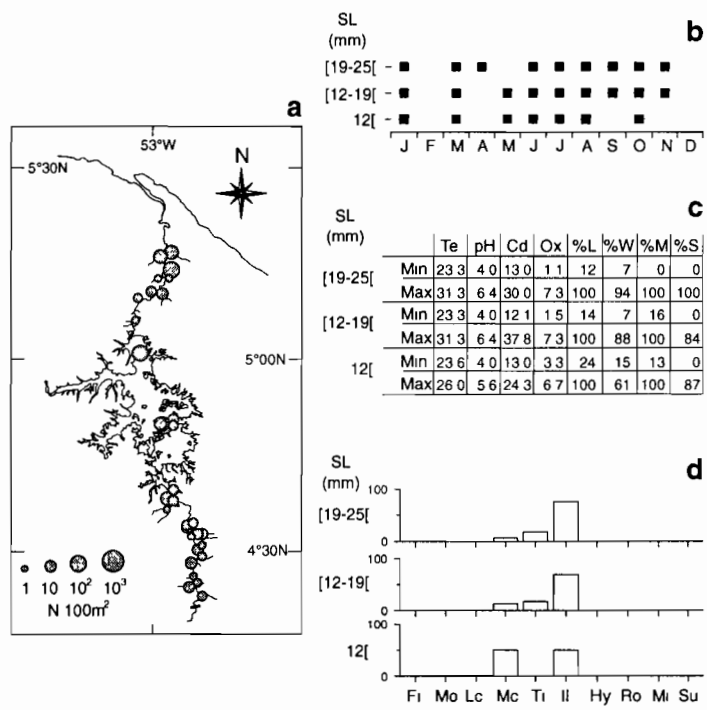


Fig. 27. *Copella carsevennensis* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <12 mm, young juveniles 12 to 19 mm, and old juveniles 19 to 25 mm Habitat and prey codes in Fig 4.

C-fin. Fins lack pigmentation except the D-fin, which bears a black, more or less ovate, spot. At 10.0–11.0 mm, *C. carsevennensis* young juveniles resemble small adults except for the rays of the P-fin, which are not fully developed and the needle-like appendicle still present (Fig. 26c).

Young *C. carsevennensis* were caught everywhere in the River Sinnamary (Fig. 27a). The smallest individuals were present year-round, suggesting that this species reproduces continuously (Fig. 27b). All stages were observed over a large range of habitats including very deoxygenated waters for the larger individuals (Fig. 27c). Very young stages mostly ate micro-crustaceans and insect larvae, the latter becoming more important in the diet of larger individuals (Fig. 27d).

Pyrrhulina filamentosa Valenciennes in Cuvier, 1846

Early life stages of *P. filamentosa* have a moderately elongate body, a pointed snout, and an oblique mouth that reaches to the anterior limit of the large eyes (Fig. 28a). The anterior half of the gut is large, whereas its posterior part appears as a straight tube. The posterior end of the notochord forms a characteristic long curved needle-like appendicle like in *C. carsevennensis*. Remnants of the finfold are present at the ventral edge of the belly and dorsally at the posterior end of the caudal peduncle, but the formation of D-, C- and A-fin rays has already begin. The pigmentation is heavy on the dorsal surface of their snout, head and body only. It is lighter on the dorso-lateral surface of the body, denser just above the half posterior part of the gut.

From their smallest size onwards, young *P. filamentosa* (Fig. 28a) can be distinguished from young *C. carsevennensis* (Fig. 26a) by the shape of the superior jaw, which is concave and omega-shaped when view from above for *C. carsevennensis* (Fig. 28b) and convex for *P. filamentosa* (Fig. 28c).

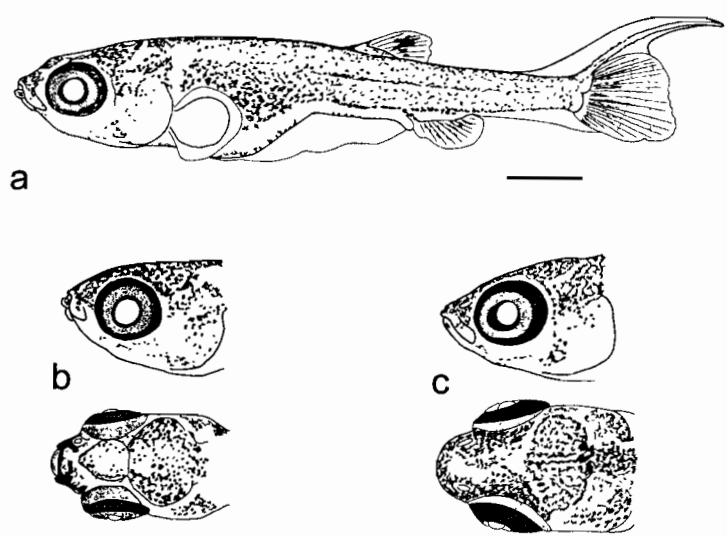


Fig. 28. *Pyrrhulina filamentosa* 9 0 mm (a) with lateral and dorsal view of the head of b) *Copella carsevennensis* 6.5 mm and c) *Pyrrhulina filamentosa* 9.1 mm.

Young *P. filamentosa* were caught everywhere in the River Sinnamary (Fig. 29a). The early life stages were present year-round (Fig. 29b). All stages were observed over a large range of habitats, including very deoxygenated waters (Fig. 29c). Insect larvae and micro-

crustaceans were the main diet of early life stages, whereas the food of juveniles included a larger proportion of terrestrial insects (Fig. 29d).

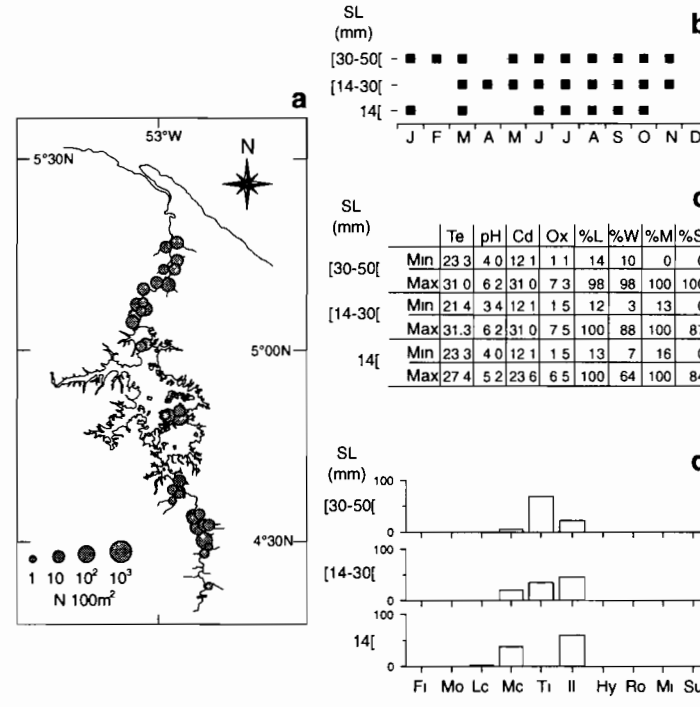


Fig. 29. *Pyrrhulina filamentosa* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <14 mm, young juveniles 14 to 30 mm, and old juveniles 30 to 50 mm. Habitat and prey codes in Fig. 4

6. Characidae

With 70 different species, the characids are the largest family of freshwater fish in French Guiana (Planquette et al. 1996). In the River Sinnamary, we caught the progeny of 24 out of the 32 species listed by Tito de Morais & Lauzanne (1994).

a. Characidae Characidiinae

We caught the progeny of the three different species of Characidiinae present in the River Sinnamary (Tito de Morais & Lauzanne 1994): *Characidium fasciadorsale* Fowler, 1914, *Melanocharacidium* cf. *blennioidides* (Eigenmann, 1909) and *Microcharacidium eleotrioides* (Géry, 1960).

Characidium fasciadorsale Fowler, 1914

At 8.0 mm, early life stages of *C. fasciadorsale* possess an elongate compressed body, a triangular head of moderate size, a pointed snout, a terminal mouth, large nearly round eyes and a long gut (Fig. 30a). At that SL, the notochord is curved and the finfold is discontinuous with remnants present dorsally and ventrally. The rays of the D- and C-fin are developing

whereas only incipient rays can be observed where the A-fin will form. The D-fin presents a high height / width ratio characteristic of Characidiinae. Very young stages are lightly pigmented with only few melanophores on the cleithrum, on each side of the gut, ventrally and dorsally on the caudal peduncle, dorsally on the body, the nape and the head. The C-fin is peppered with small melanophores.

At 10.0–11.0 mm, the body becomes deeper in its half anterior part (Fig. 30b). Although remnants of the finfold can be observed on some individuals anteriorly to their D-fin, all fins except the pectoral ones possess rays. Pigmentation includes patches of ventral and dorsal melanophores and a thin mediolateral series over the body. All fins also bear tiny melanophores along their rays. At 14.0 – 15.0 mm, the general body shape and pattern of pigmentation of young juveniles resemble that of small adults, although P-fin rays are not developed (Fig. 30c).

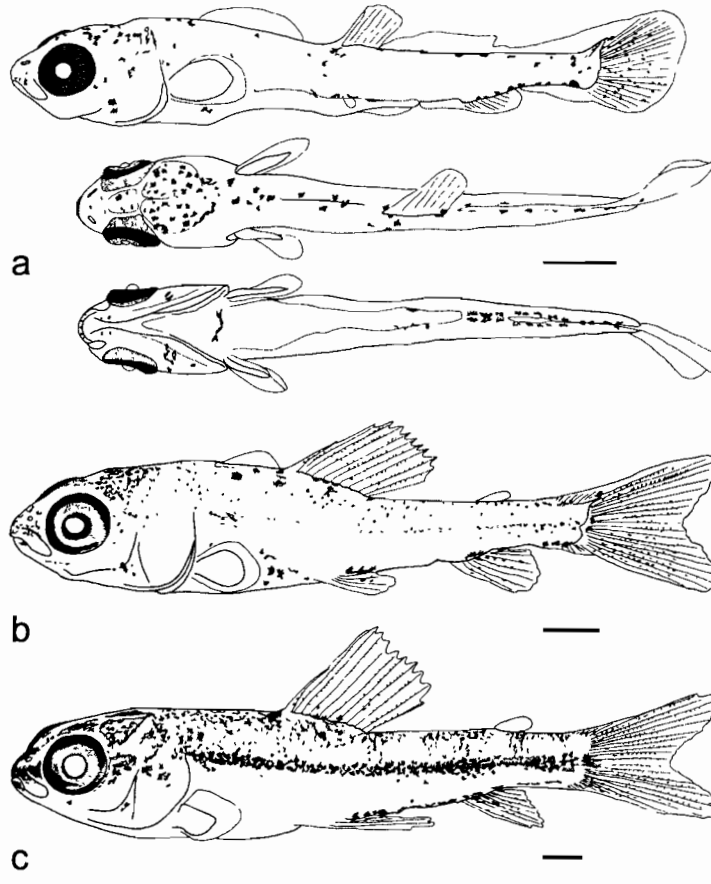


Fig. 30. *Characidium fasciadorsale* a) 8.0 mm lateral, dorsal and ventral view, b) 10.0 mm and c) 14.3 mm Horizontal bars represent 1 mm

Early life stages of *C. fasciadorsale* (Fig. 30a) are easily distinguished from *M. eleotrioides* (Fig. 34a) which do not have melanophores on their cleithrum and have V-fins that develop before the A-fin. When *C. fasciadorsale* individuals become larger (Figs. 30b and c), their head is larger than that of *M. eleotrioides* (Fig. 34b and c) and presents

a mediolateral continuous series of melanophores. At identical sizes, young *C. fasciadorsale* (Fig. 30) are less pigmented than young *M.* cf. *blennioidides* (Fig. 32) and present a mediolateral continuous series of melanophores.

Young *C. fasciadorsale* were caught everywhere in the sampled sections except in the lower part of the reservoir (Fig. 31a). The smallest individuals where caught from March to September (Fig. 31b). Young *C. fasciadorsale* were observed in a large range of habitats (Fig. 31c). The diet of the smallest individuals comprised micro-crustaceans and insect larvae, the latter being of increasing importance in the diet of larger individuals (Fig. 31d).

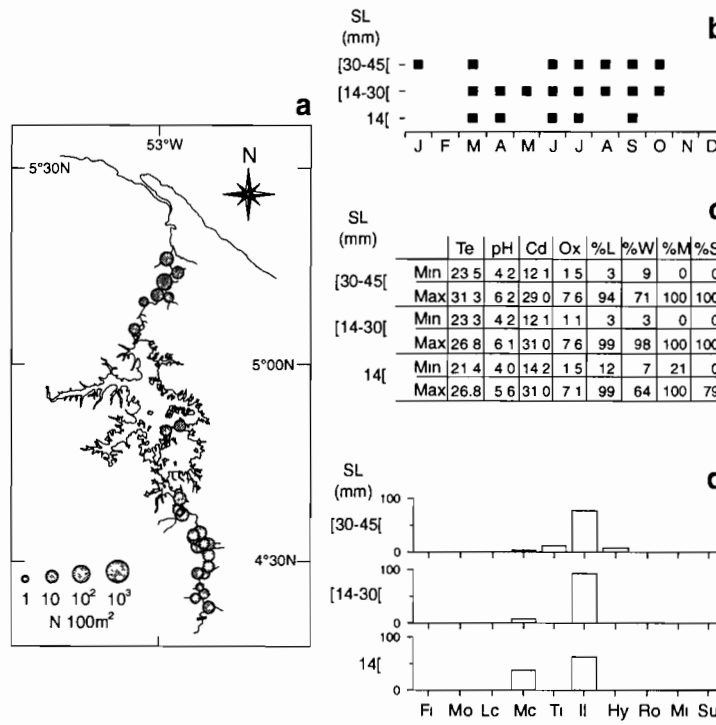


Fig. 31. *Characidium fasciadorsale* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <14 mm, young juveniles 14 to 30 mm, and old juveniles 30 to 45 mm Habitat and prey codes in Fig. 4.

Melanocharacidium cf. *blennioides* (Eigenmann, 1909)

At 9.5 mm, the cylindrical body of *M.* cf. *blennioides* early life stages is moderately elongate, the triangular head is large with a pointed snout, the terminal mouth reaches to the anterior edge of the pupil and the large eyes are obliquely elongate (Fig. 32a). The rays of all the fins except the pectoral ones are present. The D-fin is deeper than long, and the posterior tip of the V-fin rays almost reach to the anterior origin of the A-fin. Dense patches of melanophores situated almost exclusively dorsally and ventrally and small blotches situated anteriorly to the eye and on the opercula contrast highly with the unpigmented body. One larger and denser patch of melanophores is also present at the extremity of the caudal peduncle. The V-fins are unpigmented, the A-fin has a series of melanophores at its base, the C-fin two vertical bands and the D-fin is peppered with tiny melanophores on its base only.

At 11.5 mm, the body becomes slightly deeper, but the head, mouth and eyes remain large (Fig. 32b). The rays of the P-fin begin to form and the posterior tip of the V-fin rays now reach to the A-fin. At that SL, the characteristic dorsal and ventral patches of

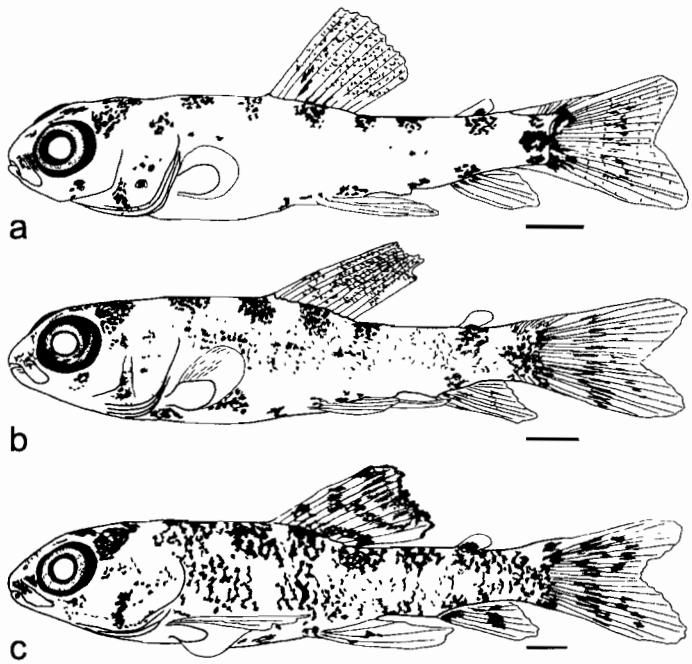


Fig. 32. *Melanocharacidium* cf. *blennioides* a) 9.5 mm, b) 11 5 mm and c) 13 0 mm. Horizontal bars represent 1 mm

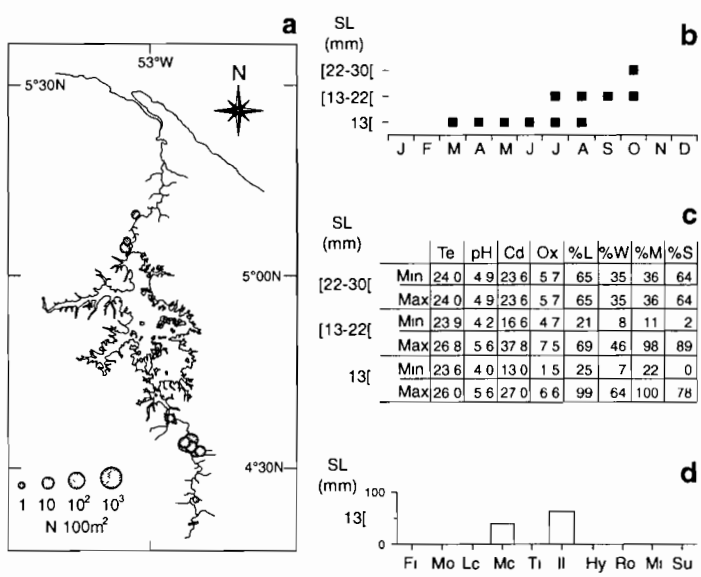


Fig. 33. *Melanocharacidium* cf. *blennioides* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics for early life stages <13 mm, young juveniles 13 to 22 mm, and old juveniles 22 to 30 mm, and d) relative importance of various dietary items for early life stages only. Habitat and prey codes in Fig. 4.

melanophores remain conspicuous, but lateral pigmentation intensifies. Fins become more heavily pigmented except V- and P-fins. From 13.0 mm onwards, *M.* cf. *blennioidides* young juveniles resemble small adults (Fig. 32c).

Young *M.* cf. *blennioides* (Fig. 32) are easily distinguished from young *C. fasciadorsale* (Fig. 30) and *M. eleotrioides* (Fig. 34) by the characteristic patches of melanophores they bear.

We caught young *M.* cf. *blennioides* in downstream tributaries situated near the dam, in the upper reaches of the reservoir and in the upstream section (Fig. 33a). Smallest individuals were caught from March to August only (Fig. 33b), sometimes in deoxygenated waters (Fig. 33c). The diet of individuals <13.0 mm comprised micro-crustaceans and insect larvae (Fig. 33d).

Microcharacidium eleotrioides (Géry, 1960)

At 5.0 mm, the compressed body of *M. eleotrioides* early life stages is elongate, their ovate head is small, their snout is clearly convex, their terminal mouth reaches to the anterior edge

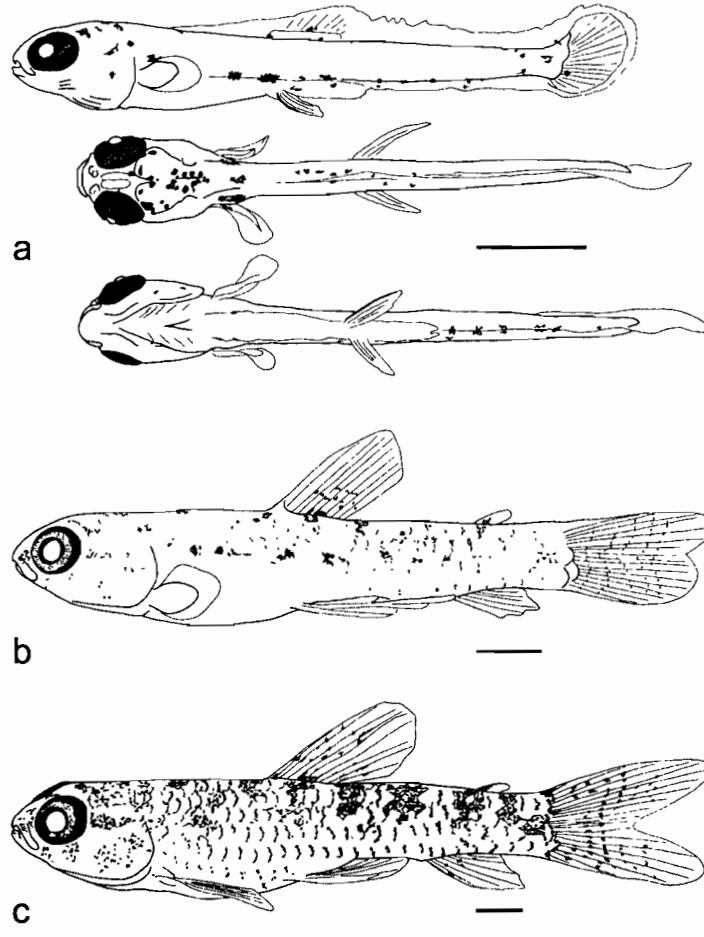


Fig. 34. *Microcharacidium eleotrioides* a) 5.0 mm lateral, dorsal and ventral view, b) 8.5 mm and c) 11.5 mm. Horizontal bars represent 1 mm.

of the pupil, their eyes are large and obliquely elongate, and their straight gut reaches 50 % of SL (Fig. 34a). Ventrally, the finfold remains posterior to the anus only, whereas dorsally it is still continuous from the nape to the C-fin. Rays of the C- and V-fins are developing whereas only incipient rays of the D-fin can be observed. Pigmentation includes large melanophores on the dorsal surface of the head and gut only and smaller melanophores dorsally near D-fin base, on the extremity of the caudal peduncle, and ventrally on the tail.

At 8.5–9.0 mm, young *M. eleotrioides* present a deep round body, the head is large and the eyes are round (Fig. 34b). The finfold has disappeared. The rays of all fins except the pectoral ones are present and a small adipose fin appears. The D-fin is deep and the V-fins reach to the anterior limit of the A-fin. Individuals are unpigmented on their ventral surface and lightly pigmented on their body and head except dorsally at the base of the D-fin and mediolaterally, posteriorly to the anus, where melanophores have coalesced. The fins are unpigmented except at the D-fin base. At 11.5 – 12.0 mm, young juveniles resemble small adults (Fig. 34c).

Small *M. eleotrioides* (Fig. 34a) lack the melanophores that small *C. fasciadorsale* have on their cleithrum (Fig. 30a). Largest *M. eleotrioides* (Figs. 34b and c) have a smaller head than *C. fasciadorsale* at the same size (Figs. 30b and c) and do not have a mediolateral series of melanophores. At identical sizes young *M. eleotrioides* (Fig. 34) are less pigmented than young *M.* cf. *blennioides* (Fig. 32).

We caught young *M. eleotrioides* mostly upstream from the reservoir (Fig. 35a). The smallest individuals were observed as early as January and as late as October (Fig. 35b). Young *M. eleotrioides* were observed in habitats presenting different characteristics but only the smallest individuals were caught in low-oxygenated waters (Fig. 35c). Their diet consisted in micro-crustaceans and insect larvae (Fig. 35d).

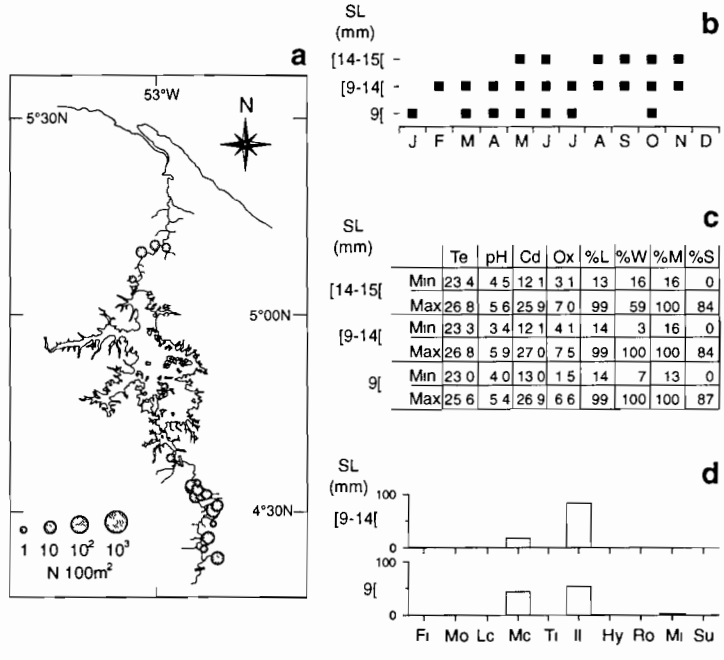


Fig. 35. *Microcharacidium eleotrioides* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics for early life stages <9 mm, young juveniles 9 to 14 mm, and old juveniles 14 to 15 mm and d) relative importance of various dietary items for early life stages and young juveniles only. Habitat and prey codes in Fig. 4.

b. Characidae Characinae

Acestrorhynchus spp. [*A. falcatus* (Bloch, 1794) and *A. microlepis* (Schomburgk, 1841)]

We were unable to differentiate young *A. falcatus* (Bloch, 1794) from young *A. microlepis* (Schomburgk, 1841) and thus grouped them at the genus level. At 8.5 mm, the compressed body of *Acestrorhynchus* spp. early life stages is elongate, the ovate head is of moderate size, the snout is pointed, the large terminate mouth reaches to the pupil, the horizontally elongate eyes are large, the long slightly undulating gut presents a relatively large diameter and the notochord is just starting to curve (Fig. 36a). Remnants of the finfold are present ventrally, posterior to the anus and dorsally on the extremity of the caudal peduncle. Incipient rays of the C- and A-fin and the anlagen of the D-fin can be observed. The pigmentation is light with tiny melanophores scattered dorsally on the body and head, laterally on the operculum, the gut, the posterior half of the body and the posterior extremity of the finfold, and ventrally mostly on the gut.

At 14.0 mm, the general shape of young juveniles resembles that of adults with an elongated body, a large head with a long pointed snout and large eyes, and a D-fin that is set relatively back on the body (Fig. 36b). At that SL, only the rays of the D-, C- and A-fin are present. The pigmentation is heavier, the dorsal surface of the snout, head and body being darker than the rest of the body. The C-fin membrane is peppered with small melanophores,

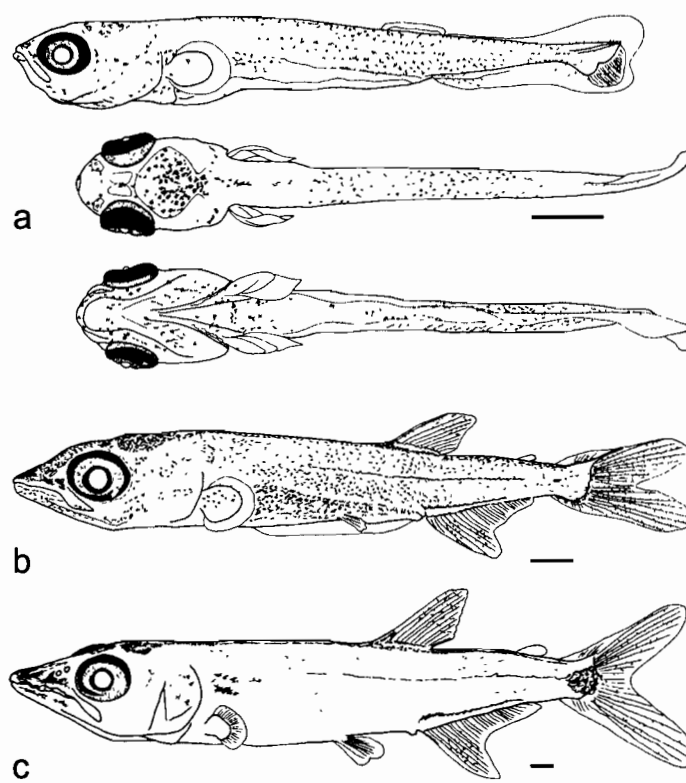


Fig. 36. *Acestrorhynchus* spp. a) 8.5 mm lateral, dorsal and ventral view, b) 14.0 mm and c) 26.0 mm. Horizontal bars represent 1 mm.

whereas only one patch of melanophores can be observed on the D-fin and two patches on the A-fin. At 26.0 mm, the general body shape of young juveniles has not changed markedly except that all fins possess rays (Fig. 36c). Their body is metallic grey, darker dorsally, with a thin black line of pigmentation that ends on the posterior extremity of the caudal peduncle with a characteristic black spot. The size of the humeral spot is very variable and thus cannot be used to distinguish *A. falcatus* from *A. microlepis*.

From their smallest size onwards, young *Acestrorhynchus* spp. are easily distinguished from other taxa by their pointing snout, large mouth, large eyes, lightly pigmented body and the position of their D-fin relatively to the A-fin.

Young *Acestrorhynchus* spp. were caught in all three sections of the River Sinnamary (Fig. 37a). The smaller specimens were caught from March to August (Fig. 37b). They were observed in a large range of habitats, but larger individuals tended to avoid deoxygenated waters (Fig. 37c). Their diet switched during ontogeny from insect larvae and micro-crustaceans to insect larvae, then ultimately to fish only (Fig. 37d).

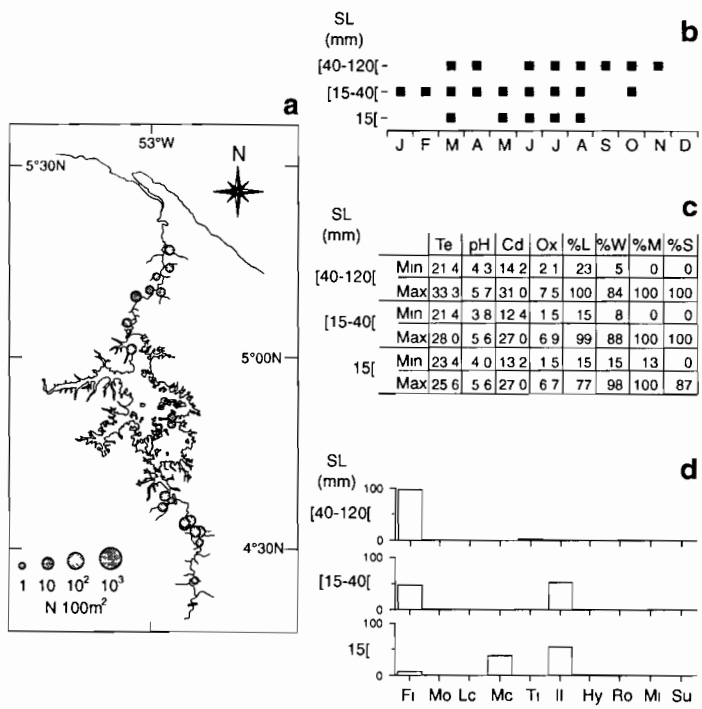


Fig. 37. *Acestrorhynchus* spp a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <15 mm, young juveniles 15 to 40 mm, and old juveniles 40 to 120 mm. Habitat and prey codes in Fig. 4.

Charax pauciradiatus Günther, 1864

Early life stages of *C. pauciradiatus* 8.0 mm present a moderately elongate body with a deeper anterior half that contrasts with a slender tail, a squarish head of moderate size, a concave snout, an oblique large mouth that reaches to mid-pupil, round eyes of moderate size and a very compact gut (Fig. 38a). The finfold is continuous ventrally but presents only remnants dorsally. The rays of the C-fin are present. Incipient rays can be observed on the A-

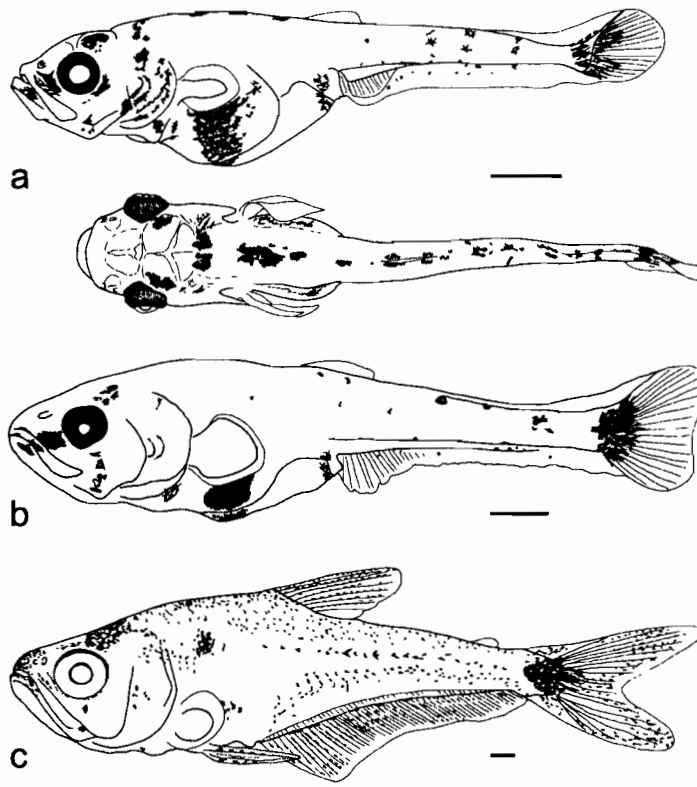


Fig. 38. *Charax pauciradiatus* a) 8.0 mm lateral and dorsal view, b) 10.5 mm and c) 22.0 mm Horizontal bars represent 1 mm.

fin in its anterior part. Consistent pigmentation includes melanophores that have more or less coalesced into large black patches that contrast with the whitish appearance of the body. These patches are located dorsally on the midbrain, nape and body, ventrally on the anterior part of the gut and the anus and laterally on the lower maxilla, anteriorly and posteriorly to the eyes, on the opercula and caudal peduncle. On the tail, the patch of melanophores extends to the base of the C-fin, forming a conspicuous and characteristic black spot.

At 10.5 mm, the general body shape is the same, but the rays of the C-fin are fully developed (Fig. 38b). The patches of melanophores on the head, cleithrum, ventral surface of the gut, anus and tail contrast greatly with the virtually unpigmented body. At 22.0 mm, young juveniles resemble small adults with a characteristic diamond-shape body and a very long A-fin (Fig. 38c).

Small *C. pauciradiatus* are easily distinguished from other taxa by their black and white general appearance they share only with young *Phenacogaster* aff. *megalostictus* (Fig. 73). At identical sizes the small *C. pauciradiatus* (Fig. 38a) have a deeper and less pigmented body than small *P.* aff. *megalostictus* (Fig. 73a), and bear a black spot anteriorly to the eye. Larger *C. pauciradiatus* have more C-fin rays (II 50–52) than *P.* aff. *megalostictus* (II 37– 38).

Young *C. pauciradiatus* were only found in the downstream section of the River Sinnamary (Fig. 39a). The smallest individuals were observed in March, June and July (Fig. 39b) in oxygenated habitats where leaves, wood and muddy substrate were abundant (Fig. 39c). Their diet comprised micro-crustaceans and insect larvae (Fig. 39d).

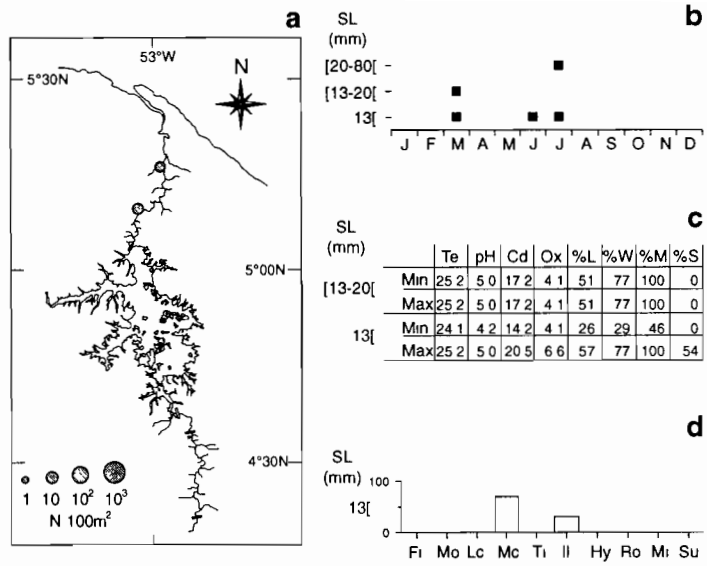


Fig. 39. *Charax pauciradiatus* a) spatial distribution (all individuals), b) temporal occurrence for early life stages <13 mm, young juveniles 13 to 20 mm, and old juveniles 20 to 80 mm, c) habitat characteristics for early life stages and young juveniles and d) relative importance of various dietary items for early life stages only. Habitat and prey codes in Fig. 4.

c. Characidae Cheirodontinae

Pristella maxillaris (Ulrey, 1894) and *Pseudopristella simulata* Géry, 1960

The early life stages of both species present a moderately deep laterally compressed body, an ovate head of moderate size, a short convex snout, an oblique mouth that does not reach to the anterior edge of the pupil, large round eyes and a triangular coiled gut (Fig. 40a for *P. maxillaris* and 40c for *P. simulata*). At 8 mm, the D-, C- and A-fin bear rays and only the buds of the V-fins can be observed. *P. maxillaris* early life stages are lightly pigmented on the head, nape and body anteriorly to the D-fin. On the lateral surface of the body the tiny melanophores form a horizontal line which crosses V-shape lines that enhance the myosepta. Melanophores aggregate on the anterior part of the gut where they extend to the remnants of the finfold. The A- and C-fin are peppered with tiny melanophores that align along the rays. The D-fin is unpigmented with the exception of a central triangular patch of melanophores. *P. simulata* early life stages are heavily pigmented dorsally where melanophores coalesce in a continuous narrow black stripe anteriorly to the D-fin. Ventrally, the melanophores on the gut do not extend over the finfold. Laterally, those that form the horizontal median and the V-shape vertical lines are larger and darker. The pigmentation on the fins is dense especially on the base of the A- and C-fin. At 11.5–12.5 mm, young juveniles of both species resemble small adults except for the lack of ray on the P-fin (Fig. 40b and 40d, respectively).

Identification of these two species cannot be based solely on their pattern of pigmentation, which varies between individuals of the same species. The number of A-fin rays (II 20–22 for *P. maxillaris* and II 23 – 25 for *P. simulata*) helps to differentiate the youngest stages of the two species, as all rays on the A-fin are present at some point between 5.0 and 6.0 mm.

Young *P. maxillaris* and young *P. simulata* were caught at every sampling station in the River Sinnamary except the central part of the reservoir (Fig. 41a and 42a, respectively).

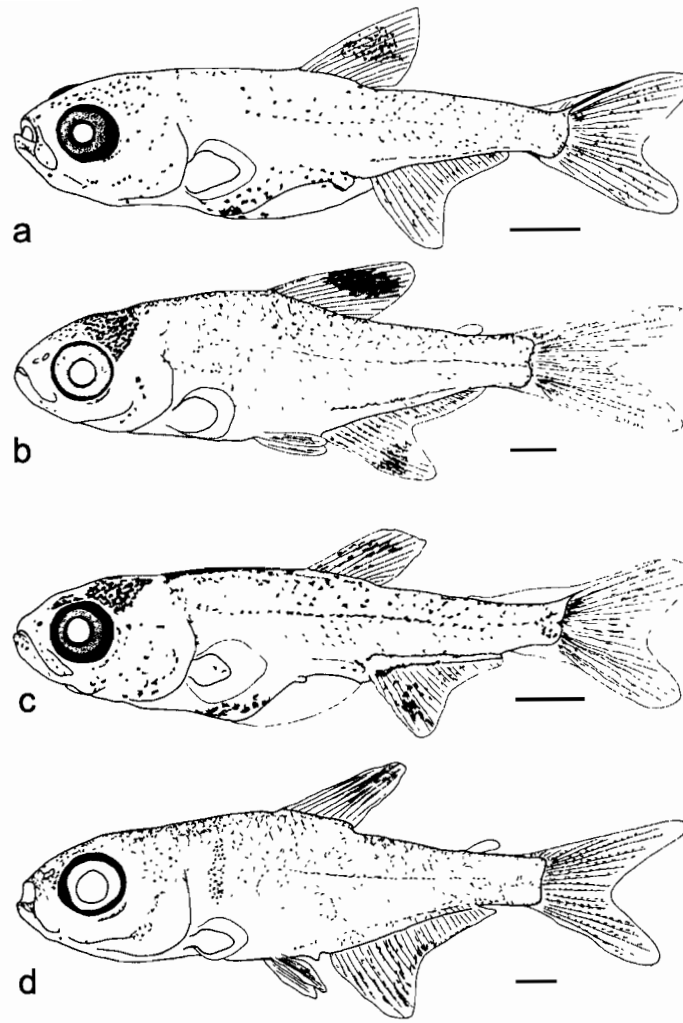


Fig. 40. *Pristella maxillaris* a) 8.0 mm and b) 11.5 mm and *Pseudopristella simulata* c) 8.0 mm and d) 12.5 mm. Horizontal bars represent 1 mm

Early life stages of both species were present in our samples from March to October (Fig. 41b and 42b, respectively). Both species were caught in a large range of habitats (Fig. 41c and 42c) but young *P. maxillaris* appeared to avoid locations covered entirely with sand. The diet of both species comprised mainly micro-crustaceans and insect larvae (Fig. 41d and 42d).

d. Characidae Serrassalminae

Myleus rhomboidalis (Cuvier, 1818) and *M. ternetzi* (Norman, 1929)

Young *Myleus rhomboidalis* or *M. ternetzi* were never caught with rotenone (Table 2), the smallest specimen were caught with light traps in the downstream section, the largest specimens were dip-netted in the section of the River Sinnamary that is now flooded by the reservoir.

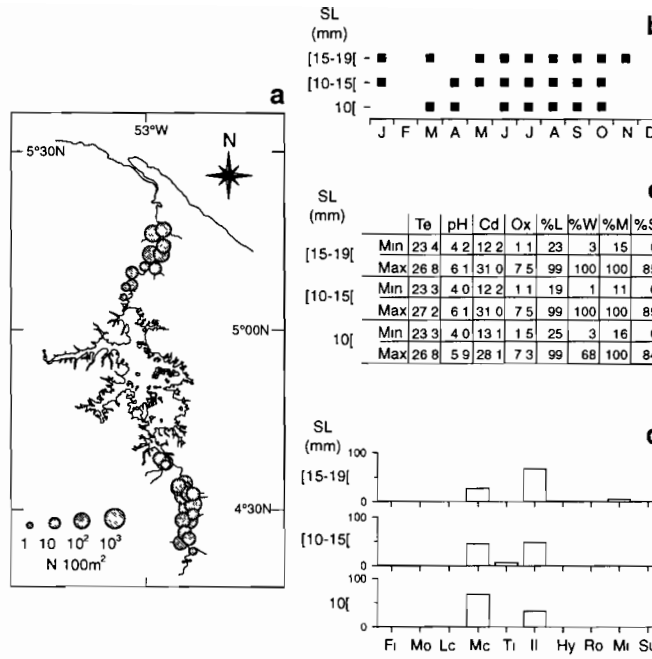


Fig. 41. *Pristella maxillaris* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <10 mm, young juveniles 10 to 15 mm, and old juveniles 15 to 19 mm. Habitat and prey codes in Fig 4.

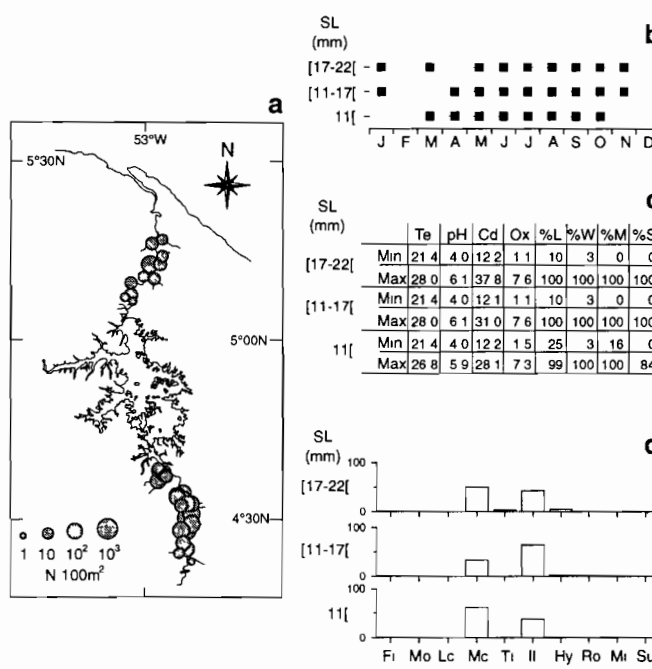


Fig. 42. *Pseudopristella simulata* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <11 mm, young juveniles 11 to 17 mm, and old juveniles 17 to 22 mm Habitat and prey codes in Fig. 4.

We were unable to identify early life stages of *Myleus* to the species level. At 10.0 mm, their cylindrical body is elongate, their ovate head is of moderate size with a blunt snout, the upper maxilla reaches to the mid-pupil, the squarish eyes are large, and the gut of relatively large diameter reaches to mid-body (Fig. 43a). At that SL, the notochord is flexed and the finfold is still present ventrally and dorsally. The C-fin rays are developing whereas those of the D-fin are only incipient. The head, body and tail are covered with brownish melanophores that give the individuals a characteristic appearance. Some of these melanophores are also present at the base of the D- and C-fin. At 13.5 mm, the body of *Myleus* spp. is deep and compressed laterally, the head is large with a curved snout and large round eyes and only the D-, C- and A-fin are fully developed (Fig. 43b). The brownish melanophores have coalesced in larger patches on the snout, the dorsal surfaces of the head, body and tail, ventrally on the gut and tail. Laterally, dense patches emerge from an homogeneous pattern of tiny pigments.

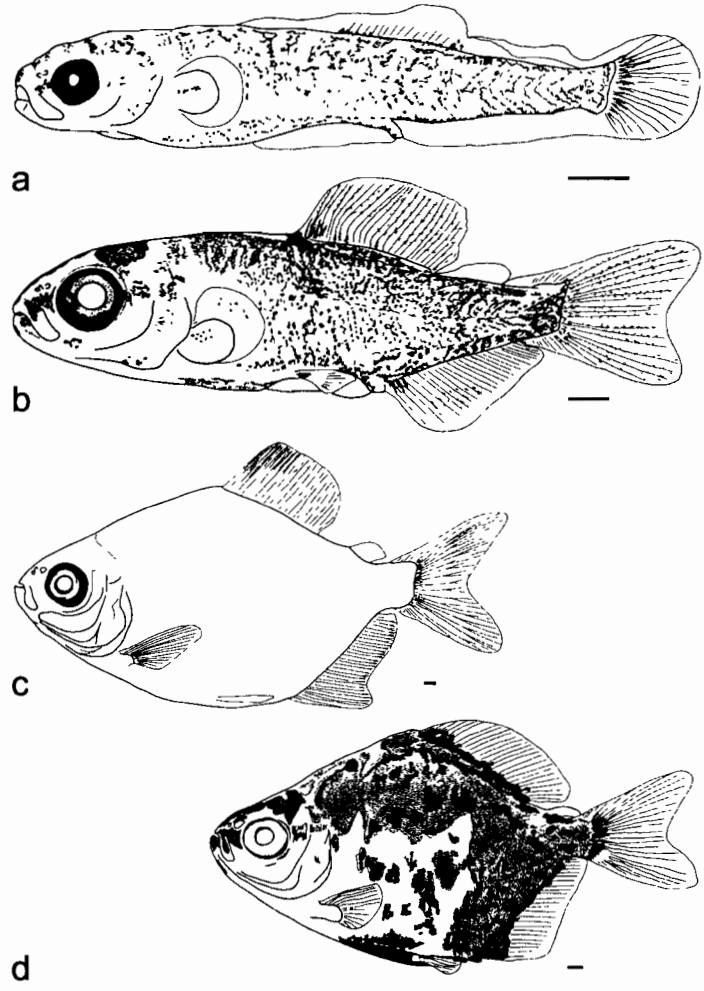


Fig. 43. *Myleus* spp. a) 10.0 mm and b) 13.5 mm and c) *M rhomboidalis* 33.0 mm and d) *M. ternetzi* 25.0 mm. Horizontal bars represent 1 mm.

From 25.0–30.0 mm onwards, the young *M. rhomboidalis* (Fig. 43c) can be easily distinguished from young *M. ternetzi* (Fig. 43d) by their adipose fin, their shorter D-fin and their unpigmented, silver grey appearance.

e. Characidae Stethaprioninae

Poptella brevispina Reis, 1989

P. brevispina of 6.5 mm present a moderately elongated laterally compressed body, an ovate head of moderate size, a pointed snout, an upper jaw that reaches to the pupil, round eyes of moderate size and a coiled gut of relatively large diameter (Fig. 44a). At that SL, the finfold remains mostly ventrally anterior and posterior to the anus, where the incipient rays of the A-fin develop. Some

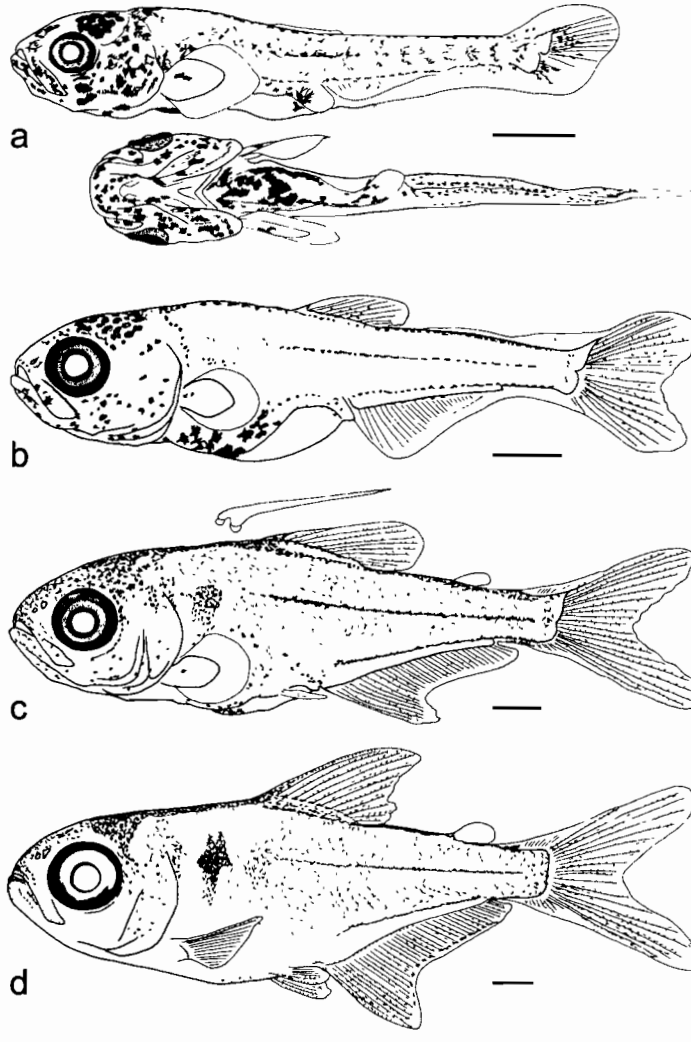


Fig. 44. *Poptella brevispina* a) 6.5 mm lateral and ventral view, b) 8.5 mm and c) 12.0 mm with enlargement of the first dorsal ray and d) 14.0 mm. Horizontal bars represent 1 mm.

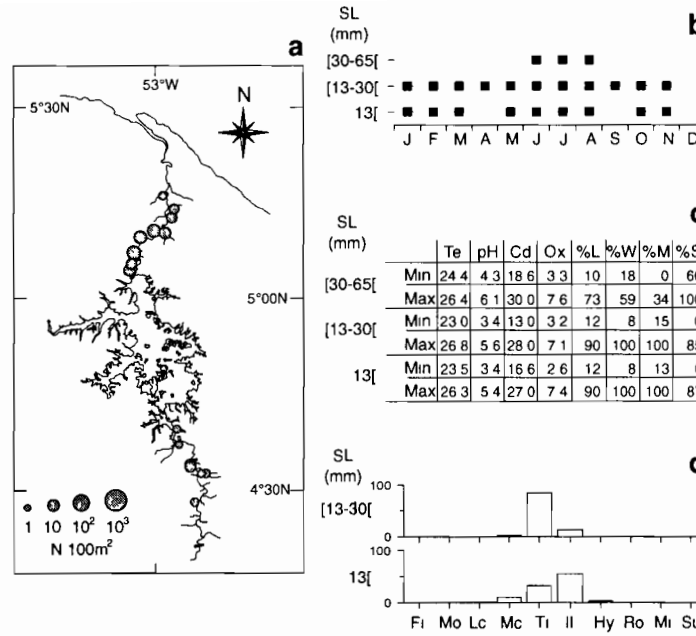


Fig. 45. *Poptella brevispina* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics for early life stages <13 mm, young juveniles 13 to 30 mm, and old juveniles 30 to 65 mm, and d) relative importance of various dietary items for early life stages and young juveniles. Habitat and prey codes in Fig 4.

rays of the C-fin are present and the anlagen of the D-fin can be detected. The superficial melanophores and the deeper V-shape pigmentation give early life stages a characteristic dark appearance. The maxilla, the snout, the dorsal surface of the head, the opercula, the cleithrum and the ventral surface of the gut present dark, sometime large, melanophores. These deep black melanophores are smaller and form a continuous double row dorsally over the entire body and ventrally on the tail. They also form a patch at the base of the C-fin.

At 8.0–9.0 mm, the anterior half of the body and the head increase in depth, the eyes are larger relative to head size, the gut is coiled in a triangular shape and the D- and C-fin rays are present (Fig. 44b). The melanophores are grouped in patches on the dorsal surface of the head and ventrally on the anterior half of the gut. They align in rows dorsally, mediolaterally and ventrally. Tiny melanophores are also present on the base of the D- and A-fin and along the C-fin rays. At 12.0 mm, the diamond-shape body is that of a small characid but pelvic fins are present as buds only and the P-fin rays are not present (Fig. 44c). Pigmentation increases especially on the dorsal surface of the head and body, along a mediolateral horizontal line and along the base of the A-fin. The ventral patch of pigment is still visible anteriorly on the gut and extends to the remnant of the V-finfold. The base of the first ray of the D-fin presents the saddle-like shape characteristic of the species observable when bending the spine backward. At 14.0 mm, young juveniles resemble small adults but with a slender body (Fig. 44d).

Young *P. brevispina* were mostly caught downstream from the dam but also in the upper reaches of the reservoir and in the upstream section (Fig. 45a). The smallest individuals were caught year-round (Fig. 45b). All size classes appeared to avoid deoxygenated waters (Fig. 45c). Smaller individuals preyed upon insect larvae, terrestrial insects and micro-crustaceans and when larger switched to terrestrial insects (Fig. 45d).

d. Characidae Tetragonopterinae

Astyanax bimaculatus (Linnaeus, 1758)

The smallest *A. bimaculatus* we caught was 10.0 mm, so that youngest stages of this species are still undescribed. At that SL, *A. bimaculatus* present a moderately deep laterally compressed body, a head of moderate size, a pointed snout, a terminal mouth that reaches to the pupil and slightly ovate eyes of moderate size (Fig. 46a). The first half of the gut is coiled, the second half

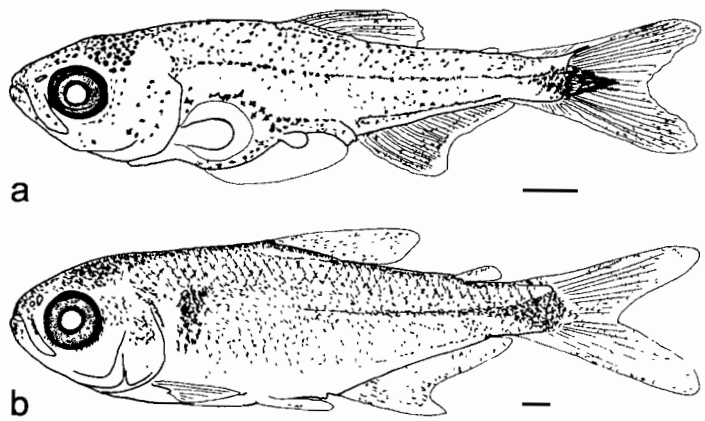


Fig. 46. *Astyanax bimaculatus* a) 10.0 mm and b) 19.0 mm. Horizontal bars represent 1 mm.

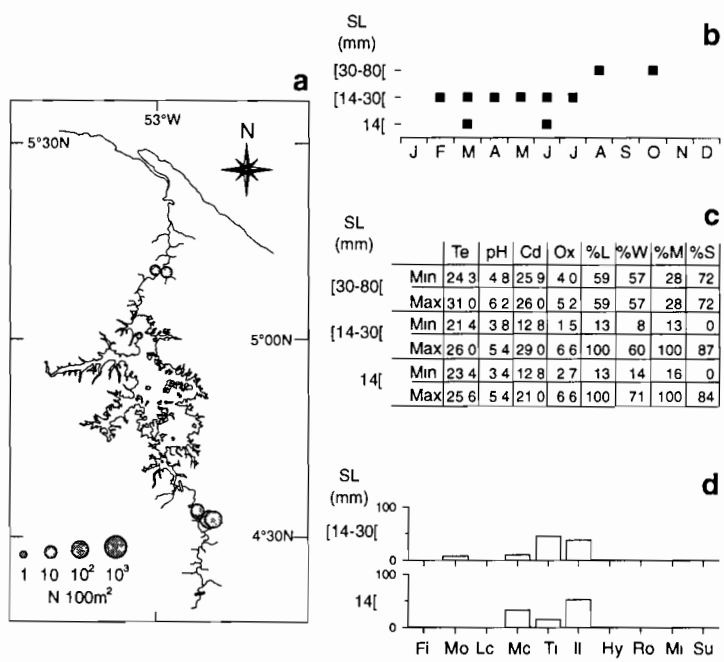


Fig. 47. *Astyanax bimaculatus* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics for early life stages <14 mm, young juveniles 14 to 30 mm, and old juveniles 30 to 80 mm and d) relative importance of various dietary items for early life stages and young juveniles. Habitat and prey codes in Fig 4.

straight. The rays of the D-, C- and A-fin are completely developed but remnants of the finfold can be seen ventrally. Small and large melanophores are evenly scattered over the entire body but are more closely spaced on the dorsal surface of the head, along a mediolateral line that ends with a diamond-shape patch, which extends along middle C-fin rays. The finfold is unpigmented. At 19.0 mm, young juveniles resemble small adults (Fig. 46b).

Young *A. bimaculatus* were caught in all the sampled sections except in the reservoir (Fig. 47a). The smallest individuals were only caught in March and June but always in low number (Fig. 47b). They were observed in different types of habitats but never when sand covered the entire bottom (Fig. 47c). The diet of young *A. bimaculatus* <14.0 mm comprised insect larvae, micro-crustaceans and terrestrial insects, the latter being of increasing importance in the diet of larger individuals (Fig. 48d).

Jubiaba cf. *keithi* (Géry, Planquette et Le Bail, 1996) [formerly identified as *Astyanax* cf. *keithi* Géry, Planquette et Le Bail, 1996]

At 10.0–10.5 mm, the body of *Jubiaba* cf. *keithi* is moderately deep, the head is moderately large, the snout is pointed, the mouth is terminal, the round eye are moderately large and the gut

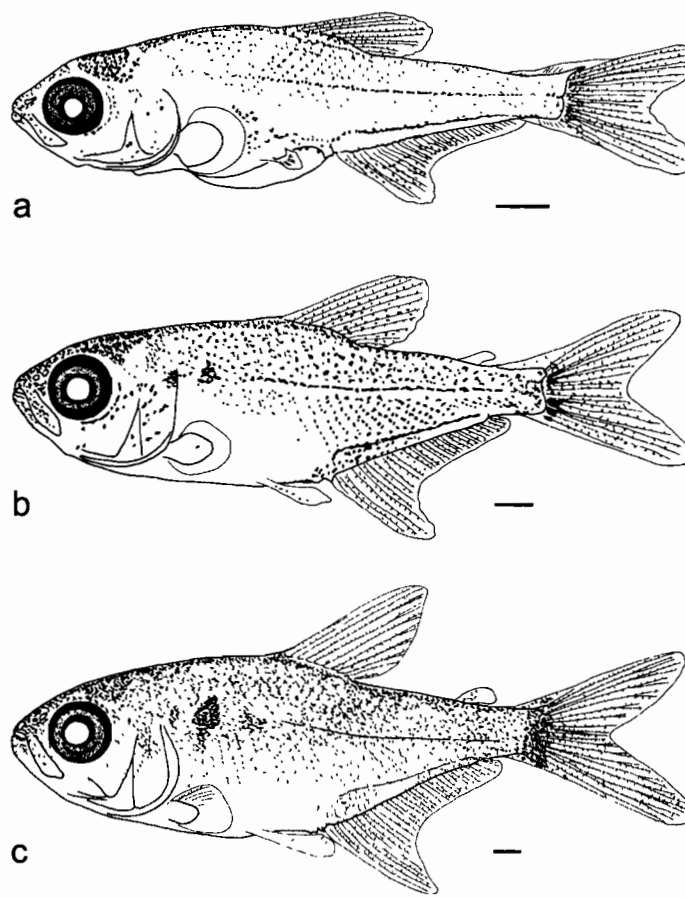


Fig. 48. *Jubiaba* cf. *keithi* a) 10 5 mm, b) 14.0 mm and c) 19.0 mm. Horizontal bars represent 1 mm.

presents a short strait posterior part (Fig. 48a). Remnants of the finfold are present ventrally anteriorly to the anus and dorsally on the caudal peduncle. The D-, C- and A-fin rays are fully developed, but V-fins are present as buds only. Small melanophores on the mediodorsal surface of the entire body and the medioventral surface of the caudal peduncle align along the myosepta. Dense melanophores form blotches on the snout, a large patch on the hindbrain and a dorsal band anteriorly to the D-fin. Some of these coalesce into one mediolateral row and one at the base of the A-fin. Melanophores on the fins align along the rays but tend to be denser at the base of the C-fin, forming a vertical black band characteristic of the species.

At 13.5–14.0 mm, the body of young juveniles presents the characteristic diamond shape of small characids (Fig. 48b). The rays of the V-fins are developing and the elongate adipose fin is clearly differentiated. The general pigmentation is heavy with dark large melanophores evenly distributed on the mediodorsal surface of the body and aligned along the myosepta of the medioventral surface of the caudal peduncle. Some of these melanophores aggregate and form an humeral spot, whereas others coalesce completely to form one continuous mediolateral thin line and one continuous line on the A-fin base. The elongate spot at the base of the C-fin is clearly observed on every individual. At 19.0 mm, older juveniles resemble small adults (Fig. 48c).

Early life stages of *J.* cf. *keithi*, *A. bimaculatus* and *P. brevispina* present a larger number of rays on their A-fin, which differentiates them easily from other species (II 32-33 for *J.* cf. *keithi*, II 27–31 for *A. bimaculatus* and II 31–33 for *P. brevispina*). These three species can be distinguished mainly from the general pattern of their pigmentation (Fig. 49). *J.* cf. *keithi* present a small black spot at the anterior limit of the ventral finfold, a vertically elongate dark spot at the base of their C-fin and a C-fin with tiny melanophores along its rays (Fig. 49a). Small *P. brevispina* bear a large conspicuous black spot on the anterior limit of the ventral finfold, and no obvious pigmentation on the C-fin (Fig. 49b). Small *A. bimaculatus* are identified from the lack of pigmentation on their ventral finfold, the diamond-shape patch of melanophores at the base of their C-fin and distal melanophores on their C-fin (Fig. 49c).

Young *J.* cf. *keithi* were never caught in all sampled sections except in the central part of the reservoir (Fig. 50a). The smallest individuals were caught from February to August (Fig. 50b). They appear to inhabit a large range of habitats, which broaden even further in older individuals to include habitats entirely covered by sand (Fig. 50c). Smallest individuals ingest micro-crustaceans, insect larvae and some terrestrial insect, the diet of larger individuals includes more insect larvae and terrestrial insects (Fig. 50d).

Jubiaba meunieri (Géry, Planquette et Le Bail, 1996) [formerly identified as *Astyanax meunieri* Géry, Planquette et Le Bail, 1996]

At 7.0–7.5 mm early life stages of *J. meunieri* present a moderately elongate and moderately compressed body (Fig. 51a). The ovate head is moderately large with an oblique terminal mouth, and large round eyes. The notochord is flexed and the incipient rays of the C-fin appear in the almost continuous finfold. The melanophores are scattered over the snout, head, opercula and gut. They form small dark patches on the ventral finfold anteriorly where it meets the gut and posteriorly near the anus. On the body and tail, the melanophores form double rows on the ventral and dorsal sides and single thin rows along the mediolateral line. Some melanophores are also present near the base of the C-fin.

At 8.0–8.5 mm, the body is deep and their head is large (Fig. 51b). D- and C-fin rays are present. Some remnants of the finfold are present dorsally between the D- and C-fin and

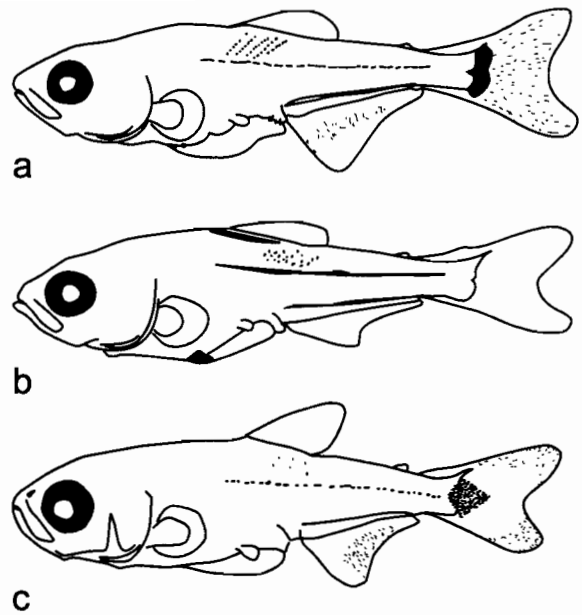


Fig. 49. Comparison of young stages of a) *Jubiaba* cf. *keithi*, b) *Poptella brevispina* and c) *Astyanax bimaculatus*.

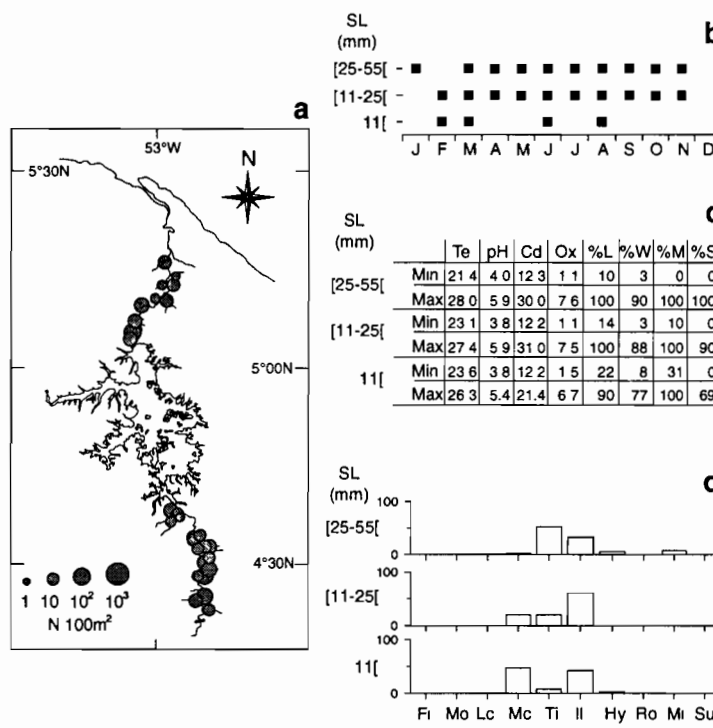


Fig. 50. *Jubiaba* cf. *keithi* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <11 mm, young juveniles 11 to 25 mm, and old juveniles 25 to 55 mm. Habitat and prey codes in Fig. 4

ventrally anterior to the anus. The general pigmentation remains basically the same with the exception of some melanophores that lightly scatter the caudal peduncle and the C-fin. From 23.0 mm onwards, juveniles resemble small adults (Fig. 51c).

J. meunieri early life stages (Fig. 51a) should not be misidentified with small *P. brevispina* (Fig. 44a), which look much darker. When young *J. meunieri* grow (Fig. 51b), the ventral black spot on their finfold remains less conspicuous than it does in young *P. brevispina* where it always extends from the finfold to the gut (Fig. 44b). Both young *J. meunieri* (Fig. 51) and *J.* cf. *keithi* (Fig. 48) present a vertical black spot on the base of their C-fin, but the body of young *J.* cf. *keithi* is more densely pigmented and does not present an anterior spot on the ventral finfold. When older, individuals of the two species can be easily separated by the number of rays on their A-fin, which is II 28–30 for *J. meunieri* and II 32–33 for *J.* cf. *keithi*.

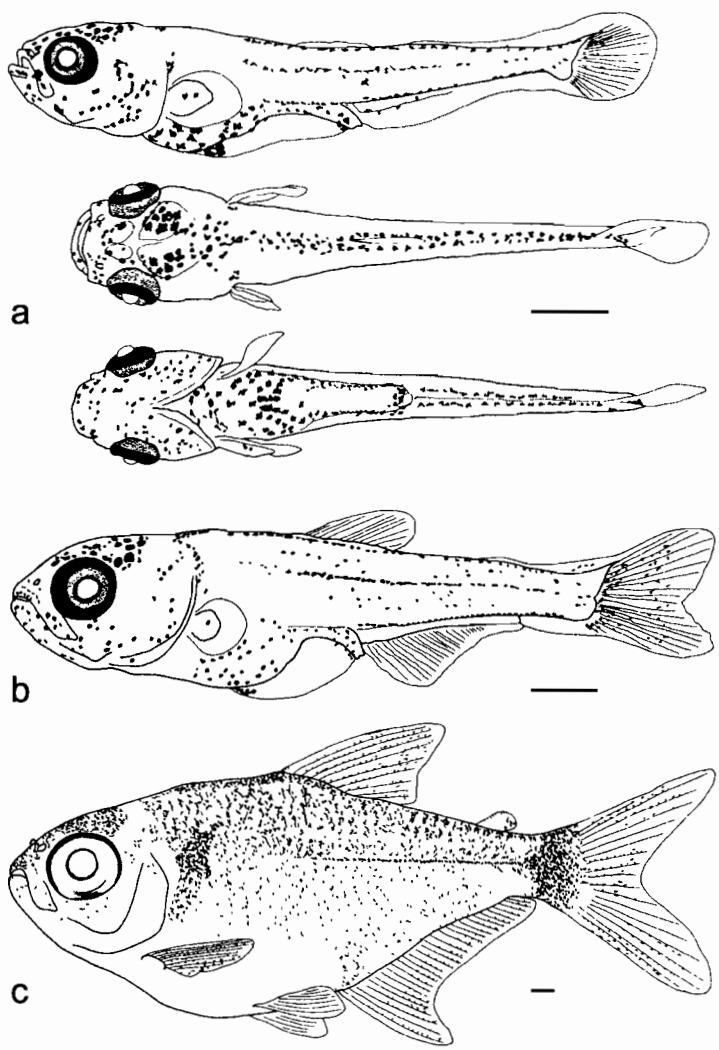
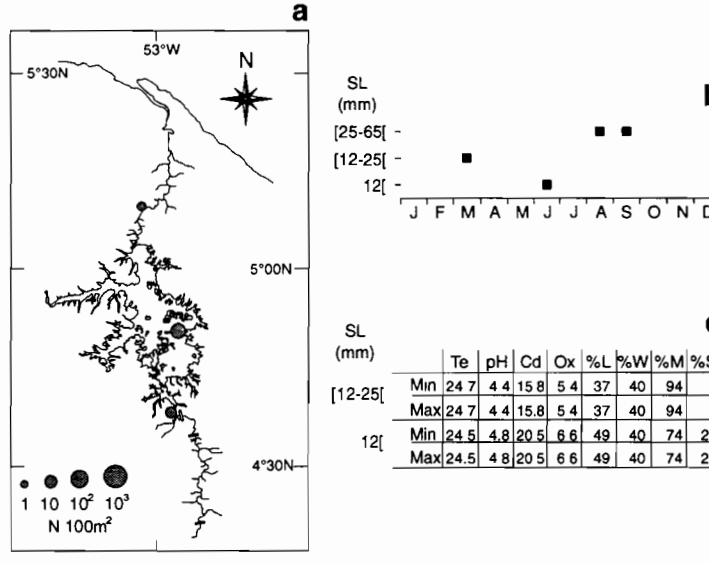


Fig. 51. *Jubiaba meunieri* a) 7 5 mm, b) 8.0 mm and c) 23.0 mm. Horizontal bars represent 1 mm

We caught young *J. meunieri* downstream of the dam, in the reservoir and at the upstream extent of the reservoir (Fig. 52a), but on too few occasions to detect any pattern in their temporal and spatial occurrence (Fig. 52b and 52c) or to study their diet.



	Te	pH	Cd	Ox	%L	%W	%M	%S
Min	24.7	4.4	15.8	5.4	37	40	94	6
Max	24.7	4.4	15.8	5.4	37	40	94	6
Min	24.5	4.8	20.5	6.6	49	40	74	26
Max	24.5	4.8	20.5	6.6	49	40	74	26

Fig. 52. *Jubiaba meunieri* a) spatial distribution (all individuals), b) temporal occurrence for early life stages <12 mm, young juveniles 12 to 25 mm, and old juveniles 25 to 65 mm, and c) habitat characteristics for early life stages and young juveniles. Habitat codes in Fig. 4.

Bryconops spp. [*B. affinis* (Günther, 1864), *B. caudomaculatus* (Günther, 1869) and *B. melanurus* (Bloch, 1795)]

We were unable to differentiate the young stages of the three species of *Bryconops* present in the River Sinnamary and thus grouped them at the genus level. At 10.0 mm, the body is moderately elongate, the rotund head is moderately large, the snout is convex, the terminal mouth reaches to the anterior margin of the pupil, and the round eyes are large (Fig. 53a). At that SL, the notochord is flexed and the rays of the D-, C- and V-fins are present. Parts of the finfold remain between the D- and the C-fin and ventrally anteriorly to the anus. The body is almost unpigmented except a thin mediolateral line of melanophores, another one at the base of the A-fin, a patch of pigments dorsally on the head and some tiny melanophores scattered on the operculum. Fins are almost unpigmented except a V-shape patch of melanophores on the C-fin. At 25.0 mm, young *Bryconops* spp. resemble small adults (Fig. 53b).

Small *Bryconops* spp. (Fig. 53a) are easily distinguished from small *Piabucus dentatus* (Fig. 75b) by their deeper body, the lack of pigmentation on their back, lateral surface of the gut and cleithrum. Larger *Bryconops* spp. are easily distinguished by the lower number of rays they have on their A-fin (II 26 – 32 for *Bryconops* spp. *vs.* III 42 for *P. dentatus*).

Young *Bryconops* spp. were caught in all sampled sections of the River Sinnamary (Fig. 54a) almost all year-round (Fig. 54b) in a wide range of habitats characterised by very deoxygenated waters (Fig. 54c). Individuals <15.0 mm ingested mainly insect larvae and switched to terrestrial insect when larger (Fig. 54d).

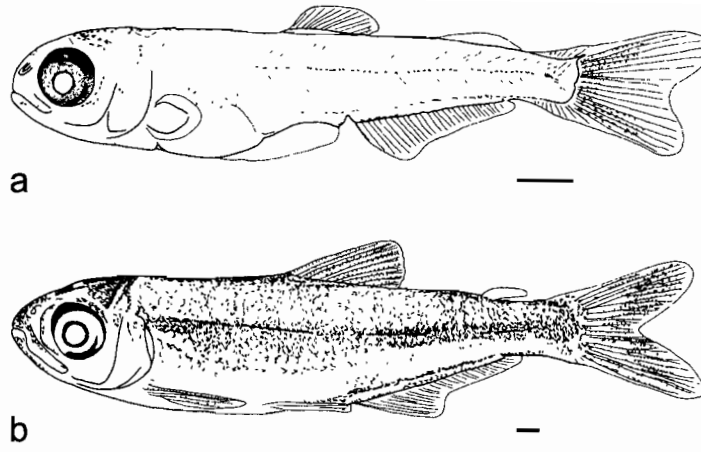


Fig. 53. *Bryconops* spp a) 10 0 mm and b) 25.0 mm. Horizontal bars represent 1 mm.

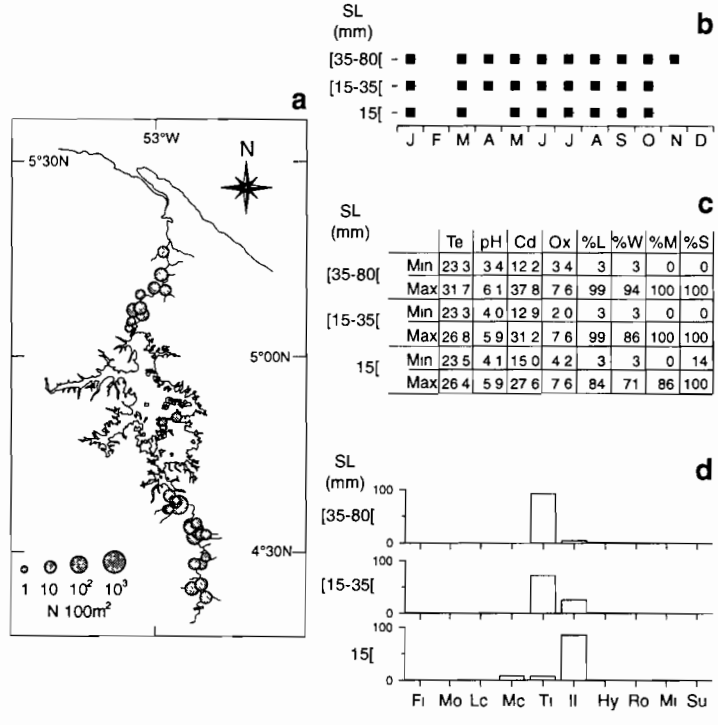


Fig. 54. *Bryconops* spp. a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <15 mm, young juveniles 15 to 35 mm, and old juveniles 35 to 80 mm Habitat and prey codes in Fig. 4.

Hemigrammus ocellifer (Steindachner, 1882)

H. ocellifer at 7.0 mm present a moderately deep body and large head, a terminal mouth and moderately large round eyes (Fig. 55a). At that SL, the notochord is flexed, the D- and C-fin are completed when the rays of the A-fin are developing. Parts of the finfold remain ventrally

anterior to the anus and between the D- and C-fin. Pigmentation consists of different size of melanophores, which are scattered on the head, body and fins. The melanophores are large and tend to coalesce on the nape, anterior to the D-fin and ventrally on the head and gut. Some melanophores form a mediolateral line but the others, which are evenly scattered, blur the pattern. Tiny melanophores pepper the D-, A- and C-fin but tend to aggregate in a vertical black band at the base of the latter. The ventral remnant of the finfold is mostly unpigmented except some small melanophores near the anus.

At 8.0–8.5 mm, the body deepens, the rays of the A-fin are present and the buds of the V-fin begin to develop (Fig. 55b). The general pigmentation is denser but presents a low contrast because of the relatively homogeneous size and even distribution of the

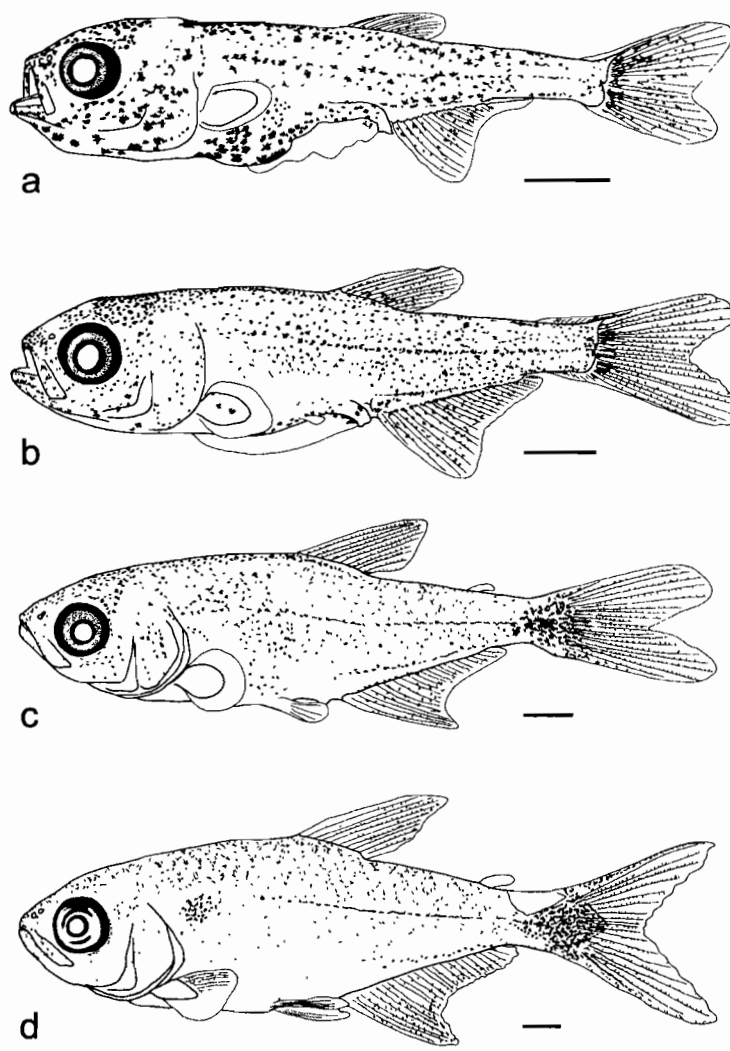


Fig. 55. *Hemigrammus ocellifer* a) 7.0 mm, b) 8.0 mm, c) 11.0 mm and d) 15.0 mm. Horizontal bars represent 1 mm.

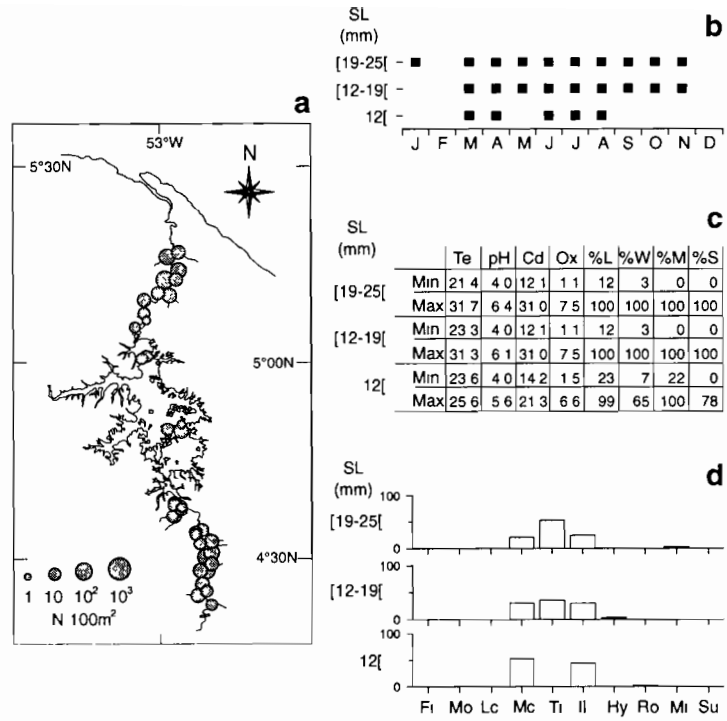


Fig. 56. *Hemigrammus ocellifer* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <12 mm, young juveniles 12 to 19 mm, and old juveniles 19 to 25 mm Habitat and prey codes in Fig. 4

melanophores that cover almost entirely the head, body and fins. The only exception is the dark vertical band of melanophores at the base of the C-fin that is broader and extends to the tip of the tail.

At 11.0–11.5 mm, the body presents the diamond shape characteristic of small characids (Fig. 55c). The snout is more elongate and clearly pointed. The adipose fin is differentiated and the rays of the V-fins are developing. The general pigmentation remains of low contrast with the exception of a thin mediolateral line of coalesced melanophores and the caudal spot that eventually becomes diamond-shaped. On some individuals a metallic sheen that persists in preserved specimens can be detected dorsally on the tail anterior to the C-fin. At 15.0 mm, juveniles resemble small adults with a faint humeral spot, a diamond-shape caudal spot and the iridescent spot on the upper half of the caudal peduncle (Fig. 55d).

Small *H. ocellifer* with incomplete A-fin (Fig. 55a) are more pigmented than small *J. meunieri* (Fig. 51a) but much less so than small *P. brevispina* (Fig. 44a). Larger individuals of *H. ocellifer* (Figs. 55c and d) can be distinguished from young *A. bimaculatus* (Fig. 46a) by the lower number of rays on their A-fin (II 21–24).

We caught young *H. ocellifer* in all sections of the River Sinnamary we sampled (Fig. 56a). Early life stages were observed only from March to August (Fig. 56b). Young *H. ocellifer* were obtained from a large range of habitats, except for the smallest individuals with respect to %S (Fig. 56c). They ingested micro-crustaceans and insect larvae at the beginning of their life and later included terrestrial insects in their diet (Fig. 56d).

Hyphessobrycon aff. *sovichthys* Schultz, 1944

At 10.0–11.0 mm, *H.* aff. *sovichthys* already resemble young adults except that the rays of P-fin are not present (Fig. 57a). The body is moderately deep, the head moderately large with

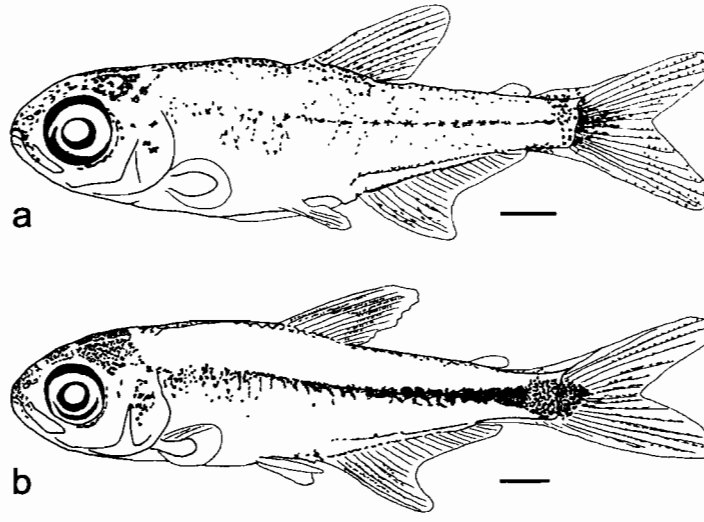


Fig. 57. *Hyphessobrycon* aff. *sovichthys* a) 10.0 mm and b) 11.0 mm. Horizontal bars represent 1 mm

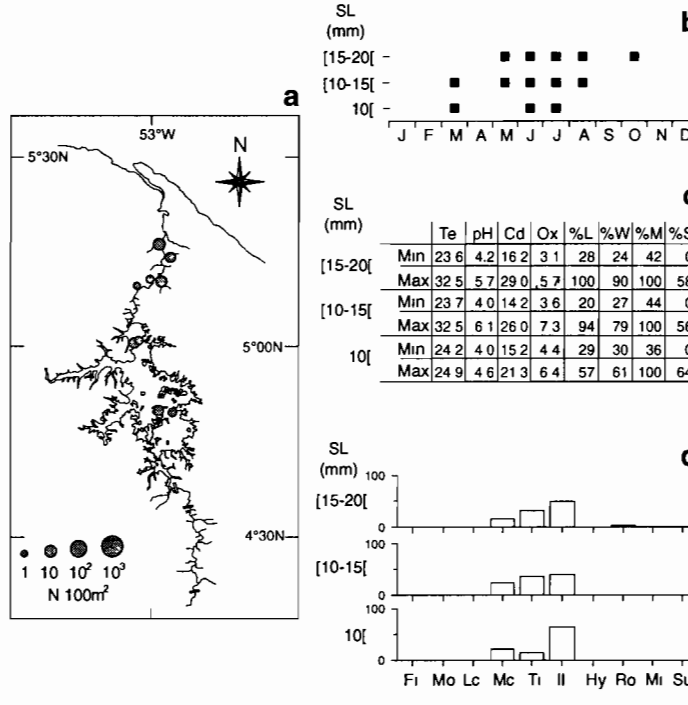


Fig. 58. *Hyphessobrycon* aff. *sovichthys* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics and d) relative importance of various dietary items for early life stages <10 mm, young juveniles 10 to 15 mm, and old juveniles 15 to 20 mm. Habitat and prey codes in Fig 4

a convex snout, terminal mouth and large round eyes. Melanophores concentrate on the snout, dorsally on the head, body and tail, forming a mediolateral line that starts near the operculum and extends to the base of the C-fin, where it enlarges in a diamond-shape caudal spot. They also align along a thin, almost continuous, line above the base of the A-fin. The mediolateral line eventually broadens when individuals become larger and contrast with the silverish aspect of the body (Fig. 57b).

Young *H.* aff. *sovichthys* have a more rounded snout and a lower number of A-fin rays (II 20–21) than young *A. bimaculatus* (Fig. 46a) or young *H. ocellifer* (Fig. 55c).

We caught young *H.* aff. *sovichthys* in all sampled sections of the River Sinnamary except upstream from the reservoir (Fig. 58a). Their occurrence in our samples was too low to suggest a temporal pattern of reproduction (Fig. 58b). Whatever their size, the young stages of this species inhabited oxygenated waters over bottoms of mud and some sand (Fig. 58c). They ingested insect larvae, aquatic insect and micro-crustaceans (Fig. 58d).

Moenkhausia chrysargyrea (Günther, 1864)

At 8.0–8.5 mm the body of *M. chrysargyrea* is moderately deep, the head moderately large, the snout pointed, the mouth terminal, and the eyes round and large (Fig. 59a). At that SL, the notochord is flexed, the rays of the D-, C- and A-fin are present. Remnants of the finfold are present ventrally anterior to the anus and between the D- and C-fin. Pigmentation consists in a continuous dorsal patch of small melanophores from the snout to the fin and a sprinkling of them on the body, tail and gut. These melanophores form a thin mediolateral line as well as one at the base of the A-fin. On the finfold, there are two small patches of melanophores: one in its anterior part and one located near the anus. Tiny melanophores are distributed along the rays of the D-, C-, and A-fin.

At 11.0–11.5 mm, the body and head become slightly deep, the V-fin rays are developing and the adipose fin is differentiated (Fig. 59b). The pattern of pigmentation gradually approaches that of adults: the snout, the dorsal surface of the head, the body and the tail become dark, an ovate humeral spot appears, a thin, black, mediolateral line and another thin line on the base of the A-fin contrast with the almost uniform distribution of the melanophores. At 17.0–18.0 mm *M. chrysargyrea* juveniles resemble small adults (Fig. 59c).

Small *M. chrysargyrea* (Fig. 59a and b) resemble young *P. brevispina* (Fig. 44a and b) or young *J. meunieri* (Fig. 51a and b) but they have fewer A-fin rays (only II 21–23 for *M. chrysargyrea* when this number reaches II 31–33 for *P. brevispina* and II 28–30 for *J. meunieri*). Young *M. chrysargyrea* (Fig. 59b) are easily distinguished from young *A. bimaculatus* (Fig. 46a) or young *J.* cf. *keithi* (Fig. 48a), the former not being pigmented on the anterior limit of their finfold but having a caudal spot.

Young *M. chrysargyrea* were caught everywhere in the Sinnamary except in the central part of the reservoir (Fig. 60a). Early life stages were observed from January to July (Fig. 60b). Regardless of size, they were caught in a wide range of habitats, the smallest individuals being absent from those entirely covered by sand (Fig. 60c). The smallest individuals ingested insect larvae, micro-crustaceans and terrestrial insects, the latter being of increasing importance in the diet of larger specimens (Fig. 60d).

Moenkhausia collettii (Steindachner, 1882)

Young *M. collettii* were among the most abundant taxa we caught with rotenone (Table 2). At 7.5 mm, the body is moderately deep and compressed, the head is moderately large and

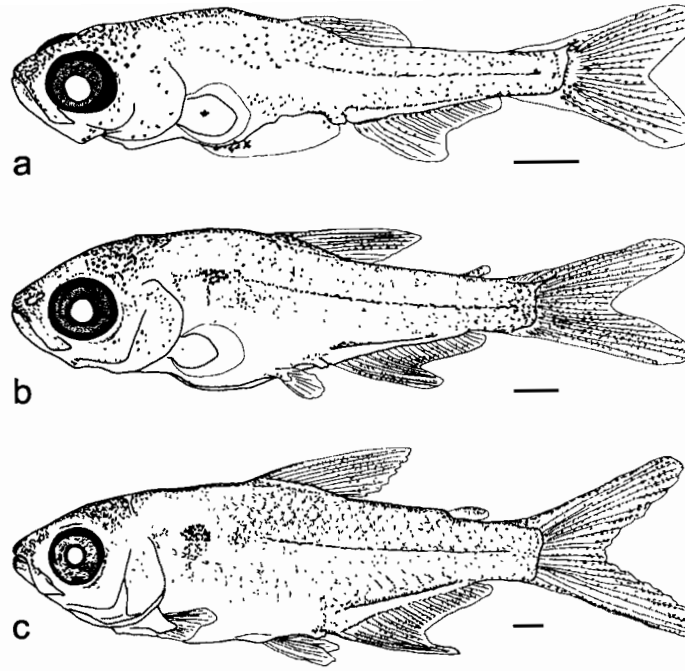


Fig. 59. *Moenkhausia chrysargyrea* a) 8.5 mm, b) 11 5 mm, and c) 17.5 mm. Horizontal bars represent 1 mm

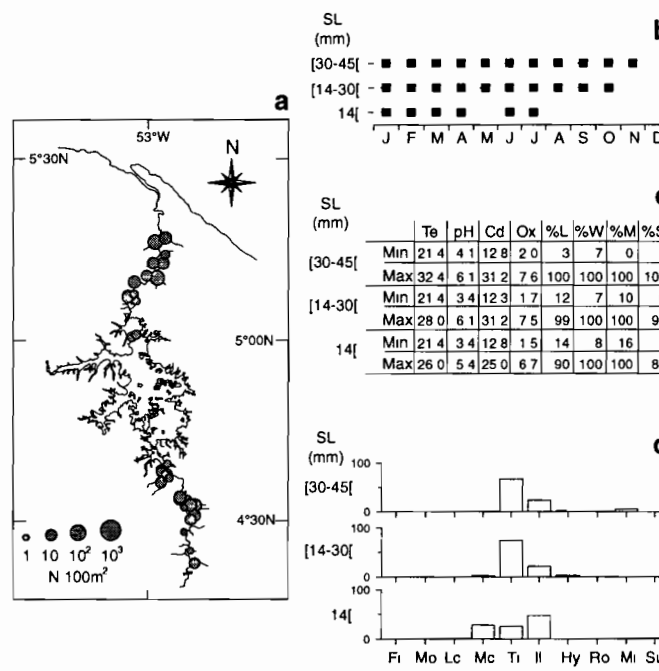


Fig. 60. *Moenkhausia chrysargyrea* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <14 mm, young juveniles 14 to 30 mm, and old juveniles 30 to 45 mm. Habitat and prey codes in Fig 4.

clearly triangular with a pointed snout, a large terminal mouth, and round eyes of moderate size (Fig. 61a). The C-fin is the only fin with rays. The finfold remains dorsally between the D- and the C-fin, ventrally anterior to the anus and between the A- and C-fin. Individuals are lightly pigmented with tiny melanophores that tend to align a thin mediolateral line. Internal pigments form several V-shape lines on the caudal peduncle but these disappear rapidly with increasing SL. The melanophores are larger on the dorsal surface of the head, laterally on the opercula and ventrally on the cleithrum and on the gut. Those on the gut may extend to the finfold. Small melanophores may appear denser near the base of the C-fin, forming two small patches, but never a continuous vertical band.

At 8.5–9.0 mm, the general body shape remains the same (Fig. 61b). The ventral finfold remains but the rays of the D- and A-fin are present, the adipose fin and the ventral buds differentiate. The external pigmentation remains the same on the head, body and tail. Melanophores align along the rays of the C-fin and no longer cluster at its base. From 16.0 mm onwards, juveniles resemble small adults except that the rays of their P-fins are not fully developed (Fig. 61c).

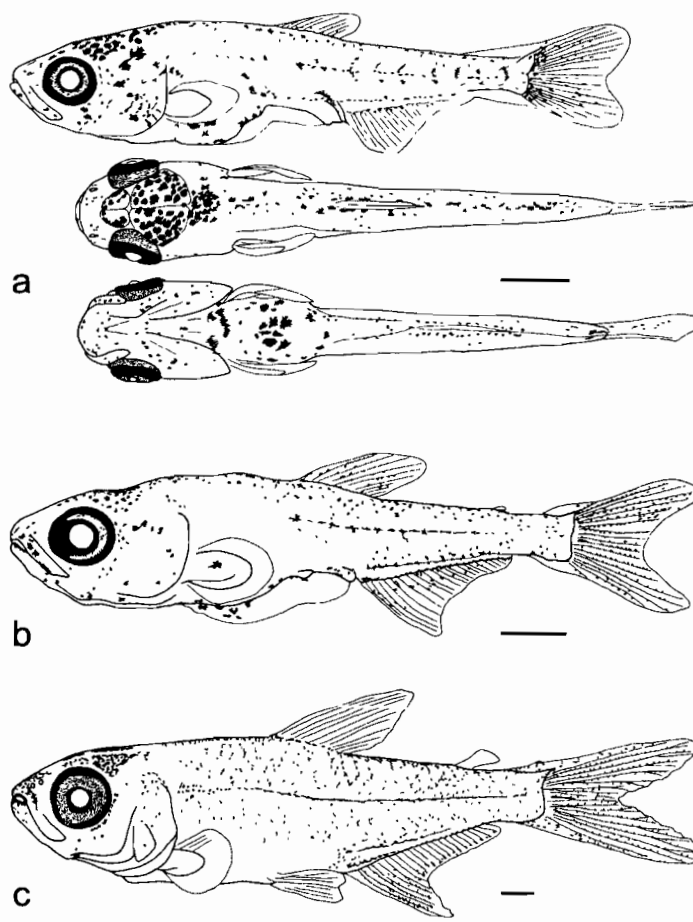


Fig. 61. *Moenkhausia collettii* a) 7.5 mm lateral, dorsal and ventral view, b) 8 5 mm, c) 12.5 mm and d) 16.0 mm. Horizontal bars represent 1 mm

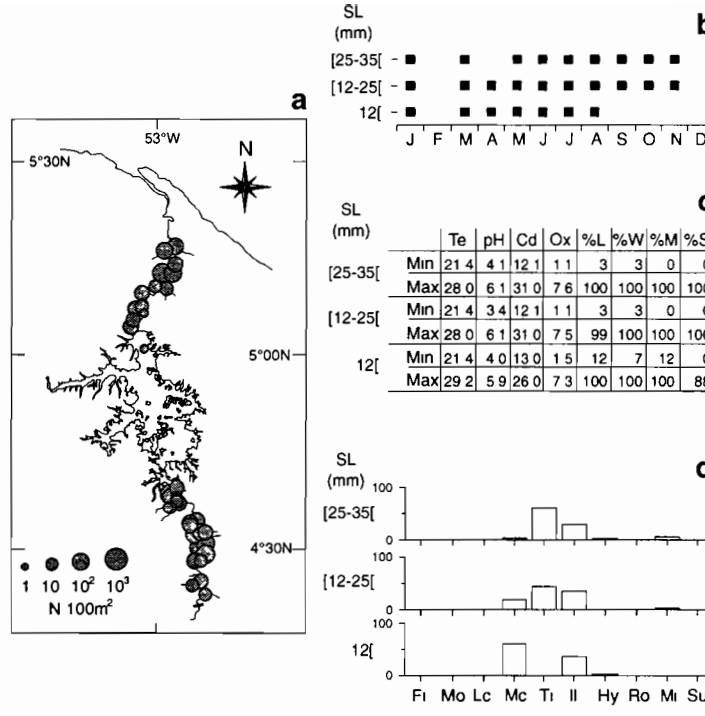


Fig. 62. *Moenkhausia collettii* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <12 mm, young juveniles 12 to 25 mm, and old juveniles 25 to 35 mm. Habitat and prey codes in Fig 4

Young *M. collettii* cannot be distinguished easily from young *M. chrysargyrea* (Fig. 59a and b) by their number of rays on the A-fin (II 21–22 and II 21–23 respectively). However young *M. chrysargyrea* present deeper head and body, their snout is less pointed, their eyes are larger, they have melanophores on the finfold near the anus, and their pigmentation is continuous from the tip of the snout to the anterior limit of their D-fin.

Young *M. collettii* were not caught in the central part of the reservoir (Fig. 62a). The early life stages were observed from January to August (Fig. 62b). Regardless of size, they were caught in a wide range of habitats, the smallest individuals being absent from those entirely covered by sand (Fig. 62c). Smallest individuals ingested insect larvae and microcrustaceans, larger specimens included terrestrial insects in their diet (Fig. 62d).

Moenkhausia georgiae Géry, 1966

At 7.0–7.5 mm, the body of *M. georgiae* early life stages is moderately elongate, the triangular head is of moderate size, the snout is slightly concave, the terminal mouth reaches to the pupil and the round eyes are large (Fig. 63a). The gut has a relatively large diameter; its shape resembling an elongate triangle. The notochord is curved in an S-shape. The finfold remains ventrally anterior to the anus and between the A- and C-fin. Dorsally, the finfold has almost disappeared. The rays of the C-fin have already formed, those of the D- and A-fin are just developing. The consistent pigmentation includes large more or less coalescent melanophores that concentrate mainly on the head and the anterior part of the gut. Much

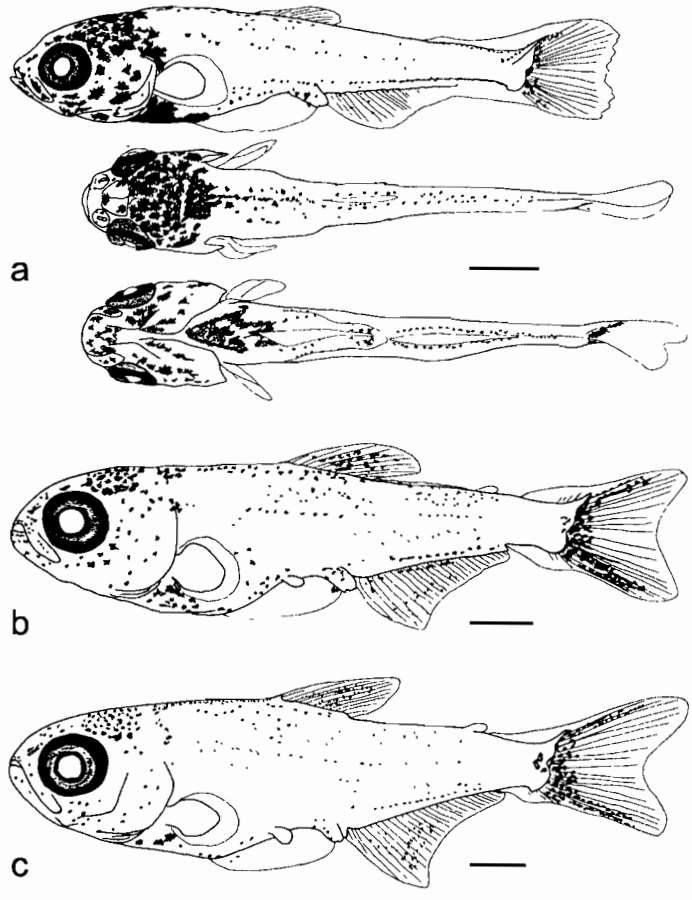


Fig. 63. *Moenkhausia georgiae* a) 7 5 mm lateral, dorsal and ventral view, b) 9.0 mm, and c) 9 5 mm. Horizontal bars represent 1 mm.

smaller melanophores scatter the posterior part of the gut and the lateral surface of the trunk and the tail. They align a double row ventrally and dorsally on the tail and form a curved line at the base of the C-fin. The D- and A-fins are virtually unpigmented.

At 9.0 mm, the body deepens, the head is more ovate with a convex snout but the eyes remain large (Fig. 63b and c). The D-, C- and A-fin are completed, the adipose fin is differentiated and ventral buds develop. The finfold remains only ventrally on the gut, anterior to the anus. On most individuals, the general pigmentation is less contrasted because of the smaller size of the melanophores on the head and on the anterior part of the gut. Some of the small melanophores on the body form a thin mediolateral line, the others are scattered on the trunk and the tail. A small black spot forms at the extremity of the tail. Pigmentation at the base of the C-fin intensifies with growth and a C-shaped band of melanophores now extends along the upper and lower edge of the fin.

Small *M. georgiae* present a contrasted pattern of pigmentation, which permits easy identification. When they are larger, the pigmentation of the C-fin resembles that of young *M. oligolepis* (Fig. 68b), but their body is more lightly pigmented and the A-fin has more rays (II 23–26 for *M. georgiae* and II 21 – 22 for *M. oligolepis*).

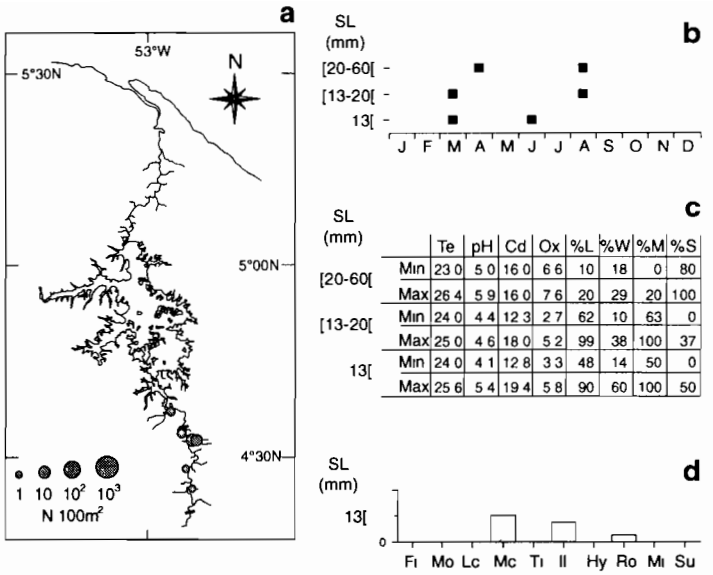


Fig. 64. *Moenkhausia georgiae* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics for early life stages <13 mm, young juveniles 13 to 20 mm, and old juveniles 20 to 60 mm, and d) relative importance of various dietary items for early life stages only. Habitat and prey codes in Fig. 4

Young *M. georgiae* were caught only upstream from the reservoir (Fig. 64a) but on too few occasions to detect any pattern in their temporal occurrence (Fig. 64b). Smaller individuals were always observed in habitats presenting a bottom mostly covered by mud and leaves (Fig. 64c). Diet was analysed only for the smallest individuals, which consumed micro-crustaceans, insect larvae and rotifers (Fig. 64d).

Moenkhausia hemigrammoides Géry, 1966 and *Hemigrammus unilineatus* (Gill, 1858)

M. hemigrammoides and *H. unilineatus* are very similar and we were unable to identify individuals smaller than 8.0 mm and 9.0 mm, respectively. The youngest stages of these two species thus remain unknown.

At 8.5–9.0 mm, early life stages of *M. hemigrammoides* have a moderately elongated body, a triangular large head with a pointed snout, a large terminal mouth, and nearly round eyes of moderate size (Fig. 65a). The anterior part of the gut is triangular, the posterior part is straight. At that SL, the rays of the D-, C- and A-fin are present, the adipose fin is differentiate and ventral buds appear. The finfold remains only ventrally on the gut anterior to the anus. Pigmentation consists of medium-to-large sized melanophores of medium to large size spread over the head, trunk and tail. Their density is higher on the dorsal surface of the head, where they form a patch that extends dorsally towards the anterior limit of the D-fin. Some larger melanophores are also present ventrally on the opercula and the anterior part of the gut. On the tail, the melanophores align and form a thin mediolateral line. All the fins are pigmented. A remnant of the finfold presents two small groups of melanophores, one anterior near the gut and one posterior near the anus. The pigmentation forms an ovate patch near the tip of the D-fin and an oblique band on the A-fin anteriorly.

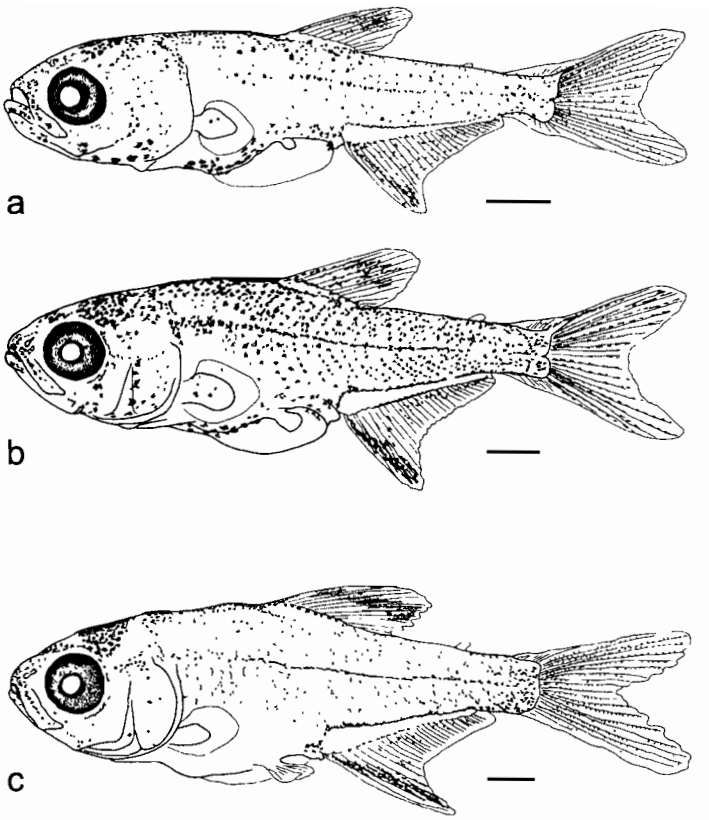


Fig. 65. *Moenkhausia hemigrammoides* a) 8.5 mm and b) 10.5 mm, and c) *Hemigrammus unilineatus* 11.0 mm. Horizontal bars represent 1 mm.

At 10.5–11.0 mm, the body deepens and the snout is clearly pointed (Fig. 65b). For most individuals, the pigmentation is heavy. Dorsally, the melanophores have coalesced and form a continuous black band from the nape to the anterior limit of the D-fin. On the trunk and tail, the mediolateral line is conspicuous and the other melanophores generally align along the myosepta. The ovate patch of melanophores on the D-fin and the oblique band on the C-fin appear clearly for every specimen.

At the same size, young *H. unilineatus* (Fig. 65c) look like young *M. hemigrammoides* (Fig. 65b) except for subtle differences in pigmentation. However the shape of the pigmented patch on the D-fin or the generally lighter pigmentation of the body and trunk are not sufficient to distinguish these two taxa. Once the A-fin is completed, the lower number in young *M. hemigrammoides* (II 24–26) compared to *H. unilineatus* (II 27–30) appears to be the only criterion for distinguishing the young of these two species.

Young *M. hemigrammoides* were caught downstream from the dam, in the reservoir and in the upstream section of the River Sinnamary (Fig. 66a). The smallest individuals were caught from March to July only (Fig. 66b). Young *M. hemigrammoides* were never observed in deoxygenated waters or in totally sandy habitat (Fig. 66c). The diet of small individuals consists of micro-crustaceans and insect larvae, whereas that of larger individuals include more terrestrial insects (Fig. 66d).

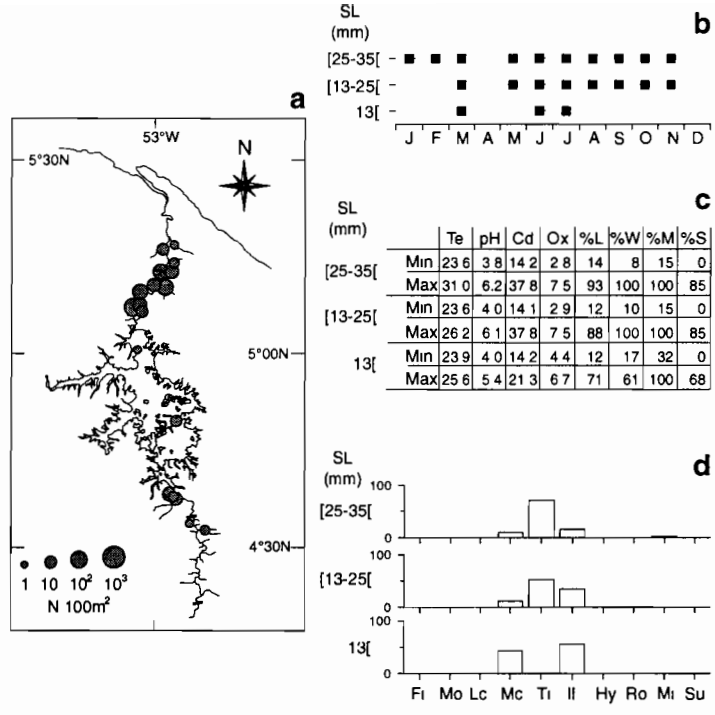


Fig. 66. *Moenkhausia hemigrammoides* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <13 mm, young juveniles 13 to 25 mm, and old juveniles 25 to 35 mm. Habitat and prey codes in Fig. 4.

Young *H. unilineatus* were never caught in the reservoir (Fig. 67a). The smallest individuals were caught from March to August only (Fig. 67b). Like young *M. hemigrammoides*, young *H. unilineatus* were never observed in deoxygenated waters or in totally sandy habitat (Fig. 67c). The diet of both species consists of micro-crustaceans and insect larvae for small individuals and terrestrial insects for larger ones (Fig. 67d).

Moenkhausia oligolepis (Günther, 1864)

At 7.5–8.0 mm the body of *M. oligolepis* is moderately elongate, the ovate head is of moderate size with a pointed snout, a terminal mouth and moderately large round eyes (Fig. 68a). The gut does not present a straight terminal part. At that SL, the finfold remains ventrally on the gut anterior to the anus, between the A- and C-fin, and dorsally anterior to the C-fin. The rays of the D- and A-fin are developing and only the C-fin is completed. Individuals are heavily pigmented with large melanophores spread on the snout, upper maxilla, dorsal surface of the head, opercula, nape, mediodorsal surface of the trunk, the entire tail and the gut. These large melanophores extend to the middle rays of the C- and A-fin. On the C-fin, the melanophores are generally separated from those on the tail by a vertical unpigmented band. The finfold is unpigmented.

At 14.0 mm, young juveniles resemble small adults (Fig. 68b) but their body remains more slender. The intensity of the caudal spot and its extensions on the C-fin varies from individual to individual. The lighter, slightly iridescent, more or less V-shaped zone on the

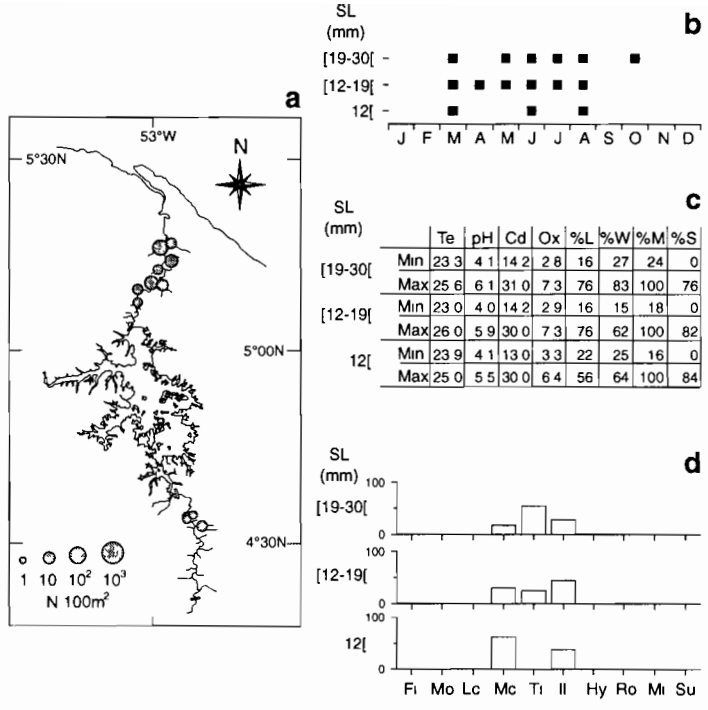


Fig. 67. *Hemigrammus unilineatus* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <12 mm, young juveniles 12 to 19 mm, and old juveniles 19 to 30 mm Habitat and prey codes in Fig. 4.

caudal peduncle is clearly present on all the specimen. The D- and A-fin remain pigmented along their rays, but the middle C-fin rays become less coloured.

Small, lightly pigmented *M. oligolepis* are likely to be misidentified as small *H. ocellifer* (Fig. 55c): the shapes of their body are identical, the numbers of rays they have on their A-fin overlap (II 21 – 22 for *M. oligolepis*, II 21 – 24 for *H. ocellifer*), and the diamond-shaped caudal spot is preceded by a dorsal metallic sheen on the tail anterior to the C-fin. However, in *M. oligolepis* the posterior limit of the D-fin aligns vertically with the anterior limit of the A-fin (Fig. 69a) whereas in *H. ocellifer* the position of the D-fin clearly overlaps that of the anterior limit of the A-fin (Fig. 69b).

Young *M. oligolepis* were caught downstream of the dam, in the reservoir and in the upstream section (Fig. 70a). Early life stages were observed from February to August (Fig. 70a). All size classes exploit a large range of habitats except those entirely covered with sand (Fig. 70c). The diet of the smallest individuals consists of micro-crustaceans, insect larvae and terrestrial insects, the later becoming increasing important in largest individuals (Fig. 70d).

Moenkhausia surinamensis Géry, 1966

The smallest *M. surinamensis* we caught were 12.0 mm, so that early life stages of this species remain unknown. At that SL, the body is moderately deep, the roundish head is of moderate size with a slightly rounded snout, a terminal mouth and large round eyes (Fig. 71a). The finfold remains only ventrally on the gut anteriorly to the anus. The D-, C- and A-fin are

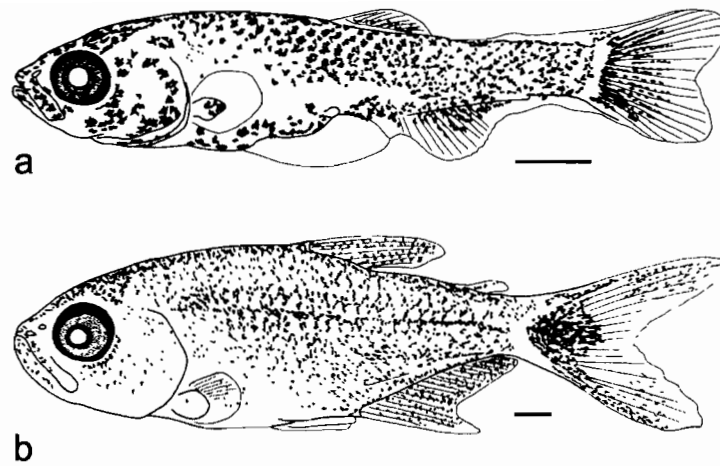


Fig. 68. *Moenkhausia oligolepis* a) 7.5 mm, and b) 14.0 mm. Horizontal bars represent 1 mm.

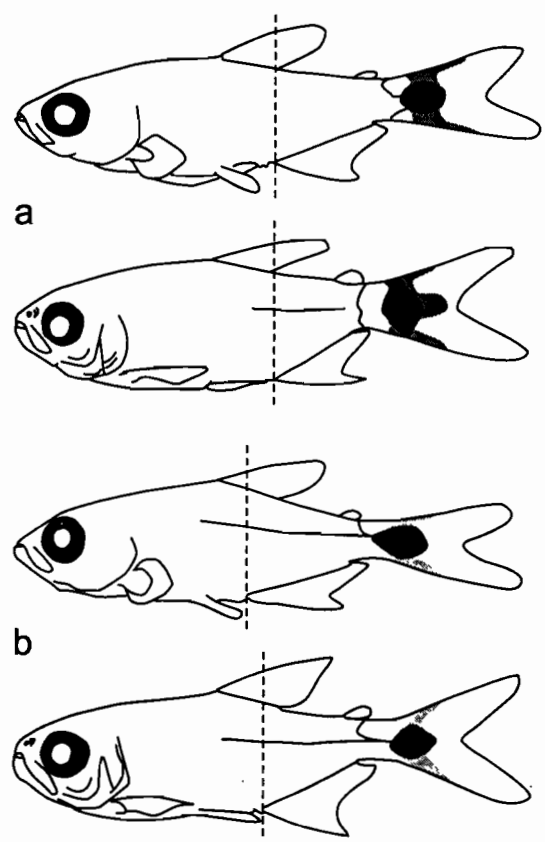


Fig. 69. Comparison of young stages of a) *Moenkhausia oligolepis* 11.0 and 19 0 mm and b) *Hemigrammus ocellifer* 11.0 and 19.0 mm

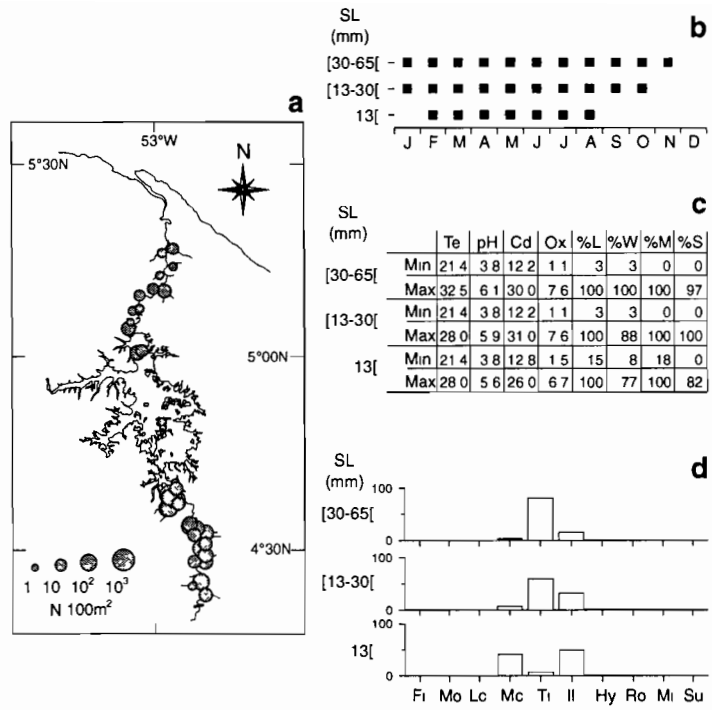


Fig. 70. *Moenkhausia oligolepis* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <13 mm, young juveniles 13 to 30 mm, and old juveniles 30 to 65 mm Habitat and prey codes in Fig. 4.

complete. The adipose fin is differentiated, the V- and P-fins are developing. The trunk and the anterior part of the tail are evenly covered with small melanophores. Pigmentation is densest on the snout, the dorsal surface of the head, and along a mediolateral line, which begins anterior to the anus and ends as a diamond-shaped patch at the base of the C-fin. Small unpigmented areas precede this spot ventrally and dorsally. The ventral surfaces of the head and body are also unpigmented. The D-, C- and A-fin bear tiny melanophores along their rays. The finfold is unpigmented. At 25.0 mm, young *M. surinamensis* resemble small adults (Fig. 71b).

Small *M. surinamensis* are easily distinguished from young *H. ocellifer* or young *M. oligolepis* by the high number A-fin rays (I 27–29).

Young *M. surinamensis* were only caught in the downstream and upstream sections (Fig. 72a) but on too few occasion to detect any pattern in their temporal occurrence (Fig. 72b). They were observed in a wide range of habitats (Fig. 72c) and consumed mainly terrestrial insects (Fig. 72d).

Phenacogaster aff. *megalostictus* Eigenmann, 1909

At 7.0–7.5 mm, the body of *Phenacogaster* aff. *megalostictus* early life stages is elongate, the ovate head is moderately large, the snout is rounded, the mouth is terminal and the round eyes are of moderate size (Fig. 73a). The notochord is curved into a S-shape. The finfold is continuous dorsally and ventrally. The rays of the C-fins are developing when only incipient rays of the A-fin are present. At that SL, the pigmentation is light with some small

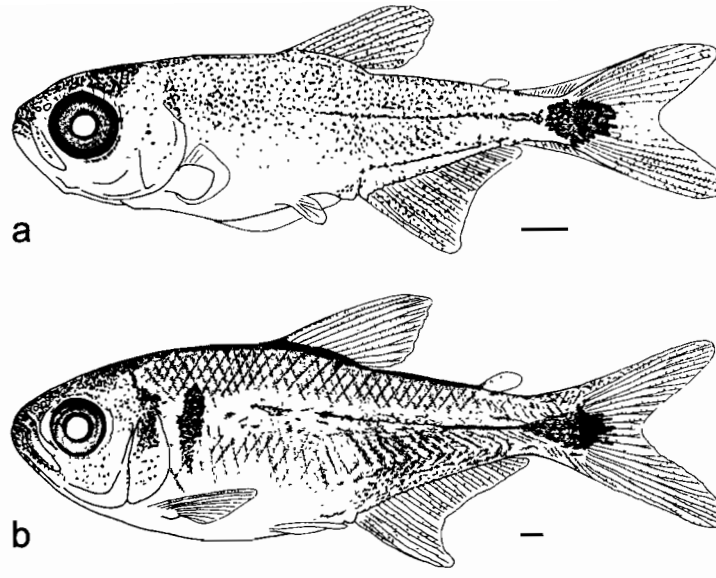


Fig. 71. *Moenkhausia surinamensis* a) 12.0 mm, and b) 25 0 mm. Horizontal bars represent 1 mm

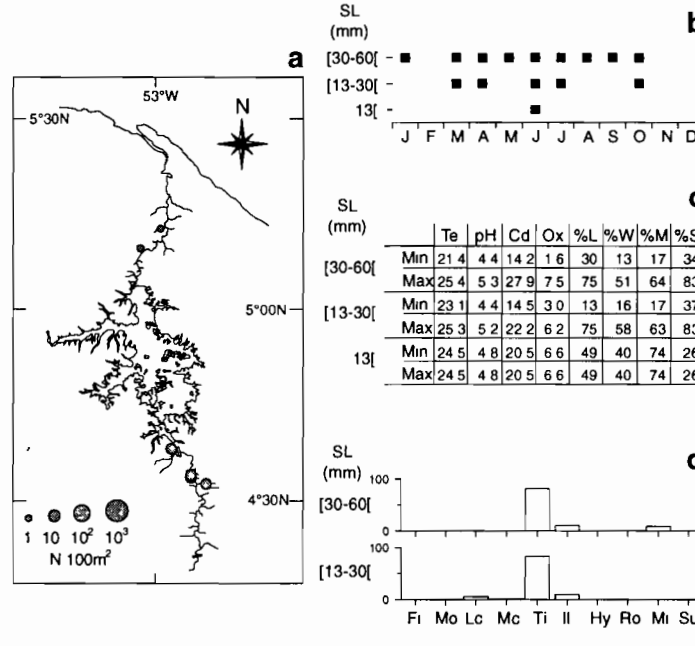


Fig. 72. *Moenkhausia surinamensis* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics for early life stages <13 mm, young juveniles 13 to 30 mm, and old juveniles 30 to 60 mm, and d) relative importance of various dietary items for young- and old juveniles only Habitat and prey codes in Fig. 4.

melanophores scattered on the head, gut, and mediolateral surface of the trunk and tail. Some melanophores form a distinct patch on the cleithrum and another less conspicuous one on the tip of the tail. The ventral finfold anterior to the anus has one dark patch of pigmentation at

each extremity. Posterior to the anus, the finfold has a scattering of tiny melanophores. These small-sized pigments are also present at the base of the C-fin and dorsally on the finfold.

At 8.5–9.0 mm, the body is deeper and takes the shape of an elongated diamond, which is characteristic of the species (Fig. 73b). When the rays of the D- and A-fin are developing, the C-fin is already complete. The finfold remains only ventrally on the gut anterior to the anus. Young juveniles develop a characteristic pigmentation that consists of large melanophores that contrast greatly with the bright white appearance of the rest of the body. These melanophores form two blotches, one on the dorsal surface of the head and one on the tip of the tail, as well as forming intermittent lines along the dorsal, mediolateral and ventral sides. The caudal spot merges with the melanophores that cover the base of the C-fin. The two spots on the ventral finfold are still present, the D- and A-fins are scattered with melanophores. At 15.0–15.5 mm, juveniles resemble small adults except that their P-fins are not present (Fig. 73c).

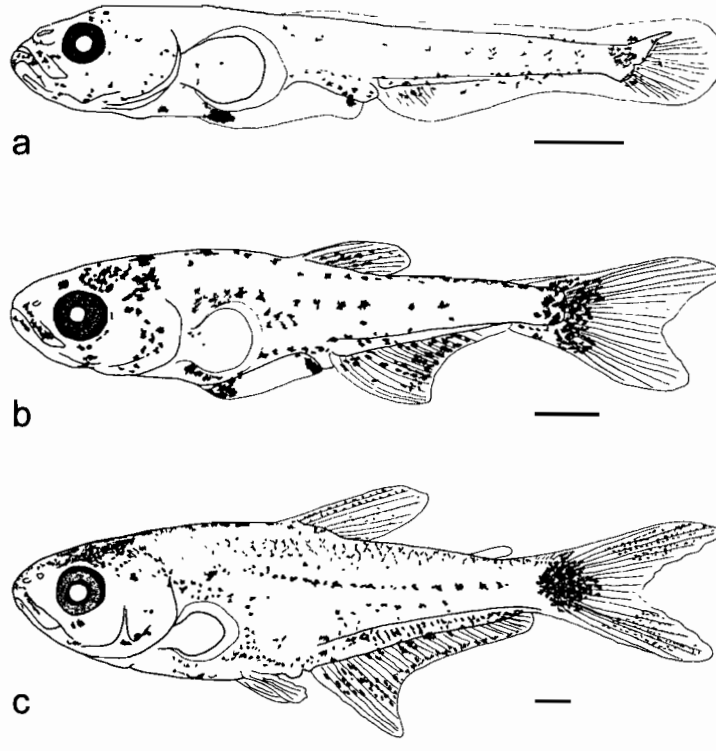


Fig. 73. *Phenacogaster* aff. *megalostictus* a) 7.5 mm, b) 8.5 mm and c) 15.5 mm Horizontal bars represent 1 mm.

Young *P.* aff. *megalostictus* (Fig. 73b) and young *C. pauciradiatus* (Fig. 38b) have an identical contrasted pattern of pigmentation, but at identical sizes the latter have a more hunchback appearance, a less pigmented body and a characteristic oblique black spot that starts anterior to the eye and extends along the upper and lower maxilla. When they become older, young *P.* aff. *megalostictus* have less A-fin rays (II 37–38) than *C. pauciradiatus* (II 50–52).

Young *P.* aff. *megalostictus* were mostly caught upstream of the dam, but a few individuals were also sampled in the reservoir and downstream of the dam (Fig. 74a). The

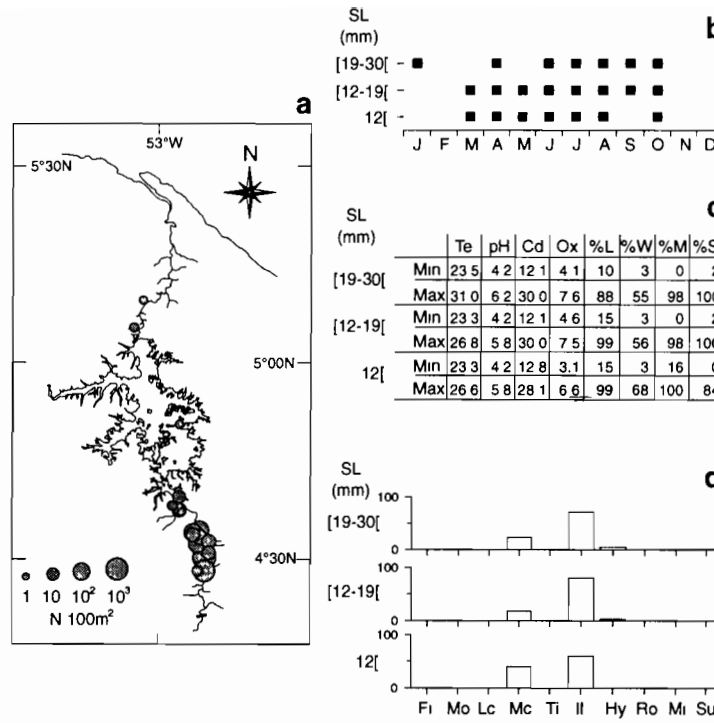


Fig. 74. *Phenacogaster* aff. *megalostictus* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <12 mm, young juveniles 12 to 19 mm, and old juveniles 19 to 30 mm Habitat and prey codes in Fig. 4.

smallest individuals were observed from March to October (Fig. 74b). All size classes were found in a wide range habitats with well oxygenated water (Fig. 74c). Whatever their size, young *P.* aff. *megalostictus* ingested mainly insect larvae and micro-crustaceans (Fig. 74d).

Piabucus dentatus (Köhlreuter, 1761)

At 8.5 mm, the body of *P. dentatus* early life stages is elongate, the rotund head is small, the short snout is rounded, the terminal mouth barely reaches the anterior limit of the eyes, which are round and large (Fig. 75a). The terminal part of the gut has a large diameter. The finfold is almost continuous and only incipient rays of the C-fin and the anlagen of the A-fin can be detected. The pigmentation consists of one patch of melanophores dorsally on the head, one mediolateral series from mid trunk to the tip of the tail, and ventrally on the tail a double row of melanophores, which continue laterally on the gut and rejoin a diffuse blotch on the cleithrum. The finfold is almost unpigmented except at the base of the C-fin.

At 11.0 mm, the body is not deeper and the head is of moderate size (Fig. 75b). The rays of the D-, A- and C-fin are present. Adult pigmentation is developing, including the dark blotches on the snout and dorsally on the head, and the dorsal, mediolateral and ventral almost solid lines of melanophores. Other melanophores remain scattered on the lateral and ventral surfaces of the gut. Only the C-fin presents tiny melanophores along its rays. From 20.0 mm on, young *P. dentatus* resemble small adults (Fig. 75c).

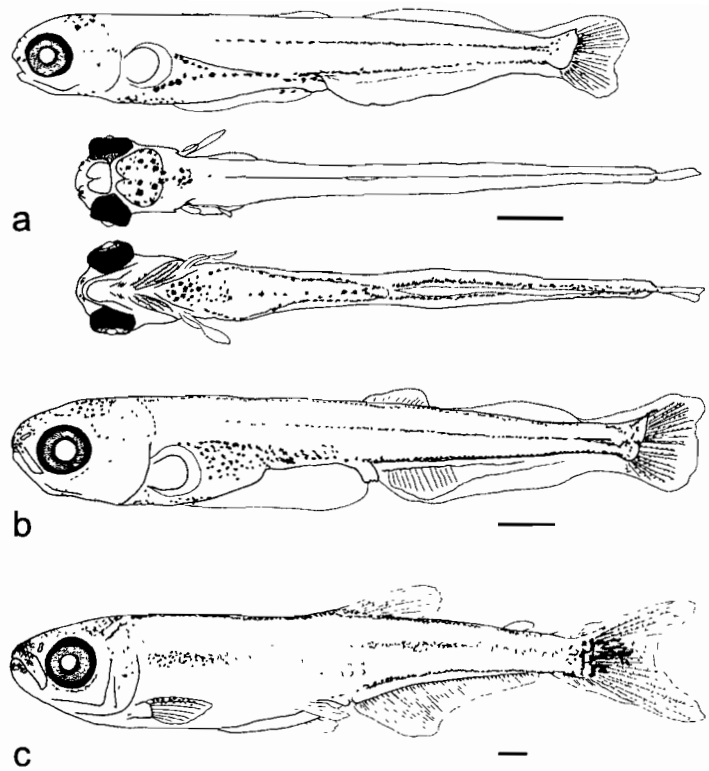


Fig. 75. *Piabucus dentatus* a) 8.5 mm, b) 11 0 mm, and c) 20.0 mm Horizontal bars represent 1 mm.

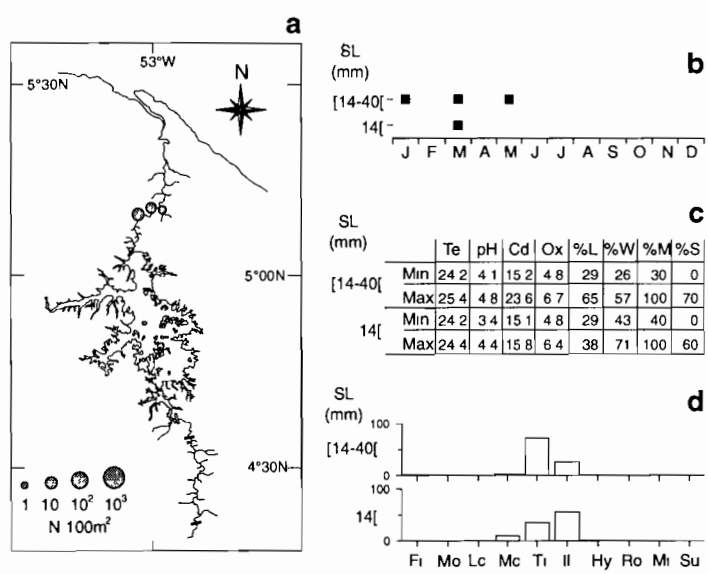


Fig. 76. *Piabucus dentatus* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <14 mm and young juveniles 14 to 40 mm. Habitat and prey codes in Fig 4

Young *P. dentatus* (Fig. 75b) have a slender more pigmented body than small *Bryconops* spp. (Fig. 53a). Larger specimens can be also identified by the number of A-fin rays (III 42 for *P. dentatus vs.* II 26–32 for *Bryconops* spp.).

Young *P. dentatus* were caught downstream of the dam only (Fig. 76a), between January and March (Fig. 76b) in habitats with well oxygenated waters and a lot of woody debris (Fig. 76c). The diet of early life stages included insect larvae, terrestrial insects and micro-crustaceans, whereas that of juveniles was based mainly on terrestrial insects and insect larvae (Fig. 76d).

B. SILURIFORMES

1. Doradidae

Doras carinatus (Linnaeus, 1766)

This is the only species of Doradidae in the River Sinnamary (Tito de Morais & Lauzanne 1994) and we caught only one specimen with rotenone (Table 2). However we present it here because of the rarity of information about young stages of neotropical Siluriformes in the scientific literature. The length of this young *D. carinatus* was only 12.5 mm, but it already looked like a small adult except that the lateral series of bony plates were not present (Fig. 77). At that SL, the body is as large as it is deep in its half anterior part, and the tail is moderately compressed. The head is moderately large, the snout is blunt and the small mouth is inferior. The ovate small eyes are positioned dorsally. The branched maxillary barbels reach to the base of the P-fins. The finfold remains ventrally between the anus and the A-fin and between the A- and C-fin, and dorsally between the adipose and C-fin. All the fins are completed, each P-fin already presenting a large thorny spine. The head, body and tail are peppered with small melanophores, but the ventral surface remains unpigmented. The melanophores tend to coalesce in a small humeral spot.

Amongst the Siluriformes of the River Sinnamary, young *D. carinatus* cannot be misidentified with another species from the time they bear their branched maxillary barbels.

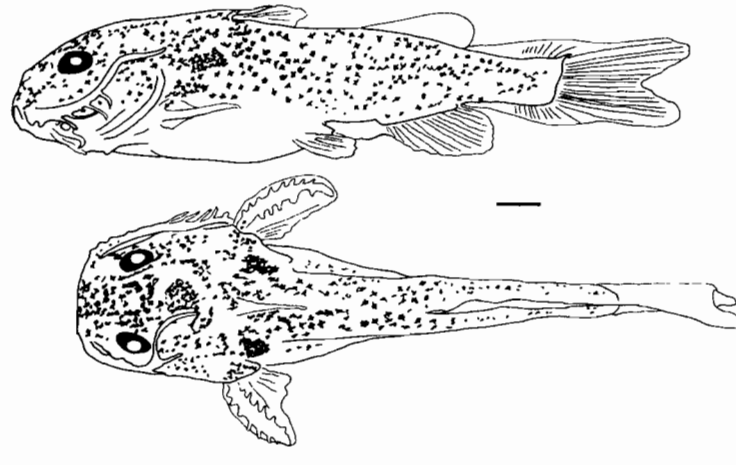


Fig. 77. *Doras carinatus* 12.5 mm lateral and dorsal view Horizontal bar represents 1 mm.

2. Auchenipteridae

Of the four species of auchenipterids present in the River Sinnamary, we collected the progeny of *Parauchenipterus galeatus* (Linnaeus, 1766) and *Tatia* aff. *intermedia* (Steindachner, 1876) but never that of *Auchenipterus nuchalis* (Spix, 1829) and *Pseudauchenipterus nodosus* (Bloch, 1794).

Parauchenipterus galeatus (Linnaeus, 1766)

At 9.5–10.0 mm, the compressed body is moderately elongated, the depressed ovate head is moderately large, the snout is convex, the small mouth is inferior and the round eyes are small (Fig. 78a). The gut is very compact. At that SL, the notochord is flexed. The finfold remains dorsally between the D- and the C-fin and ventrally between the A- and the C-fin. The rays of the D-, P- and C-fin are present, those of the A- and V-fins are still developing. The first ray of each P-fin is enlarged into a large short spine on which small curved hooks develop. The maxillary barbels reach to the anterior limit of the A-fin, whereas the first mandibular barbels reach to the P-fins only and the second pair is shorter. The head, body and tail are scattered with large, evenly distributed melanophores, which are denser on the nape anterior to the D-fin and on the gut posterior to the P-fins. Ventrally, young *P. galeatus* are almost unpigmented on the head and the gut. Dorsally, the melanophores extend to the spine of the D-fin and to the remnants of the finfold. Some smaller melanophores scatter the base of the C-fin and the developing A-fin.

At 12.0 mm, the body becomes deeper, with a short trunk relative to the tail length, a round head and a very compact gut (Fig. 78b). The V- and A-fins are not completely developed. The D- and C-fin are not yet pointed like in adults. The maxillary barbels reach to mid-A-fin, the first pair of mandibular barbels reach to the anterior limit of the A-fin and the second pair remains shorter. Melanophores have spread to the ventral surface of the gut and intensified dorsally forming a continuous dark surface from the tip of the snout to the tip of the tail. They also cover all the fins.

At identical sizes, young *P. galeatus* (Fig. 78) present a slender body, longer maxillary barbels and a longer A-fin (20 to 25 rays) than young *T. intermedia* (Fig. 80).

Young *P. galeatus* were caught downstream from the dam only (Fig. 79a) on too few occasions for detecting any temporal pattern of occurrence (Fig. 79b). They were found in habitats with well oxygenated waters and with woody debris (Fig. 79c). Specimens were not caught in sufficient number to study their diet.

Tatia aff. *intermedia* (Steindachner, 1876)

The smallest *T.* aff. *intermedia* we caught was 7.5 mm. At that SL, the body is moderately elongate, the rounded head is small with a convex snout and small round eyes, and the mouth is small and inferior (Fig. 80a). The ovate yolk-sac is still present. The finfold is continuous from the nape to the anus, but incipient rays can be observed on the A-fin. The maxillary and first pair of mandibular barbels reach to the pectoral buds. The entire body is evenly spread with large melanophores that extend over the finfold.

At 9.5–10.0 mm, the body shape remains the same but the mouth is more terminal (Fig. 80b). The rays of D-, C-, A- and P-fins are developing, D- and P-fins presenting a short spine. The maxillary barbels are longer and reach to the posterior limit of the D-fin. The

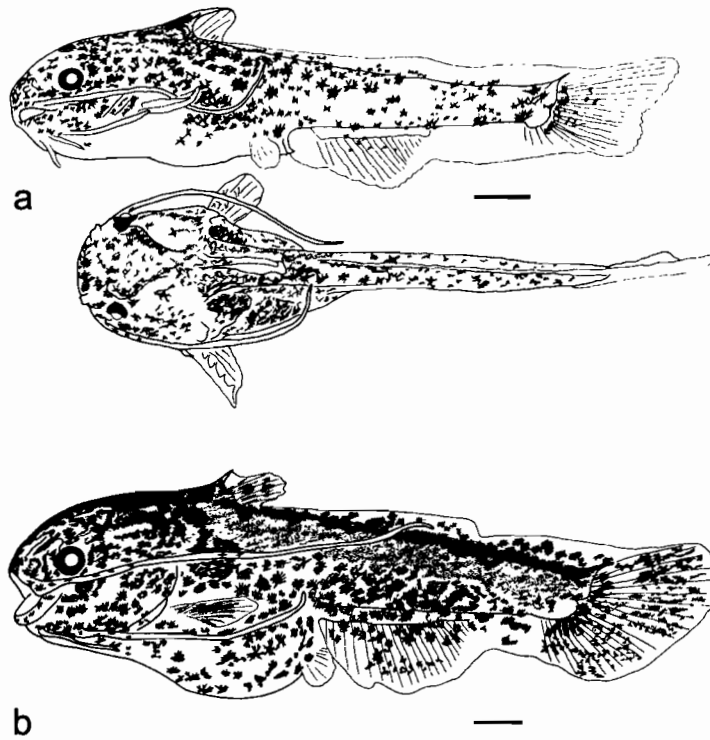
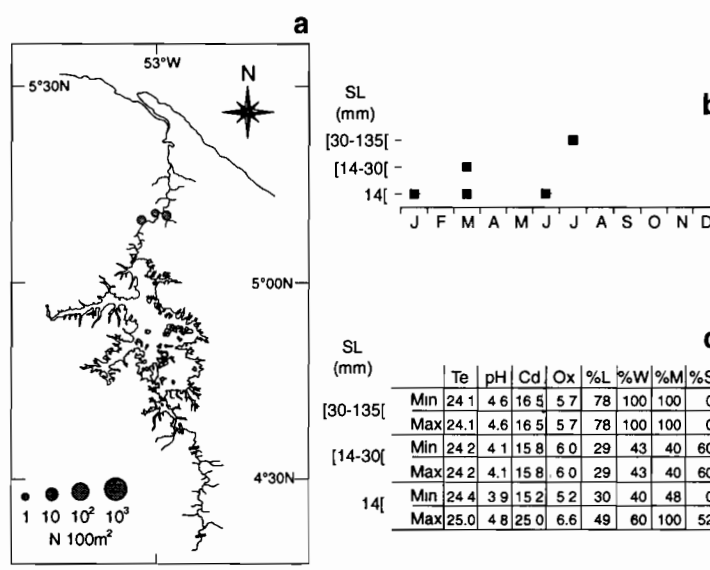


Fig. 78. *Parauchenipterus galeatus* a) 10 0 mm lateral and dorsal view and b) 12 0 mm. Horizontal bars represent 1 mm.



c

SL (mm)		Te	pH	Cd	Ox	%L	%W	%M	%S
[30-135[	Min	24 1	4 6	16 5	5 7	78	100	100	0
	Max	24.1	4.6	16 5	5 7	78	100	100	0
[14-30[	Min	24 2	4 1	15 8	6 0	29	43	40	60
	Max	24 2	4.1	15 8	6 0	29	43	40	60
14[	Min	24 4	3 9	15 2	5 2	30	40	48	0
	Max	25.0	4 8	25 0	6.6	49	60	100	52

Fig. 79. *Parauchenipterus galeatus* a) spatial distribution (all individuals), b) temporal occurrence, and c) habitat characteristics for early life stages <14 mm, young juveniles 14 to 30 mm, and old juveniles 30 to 135 mm. Habitat codes in Fig. 4.

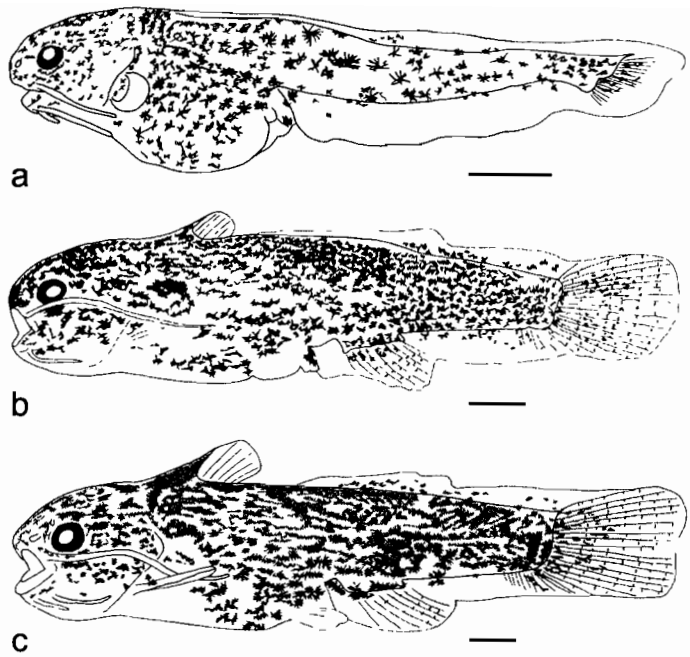


Fig. 80. *Tatia* aff. *intermedia* a) 7.5 mm, b) 9.5 mm, and c) 11.5 mm Horizontal bars represent 1 mm.

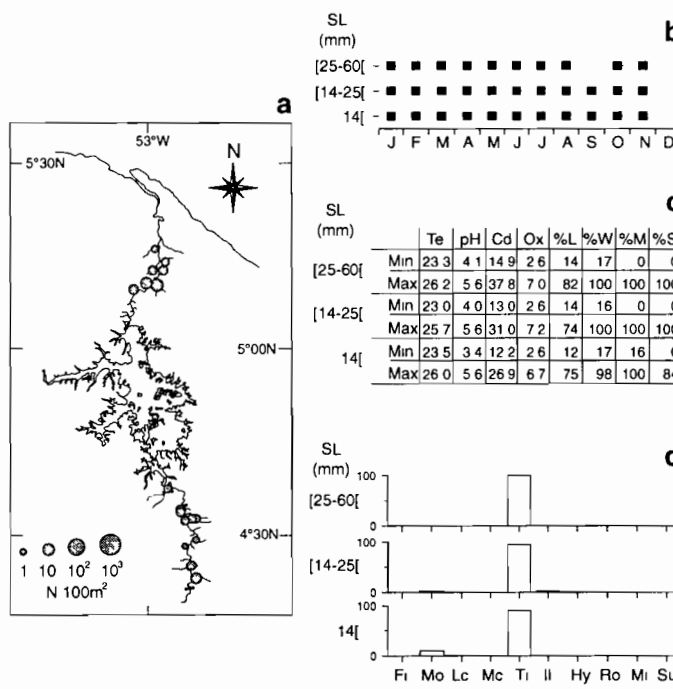


Fig. 81. *Tatia* aff *intermedia* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <14 mm, young juveniles 14 to 25 mm, and old juveniles 25 to 60 mm. Habitat and prey codes in Fig 4.

melanophores tend to coalesce on the snout, dorsally on the head and tail. The pigmentation is lighter ventrally on the head and gut. Scattered melanophores occur on the remnants of the finfold ventrally and dorsally, on the C-fin and on the base of the A-fin. At 11.5–12.0 mm, the V-fins appear (Fig. 80c). The melanophores on the head, body and tail coalesce into longitudinally elongate bands of pigments more or less anastomosed. The ventral surface of the head and of the first half of the gut are unpigmented. Some melanophores scatter the dorsal and ventral remnants of the finfold as well as the base of the C- and A-fin.

At identical sizes, young *T.* aff. *intermedia* (Fig. 80) have a deeper body and shorter maxillary barbels than young *P. galeatus* (Fig. 78). Moreover their A-fin has only between 7 and 11 rays.

We caught young *T.* aff. *intermedia* in all sampled sections except in the central part of the reservoir (Fig. 81a). The early life stages were observed year-round (Fig. 81b). We caught young *T.* aff. *intermedia* in a large range of habitats but never in well deoxygenated waters (Fig. 81c). Regardless of SL, their diet comprised mainly terrestrial insects (Fig. 81d).

3. Pimelodidae

Tito de Morais & Lauzanne (1994) indicated that 12 species of pimelodids are present in the River Sinnamary, but we caught the young stages of four species only: *Pimelodella cristata* (Müller & Troschel, 1848) and *P. geryi* Hoedeman, 1961, formerly identified as *P. gracilis* (Val. in Cuvier et Valenciennes, 1840), *Pseudopimelodus raninus* (Valenciennes, 1840), and *Rhamdia quelen* (Quoy et Gaimard, 1824).

Pimelodella spp. [*P. cristata* (Müller et Troschel, 1848) and *P. geryi* Hoedeman, 1961]

We were unable to distinguish the young stages of the two species of *Pimelodella* present in the River Sinnamary and thus grouped them at the genus level. At 8.5–9.0 mm, the body is moderately elongate and laterally compressed (Fig. 82a). The ovate head is moderately large and depressed, the snout is rounded, the wide mouth is terminal and the round eyes are very small. At that SL, the finfold remains ventrally on the gut and the tail only. The rays of all the fins, except the ventral, are developing. The maxillary barbels reach to mid-way along the A-fin, whereas the two pairs of mandibular barbels are shorter than the head. The small *Pimelodella* spp. are lightly pigmented on the head, nape and gut, where tiny melanophores form more or less dense patches. The body, the tail and the fins are unpigmented.

At 13.0–13.5 mm, the body deepens, the head and eyes becoming larger (Fig. 82b). All the fin rays are present and the long adipose fin is differentiating. The nasal barbels reach to the anus, the first pair of maxillary barbels reaches to the V-fins and the second pair is shorter. Pigmentation intensifies dorsally on the head, nape, body and tail. Laterally, the head appears darker than the rest of the body and tail. The fins are almost unpigmented. At 21.0 mm, juveniles look like small adults (Fig. 82c).

Very young *Pimelodella* spp. are easily distinguished from other catfish by their slender, almost unpigmented body. Larger young *Pimelodella* spp. present a homocercal C-fin when *P. raninus* of the same size present an heterocercal one (Fig. 84) and a lighter body pigmentation than young *R. quelen* (Fig. 86).

Young *Pimelodella* spp. were caught mostly in the upstream section, and never in the central part of the reservoir (Fig. 83a). The early life stages were too infrequently captured to detect any pattern in their temporal occurrence (Fig. 83b). We caught young *Pimelodella*

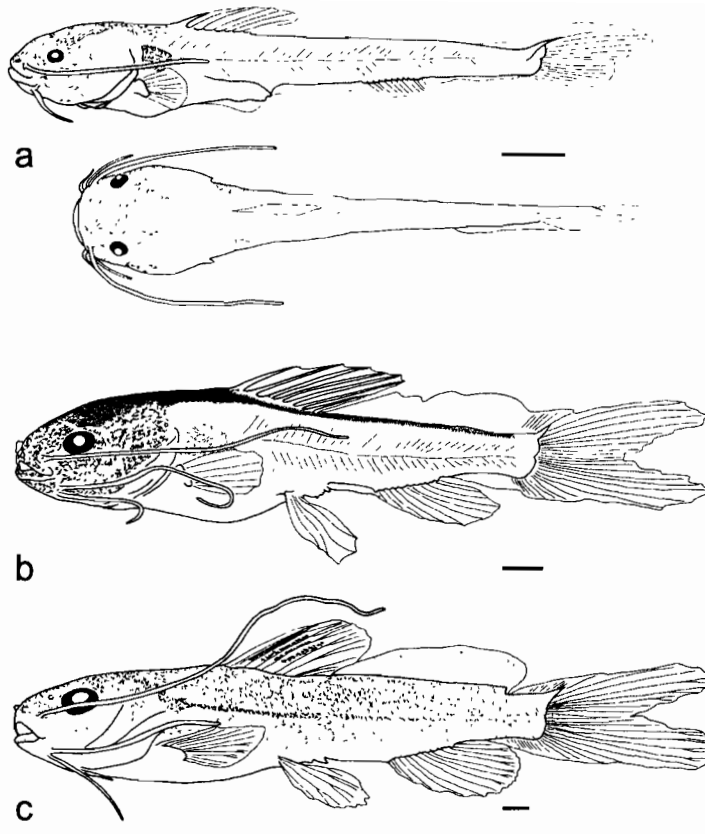


Fig. 82. *Pimelodella* spp a) 8.5 mm lateral and dorsal view, b) 13.0 mm, and c) 21.0 mm. Horizontal bars represent 1 mm.

spp. in a wide range of habitats, largest specimens being present in more deoxygenated waters than smallest individuals (Fig. 83c). Their diet consisted of micro-crustaceans and insect larvae for young individuals and more diversified prey for older specimens including terrestrial insects and fish (Fig. 83d).

Pseudopimelodus raninus (Val. in Cuvier et Valenciennes, 1840)

At 8.5 mm, the body of *P. raninus* early life stages is moderately deep, the ovate depressed head is large, the snout is rounded, the wide mouth is slightly inferior, the round eyes are very small and the gut is compact (Fig. 84a). The finfold remains ventrally between the anus and the A-fin and between the A- and C-fin, and dorsally between the D- and C-fin. All the fins are present but the adipose fin is not yet differentiated. The maxillary barbels reach to the anterior limit of the D-fin, the first mandibular pair of barbels reaches to the P-fins and the second pair is shorter. Pigmentation consists of tiny melanophores that are evenly scattered over the head, trunk and tail. These pigments form one dense patch on the dorsal surface of the head and a lateral one above each P-fin. They extend anteriorly to the D-fin, the dorsal finfold, and the base of the C-fin.

At 11.5–12.0 mm, the general body and head shapes remain the same as younger individuals but the D-, C- and V-fins are more elongated (Fig. 84b). The intense pigmentation

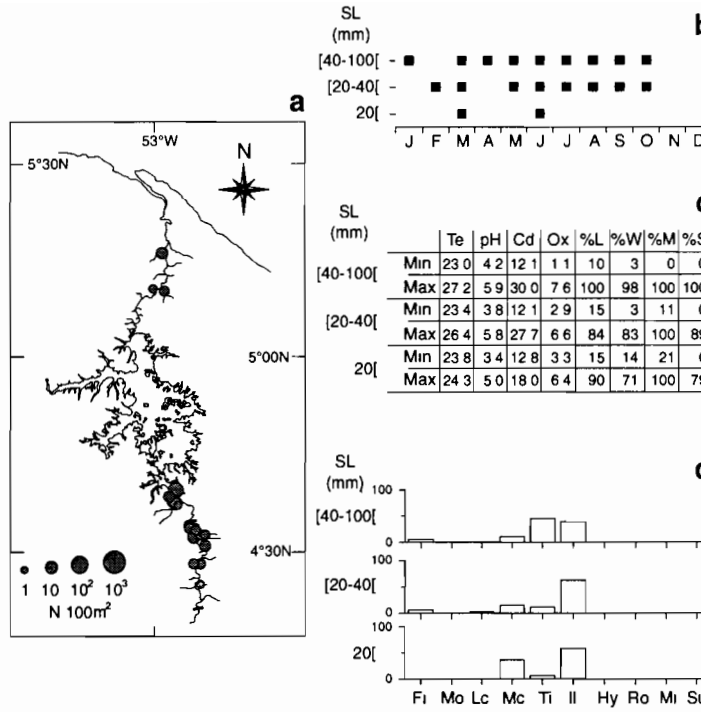


Fig. 83. *Pimelodella* spp. a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <20 mm, young juveniles 20 to 40 mm, and old juveniles 40 to 100 mm. Habitat and prey codes in Fig. 4.

on the dorsal surface of the head, trunk and tail extends to the large humeral spot and to the anterior part of the D-fin. Laterally, the body and tail are less pigmented, the ventral surface of the gut is completely unpigmented. At 14.0 mm, the head is more elongated and depressed, the adipose fin is differentiated and the C-fin presents a more rounded shape (Fig. 84c). The general appearance and pigmentation of the body is that of a small adult with the exception of the C-fin, which lacks the large characteristic vertical dark band of pigments.

Whatever their size, young *P. raninus* are easily distinguished from other young Siluriformes by their heterocercal C-fin.

Young *P. raninus* were caught in all sampled sections except the reservoir (Fig. 85a). The early life stages were observed as early as January and as late as October (Fig. 85b). Regardless of SL, they were found in a wide range of habitats (Fig. 85c). The smallest *P. raninus* ingested insect larvae and micro-crustaceans, whereas larger individuals included fish and large crustaceans in their diet (Fig. 85d).

Rhamdia quelen (Quoy et Gaimard, 1824)

At 14.0 mm, the body of *R. quelen* early life stages is elongate, the ovate depressed head is of moderate size, the rounded snout is elongate, the wide mouth is slightly inferior and the obliquely ovate eyes are small (Fig. 86a). At that SL, the rays of all fins are present and the adipose fin is almost completely differentiated. The maxillary barbels reach to mid-way along

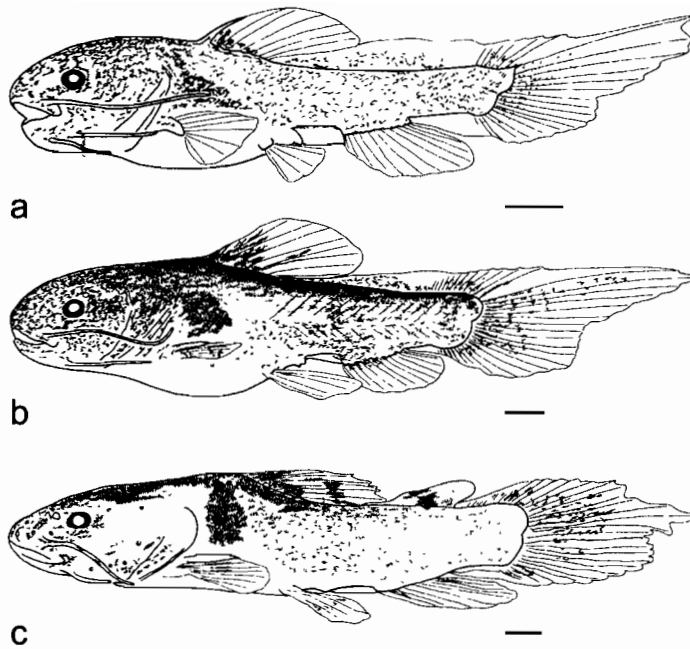


Fig. 84. *Pseudopimelodus raninus* a) 8.5 mm, b) 11.5 mm, and c) 14.0 mm. Horizontal bars represent 1 mm.

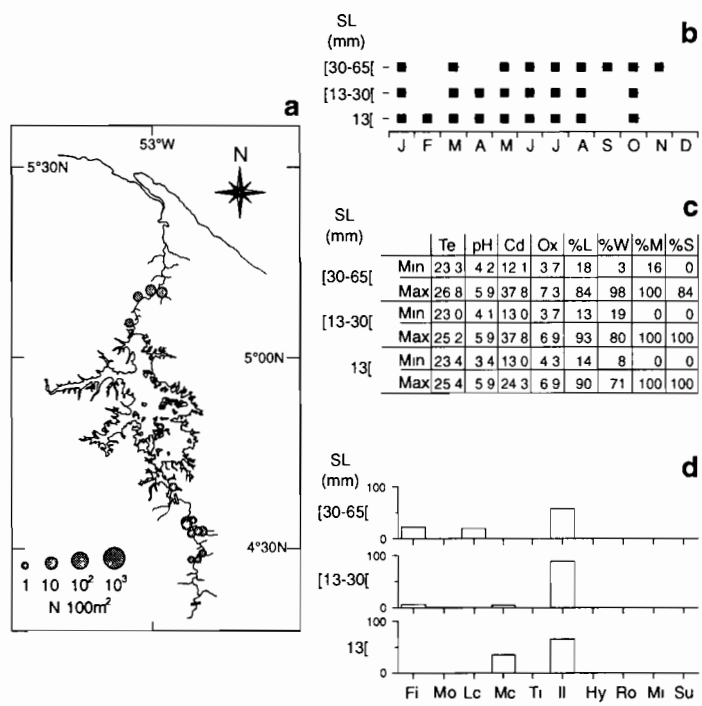


Fig. 85. *Pseudopimelodus raninus* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <13 mm, young juveniles 13 to 30 mm, and old juveniles 30 to 65 mm. Habitat and prey codes in Fig. 4.

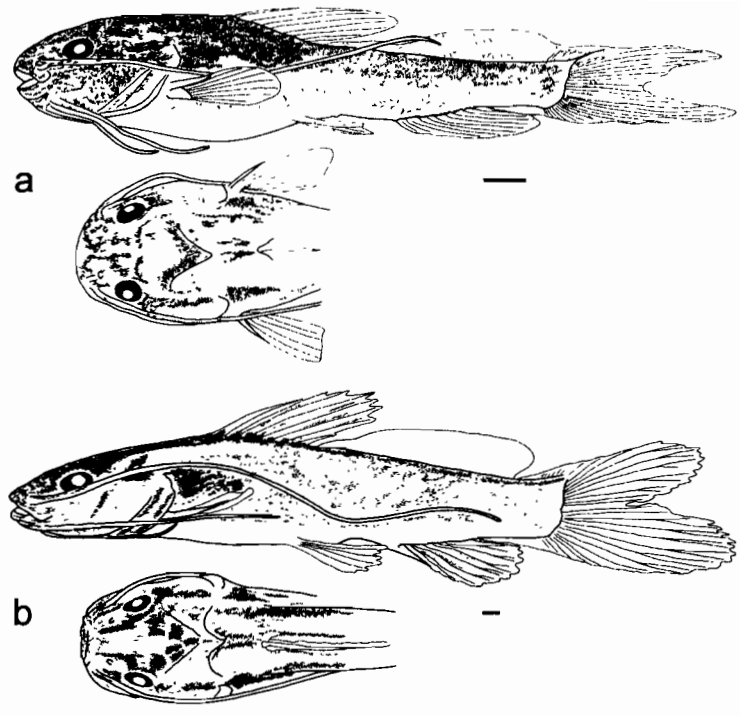


Fig. 86. *Rhamdia quelen* a) 14.0 mm with dorsal view of the head, and b) 32.0 mm with dorsal view of the head. Horizontal bars represent 1 mm.

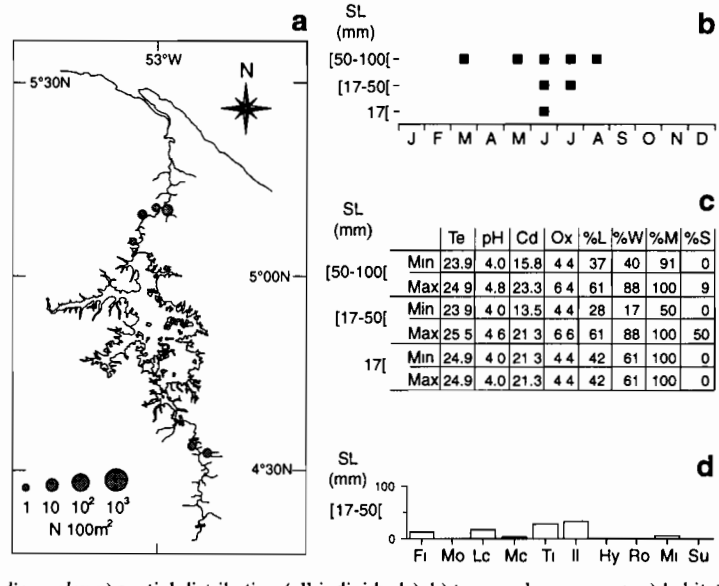


Fig. 87. *Rhamdia quelen* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics for early life stages <17 mm, young juveniles 17 to 50 mm, and old juveniles 50 to 100 mm, and d) relative importance of various dietary items for young juveniles only. Habitat and prey codes in Fig. 4.

the A-fin, the two pairs of mandibular ones reach only to the P-fins. The pigmentation consists of a dark homogeneous pigmentation on the dorsal surface of the head, trunk and tail, which becomes lighter laterally and is absent ventrally. The adipose fin is peppered with tiny melanophores. At 32.0 mm, young *R. quelen* look like small adults (Fig. 86b).

At 13.0–14.0 mm, the general body shape of young *R. quelen* resembles that of young *Pimelodella* spp. (Fig. 82b), but the body pigmentation of the latter is darker and the dorsal finfold is peppered by small melanophores. At 20.0–30.0 mm, *R. quelen* juveniles lack the patch of pigments on the D-fin and the medio-lateral black line which are characteristic of *Pimelodella* spp. juveniles (Fig. 82c).

Young *R. quelen* were never caught in the reservoir (Fig. 87a) and occurred too infrequently in our samples to detect any pattern in their temporal occurrence (Fig. 87b). Irrespective to SL, they were caught in habitats with well oxygenated waters and with a bottom mostly covered by mud, leaves and woody debris (Fig. 87c). Individuals between 17.0 and 50.0 mm preyed mainly on insect larvae and terrestrial insects but also large crustaceans and fish (Fig. 87d).

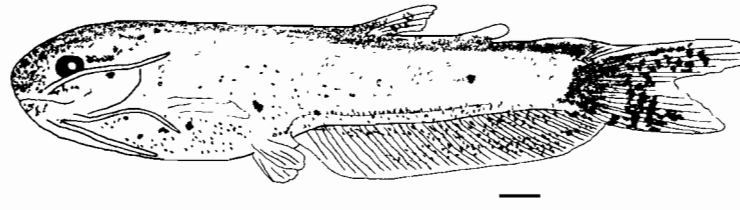


Fig. 88. *Helogenes marmoratus* 14.5 mm. Horizontal bars represent 1 mm

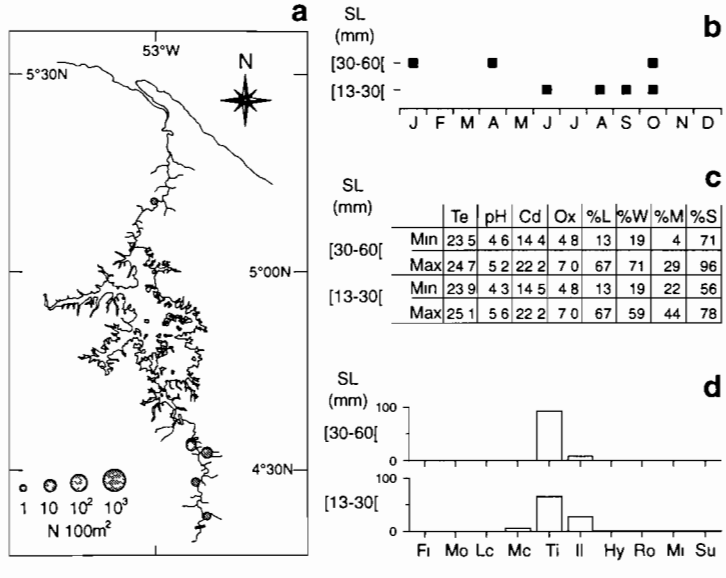


Fig. 89. *Helogenes marmoratus* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for young juveniles 13 to 30 mm, and old juveniles 30 to 60 mm. Habitat and prey codes in Fig. 4.

4. Cetopsidae

Helogenes marmoratus (Günther, 1863)

This species is the only Cetopsidae Helogeninae of French Guiana (Le Bail et al. 2000). We caught few young *H. marmoratus* (Table 2), the smallest being 14.5 mm. At that SL, specimens already look like small adults except that their snout is more rounded. They are easily identified by their elongated A-fin (39–48 rays), which originates much more anteriorly than the D-fin (Fig. 88).

We caught young *H. marmoratus* in the upstream and downstream sections (Fig. 89a). Individuals 13.0 to 30.0 mm were caught at the end of the rainy season (Fig. 89b) in habitats with well oxygenated waters where the bottom was mostly covered with sand (Fig. 89c). Their diet consisted mainly of terrestrial insects and insect larvae (Fig. 89d).

5. Asprenidae

Dysichthys coracoideus (Cope, 1874) [formerly identified as *Bunocephalus coracoideus* Cope, 1874]

This species is the only Asprenidae in the River Sinnamary (Tito de Morais & Lauzanne 1994). The smallest *D. coracoideus* we caught was 6.5 mm. At that SL, the body is elongate, the moderately elongate head is strongly depressed but the cross-section of the tail is cylindrical (Fig. 90a). The snout is convex and the small mouth is inferior. The very small obliquely elongate eyes are located dorsally. The rays of the P- and C-fin are developing, the first ray on the P-fins being transformed into a large curved spine. Incipient rays of the A-fin develop at mid-body. The maxillary barbels almost reach to the P-fins. The pigmentation consists of coalesced melanophores forming large patches on the head, trunk, tail and C-fin, giving a mottled appearance.

At 9.5–10.0 mm, the body shape looks more like that of adults (Fig. 90b). The body is strongly depressed, the head takes a diamond shape when viewed from above, the mouth is inferior, and the eyes are small and situated dorsally. At that SL, the rays of all fins are present. The blotches of melanophores are larger, especially on the tail, and only the P-fins remain unpigmented. At 14.0 mm, young *B. coracoideus* resemble small adults (Fig. 90c).

Young *D. coracoideus* were caught downstream from the dam only (Fig. 91a) but on too few occasions to detect any consistent temporal pattern (Fig. 91b). They were always found in habitats with well oxygenated waters and with large amounts of leaves on the bottom (Fig. 91c). Smallest individuals ingested insect larvae, whereas largest specimens fed on terrestrial insects, molluscs and even fish (Fig. 91d).

6. Trichomycteridae

Ituglanis amazonicus (Steindachner, 1882) [formerly identified as *Trichomycterus guianense* (Eigenmann, 1909)]

This species is the only Trichomycteridae inhabiting the River Sinnamary if we exclude the estuary (Tito de Morais & Lauzanne 1994). At 9.5 mm the body of *I. amazonicus* is elongate, the ovate depressed head is of moderate size, the snout is convex, the mouth is

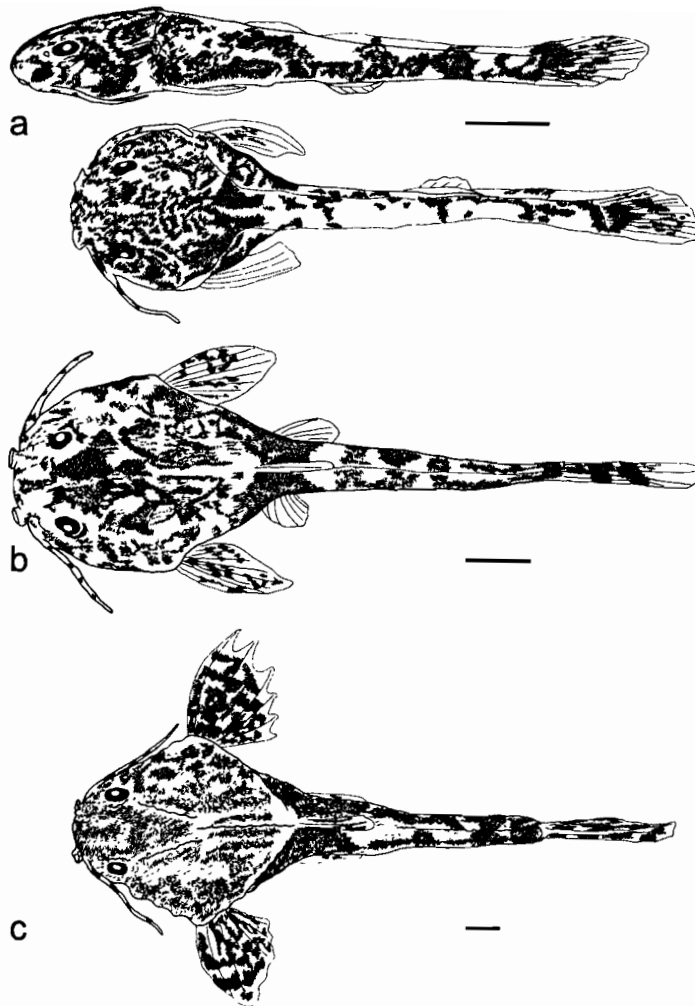


Fig. 90. *Dysichthys coracoideus* a) 6.5 mm lateral and dorsal view, b) 9.5 mm, and c) 14.0 mm. Horizontal bars represent 1 mm.

inferior, the very small round eyes are located dorsally, and the straight gut is of large diameter (Fig. 92a). The finfold remains dorsally and ventrally. The rays of the D-, C- and A-fin are developing, whereas the P-fins are already completed. The first pair of maxillary barbels almost reaches to the extremity of the P-fins. The second pair of maxillary barbels and the nasal barbels are shorter than the first pair of maxillary barbels. Small melanophores scatter the dorsal surface of the trunk and tail. They form patches on the dorsal surface of the head and on the opercula. The ventral surface of the head and body as well as all the fins are unpigmented. At 10.0–10.5 mm, *I. amazonicus* early life stages look like small adults except that remnants of the finfold still exist anterior to the D-fin, between the D- and C-fin, between the C- and A-fin and on the second half of the gut (Fig. 92b).

Young *I. amazonicus* were never caught in the reservoir (Fig. 93a). The smallest specimens were observed from January to August (Fig. 93b). Young *I. amazonicus* were

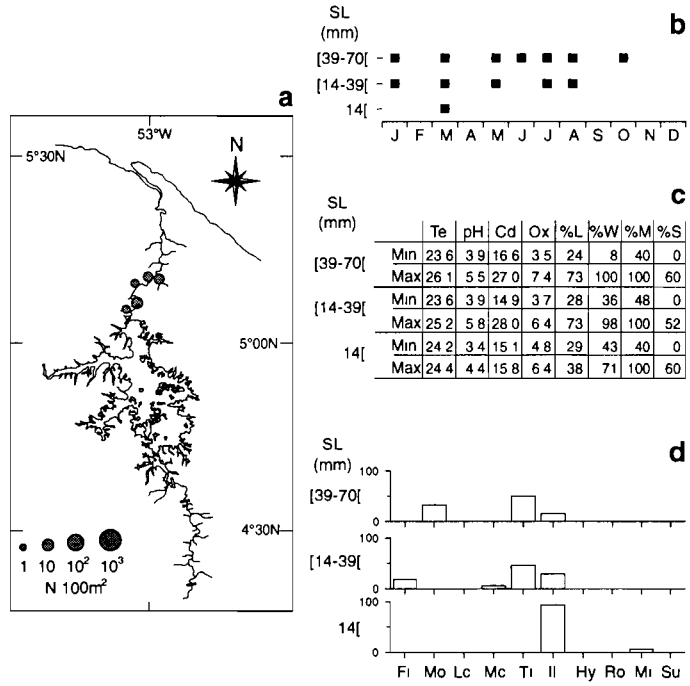


Fig. 91. *Dysichthys coracoideus* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <14 mm, young juveniles 14 to 39 mm, and old juveniles 39 to 70 mm. Habitat and prey codes in Fig. 4.

caught in a wide range of habitats, the largest apparently supporting deoxygenated waters (Fig. 93c). Regardless of SL, young *I. amazonicus* ingested mostly insect larvae but also terrestrial insects and micro-crustaceans (Fig. 93d).

7. Callichthyidae

We caught young stages only of two species of armoured catfish, *Callichthys callichthys* (Linnaeus, 1758) and *Megalechis thoracata* (Valenciennes, 1840), but never those belonging to the genus *Corydoras*.

Callichthys callichthys (Linnaeus, 1758)

At 7.0 mm, the body of *C. callichthys* early life stages is moderately elongate with a slightly compressed tail, the ovate head is moderately large and depressed, the snout is pointed, the wide mouth is terminal and the round eyes are small (Fig. 94a). At that SL, the rays of the P, D- and C-fin are present, those of the A-fin are developing, but the finfold remains dorsally between the D- and the C-fin and ventrally between the anus and the C-fin. The nasal barbels are longer than the maxillary ones and reach to the anus. The head, trunk, and tail, as well as the bases of the D-, C- and P-fins and the finfold, are peppered with small melanophores. The pigmentation is darker on the dorsal surface of the head and on the nape.

At 8.0 mm, body shape remains the same (Fig. 94b). The rays of all the fins are present, but remnants of the finfold exist on the tail dorsally and ventrally. The barbels remain

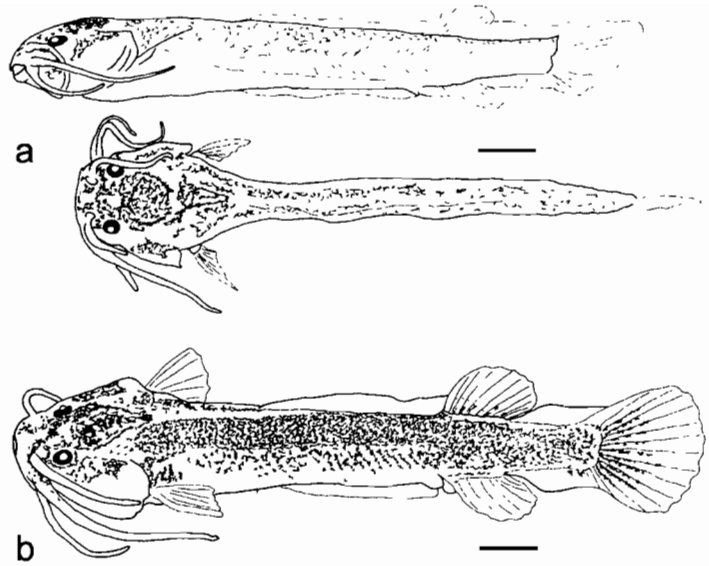


Fig. 92. *Ituglanis amazonicus* a) 9 5 mm lateral and dorsal view, and b) 10 0 mm Horizontal bars represent 1 mm

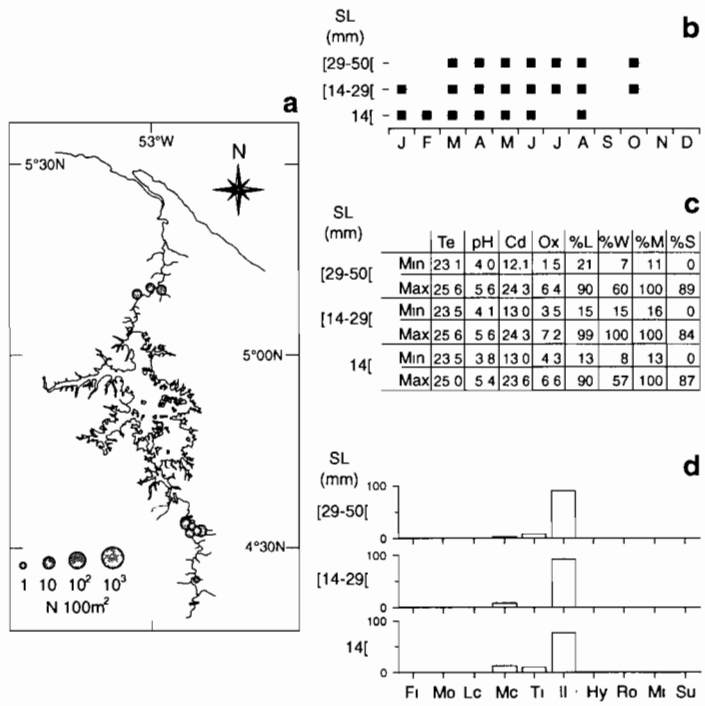


Fig. 93. *Ituglanis amazonicus* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <14 mm, young juveniles 14 to 29 mm, and old juveniles 29 to 50 mm Habitat and prey codes in Fig. 4

proportionally of the same size. Melanophores have coalesced into patches of different sizes that are anastomosed on the head. The base of the D-fin and the central rays of the C-fin are also pigmented. At 20.0 mm, young juveniles present a deeper body and the tail has the same depth as the trunk (Fig. 94c). The snout is more rounded and the eyes proportionally smaller than in younger specimens. The adipose fin is differentiated. The pigmentation consists of dark patches of pigments that cover the head and body dorsally and laterally, extending to the D- and C-fin and even to the barbels. At 23.0 mm, older juveniles resemble small adults except that the body is shorter, the armoured body plates are not complete, and the patchy pigmentation is contrasted (Fig. 94d).

We caught young *C. callichthys* upstream from the reservoir and downstream from the dam (Fig. 95a). The smallest individuals were caught between February and May only

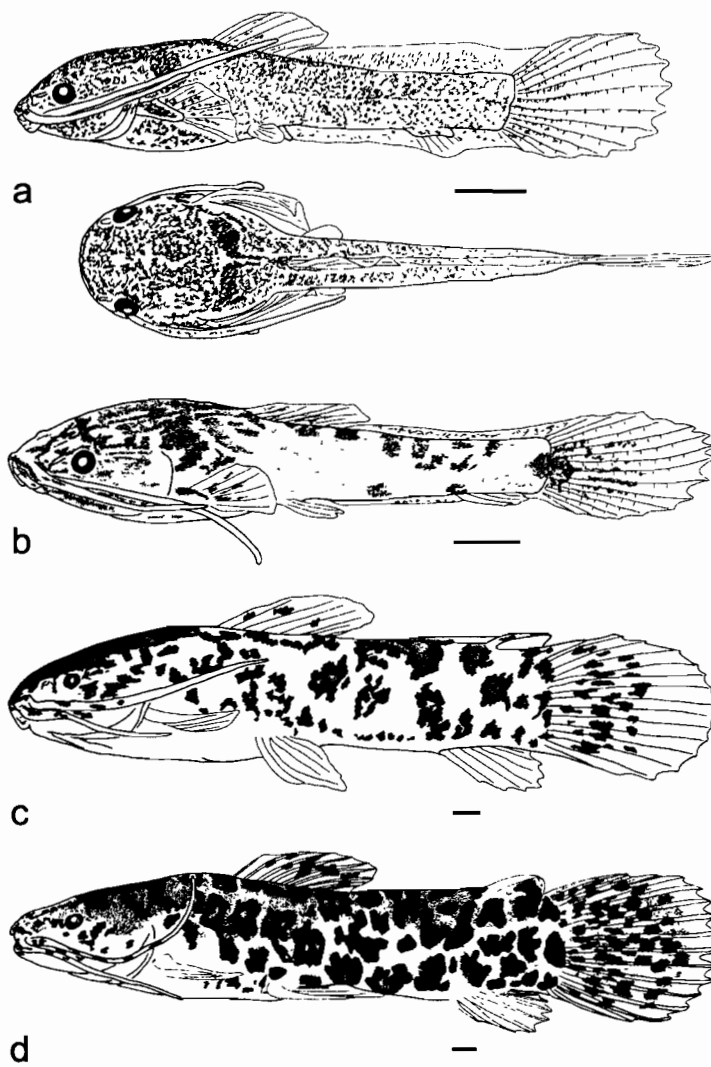


Fig. 94. *Callichthys callichthys* a) 7.0 mm lateral and dorsal view, b) 8.0 mm, c) 20.0 mm, and d) 23.0 mm. Horizontal bars represent 1 mm.

(Fig. 95b). Whatever their size, young *C. callichthys* were observed in a wide range of habitats except those covered entirely with sand (Fig. 95c). Their diet consists mainly of micro-crustaceans and insect larvae (Fig. 95d).

Megalechis thoracata (Valenciennes, 1840) [formerly identified as *Hoplosternum thoracatum* (Val. in Cuv. et Val., 1840)]

The smallest *M. thoracata* we caught was 6.5 mm. At that SL, the body is moderately elongate with a slightly compressed tail, the ovate head is moderately large and depressed, the snout is pointed, the wide mouth is terminal and the round eyes are small (Fig. 96a). The rays of the C-fin are present, those of the D-fin are just developing and anlagen of the A-fin can be detected. The nasal barbels are slightly longer than the maxillary ones and reach to the base of P-fins. The body is covered dorsally on the trunk and tail and ventrally on the tail by elongate patches by melanophores that extend to the finfold. Patches are also present on the dorsal surface of the head, on the nape and on the opercula. Some small melanophores are also observed along the rays of the C-fin.

At 9.5–10.0 mm, general body shape remains the same (Fig. 96b). The rays of all the fins are present, but remnants of the finfold exist dorsally and ventrally on the tail. The adipose fin is differentiating. The barbels are proportionally longer and the second pair now reach to the base of the V-fins. Melanophores have coalesced into large dark anastomosed patches and form a continuous dark area from the tip of the snout to the base of the D-fin.

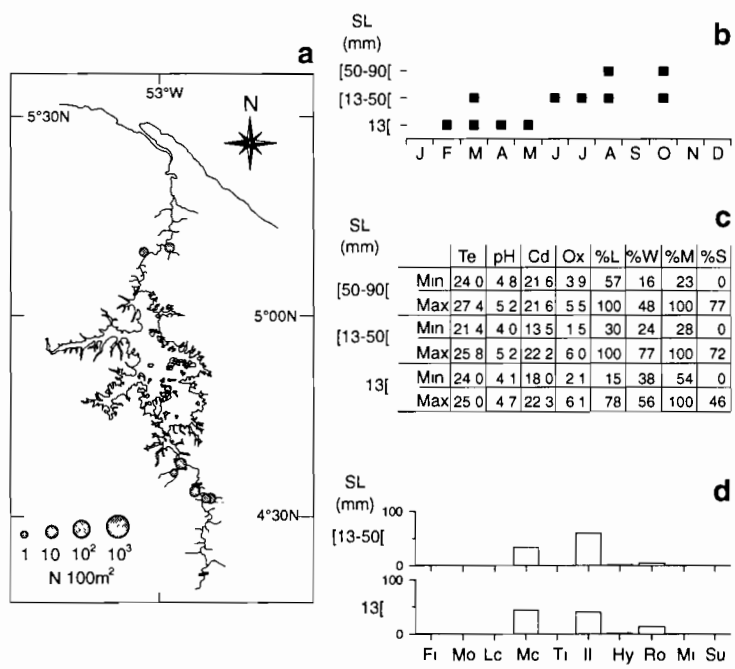


Fig. 95. *Callichthys callichthys* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics for early life stages <13 mm, young juveniles 13 to 50 mm, and old juveniles 50 to 90 mm and d) relative importance of various dietary items for early life stages and young juveniles only. Habitat and prey codes in Fig. 4.

Pigmentation on the C-fin consists of small dark patches. At 15.5–16.0 mm, the body depth increases and the tail has the same depth as the trunk (Fig. 96c). The snout is slightly rounded and the eyes are proportionally smaller. The adipose fin is completely differentiated. Dark vertical bands of pigmentation cover the trunk and tail, often extending to the fins. Smaller, often unaligned, narrow vertical black bands cover the C-fin. At 22.0 mm, older juveniles resemble small adults (Fig. 96d).

Our descriptions of the progeny of these two callichthyds species correspond to those already published by M o l (1996) from artificially reared young. The young of the two species are easily distinguished by their general pigmentation. At identical sizes, the pigmentation of young *M. thoracata* consists of vertical dark bands whereas that of young *C. callichthys* is more spotted.

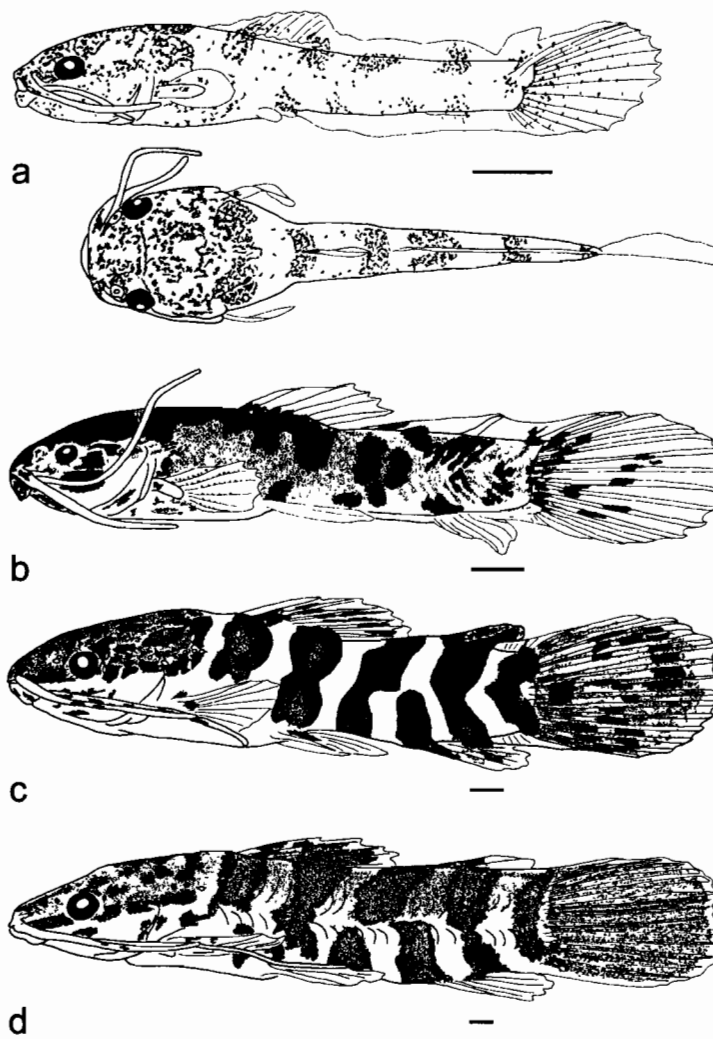


Fig. 96. *Megalechis thoracata* a) 6 5 mm lateral and dorsal view, b) 10.5 mm, c) 16.0 mm, and d) 22.0 mm. Horizontal bars represent 1 mm.

We caught young *M. thoracata* upstream of the reservoir, in the central part of the reservoir and downstream of the dam (Fig. 97a). The smallest individuals were caught between January and June (Fig. 97b). Whatever their size, young *M. thoracata* were observed in a wide range of habitats with the exception of those covered entirely with sand (Fig. 97c). Their diet consisted mainly of micro-crustaceans and insect larvae (Fig. 97d).

C. GYMNOTIFORMES

1. Sternopygidae

In the River Sinnamary, there are two species belonging to the Sternopygidae family (T i t o d e M o r a i s & L a u z a n n e 1994), but we never caught the progeny of *Eigenmannia virescens* (Valenciennes, 1847).

Sternopygus macrurus (Bloch et Schneider, 1801)

The smallest *S. macrurus* we caught was 7.0 mm. At that size, the body is elongate, cylindrical in its first half, slightly compressed laterally in its second half (Fig. 98a). The ovate head is moderately large, the snout is blunt, the terminal mouth is small and the round eyes are small. The finfold is present ventrally on the gut and tail and dorsally from the tip of the tail to mid-trunk. Pigmentation consists of small melanophores scattered on the head trunk and tail.

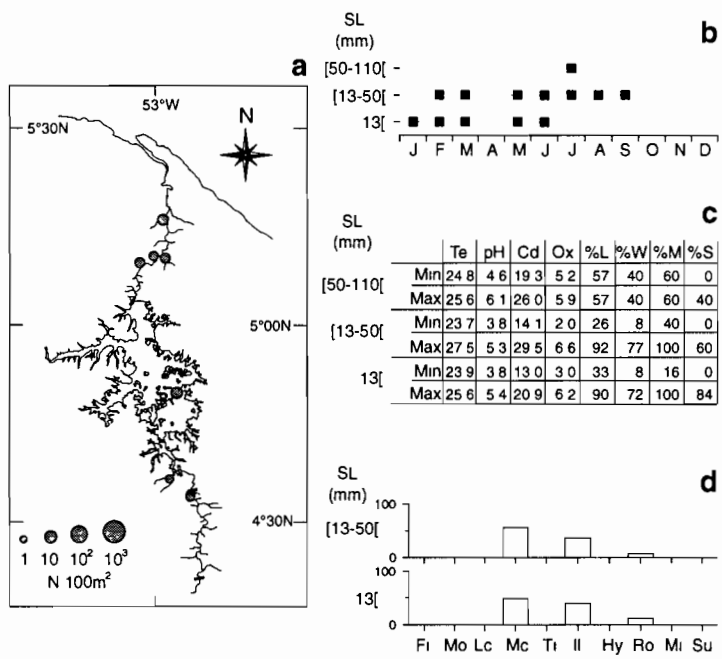


Fig. 97. *Megalechis thoracata* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics for early life stages <13 mm, young juveniles 13 to 50 mm, and old juveniles 50 to 110 mm, and d) relative importance of various dietary items for early life stages and young juveniles only. Habitat and prey codes in Fig. 4.

At 10.0 mm, the general body shape is identical but snout length increases, the tail is more tapered, and anlagen of the A-fin is apparent (Fig. 98b). Pigmentation intensifies and extends to the lateral and ventral surface of the gut as well as to the dorsal and ventral finfold. From about 12.0 mm onwards, the tail begins to lengthen, the dorsal finfold disappears, the number of rays in P-fins is completed, and the rays of the A-fin start to develop (Fig. 98c). The head, trunk and tail are uniformly spread with small melanophores, which give specimen a very dark appearance. At 30.0 mm, juveniles resemble small adults with the characteristic triangular humeral dark spot.

Young *S. macrurus* are easily identified from their smallest size because they do not present the well separated nostrils of Hypopomidae nor the depressed head and prominent mandible of Gymnotidae.

We never caught young *S. macrurus* in the central part of the reservoir (Fig. 99a). The smallest individuals were observed from January to November (Fig. 99b). Young

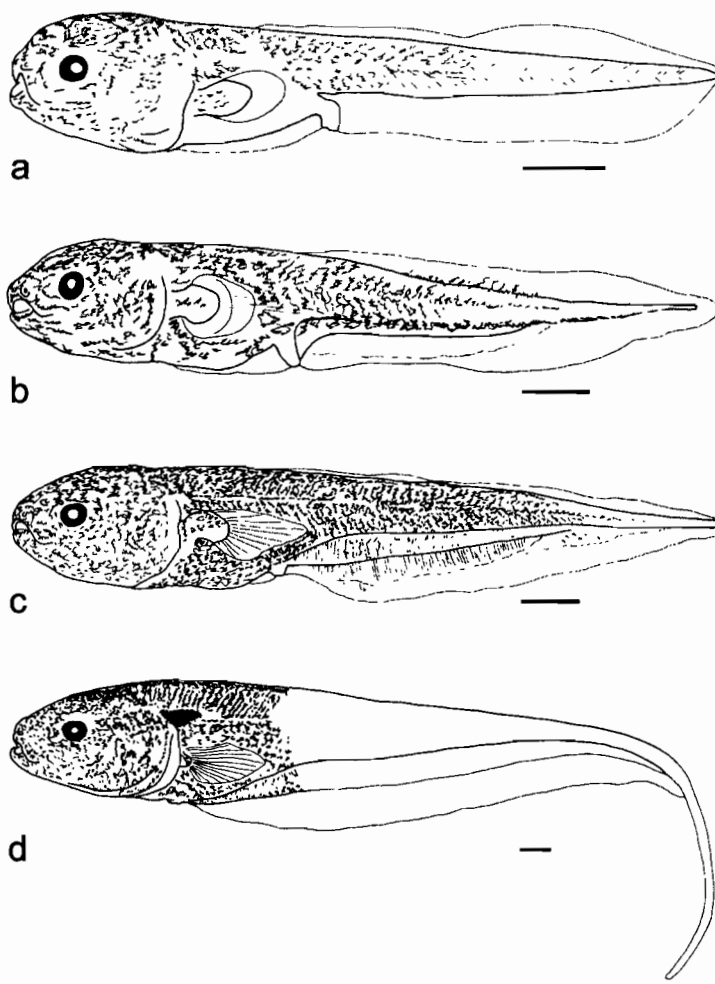


Fig. 98. *Sternopygus macrurus* a) 7.0 mm, b) 10.0 mm, c) 12.0 mm, and d) 30.0 mm with partial representation of the pigmentation pattern Horizontal bars represent 1 mm.

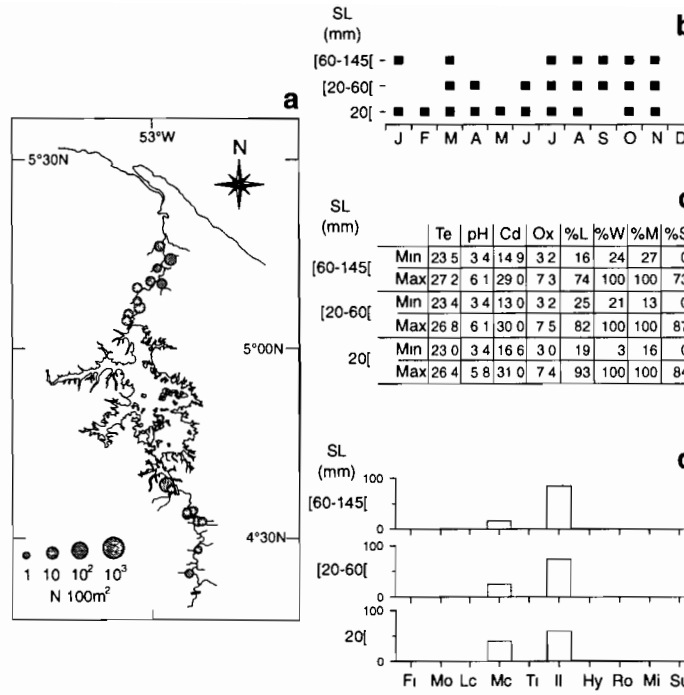


Fig. 99. *Sternopygus macrurus* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <20 mm, young juveniles 20 to 60 mm, and old juveniles 60 to 145 mm. Habitat and prey codes in Fig 4.

S. macrurus were always observed in well oxygenated waters and never in habitats entirely covered with sand (Fig. 99c). Whatever their size, they ingested insect larvae and micro-crustaceans (Fig. 99d).

2. Hypopomidae

Hypopomidae are easily identified by their well separated nostrils and their usually short snout (Swing & Ramsey 1989). We caught the two species of hypopomids present in the River Sinnamary that Tito de Morais & Lauzanne (1994) listed as Rhamphichtyidae.

Brachyhypopomus beebei (Schultz, 1944)

At 11.0 mm, the body of *B. beebei* early life stages is elongate (Fig. 100a). The ovate head is of moderate size, the snout is elongate and rounded, the terminal mouth is very small and the round eyes are also very small. At that size, the finfold is still present dorsally from mid-tail and ventrally on the gut and tail. Incipient rays of the A- and P-fins are present. The surfaces of the head, trunk and tail are uniformly spread with small melanophores, which are denser dorsally. At 17.0 mm the young juveniles resemble small adults except that the rays of their P-fins are not completely developed (Fig. 100b).

We caught young *B. beebei* mostly in the upstream and downstream sections but also in the central part of the reservoir on one occasion (Fig. 101a). The smallest individuals were

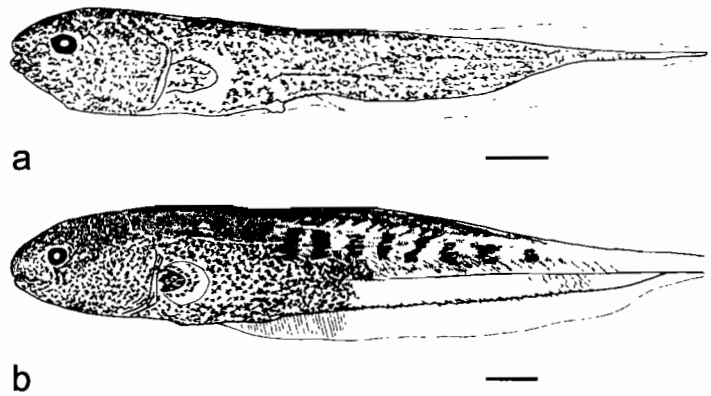


Fig. 100. *Brachyhypopomus beebei* a) 11.0 mm, and b) anterior two-thirds of a 17.0 mm specimen. Horizontal bars represent 1 mm.

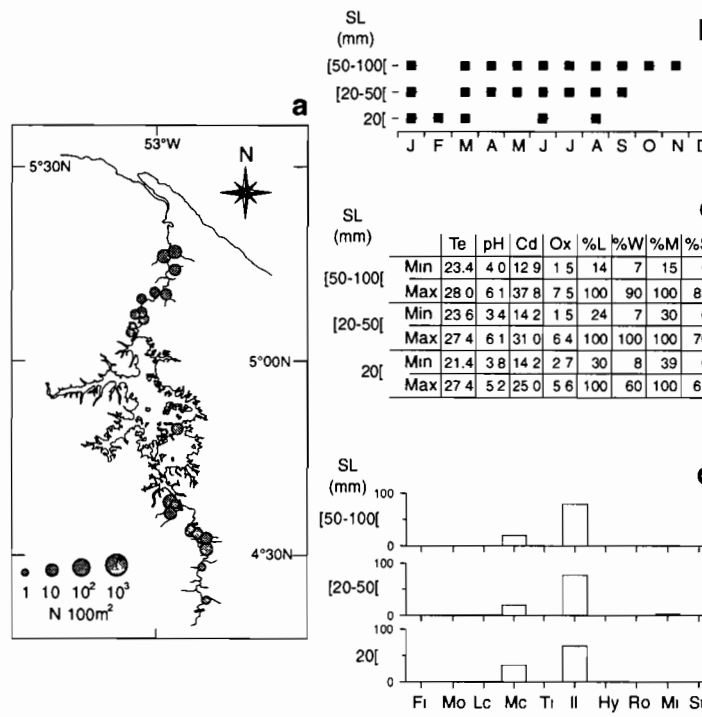


Fig. 101. *Brachyhypopomus beebei* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <20 mm, young juveniles 20 to 50 mm, and old juveniles 50 to 100 mm. Habitat and prey codes in Fig. 4.

observed from January to August (Fig. 101b). *B. beebei* appear to become more tolerant to deoxygenated waters as they grow, but regardless of SL, they avoid habitats completely covered with sand (Fig. 101c). Their diet consists of micro-crustaceans and insect larvae only (Fig. 101d).

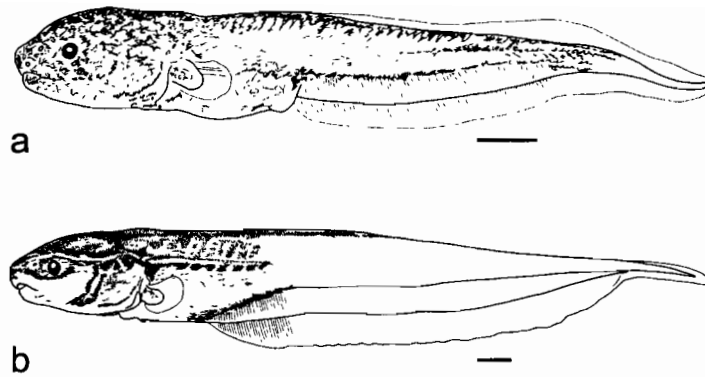
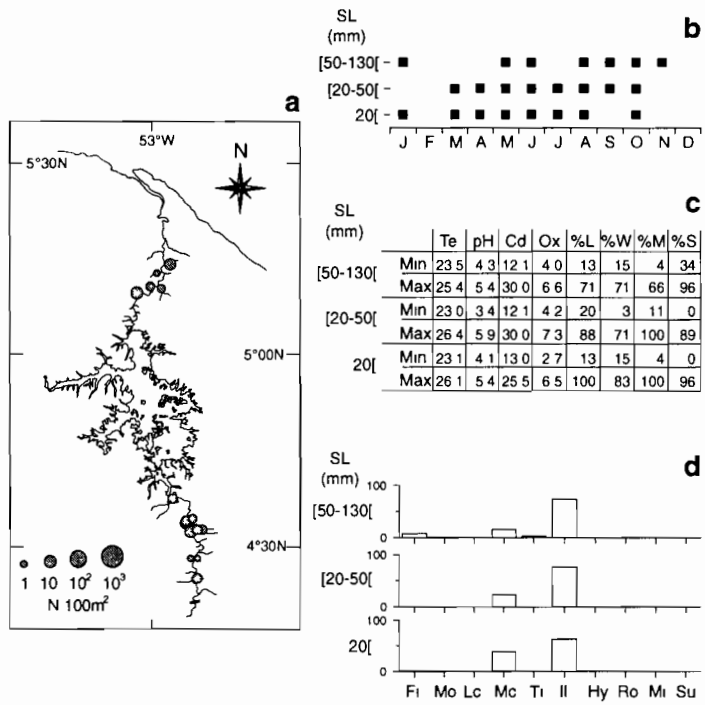


Fig. 102. *Hypopomus artedi* a) 12 0 mm and b) 15.0 mm. Only the body shape of the posterior two-thirds of the 15 mm specimen is drawn. Horizontal bars represent 1 mm.



SL (mm)		Te	pH	Cd	Ox	%L	%W	%M	%S
[50-130[	Min	23 5	4 3	12 1	4 0	13	15	4	34
	Max	25 4	5 4	30 0	6 6	71	71	66	96
[20-50[	Min	23 0	3 4	12 1	4 2	20	3	11	0
	Max	26 4	5 9	30 0	7 3	88	71	100	89
20[	Min	23 1	4 1	13 0	2 7	13	15	4	0
	Max	26 1	5 4	25 5	6 5	100	83	100	96

Fig. 103. *Hypopomus artedi* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <20 mm, young juveniles 20 to 50 mm, and old juveniles 50 to 130 mm. Habitat and prey codes in Fig 4.

Hypopomus artedi (Kaup, 1856)

At 12.0 mm, the body of *H. artedi* early life stages is elongate, the head is moderately large, the snout is blunt, the mouth is moderately large and slightly inferior, the round eyes are very small (Fig. 102a). The finfold is present on the tail dorsally and ventrally. Incipient rays develop on the P- and A-fin. Pigmentation consists of tiny melanophores that give a uniform

light grey appearance to the head, trunk and tail over which darker lines contrast on the snout, dorsal surface of the head and body, and base of the A-fin. At 15.0 mm, young juveniles resemble small adults (Fig. 102b).

Amongst the hypopomids of the River Sinnamary, young *H. artedi* (Fig. 102) differ from young *B. beebei* (Fig. 100) by their less tapered tail, clearly blunt snout and smaller eyes.

We caught young *H. artedi* in all sampled sections except in the reservoir (Fig. 103a). Early life stages were present in our samples from as early as January to as late as October (Fig. 103b). Young *H. artedi* were observed in a wide range of habitats but not in deoxygenated waters (Fig. 103c). Small individuals ingested insect larvae and micro-crustaceans but the diet of individuals >50.0 mm expanded to terrestrial insects and fish (Fig. 103d).

3. Gymnotidae

Gymnotus spp. [*G. anguillaris* Hoedeman, 1962 and *G. carapo* Linnaeus, 1758]

We were unable to differentiate the young stages of the two species of *Gymnotus* present in the River Sinnamary and thus we grouped them at the genus level. At 15.0 mm, the body is elongate, the ovate depressed head is moderately large, the snout is blunt, the mouth is terminal, the mandible is prominent and the eyes are very small (Fig. 104a). The finfold is still present dorsally and ventrally. Incipient rays develop on the A- and P-fins. Pigmentation consists of very small melanophores spread over the entire head and body. At 19.0–20.0 mm, young juveniles resemble small adults (Fig. 104b). From that SL onwards, *G. anguillaris* juveniles can be tentatively distinguished from *G. carapo* juveniles by the slender body and smaller head of the former (Fig. 105).

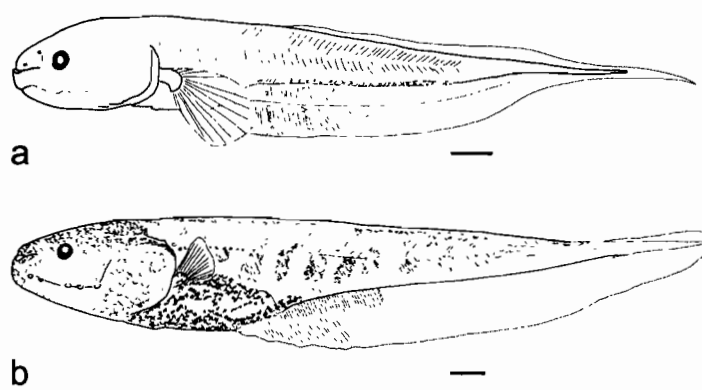


Fig. 104. *Gymnotus* spp. a) 15.0 mm, and b) 20 0 mm Horizontal bars represent 1 mm.

We caught young *Gymnotus* spp. in all sampled sections except in the reservoir (Fig. 106a). Small individuals occurred in our samples from January to October (Fig. 106b). The range of habitats where we found young *Gymnotus* spp. is larger for older individuals, including those with deoxygenated waters and/or sandy bottoms (Fig. 106c). Young *Gymnotus* spp. mainly fed on insect larvae but also on micro-crustaceans, terrestrial insects and even fish (Fig. 106d).

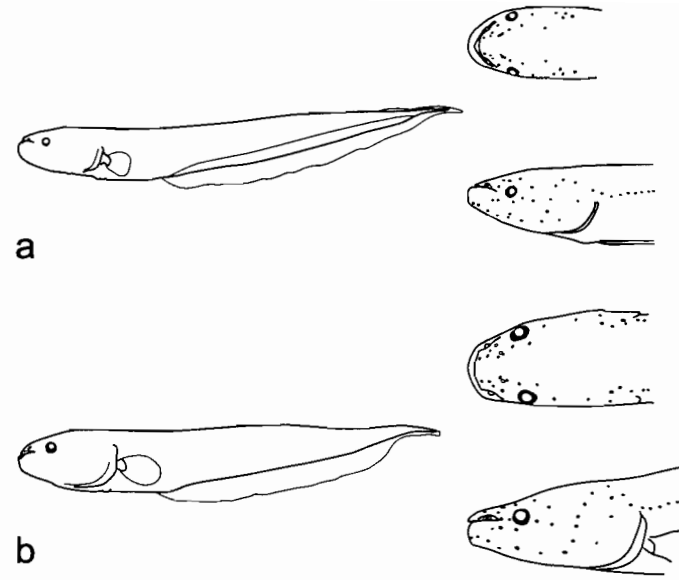


Fig. 105. Comparison of young stages of a) *Gymnotus anguillaris* ca. 19.0 and 50.0 mm (head only, lateral and dorsal view) and b) *G. carapo* ca. 19.0 and 50.0 mm (head only, lateral and dorsal view)

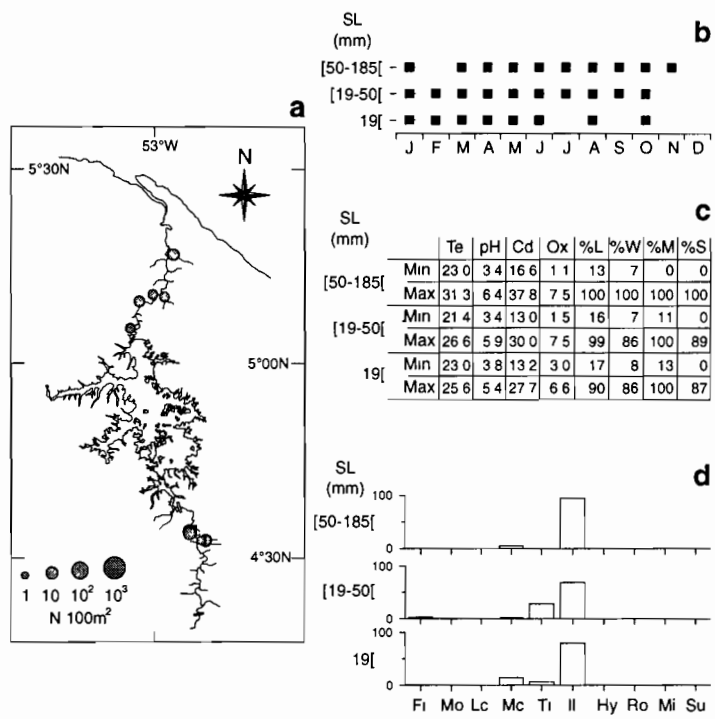


Fig. 106. *Gymnotus* spp. a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <19 mm, young juveniles 19 to 50 mm, and old juveniles 50 to 185 mm. Habitat and prey codes in Fig. 4.

D. CYPRINODONTIFORMES

Four species of cyprinodonts are present in the River Sinnamary (Tito de Morais & Lauzanne 1994) but we only confidently identified the progeny of *Rivulus agilae* Hoedeman, 1954 and *R. xiphidius* Huber, 1979.

1. Rivulidae

Rivulus agilae Hoedeman, 1954

At 6.5 mm, the body of early life stages of *R. agilae* is moderately elongate, the rounded head is of moderate size, the snout is pointed, the mouth is oblique and the eyes are large (Fig. 107a). Although remnants of the dorsal finfold exist anterior to the D-fin, the rays of all fins are already present. Small melanophores scatter the body dorsally and laterally. Ventrally, they

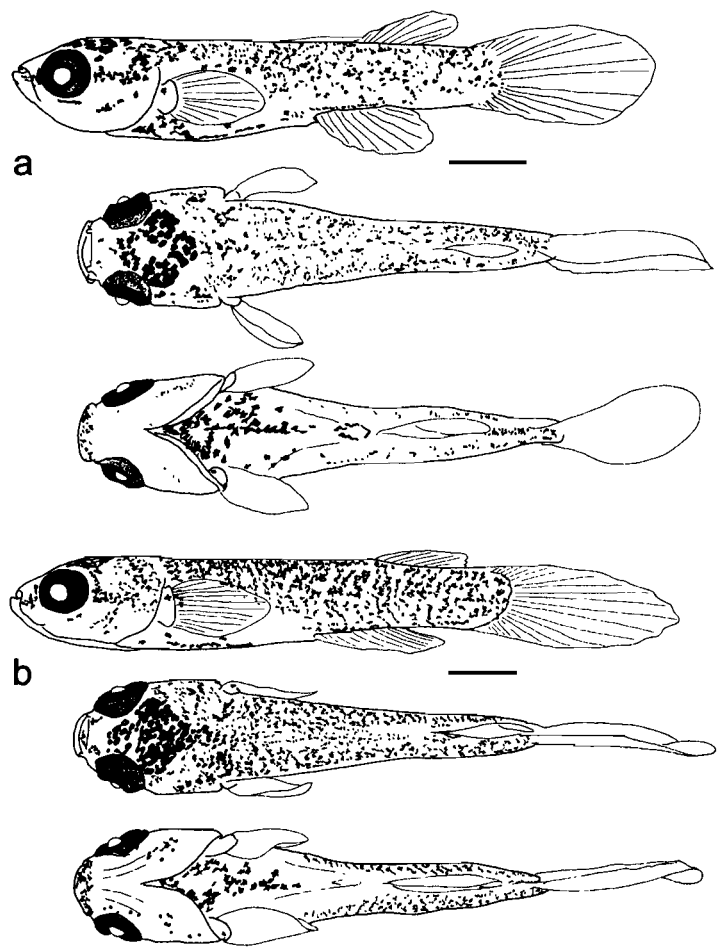


Fig. 107. *Rivulus agilae* a) 6.5 mm lateral, dorsal and ventral view, and b) 7.5 mm lateral, dorsal and ventral view. Horizontal bars represent 1 mm.

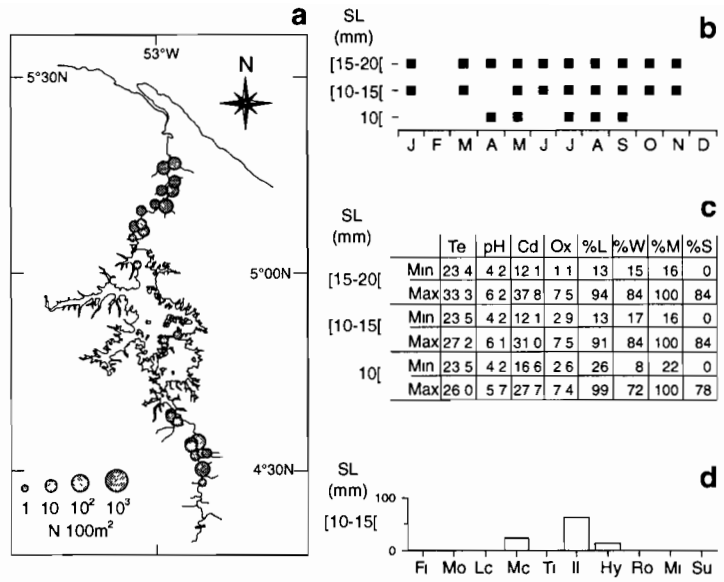


Fig. 108. *Rivulus agilae* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics for early life stages <10 mm, young juveniles 10 to 15 mm, and old juveniles 15 to 20 mm, and d) relative importance of various dietary items for young juveniles only. Habitat and prey codes in Fig. 4.

are larger and coalesced on the anterior part of the gut and near the anus. On the head, they form four large patches dorsally and one horizontal band that bisects the eye and extends laterally onto the snout. At 7.5 mm, the general body shape remains the same (Fig. 107b). On the body and head, pigmentation has intensified, but the gut remains lighter with only some melanophores on its ventral surface.

We caught young *R. agilae* in the upstream section, in the reservoir and downstream from the dam (Fig. 108a) and the smaller individuals only from April to September (Fig. 108b). Young *R. agilae* were caught in a wide range of habitats and even in poorly oxygenated waters in the case of large specimens (Fig. 108c). Individuals between 10 and 15.0 mm ingested mainly insect larvae, micro-crustaceans and hydracaria (Fig. 108d).

Rivulus xiphidius Huber, 1979

At 6.0 mm, the body of *R. xiphidius* early life stages is elongate, the ovate head is large, the snout is pointed, the mouth is oblique and the round eyes are large (Fig. 109a). At that SL, all the fins are complete. Pigmentation consists of small melanophores scattered over the trunk and tail. Those placed medioventrally form a horizontal band, which extends from the tip of the tail to the tip of the inferior jaw. On the gut the melanophores are larger and coalesce. At 7.5–8.0 mm, young juveniles resemble small adults, with a conspicuous large horizontal band of medioventral melanophores (Fig. 109b).

At identical sizes, small *R. xiphidius* possess denser pigmentation than *R. agilae*, especially on the ventral surface of the head, gut and tail (Fig. 107b). In larger *R. xiphidius*, the lateral melanophores aggregate in a large ventro-lateral horizontal band when those of young *R. agilae* tend to form chevrons.

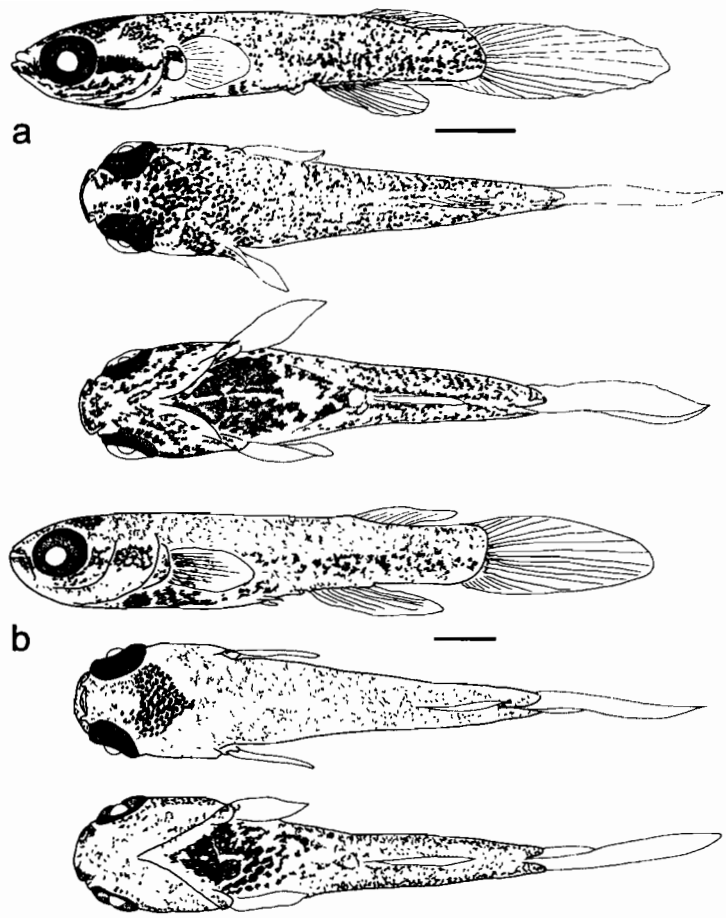


Fig. 109. *Rivulus xiphidius* a) 6.0 mm lateral, dorsal and ventral view, and b) 8 0 mm lateral, dorsal and ventral view. Horizontal bars represent 1 mm.

We caught young *R. xiphidius* in the upstream section as well as downstream of the dam (Fig. 110a). The smallest individuals were found from January to October (Fig. 110b). Young *R. xiphidius* were caught in deoxygenated waters and also in habitats almost entirely covered with sand (Fig. 110c). The smallest individuals ingested micro-crustaceans and insect larvae, the latter becoming the predominant prey of largest individuals (Fig. 110d).

2. Poeciliidae

Micropoecilia spp. [*M. bifurca* (Eigenmann, 1909), *M. parae* (Eigenmann, 1894), and *M.* cf. *picta* (Regan, 1913)]

This taxa was previously identified as *Poecilia parae* (Eigenmann, 1894) by Tito de Morais & Lauzanne (1994) but Keith et al. (2000) now recognise three different species of Poeciliidae in the River Sinnamary: *Micropoecilia bifurca* (Eigenmann, 1909), *M.*

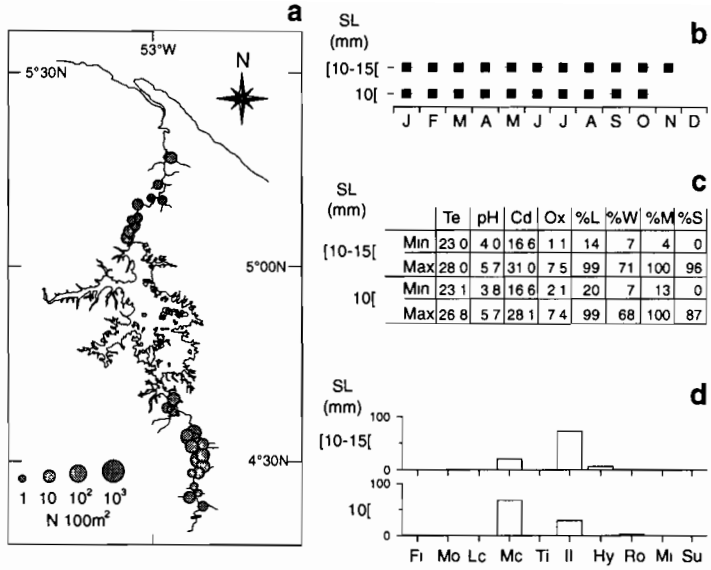


Fig. 110. *Rivulus xiphidius* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <10 mm, and young juveniles 10 to 15 mm. Habitat and prey codes in Fig 4

parae (Eigenmann, 1894), and *M.* cf. *picta* (Regan, 1913). As theses species are identified by the pigmentation of the adults only, we grouped them at the genus level.

At 7.5 mm, the body of early life stages is moderately elongate, the ovate head is moderately large, the snout is pointed, the mouth is oblique and the eyes are very large (Fig. 111a). All the fins are complete. The melanophores form thin lines that criss-cross the lateral surface of the tail and the large humeral vertical band characteristic of the species. The head is also heavily pigmented, especially on its dorsal surface. The fins are unpigmented with the exception of a small spot on the D-fin. At 11.0–11.5 mm, the general body shape remains the same (Fig. 111b). The pigmentation has intensified and young juveniles resemble small adults.

We caught young *Micropoecilia* spp. in all sampled sections except upstream of the reservoir (Fig. 112a). Small individuals were captured too infrequently to detect any pattern in their temporal occurrence (Fig. 112b). Young *Micropoecilia* spp. were never observed in poorly oxygenated waters (Fig. 112c). The diet of the smaller *Micropoecilia* spp. consisted mainly of insect larvae and micro-crustaceans (Fig. 112d).

E. PERCIFORMES

1. Nandidae

Polycentrus punctatus (Linnaeus, 1758) [formerly identified as *P. schomburgkii* Müller et Troschel, 1848]

The smallest *P. punctatus* we caught was 7 mm. At that SL, the body is deep and laterally compressed, the triangular head is large, the snout is pointed, the terminate mouth is large and

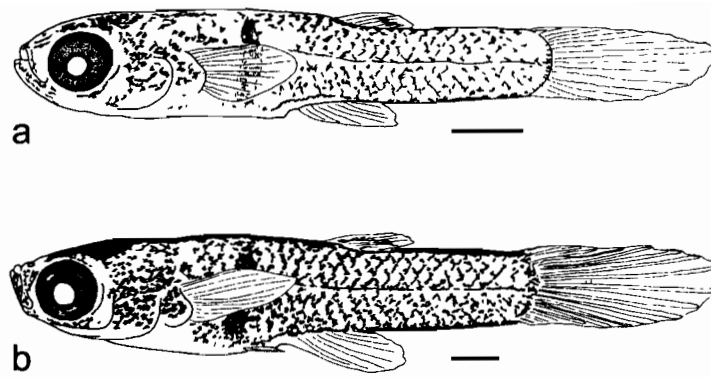


Fig. 111. *Micropoecilia* spp. a) 7.5 mm and b) 11.5 mm. Horizontal bars represent 1 mm

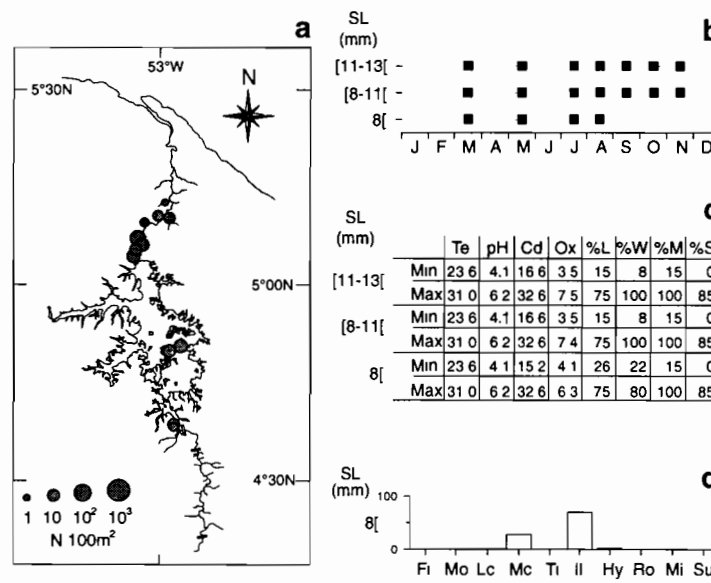


Fig. 112. *Micropoecilia* spp. a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics for early life stages <8 mm, young juveniles 8 to 11 mm, and old juveniles 11 to 13 mm and d) relative importance of various dietary items for early life stages only. Habitat and prey codes in Fig. 4.

the eyes are large (Fig. 113a). The rays of the D-, C- and A-fin are present when those of the V-fins are developing, and those of the P-fins are absent. The consistent pigmentation includes large melanophores that cover the entire head and that form four vertical band laterally on the body. All these bands extend to the D-fin and two of the three on the tail extend to the A-fin. The C-fin is unpigmented with the exception of two elongated patches at its base.

Young *P. punctatus* were caught in the reservoir and downstream from the dam (Fig. 114a). The smallest individuals were captured too infrequently to suggest a temporal pattern of occurrence (Fig. 114b). Young *P. punctatus* 13.0–30.0 mm were caught in habitats where leaves, woody debris and mud were preponderant (Fig. 114c). Smallest individuals fed on insect larvae and micro-crustaceans whereas largest specimens fed also on fish (Fig. 114d).

2. Cichlidae

In the River Sinnamary, seven species of cichlids are present (Tito de Morais & Lauzanne 1994) but we never caught the progeny of *Geophagus surinamensis* (Bloch, 1791) nor of *Satanoperca* aff. *leucosticta*.

Cleithracara maronii (Steindachner, 1882)

The smallest *C. maronii* we caught was 10.0 mm. At that SL, the laterally compressed body is deep, the rounded head is large, the snout is convex, the mouth is terminal, the round eyes are large, and all the fins are complete (Fig. 113b). Large dark black spots, more or less anastomosed, cover the head, trunk and tail, extending to the D, A- and V-fins, whereas the C-fin remains unpigmented. These patches of pigmentation are lighter on the opercula and on the gut.

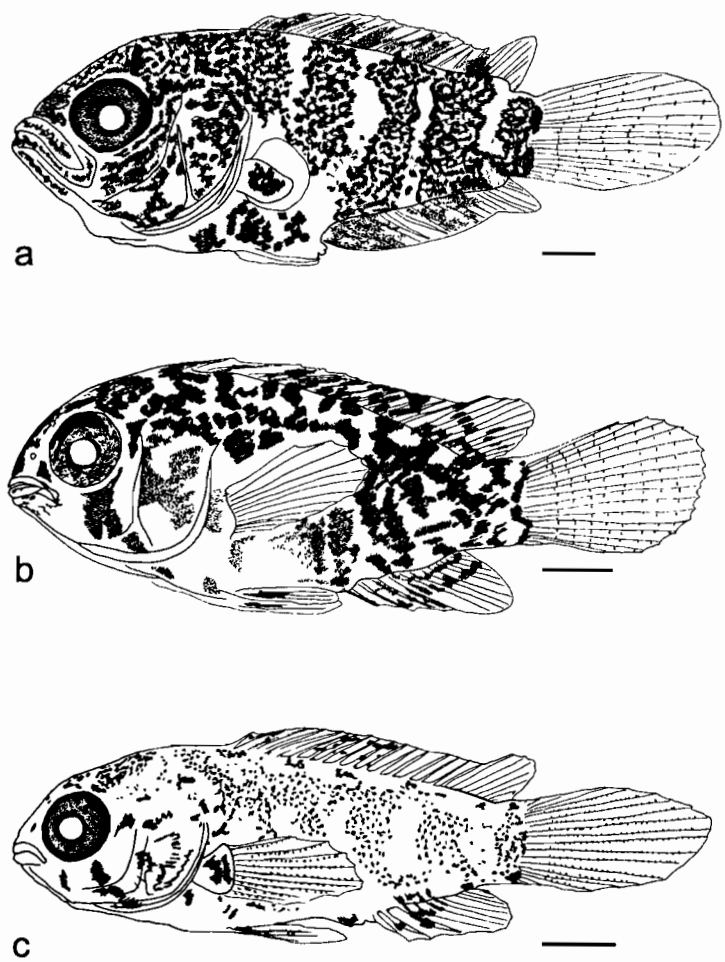


Fig. 113. Young stages of a) *Polycentrus punctatus* 7.0 mm, b) *Cleithracara maronii* 10.0 mm, and c) *Nannacara* spp. 7 0 mm Horizontal bars represent 1 mm

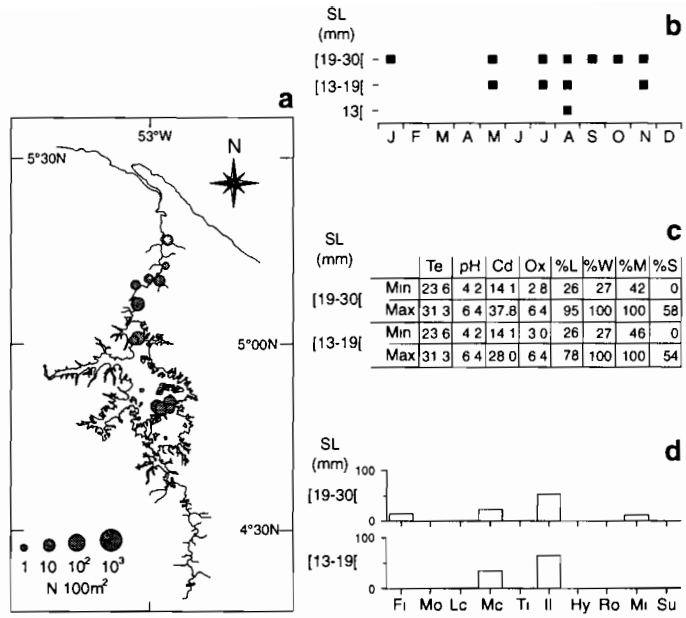


Fig. 114. *Polycentrus punctatus* a) spatial distribution (all individuals), b) temporal occurrence for early life stages <13 mm, young juveniles 13 to 19 mm, and old juveniles 19 to 30 mm, c) habitat characteristics, and d) relative importance of various dietary items for young- and old juveniles. Habitat and prey codes in Fig 4.

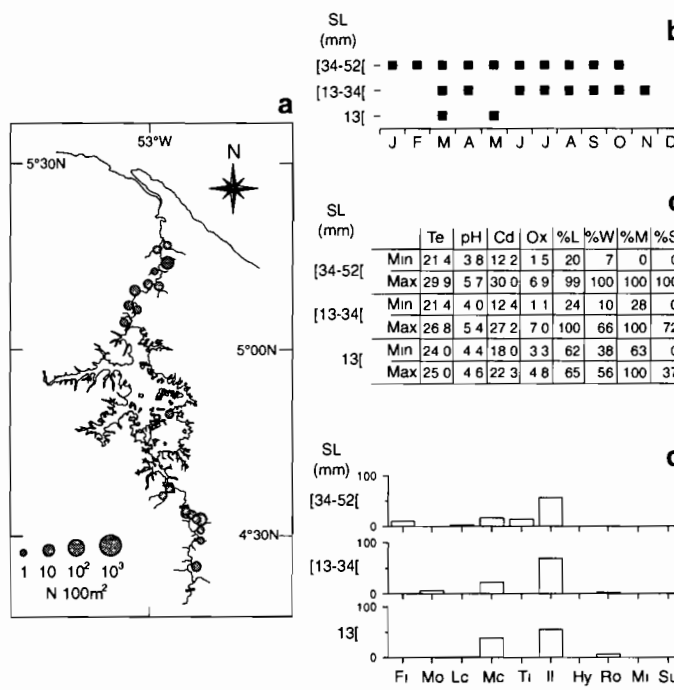


Fig. 115. *Cleithracara maronii* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <13 mm, young juveniles 13 to 34 mm, and old juveniles 34 to 52 mm. Habitat and prey codes in Fig. 4

Young *C. maronii* were caught in the upstream section, in the reservoir and downstream from the dam (Fig. 115a). The smallest individuals were caught too infrequently to detect a consistent pattern in their temporal occurrence (Fig. 115b). Smallest *C. maronii* were mostly found in well oxygenated waters of habitats with bottom mainly covered by mud, and with abundant leaves and woody debris (Fig. 115c). Largest individuals were caught in a wide range of habitats. Smallest individuals preyed mainly upon insect larvae and micro-crustaceans, whereas larger individuals also fed on molluscs, terrestrial insects and even fish (Fig. 115d).

Nannacara spp. [*N. anomala* Regan, 1905 and *N. aureocephalus* Allgayer, 1983]

We were unable to differentiate the young stages of the two species of *Nannacara* present in the River Sinnamary and thus grouped them at the genus level.
The smallest *Nannacara* spp. we caught was 7.0 mm. At that SL, the laterally compressed body is moderately deep, the rotund head is large, the snout is steep, the small mouth is terminal, the round eyes are large and all the fins are completed (Fig. 113c). Small melanophores form four or five oblique large bands on the lateral surface of the body and one large patch on the dorsal surface of the head. Large melanophores aggregate as bands on the opercula and scatter the D-, C- and V- fins. The C- and P-fins possess only tiny melanophores that align along the rays.

We caught young *Nannacara* spp. in every section of the River Sinnamary (Fig. 116a). Smallest individuals were caught from January to October (Fig. 116b) Young *Nannacara*

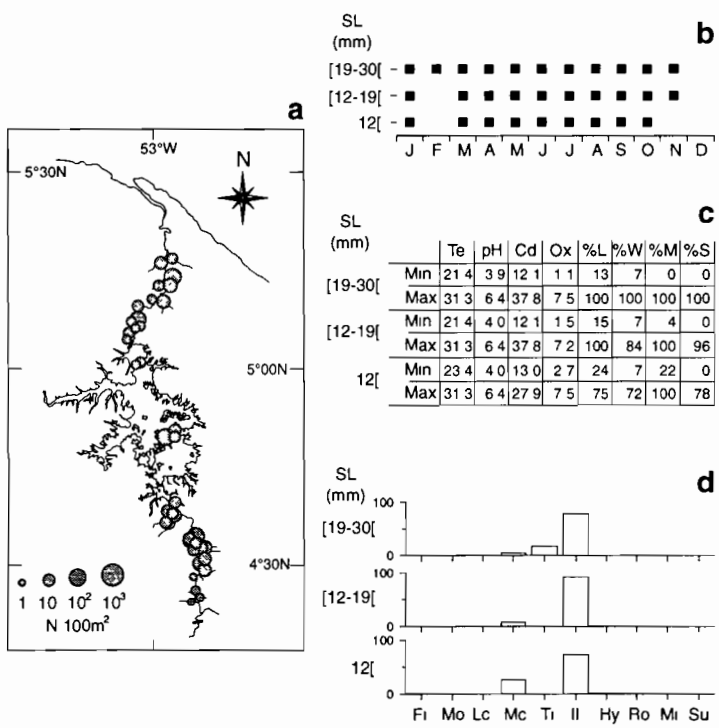


Fig. 116. *Nannacara* spp. a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <12 mm, young juveniles 12 to 19 mm, and old juveniles 19 to 30 mm Habitat and prey codes in Fig. 4

spp. were found in a wide range of habitats, the larger specimens being able to thrive in poorly oxygenated waters (Fig. 116c). All the size classes fed on insect larvae and micro-crustaceans, and largest individuals also preyed upon terrestrial insects (Fig. 116d).

Crenicichla saxatilis (Linnaeus, 1758)

At 9.0–9.5 mm, the body of *C. saxatilis* early life stages is moderately elongate, the ovate head is large, the snout is concave, the mouth is terminal, and the round eyes are large (Fig. 117a). At that SL, all fins are completed except V- ones. Pigmentation consists of one conspicuous lateral black band that extends from the eye to the middle of the C-fin and one dorsal series of patches aligned from the snout to the anterior limit of the D-fin. At 19.0 mm, young juveniles resemble small adults with the exception of the lateral black band.

We caught young *C. saxatilis* in every section of the River Sinnamary (Fig. 118a), the early life stages being observed year-round in our samples (Fig. 118b). Young *C. saxatilis* were generally present in a large range of habitats, but the youngest apparently avoided poorly oxygenated waters (Fig. 118c). Smallest individuals mainly fed on insect larvae, micro-crustaceans, terrestrial insects and occasionally fish. Largest individuals switch to larger prey such as terrestrial insects, large crustaceans and fish (Fig. 118d).

Krobia aff. *guianensis* sp.1 (Regan, 1905)

The smallest *K.* aff. *guianensis* sp1 we caught was 5.0 mm, but we were able to rear young individuals from fertilised eggs of known parents in the laboratory. One day after hatching, young *K.* aff. *guianensis* sp1 possessed a very large, yellowish yolk-sac of a length representing 50 % of SL, a curved incomplete head and unpigmented eyes (Fig. 119a). Melanophores extended over the lateral surface of the yolk-sac and on the base of anterior part of the ventral finfold only. The head, mouth, and pigmentation of the eyes developed slowly during the next 48 hours, but the pigmentation pattern remained the same (Fig. 119 b and c). At 5.2 mm, the four day-old individuals corresponded to the smallest specimens caught in nature (Fig. 119d). At that size the yolk-sac is still present but its length represents only 25 % of SL. The round head is moderately large, the snout is steep, the small mouth remains slightly inferior and the round eyes are very large. The notochord curves into an S-shape and the incipient rays of the C-fin start to form. A narrow finfold is still present dorsally and ventrally. The melanophores on the yolk-sac have coalesced into several anastomosed lines and one transversal band on the cleithrum. Pigmentation at the base of the ventral finfold now extend to the ventral surface of the trunk and tail. Melanophores of smaller size scatter the dorsal surface of the head and trunk. As young *K.* aff. *guianensis* sp1 develop, their body depth increases, the mouth becomes larger and terminal, the rays on the C- and P-fins develop, when anlagen of the D- and A-fin are evident (Fig. 119 e and f). Pigmentation pattern consists of small melanophores that form a patch on the dorsal surface of the head and four, more or less distinct, bands on the lateral surface of the body. The base of the P-fins and the lateral surface of the remnant of the yolk-sac and the gut are covered by darker melanophores. From 5.5 mm onwards, the body depth continues to increase, the head remains large, the terminal mouth now reaches to the anterior limit of the pupil and the rays of the C- and A-fin develop (Fig. 120a). At 6.5 mm, the V-fins appear and the melanophores extend over the D- and P-fins and at the base of the A-fin (Fig. 120b). At 10.0 mm, young juveniles resemble small adults (Fig. 120c).

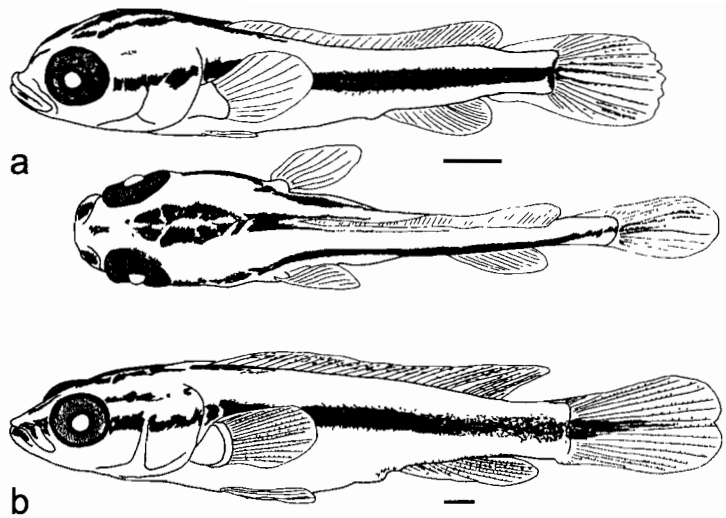


Fig. 117. *Crenicichla saxatilis* a) 9.5 mm lateral and dorsal view, and b) 19.0 mm Horizontal bars represent 1 mm.

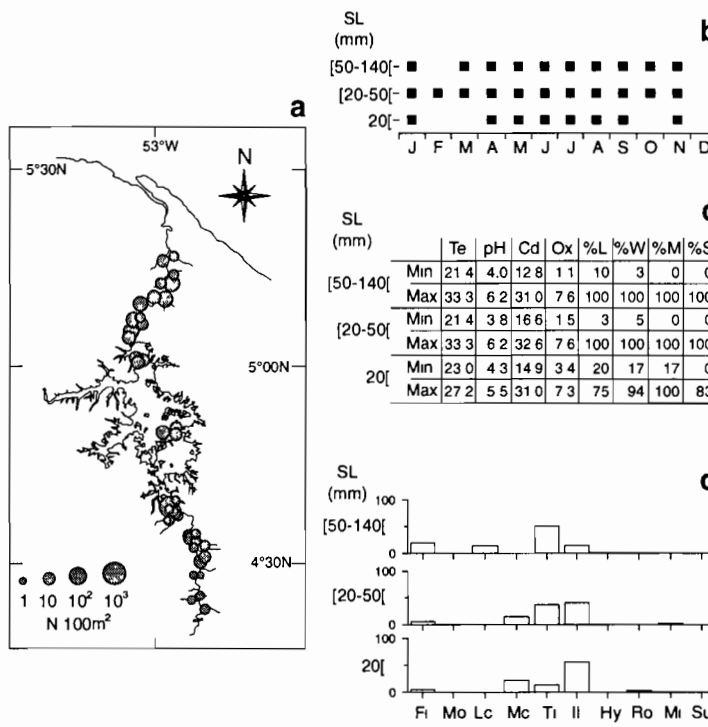


Fig. 118. *Crenicichla saxatilis* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <20 mm, young juveniles 20 to 50 mm, and old juveniles 50 to 140 mm. Habitat and prey codes in Fig. 4

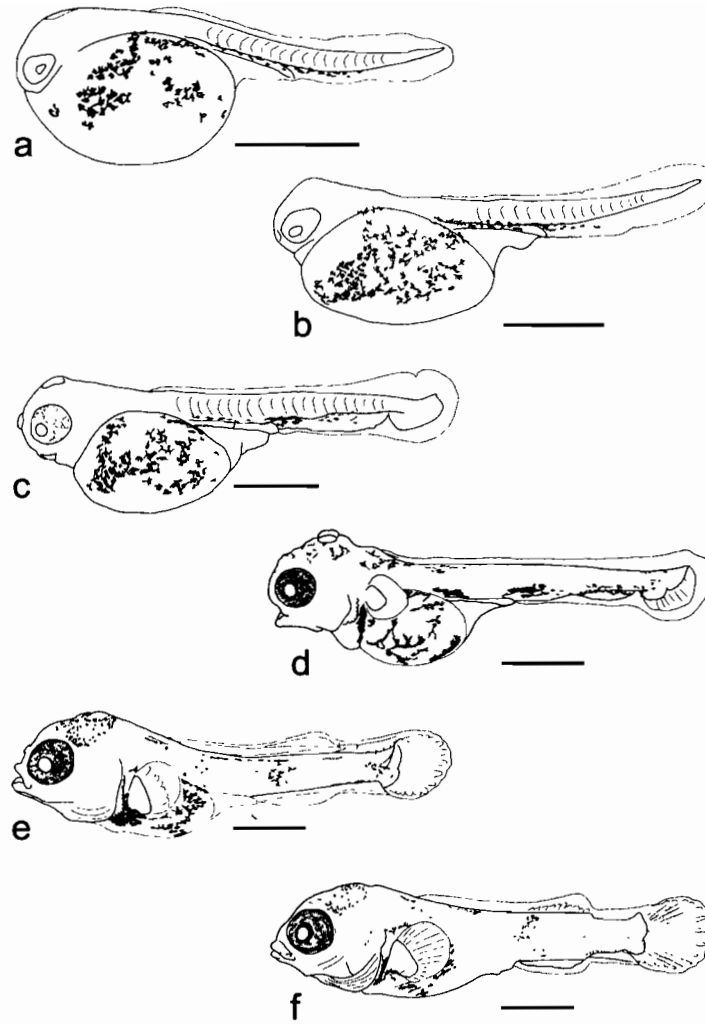


Fig. 119. *Krobia* aff. *guianensis* sp1 a) 3 5 mm (1 day old), b) 4.3 mm (2 day old), c) 4.9 mm (3 day old), d) 5.2 mm (4 day old), e) 5 3 mm (5 day old), and f) 5.4 mm (6 day old). Horizontal bars represent 1 mm.

We caught young *K.* aff. *guianensis* sp1 in every section of the River Sinnamary (Fig. 121a), with smallest individuals present year-round (Fig. 121b). From their youngest stage onwards, the progeny of *K.* aff. *guianensis* sp1 were present in a wide range of habitats, even deoxygenated waters (Fig. 121c). Smallest individuals fed mainly on of insect larvae and micro-crustaceans (Fig. 121d), whereas largest specimens also preyed upon terrestrial insects and fish.

3. Eleotridae

We caught young stages of the two species of eleotrids present in the River Sinnamary (T i t o d e M o r a i s & L a u z a n n e 1994).

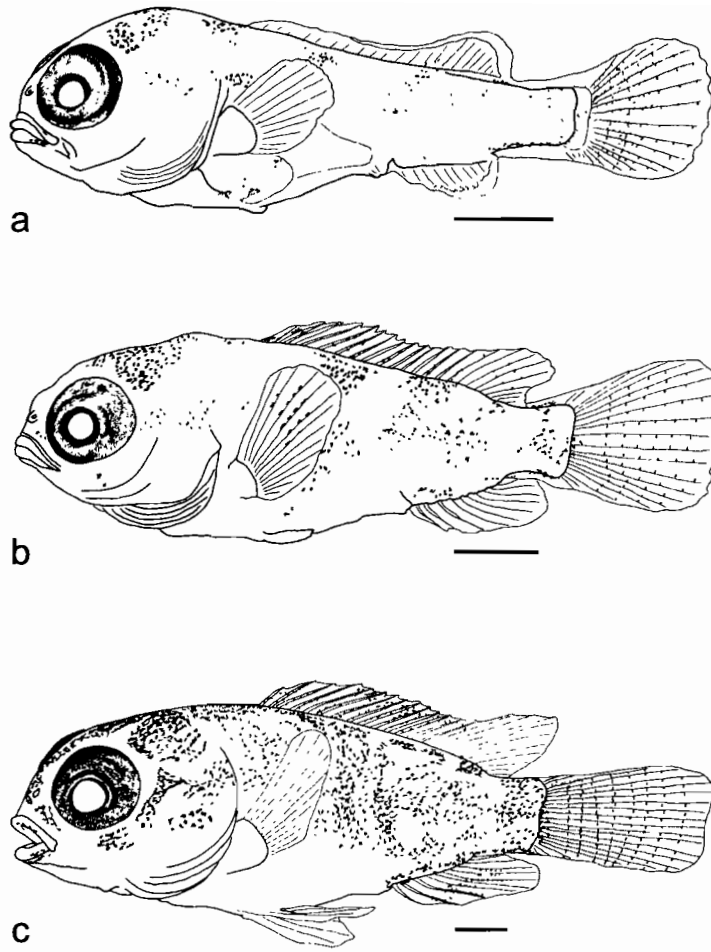


Fig. 120. *Krobia* aff. *guianensis* sp1 a) 5.7 mm (9 day old), b) 6.5 mm (15 day old), and c) 10.0 mm (37 day old). Horizontal bars represent 1 mm.

Eleotris pisonis (Gmelin, 1789) [formerly identified as *E. amblyopsis* (Cope, 1870)]

The smallest *E. pisonis* we caught was 7.5 mm. Thus, the early life stages of this species remain unknown. At that SL, young *E. pisonis* resemble small adults except that their cylindrical body is more elongate and they remain almost unpigmented (Fig. 122a). The ovate head is moderately large, the snout is rounded, the terminal mouth is large and reaches mid-pupil, the round eyes are large and all the fins are completed. Pigmentation consists of a few large melanophores scattered laterally on the head and ventrally on the cleithrum, near the pelvic fins and at the base of the A-fin. These melanophores highly contrast with the whitish appearance of the rest of the body. The fins are unpigmented.

Young *E. pisonis* were caught in the downstream section of the River Sinnamary only (Fig. 123a). The smallest individuals were caught from January to November (Fig. 123b). Young *E. pisonis* were never observed in very poorly oxygenated waters but in habitats

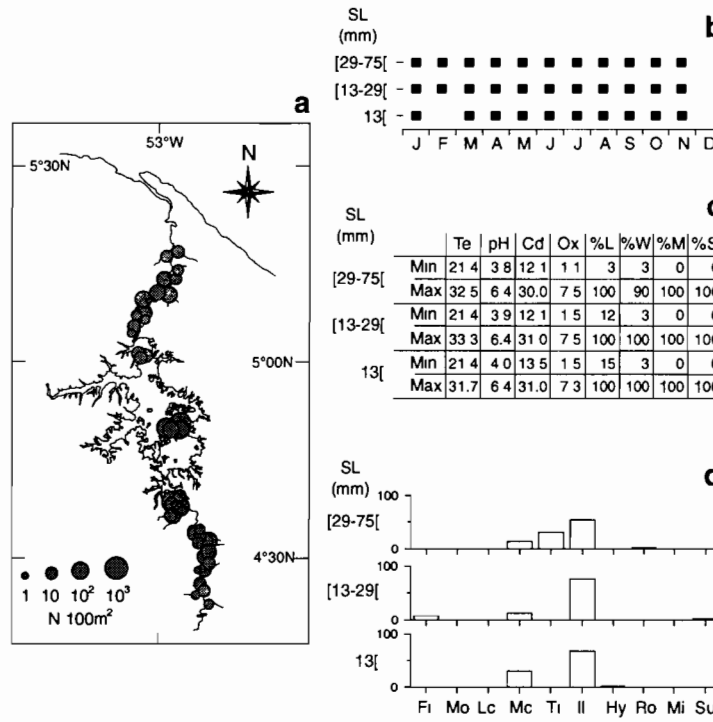


Fig. 121. *Krobia* aff *guianensis* spl a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <13 mm, young juveniles 13 to 29 mm, and old juveniles 29 to 75 mm Habitat and prey codes in Fig. 4.

where mud, leaves and woody debris were present (Fig. 123c). Regardless of size, young *E. pisonis* preyed mainly upon insect larvae, micro-crustaceans and terrestrial insects (Fig. 123d).

Dormitator maculatus (Bloch, 1790) [formerly identified as *D. macrophtalmus* Puyo, 1944]

We caught few young *D. maculatus* with rotenone (Table 2), the smallest individual being 11.5 mm. Thus, the early life stages of this species remain unknown. At that SL, the body is moderately elongate, the ovate head is moderately large, the snout is convex, the terminal mouth barely reaches to the anterior limit of the eye, the moderate-sized eyes. All the fins are completed (Fig. 122b). Small melanophores are scattered over the dorsal and lateral surfaces of the head, trunk and tail but are absent ventrally. Some of them are larger on the opercula, at the base of the P-fins and on the ventro-lateral surface of the trunk. Tiny melanophores are scattered over the two D- and the A-fins and align along the rays of the C-fin.

At identical sizes, the head and body of young *E. pisonis* are much more slender than those of young *D. maculatus*.

Young *D. maculatus* were caught in the downstream section of the River Sinnamary (Fig. 124a), but too infrequently to detect any pattern in their temporal occurrence (Fig. 124b). They were caught in oxygenated waters where mud, leaves and woody debris are abundant (Fig. 124c). Specimens were not caught in sufficient number to study their diet.

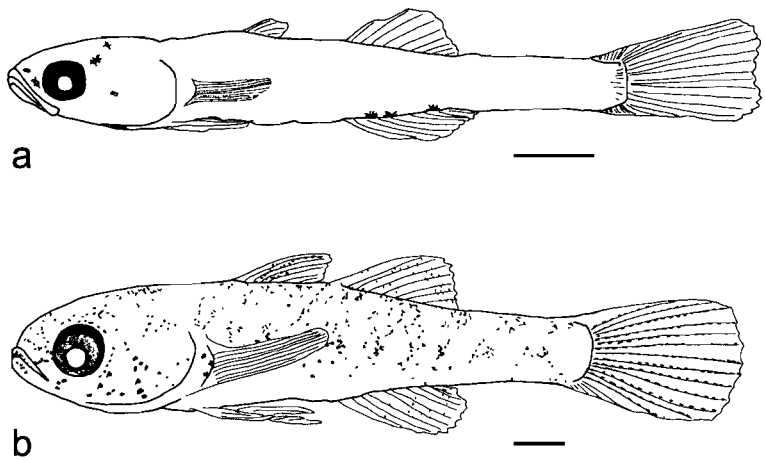


Fig. 122. *Eleotris pisonis* 7.5 mm (a) and *Dormitator maculatus* 11.5 mm (b). Horizontal bars represent 1 mm

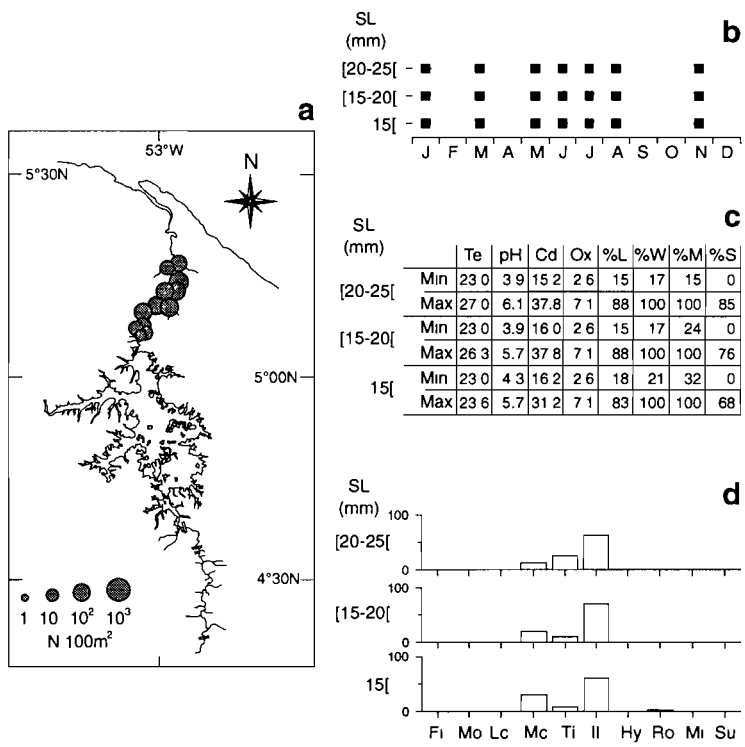
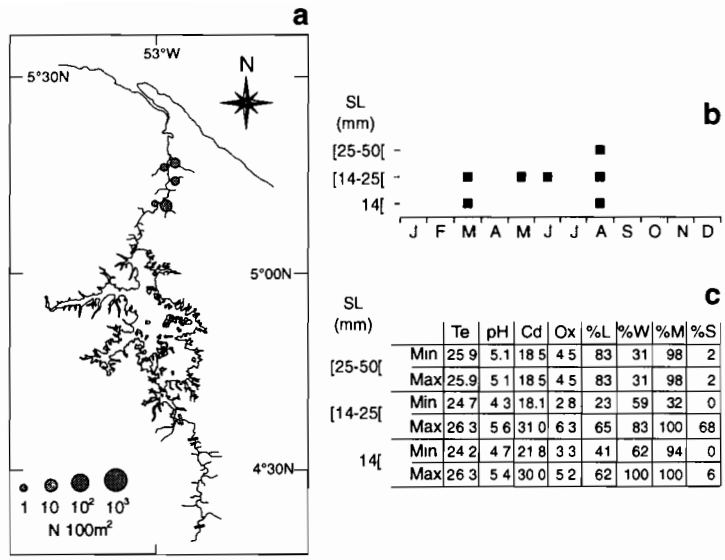


Fig. 123. *Eleotris pisonis* a) spatial distribution (all individuals), b) temporal occurrence, c) habitat characteristics, and d) relative importance of various dietary items for early life stages <15 mm, young juveniles 15 to 20 mm, and old juveniles 20 to 25 mm. Habitat and prey codes in Fig. 4



SL (mm)		Te	pH	Cd	Ox	%L	%W	%M	%S
[25-50[	Min	25 9	5.1	18 5	4 5	83	31	98	2
	Max	25.9	5 1	18 5	4 5	83	31	98	2
[14-25[	Min	24 7	4 3	18.1	2 8	23	59	32	0
	Max	26 3	5 6	31 0	6 3	65	83	100	68
14[	Min	24 2	4 7	21 8	3 3	41	62	94	0
	Max	26 3	5 4	30 0	5 2	62	100	100	6

Fig. 124. *Dormitator maculatus* a) spatial distribution (all individuals), b) temporal occurrence, and c) habitat characteristics for early life stages <14 mm, young juveniles 14 to 25 mm, and old juveniles 25 to 50 mm. Habitat codes in Fig. 4.

Conclusions

The young stages of fish presented here correspond to about half of the approximate 130 species of the River Sinnamary listed by Tito de Morais & Lauzanne (1994). The notable taxa not addressed here belong to the Elopiformes Megalopidae (one species), the Clupeiformes Clupeidae (one species) and Engraulididae (five species), the Siluriformes Arridae (one species) and Loricaridae (eight species), the Cyprinodontiformes Belonidae (one species), and the Perciformes Centropomidae (one species) and Scianidae (one species). Given the great effort exerted to sample these young fishes, we can confidently conclude that the progeny of the species that belong to these eight families do not use the tributaries of the River Sinnamary as nurseries but probably thrive in the main channel of the river and its associated small flooded areas or in other lentic habitats.

Almost all the taxa we caught were in an advanced stage of development and only early life stages of *E. erythrinus* (Fig. 18a) or *Acestrorhynchus* spp. (Fig. 36a) were caught when they still had a straight notochord. The early life stages of most of the taxa addressed here thus remain undescribed. More detailed studies on the early ontogeny of the taxa we present here would require the breeding of adults and rearing of young in captivity. Although this task is quite easy for cichlids (see the description of the early ontogeny of *K.* aff. *guianensis* sp.1 we present here), it would require extensive effort for characids and silurids.

Some taxa were not caught often enough and/or in sufficient numbers to allow us to detect reliably their patterns in temporal occurrence, habitat use, or diet. Similarly, some taxa were only sampled in the downstream and upstream sections but never in the reservoir, where our sampling effort remained low and limited to the littoral zone at the end of the rainy season (Table 1). In future studies, sampling effort should be increased both spatially and temporally in order to determine whether these species reproduce in the reservoir.

Despite some limitations, the work we present here is one of the first that address such a wide range of neotropical fish taxa. We hope that the descriptions and data we gained on the young stages of some fish species of the River Sinnamary will promote this kind of approach in different parts of the neotropics.

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Literature

ARAUJO-LIMA, C. A R M, 1985 Aspectos biologicos de peixes amazônicos. V. desenvolvimento larval do jaraqui-escama grossa, *Semaprochilodus insignis* (Characiformes, Pisces) da Amazônia central. *Rev. Brasil. Biol., 45: 423–431.*

ARAUJO-LIMA, C. A. R M., 1990 Larval development and reproductive strategies of central Amazon fishes. *Ph D Thesis, University of Stirling.*

ARAUJO-LIMA, C. A R. M., 1991: A larva da branquinha comun, *Potamorhina latior* (Curimatidae, Pisces) da amazônia central. *Rev Brasil. Biol, 51: 45–56.*

ARAUJO-LIMA, C A. R. M, KIROVSKY, A. L. & GARCIA MARCA, A., 1993: As larvas dos pacus, *Mylossoma* spp (Teleostei, Characidae, da Amazonia Central. *Rev. Brasil. Biol., 53: 591–600.*

BALON, E K & FRANK, S., 1958: Beitrag zur postembryonalen Entwicklung der Neon-Tetra (*Hyphessobrycon innesi* Myers 1936). *Acta Univ. Carolinae, 5: 3–11.*

BAYLEY, P. B., 1988: Factors affecting growth rates of young tropical floodplain fishes: seasonality and density-dependence. *Env. Biol Fish., 21: 127–142.*

BETTOLI, P. W. & MACEINA, M. J., 1996: Sampling with toxicants. In: Murphy, B. R. & Willis, D. W. (eds), Fisheries Techniques. *American Fisheries Society, Bethesda: 303–333.*

BOUJARD, T., 1992 Space-time organization of riverine fish communities in French Guiana. *Env. Biol. Fish., 34 235–246.*

CHACON, J., 1975. Embryonic and early larval stages of angati catfish, *Trachycorystes galeatus* Linnaeus 1756, at the Amanari fish culture station, Maranguape, Ceara, Brazil. *Rev. Brasil. Biol, 35: 737–744.*

CORDIVIOLA DE YUAN, E. & CAMPANA, M., 1993: Scale development of *Prochilodus lineatus* (Val.) (Pisces, Curimatidae) juveniles from the Parana River. *Rev. Hydrobiol. Trop., 26: 327–332.*

COVICH, A P., 1988: Geographical and historical comparisons of neotropical streams: biotic diversity and detrital processing in highly variable habitats. *J. N. Am. Benthol. Soc., 7: 361–386.*

DYNESIUS, M & NILSSON, C., 1994: Fragmentation and flow regulation of river systems in the northern third of the world. *Science, 266 753–762.*

GÉRY, J., 1977: Characoids of the World. *T.F.H Publications, Neptune City.*

GILDERHUS, P A , 1982: Effects of an aquatic plant and suspended clay on the activity of fish toxicants. *N. Am. J Fish. Manag., 2: 301–306.*

GODINHO, H. M., FENERICH, N. A. & NARAHARA, M Y., 1978: Desenvolvimento embrionario e larval de *Rhamdia hilarii* (Valenciennes, 1840) (Siluriformes, Pimelodidae). *Rev. Brasil. Biol., 38: 151–156.*

GRANVILLE, J J de 1979: Végétation. In ORSTOM (ed.), Atlas des DOM-TOM, IV La Guyane *ORSTOM. Paris 12–13.*

HOREAU, V., CERDAN, P & CHAMPEAU, A , 1997: La mise en eau du barrage hydroélectrique de Petit-Saut (Guyane): ses conséquences sur les peuplements d'invertébrés aquatiques et sur la nourriture des poissons *Hydroécol. Appl., 9. 213–240*

HOREAU, V., CERDAN, P., CHAMPEAU, A. & RICHARD, S., 1998 Importance of aquatic invertebrates in the diet of rapids-dwelling fish in the River Sinnamary, French Guiana *J Trop. Ecol , 14 851–864*

KEITH, P., LE BAIL, P.-Y. & PLANQUETTE, P, 2000: Atlas des poissons d'eau douce de Guyane. Tome 2, fascicule I : Batrachoidiformes, Mugiliformes, Beloniformes, Cyprinodontiformes, Synbranchiformes, Pleuronectiformes, Tetraodontiformes *Patrimoines naturels MNHN / SPN, Paris.*

KOSSOWSKI, C. & MADRID, F., 1991: Observationes de los estadios embrionario y larval des bagre rayado cabezon *Pseudoplatystoma fasciatum* (Linnaeus 1766) (Pisces, Siluriformes) *Biollania, 8: 9–15.*

KULLANDER, S. O & NIJSSEN, H., 1989: The Cichlids of Suriname *E J Brill, Leiden.*

LE BAIL, P.-Y., PLANQUETTE, P. & GÉRY, J.,1984: Clé de détermination des poissons continetaux et côtiers de Guyane. IV: Familles généralement inféodées au milieu dulcaquicole (Siluriformes exclus). *Bulletin de Liaison INRA – CRAAG N°9, Kourou.*

LE BAIL, P.-Y., KEITH, P. & PLANQUETTE, P., 2000: Atlas des poissons d'eau douce de Guyane Tome 2, fascicule II · Siluriformes. *Patrimoines naturels MNHN / SPN, Paris.*

LEIS, J. M & CARSON-EWART, B. M , (eds.) 2000· The larvae of Indo-Pacific coastal fishes. An identification guide of marine fish larvae. *Fauna Malesiana Handbook 2, Brill, Leiden.*

LOWE-McCONNELL, R. H , 1987: Ecological Studies in Tropical Fish Communities. *Cambridge University Press, Cambridge.*

MAGURRAN, A. E., 1988: Ecological Diversity and its Measurement. *Croom Helm Ltd, London.*

MÉRIGOUX, S. & PONTON, D., 1998: Body shape, diet and ontogenetic diet shifts in young fish in the River Sinnamary, French Guiana, South America. *J. Fish Biol., 52: 556–569.*

MÉRIGOUX, S. & PONTON, D., 1999: Spatio-temporal distribution of young fish in tributaries of natural and flow-regulated sections of a neotropical river in French Guiana. *Freshwat. Biol , 42: 177–198*

MÉRIGOUX, S., HUGUENY, B., PONTON, D., STATZNER, B. & VAUCHEL, Ph , 1999: Predicting diversity of juvenile neotropical fish communities: patch dynamics versus habitat state in floodplain creeks *Oecologia, 118: 503–516.*

MÉRIGOUX, S , DOLÉDEC, S. & STATZNER, B., 2001: Species traits in relation to habitat variability and state neotropical juvenile fish in floodplain creeks *Freshw. Biol. (in press).*

MÉRONA, B. de & TITO DE MORAIS, A., 1997: Les études ichtyologiques liées à la construction du barrage de Petit-Saut: un premier bilan et des recommandations. *Hydroécol Appl., 9: 241–262.*

MOL, J. H., 1996. Impact of predation on early stages of the armoured catfish *Hoplosternum thoracatum* (Siluriformes- Callichthyidae) and implications for the syntopic occurrence with other related catfishes in a neotropical multi-predator swamp. *Oecologia, 107: 395–410.*

NAKATANI, K , BAUMGARTNER, G & CAVICCHIOLI, M., 1997: Ecologia de ovos e larvas de peixes. In Vazzoler, A. E. A. M., Agostinho, A. A. & Hahn, N. S. (eds.), A planicie de inundação do alto rio Paraná· aspectos fisicos, biológicos e socioeconômicos. *Editora da Universidade Estadual de Maringá, Maringá: 281–306.*

NELSON, J. S., 1984: Fishes of the world. 2nd ed. *John Wiley & Sons, New York*

OLDANI, N. O., 1977: Identificacion y morphologia de larvas de *Apareiodon affinis* (Steindachner) (Pisces, Parodontidae) *Physis Seccion B, 37· 133–140*

OLDANI, N. O., 1979a: Identificacion y morphologia de larvas y juveniles de *Thoracocharax stellatus* (Kner, 1860) (Pisces, Gasteropelecidae) *Rev. Asoc. Cienc. Nat. Litoral, 10: 49–60.*

OLDANI, N. O , 1979b: Identification y morphologia de larvas y juveniles de *Triportheus paranensis* (Günther 1874) (Pisces, Characidae). *Rev. Asoc. Cienc. Nat. Litoral, 10: 61–71 .*

OLDANI, N. O., 1983a· Identification y morfologia de larvas, juveniles y adultos de *Mylossoma paraguayensis* Norman, 1929 (Pisces, Characidae). *Studies Neotrop. Fauna Env., 18: 89–100.*

OLDANI, N O., 1983b: Identification y morphologia de las larvas y juveniles de *Pimelodus maculatus* Lacépède 1803 (Pisces, Pimelodidae). *Rev. Asoc. Cienc. Nat. Litoral, 14: 193–202*

OUBOTER, P. E & MOL, J. H , 1993: The fish fauna of Suriname In: Ouboter, P. E. (ed.), Freshwater Ecosystems of Suriname. *Kluwer Academic, Dordrecht: 133–154.*

PENA, J C , SANCHEZ, R M & JAMETT, M M., 1988: Desarrollo embrionario, larval y del alevin de *Cichlasoma dovii* (Günther, 1864) (Pisces· Cichlidae). *Rev. Biol. Trop , 36: 417–422 .*

PLANQUETTE, P., KEITH, P. & LE BAIL, P. Y., 1996: Atlas des poissons d'eau douce de Guyane (Tome1). *IEBG – M.N.H.N., INRA, CSP, Min Env., Paris.*

PONTON, D., 1994: Sampling neotropical young and small fishes in their microhabitats: an improvement of the quatrefoil light-trap. *Arch. Hydrobiol., 131: 495–502.*

PONTON, D., 2001 ENSO and the hydrology of the River Sinnamary (French Guiana) during the rainy season: will future El Niño events increase the impact of the Petit Saut dam on downstream fish communities? *Arch. Hydrobiol., in press.*

PONTON, D. & COPP, G H., 1997: Early dry-season assemblage structure and habitat use of young fish in tributaries of the River Sinnamary (French Guiana, South America) before and after hydrodam operations. *Env. Biol. Fish., 50. 235–256.*

PONTON, D. & MÉRIGOUX, S., 2000. Comparative morphology and diet of young cichlids in the dammed River Sinnamary (French Guiana, South America). *J. Fish Biol., 56· 87–102.*

PONTON, D., MÉRIGOUX, S. & COPP, G. H., 2000: Impact of dams in the neotropics: what can be learned from young-of-the-year fish assemblages in tributaries of the River Sinnamary (French Guiana, South America)? *Aquat. Cons Mar. Freshwat. Ecosys., 10: 25–51.*

PONTON, D. & MÉRONA, B. de, 1998. Fish life-history tactics in a neotropical river with a highly stochastic hydrological regime· the River Sinnamary, French Guiana, South America. *Pol. Arch. Hydrobiol., 45: 201–224.*

PONTON, D. & VAUCHEL, Ph., 1998· Immediate downstream effects of the Petit-Saut dam on young neotropical fish in a large tributary of the River Sinnamary (French Guiana, South America). *Reg. Rivers Res Mgmt, 14: 227–243.*

POWLES, H. & MARKLE, D. F., 1984: Identification of larvae. In: Moser, H. G., Richards, W. J., Cohen, D. M., Fahay, M. P., Kendall, A W. Jr. & Richardson, S. L. (eds.), Ontogeny and Systematics of Fishes. *American Society of Ichthyologists and Herpetologists, Lawrence: 31–33.*

PROKEŠ, M , PEREZ MARTÍNEZ, A & PEÑÁZ, M., 1987: Development of *Cichlasoma tetracanthum* in the posthatching period. *Folia Zool , 36· 371–383*

RICHARD, S., ARNOUX, A. & CERDAN, P., 1997: Evolution de la qualité physico-chimique des eaux de la retenue et du tronçon aval depuis le début de la mise en eau du barrage de Petit-Saut. *Hydroécol. Appl., 9: 57–83.*

ROJAS-BELTRAN, R ,1984: Clé simplifiée des espèces de Siluriformes. *Bulletin de Liaison INRA – CRAAG N°7, Kourou.*

SHELDON, A. L & MEFFE, G K , 1993: Multivariate analysis of feeding relationships of fishes in blackwater streams *Env. Biol. Fish , 37: 161–171*

SWING, C K. & RAMSEY, J S , 1989: A field key to fish families reported from South American fresh waters *Occasional papers of the Museum of Natural Science, Louisiana State University, Baton Rouge 64· 1–73.*

TITO DE MORAIS, L. & LAUZANNE, L , 1994: Zonation longitudinale des peuplements ichtyques avant mise en eau de la retenue de Petit-Saut (Guyane française). *Rev. Hydrobiol. Trop , 27: 467–483.*

TITO DE MORAIS, L., LOINTIER, M. & HOFF, M., 1995: Extent and role for fish populations of riverine ecotones along the River Sinnamary (French Guiana). *Hydrobiologia, 303: 163–179.*

TITO DE MORAIS, A & RAFFRAY, J., 1999: Movements of *Hoplias aimara* during the filling phase of the Petit-Saut dam, French Guyana. *J Fish Biol., 54: 627–635.*

VAQUER, A., PONS, V. & LAUTIER, J., 1997 Distribution spatio-temporelle du phytoplancton dans le réservoir de Petit-Saut (Guyane française) *Hydroécol. Appl , 9: 169–193.*

VARI, R. P. & WEITZMAN, S H., 1990· A review of the phylogenetic biogeography of the freshwater fishes of South America. In· Peters, G. & Hutterer, R. (eds), Vertebrates in the Tropics *Museum Alexander Koenig, Bonn: 381–393.*

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