Habitat preference and population structure of the rock catfish (*Austroglanis sclateri*) in the Senqunyane River, Lesotho

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Abstract

Four surveys were conducted in the Senqunyane River between August 1995 and February 1996. *Austroglanis sclateri* specimens were collected by means of electro-fishing and gill netting. In relation to other studies a relatively large number of individuals (86) were sampled and the habitat for each individual was documented. The population was divided into different functional groups and habitat preference was expressed in terms of each functional group. It was evident that recruits (smallest functional group) preferred backwater pools as opposed to the larger fish, which preferred stickles and runs. The preferred bottom substrate was cobbles in the case of the recruits and rubble for the older groups. The mean preferred water depth for this species ranged between 19 and 59 cm. Recruits were mostly sampled at slow current velocities (< 0.1 m/s) while the other functional groups preferred faster current velocities with mean values being 0.44 and 0.42 m/s respectively. The baseline information regarding habitat preference is important for determining instream flow requirements. *A. sclateri* would probably not do well in impoundments as it was found that more than 90% of specimens larger than 4.5 cm (standard length) were found within current velocities exceeding 0.14 m/s and no specimens were collected at depths greater than 1.5 m.

Introduction

The rock catfish (*Austroglanis sclateri*) is listed as rare to indeterminate by the South African Red Data Book for Fishes (Skelton, 1987) and although the known abundance of this species is low it has a widespread occurrence throughout the major tributaries and main stream of the Orange - Vaal system. *A. sclateri* is not known to occur in any other river system although it has two relatives in the Olifants River system. According to Skelton (1993), these relatives, the endangered *A. barnardi* and rare *A. gilli* occur in the tributaries of the Clanwilliam Olifants system, western Cape. The known habitat requirements and ecology of the rock catfish are poorly documented and mostly speculative. According to Jubb (1972) this species frequents rocky pools. Gaigher et al. (1980), however, suggested that *A. sclateri* is possibly dependent on running water. Cambray (1984) and Skelton (1986) also support the theory that *A. sclateri* requires a rocky habitat with good flow. The reason for the uncertainty concerning its habitat preference is related to the difficulty in sampling this species. According to Cambray (1984) the rock catfish is difficult to collect, unless electro-fishing is carried out in rapids. Consequently, very few specimens have been sampled on which to base conclusions concerning its habitat preference. This lack of information is unfortunate as this species could be useful for instream flow recommendations in the context of the conservation of the aquatic ecosystem below the Mohale Dam wall in the Lesotho Highlands Water Scheme. Cambray et al. (1989) recommended that *A. sclateri* could be used as an indicator species for instream flow requirements as its habitat is sensitive to stream regulations.

This need for a well-documented indicator species for management of the Senqunyane River (downstream from Mohale Dam wall) partly served as motivation to investigate the habitat requirements of this species. Furthermore information on this Red Data species would also be of importance to ensure the survival of *A. sclateri* in a river system with ever-increasing anthropogenic threats to the aquatic environment.

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Materials and methods

Seasonal surveys

Data on the habitat preference, length frequencies and condition factors of *A. sclateri* were gathered during four surveys between 1994 to 1996, i.e.: 08-09/94; 03-04/95; 07-08/95 and 02/96, in the Senqunyane and Senqu Rivers, Lesotho.

Study area

The study area extended from a few kilometers upstream of the proposed Mohale Dam wall, at an elevation of 1 946 m above sea level (m a.s.l.) downstream in the Senqunyane River to an elevation of 1 749 m a.s.l., just downstream from Ha Thejane. Major tributaries of the Senqunyane River also formed a part of the study area and included the Likalaneng (up to 2 212 m a.s.l.), Mantsa (up to 1 843 m a.s.l.) and Bokong (up to the Tsoenyane River confluence) Rivers. The Tsoenyane River (up to 2 126 m a.s.l.), which is a tributary of the Bokong River, was also included in the study area (Fig. 1). An additional survey was conducted during February 1996 which extended the study area to include the lower Senqunyane River and the Senqu River from the confluence to Seaka Bridge (Fig. 2).

Sampling sites and description

Sampling sites were selected on the basis of the following criteria. Firstly, preference was given to the inclusion of all habitat types possibly suitable for *A. sclateri*. This was done due to the fact that previous surveys in the Orange River system achieved very low sampling success for *A. sclateri* (Van Schoor, 1972; Janse van Vuren, 1978; Cambray, 1984; MacDonald et al.,

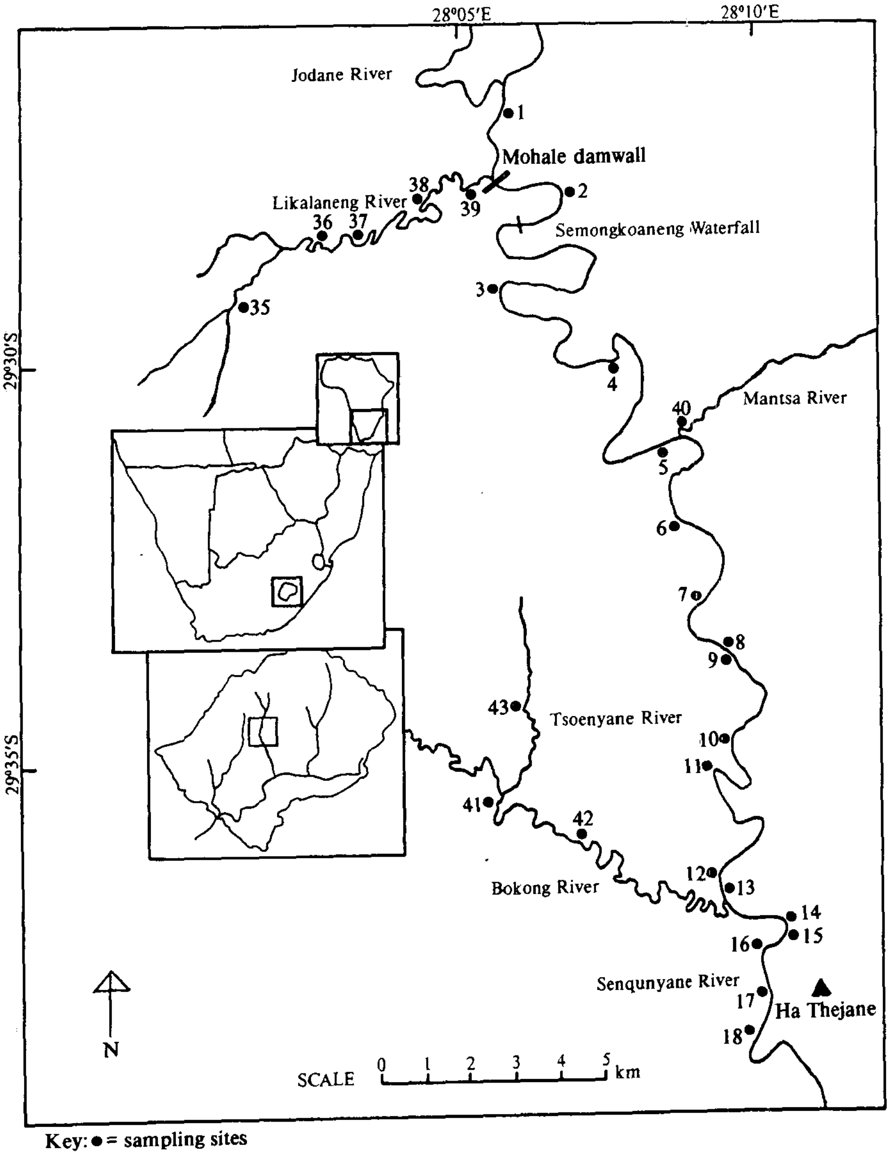

Figure 1
Map of study area indicating sampling sites in the Senqunyane River and major tributaries

1990; Loxton, Venn and Ass., 1993). Secondly, an attempt was made to include as many different habitat types as possible, regardless of the suitability for *A. sclateri.* A random sample design was not applied, as certain parts of the study area are inaccessible. The locality of each sampling site was documented by referring to latitude - longitude, elevation and river gradient as obtained from 1:50 000 topographical maps (series 350 D O S 421) and by means of a geographical positioning system (GPS). The valley slope directly adjacent to both sides of the river was determined by means of a dumpy level.

Twenty-nine sampling sites were chosen in the Senqunyane River of which 27 were downstream and two upstream from the Semongkoaneng waterfall. Five sampling sites were chosen in the Likalaneng River, one in the Mantsa River, two in the Bokong River and one in the Tsoenyane River (Table 1; Fig. 1). Sampling Site 13 was not sampled during the Autumn 1995 survey due to inaccessability of this site. Sampling Sites 19 to 34 were added during the additional survey (February 1996) during which time the other sites were not sampled. These additional sampling sites in the lower Senqunyane River and Senqu River were added in order to extend the study area as well as to include a summer survey (Table 1; Fig. 2).

Sampling methods

Electro-fishing and gill netting were used depending on habitat type sampled. An electro-shocker developed at the RAU, was used for collecting *A. sclateri* at most sites. This portable shocking apparatus consists of a 1A-pulse converter connected to a 220V generator. From the converter the current is conducted in the water through two aluminum electrodes 80 cm apart. Gillnets with stretched mesh sizes of 70 and 90 mm (length: 10 m; height: 1.9 m) were used together at sampling sites where electro-shocking was impossible e.g. deep pools. Specimens under electro-narcosis were collected with a hand-held net and kept in plastic bags filled with river water until morphometrical analysis could be completed.

Population parameters

The mass of *A. sclateri* specimens was determined on a field balance to the nearest gram and standard lengths were measured to the nearest mm. The range of lengths was divided into 1 cm intervals and each specimen was arranged into a specific length group. From these data the length frequencies were determined for each survey in order to demonstrate the population structure for specific seasons. Due to the relatively small sample size the Bhattacharya method could not be used to separate the length frequencies into cohorts (Sparre et al., 1989), consequently the length groups could not be related to age. The length/mass relationship of *A. sclateri* was determined according to the formulae of Le Cren (1957) where M = cLn (c & n = constants; M = mass and L = length). Furthermore, the condition factor for each length group was calculated as follows: condition factor = average mass for length group / calculated mass per length group.

Habitat preference

For the purpose of determining habitat preference, data concerning habitat description for specimens sampled during different surveys were pooled together. In view of the fact that age groups could not be distinguished, the population was divided into different functional groups in order to relate habitat preference with a specific functional group. The criteria for selection of functional groups were as follows:

- **Group 1**: Recruits (young of the year): It was possible to identify the first cohort at the end of summer which could be followed through to the following seasons. The recruits are specified as those fish with a length < 4.5 cm (SL).
- **Group 2**: Juveniles: Fish larger than the first cohort but sexually immature.
- **Group 3**: Adults: A minimum standard length for adult fish was assumed after collecting a ripe male measuring 14.5 cm (SL). Individuals larger than 14 cm (SL) were therefore included in the adult functional group.

Consequently, habitat preference for the sampled population was expressed in terms of the occurrence of different functional groups in relation to pool/riffle forms, bottom substrate, water depth and current velocity. Different pool/riffle forms were classified according to Schoonbee (1973) and Frissel et al. (1986). Bottom substrate classification was done according to Cuchlaine and King (1971); Cowardin et al. (1979) and Skelton and Mashapa (1989). Rank values were allocated for abundance of different substrate types (1=present; 2=minor; 3=abundant; 4=major). Water depth was measured by means of a fibreglass measuring tape. The current velocity was measured with a CATEYE 2 velocity meter. The stomach contents of two *A. sclateri* specimens were collected and preserved in 4% formalin for laboratory analysis.

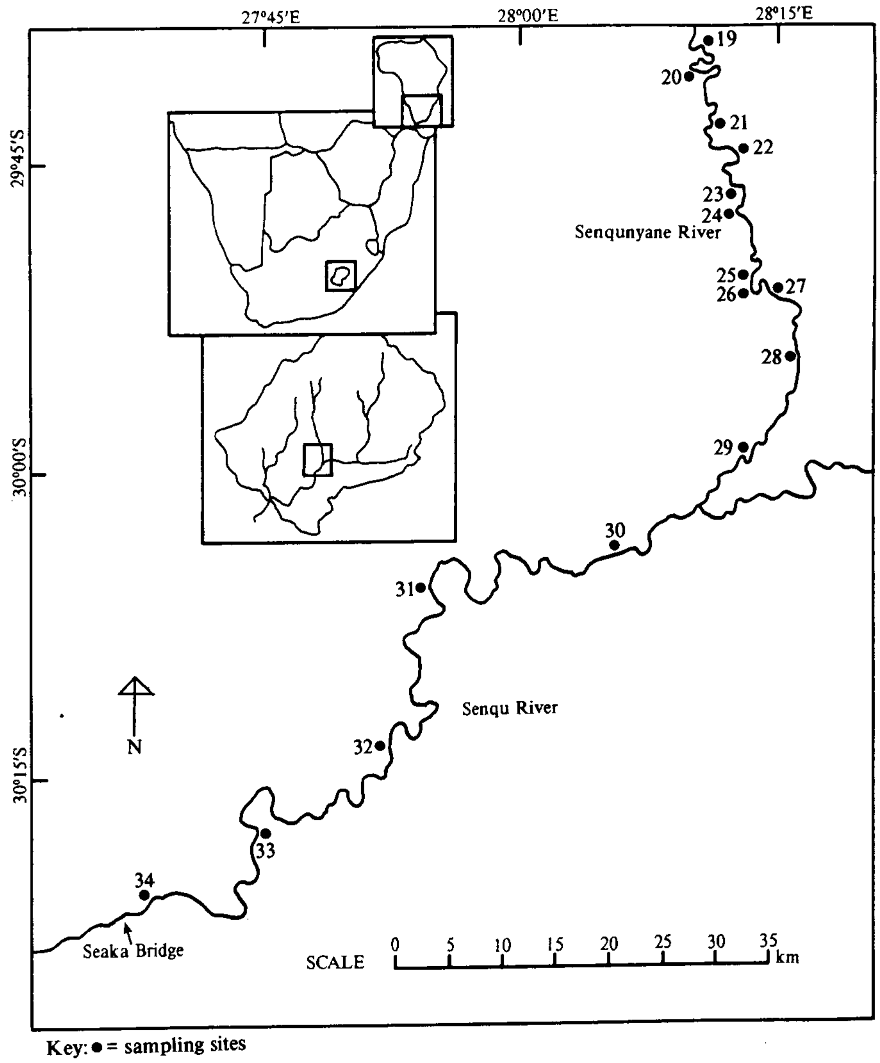

Figure 2
Map of extended study area indicating sampling sites included for the additional survey (summer, 1996)

Results

Austroglanis sclateri was sampled in the Senqunyane River from sampling Site 3 (1 885 masl) downstream to sampling Site 25 (lower Senqunyane River). No individuals were sampled either in the tributaries of the Senqunyane River or above the Semongkoaneng waterfall. One individual was sampled in the Senqu River just downstream from the Senqunyane River confluence at sampling Site 30.

Population structure

Length measurements for *A. sclateri* ranged between 27 and 240 mm (SL) with the smallest length groups (21 to 30 mm and 31-40 mm) sampled during the additional survey (summer 1996). During the first survey (winter 1994) only six *A. sclateri* were sampled. These individuals measured 36, 65, 95, 125, 215 and 240 mm (SL) respectively. Due to the Red Data status of *A. sclateri*, individuals were not dissected, therefore making discrimination between sexes impossible. Length-frequencies for different surveys are presented graphically in Fig. 3.

No condition factors could be determined for the specimens sampled during the additional survey (summer, 1996) as too few length groups were sampled. Condition factors were determined for length groups sampled during the other surveys but were inconsistent as length groups consisted of an inadequate number of sampled individuals. Hence no trend could be observed.

Habitat preference

As sampling was not performed at night, habitat preference as given below should be regarded as daytime preferences. The preferred pool/riffle form for the < 4.5 cm functional group (recruits) could only be established during the additional survey (summer 1996) when twelve individuals ranging from 2.7 to 3.6 cm (SL) were sampled in the Senqunyane River. As this functional group represents the recruits, important information on its habitat requirements in the Senqunyane River was gathered. All the recruits were sampled in backwater pools. The 4.6 to 14.0 cm length groups (juveniles) preferred stickles (51.67%). Individuals larger than 14.0 cm (adults) preferred runs (64.29%) (Table 2).

TABLE 1
LATITUDE-LONGITUDE REFERENCE, ELEVATION, RIVER GRADIENT AND VALLEY SLOPE OF SAMPLING SITES

River	Site	Latitude-Longitude	Elevation (masl)	River gradient	Valley slope
Senqunyane	1	29°26'29"S : 28°05'56"E*	1946	1:260	nr
Senqunyane	2	29°27'40"S : 28°06'46"E*	1931	1:260	E 23° W 37°
Senqunyane	3	29°29'13"S : 28°06'10"E*	1885	1:272	N 35° S 70°
Senqunyane	4	29°29'55"S : 28°07'36"E*	1864	1:196	N 45° S 14°
Senqunyane	5	29°30'48"S : 28°08'22"E*	1838	1:244	N 35° S 45°
Senqunyane	6	29°32'01"S : 28°09'19"E*	1819	1:312	N 38° S 36°
Senqunyane	7	29°32'54"S : 28°09'06"E*	1812	1:312	E 30° W 22°
Senqunyane	8	29°33'37"S : 28°09'41"E*	1804	1:312	N 33° S 16°
Senqunyane	9	29°33'41"S : 28°09'42"E*	1803	1:312	N 33° S 16°
Senqunyane	10	29°34'48"S : 28°09'59"E*	1796	1:304	E 32° W 40°
Senqunyane	11	29°35'45"S : 2809'28"E*	1782	1:304	E 60° W 31°
Senqunyane	12	29°36'30"S : 28°09'31"E*	1770	1:284	E 30° W 39°
Senqunyane	13	29°36'44"S : 28°09'23"E*	1769	1:284	E 30° W 39°
Senqunyane	14	29°37'20"S : 28°09'35"E*	1765	1:284	N 32° S 42°
Senqunyane	15	29°37'29"S : 28°10'18"E*	1759	1:284	E 35° W 20°
Senqunyane	16	29°38'13"S : 28°10'00"E*	1753	1:284	E 40° W 23°
Senqunyane	17	29°38'32"S : 28°10'00"E*	1752	1:284	E 36° W 21°
Senqunyane	18	29°38'59"S : 28°09'45"E*	1749	1:284	E 38° W 18°
Likalaneng	35	29°29'02"S : 28°01'30"E*	2212	1:28	nr
Likalaneng	36	29°28'17"S : 28°02'24"E*	2158	1:60	E 18° W 32°
Likalaneng	37	29°28'15"S : 28°03'11"E*	2125	1:48	nr
Likalaneng	38	29°27'52"S : 28°04'30"E*	2037	1:52	nr
Likalaneng	39	29°27'32"S : 28°05'13"E*	1963	1:24	nr
Mantsa	40	29°30'36"S : 28°08'49"E*	1843	1:24	E 20° W 80°
Bokong	41	29°35'37"S : 28°05'56"E*	2030	1:52	E 33° W 25°
Bokong	42	29°36'20"S : 28°07'11"E*	1953	1:64	N 28° S 28°
Tsoenyane	43	29°34'34"S : 28°06'16"E*	2126	1:32	E 14° W 20°
Senqunyane	19	29°39.03'S : 28°10.41'E**	nr	nr	nr
Senqunyane	20	29°40.35'S : 28°10.52'E**	nr	nr	nr
Senqunyane	21	29°43.69'S : 28°10.85'E**	nr	nr	nr
Senqunyane	22	29°44.32'S : 28°12.47'E**	nr	nr	nr
Senqunyane	23	29°46.10'S : 28°12.58'E**	nr	nr	nr
Senqunyane	24	29°47.56'S : 28°12.58'E**	nr	nr	nr
Senqunyane	25	29°49.91'S : 28°13.96'E**	nr	nr	nr
Senqunyane	26	29°50.79'S : 28°13.88'E**	nr	nr	nr
Senqunyane	27	29°51.78'S : 28°14.70'E**	nr	nr	nr
Senqunyane	28	29°53.34'S : 28°16.07'E**	nr	nr	nr
Senqunyane	29	29°59.65'S : 28°12.92'E**	nr	nr	nr
Senqu	30	30°04.21'S : 28°05.92'E**	nr	nr	nr
Senqu	31	30°05.39'S : 27°54.71'E**	nr	nr	nr
Senqu	32	30°13.47'S : 27°52.51'E**	nr	nr	nr
Senqu	33	30°17.55'S : 27°44.23'E**	nr	nr	nr
Senqu	34	30°20.96'S : 27°37.89'E**	nr	nr	nr

Key: N = North; S = South; E = East; W = West; nr = not recorded; * = measured from 1: 50 000 topographical maps; ** = measured with GPS-meter

Rubble was the preferred bottom substrate for all functional groups except for the recruits where cobbles occurred most frequently in the immediate vicinity where sampling took place (Table 3).

The mean water depths at which the two functional groups smaller than 14.0 cm were sampled were 19.99 and 26.50 cm respectively. Due to the fact that three adults were sampled in deep pools, the mean preferred water depth for this functional group was deeper than the mean water depth for the other groups (58.57 cm). The minimum depth at which the rock catfish was sampled, was 10 cm, while the maximum was 150 cm (Table 4).

Current velocity at which the rock catfish was sampled ranged from below detection limit (< 0.1 m/s) to 0.89 m/s. The mean current velocity at which recruits were sampled was < 0.1 m/s, but mean preferred velocities were similar for juveniles and adults, being 0.44 to 0.52 m/s respectively (Table 5).

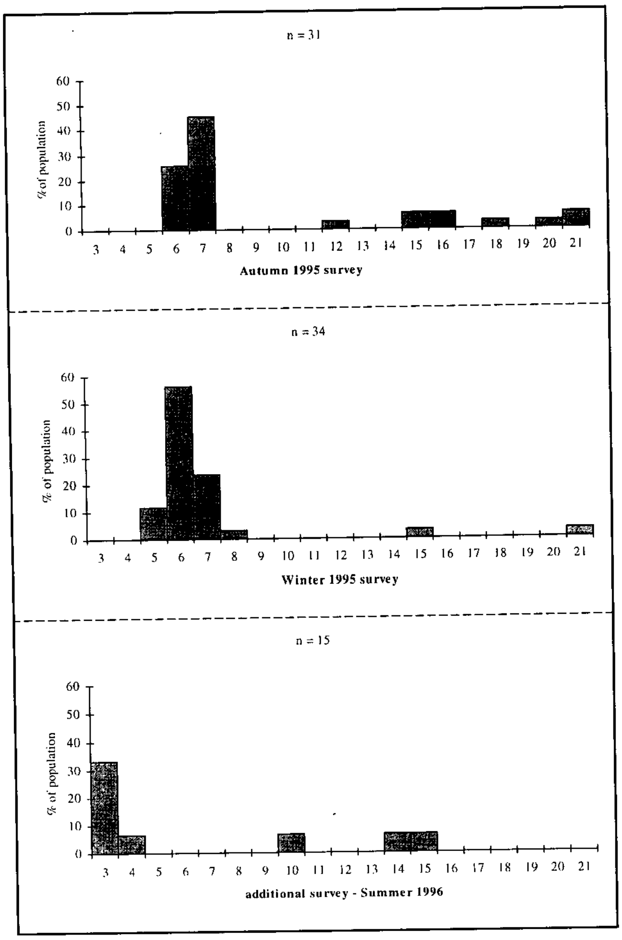

Figure 3

Length-frequency of Austroglanis sclateri

Due to the Red Data status of *A. sclateri*, only two individuals were dissected for stomach content analysis. Both specimens were collected during the summer survey at midday. The stomach of one individual contained 40 Chironomidae and 5 Caenidae, while the other stomach was completely empty.

Discussion

The absence of *Austroglanis sclateri* above the Semongkoaneng waterfall in the Senqunyane River is a result of this waterfall being an effective barrier for upstream migration. Absence from the tributaries of the Senqunyane River is probably related to the lack of fast current velocities and smothering of substrate by siltation.

A. sclateri is known to occur in very sparse numbers (Cambray, 1984; Janse van Vuren 1978). The presence of a large variety of length groups therefore indicates the high suitability of the Senqunyane River for this species. Recruitment is evident (recruits sampled during summer 1996 survey) and the population is regarded as of a stable nature with adult length groups represented during all surveys.

A relatively large number of *A. sclateri* individuals (86) were sampled during this study on which meaningful deductions on the habitat preference could be drawn for the first time. Preference for stickles (Cambray, 1984; Skelton, 1986) was confirmed as more than 45% of all individuals were sampled within this habitat parameter. Pools (Jubb, 1972) are certainly not preferred as only three individuals were sampled within pools. Rubble and to a lesser degree cobbles, were the preferred bottom substrate which supports suspicion of its preference for rocky substrates. There seems to be a movement from backwater pools to flats to stickles to runs as individuals become larger. The information gathered during the additional survey (summer, 1996), regarding habitat preference of recruits is very important specifically in order to determine instream flow requirements. *A. sclateri* would probably not do well in impounments as more than 90% of sampled

TABLE 2
HABITAT PREFERENCE OF *AUSTROGLANIS SCLATERI* IN TERMS OF % INDIVIDUALS SAMPLED PER POOL/RIFFLE FORM FOR DIFFERENT FUNCTIONAL GROUPS

Functional group	n	% of sampled individuals within specified pool/riffle form				
		Backwater pool	flat	stickle	run	pool
Recruits	12	100				
Juveniles	60		21.67	51.67	26.67	
Adults	14			14.29	64.29	21.43

TABLE 3
HABITAT PREFERENCE OF *AUSTROGLANIS SCLATERI* IN TERMS OF PRESENCE OF BOTTOM SUBSTRATE IN THE IMMEDIATE VICINITY OF SAMPLED INDIVIDUALS FOR DIFFERENT FUNCTIONAL GROUPS

Functional group	n	Association with bottom substrate				
		Rubble	Cobbles	Gravel	Sand	Silt & clay
Recruits	12		92			8
Juveniles	60	85	44	12	2	
Adults	14	86	29	2	3	3

TABLE 4 HABITAT PREFERENCE OF *AUSTROGLANIS SCLATERI* IN TERMS OF WATER DEPTH, INCLUDING MIN., MAX. AND MEAN WATER DEPTH FOR DIFFERENT FUNCTIONAL GROUPS					
Functional group	n	Min. depth (cm)	Max. depth (cm)	mean depth (cm)	Standard deviation (cm)
Recruits	12	10	35	19.99	6.74
Juveniles	60	10	60	26.50	9.61
Adults	14	25	150	58.57	37.74

TABLE 5 HABITAT PREFERENCE OF *AUSTROGLANIS SCLATERI* (EXCLUDING 3 INDIVIDUALS SAMPLED IN POOLS) IN TERMS OF MIN.-, MAX.- AND MEAN STREAM VELOCITY FOR DIFFERENT FUNCTIONAL GROUPS					
Functional group	n	min. velocity (m/s)	max. velocity (m/s)	mean velocity (m/s)	standard deviation (m/s)
Recruits	12	< 0.1	< 0.1	-	-
Juveniles	60	0.14	0.89	0.44	0.20
Adults	14	0.1	0.68	0.42	0.19

individuals larger than 4.5 cm (SL) were found within stream velocities of at least 0.14 m/s and no specimens were collected at a depth greater than 1.5 m. Urgent attention is required to identify breeding sites and requirements for this species before construction of the Mohale Dam commences.

In order to conduct reliable population analyses a minimum number of 200 individuals per population is required. (Sparre et al., 1989). Due to a smaller amount sampled and the selectivity of sampling gear, population parameters could not be calculated. In spite of severe habitat degradation in some areas in the Senqunyane River the *A. sclateri* population can be described as of under no immediate threat. Construction of the Mohale Dam wall in the LHWP will, however, alter the flow regime of the Senqunyane River, which could possibly threaten this rare species within the affected area.

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