

# **VERSLAGEN EN TECHNISCHE GEGEVENS**

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**Biological studies on groundwater crustaceans in  
southwest Anatolia, Turkey**

**List of sampling stations June-July 1996**

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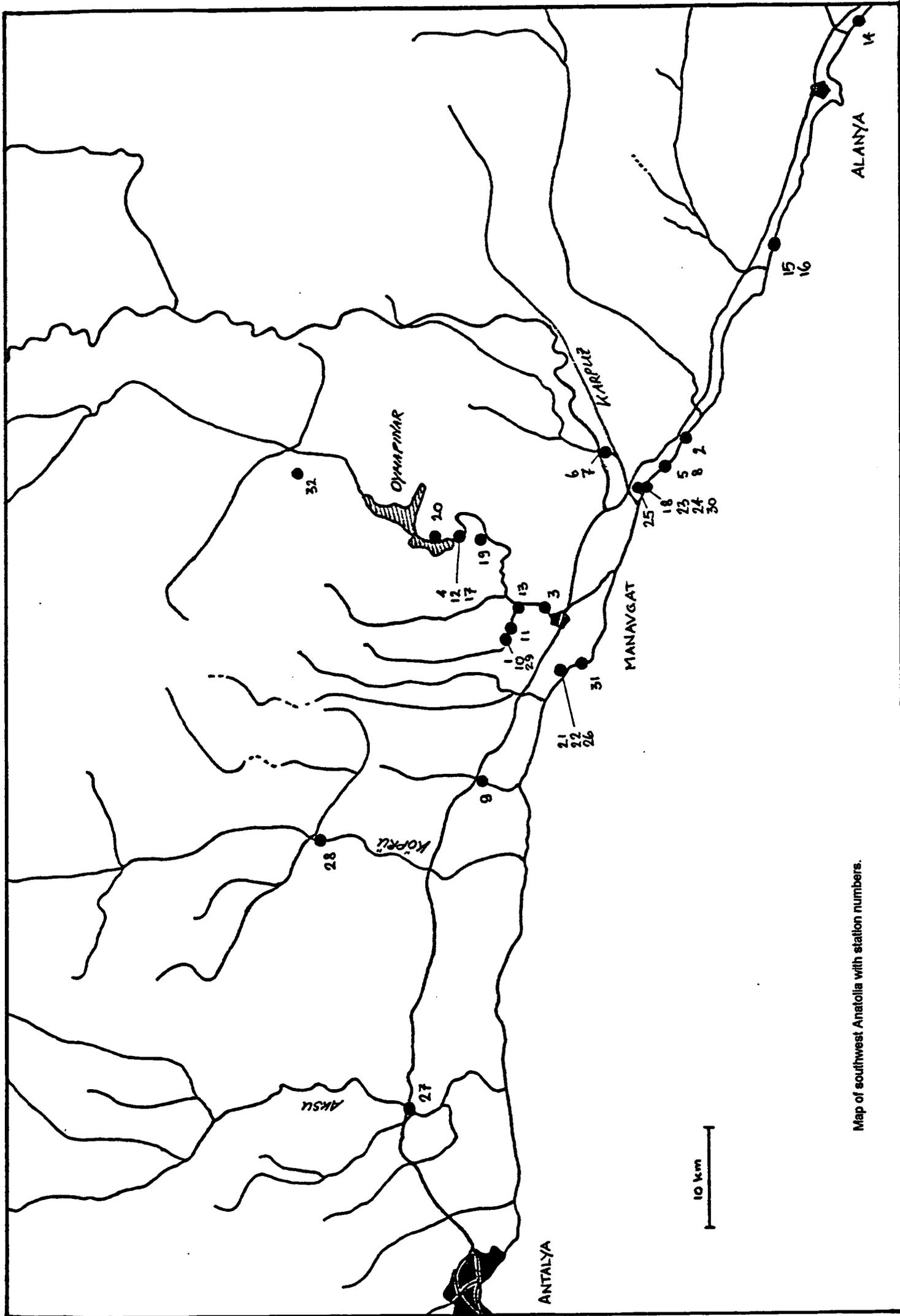
**BIOLOGICAL STUDIES ON GROUNDWATER CRUSTACEANS  
IN SOUTHWEST ANATOLIA, TURKEY**

**JULY 1996**

**BY**

**STEFAN KÖNEMANN**





Map of southwest Anatolia with station numbers.

## INTRODUCTION

In 1987 a major biospeleological expedition, 'Speleo Nederland', was carried out along the coastal Taurus mountains in southwest Anatolia (Turkey). 'Speleo Nederland' was focused on collecting the fauna of caves, wells, subterranean waterflows, and the interstices of marine gravel beaches. The special yield of stygobiont crustaceans, predominantly amphipods of the genus *Bogidiella*, promised to serve as an interesting case study to the colonization of inland groundwater by marine organisms.

Now, in July 1996, a second sampling program occurred along the southern Turkish coast between Antalya and Alanya.

Its objectives were:

- to visit one or two 'Speleo Nederland' stations (where previously at least one new species of bogidiellids had been found) and enlarge the small original sample sizes (1-3 individuals),
- to start a new series of samples at the very eastern 'frontier' of the '87 expedition in order to obtain additional distribution data about stygobiont crustaceans,
- and, last not least, to fulfill what generally is to be expected from a practical training program: acquiring understanding and comprehension of the biology of organisms in their natural environment.

Altogether, 32 samples have been collected at 21 different localities with either marine, brackish, or freshwater habitats. For each locality, biotic and abiotic characteristics have been described and measured. The sampling program yielded 8 species of (mostly stygobiont or stygophile) amphipods, including the new species *Bogidiella (Medigidiella) arista*<sup>1</sup> and the first record of *Bogidiella (Bog.) calicali* Karaman, 1988 from the eastern Mediterranean. Furthermore, from some of the stations specimens of copepods, cladocerans, mollusks, flatworms and polychaetes have been taken along as well.

<sup>1</sup> A description of this species is in preparation.

## **METHODS**

Depending on the type of habitat, three different methods have been employed to collect stygobiont organisms: a biophreatical pump (Bou-Rouch method), an automatically closing net (Cvetkov net), and a handnet.

**Pump:** A hand-operated Norton pump was mounted on a massive steel tube, which had been hammered into the sediment. The tube is about 1 m long with a diameter of 5 cm. Above its reinforced point it is regularly perforated by conical drill holes ( $\varnothing$ : 0.5 cm) at a length of 35 cm. In this way, phreatic water could alternatively be drawn from depths between 0.1 to 1 m (> 1.5 m, if a hole was dug). The pumpwater was filtered through a handnet with a mesh of 400  $\mu$ m.

This sampling method was carried out in the interstitial zones of shingle beaches (7 times) and on gravel banks of rivers and streams (3 times).

Usually, an average uptake of 80 liters resulted in a sufficient amount of individuals. In one case however, less than one individual per bucket was caught: a pump flow of approximately 300 liters with 15 minute intervals between each bucket was necessary to obtain 19 individuals (station T-96/30).

**Cvetkov net:** To the tapered end of a cone-shaped net (opening  $\varnothing$ : 30 cm) a short tube with a rubber valve and a plastic bottle were fastened. The net (mesh: 400  $\mu$ m) was weighted with leaden blocks to enforce the penetration into the sediment. By repeatedly jerking the net, the sediment is turned up and, at every upward movement, the valve opens to filter the water, keeping floating debris and organisms in the plastic bottle. If possible, the sediment was additionally stirred by means of long sticks.

The Cvetkov net was used 5 times in wells and concrete groundwater reservoirs on farmland.

**Handnet:** A handnet with a diameter of 17 cm (mesh: 400  $\mu$ m) proved to be a tool of universal usage and became considerably valuable when pump and Cvetkov net could not be employed. The net was generally used to filter particles and organisms out of the water. For this purpose the sediment was either stirred with the help of a long screwdriver or by turning around big stones and rocks.

According to the Karaman-Chappuis method (KCM), the same handnet and, in some cases, a tea strainer helped to filter the water of small pits: The pits had been dug into the sediments of sea shores (5 times) and riverbanks (14 times) until the groundwater flew in and could be sieved.

At every station the following properties of the sampled water had been measured: The temperature using a commercial thermometer, the acidity using indicator paper, and the electric conductivity by means of a battery-operated measuring instrument. The conductivity of water increases with the quantity of dissolved salts and can therefore serve as a relative

measure for the trophy. The Amsterdam tap water has a reference conductivity of 580  $\mu\text{S}/\text{cm}$  at 18° C.

All collected organisms (bold lettertype) were treated with 4 % formalin and, within the next 24 hours, preserved in 70 % ethanol.

### **NOTES TO THE LIST OF STATIONS**

The appended drawn map as well as all topographic names and grid coordinates base on the map 'Ganz Antalya. Karte und Stadtplan', 1:330 000, edited by 'Net Turistik Yayınlar San. A.S.', Istanbul 1995. Retrospectively, this map, locally purchasable in most of the shops, proved to be more accurate and detailed than the flight-chart maps and atlases of the Amsterdam 'Universiteits Bibliotheek'. Nonetheless, it failed to meet exact topographic requirements in some cases and was therefore used in combination with two additional road maps (so that, at last, there were three different maps that, altogether, came rather close to a precise projection of the countryside).

Station T-96/6 and T-96/7 correspond approximately with station 87-6/1 of the 'Speleo Nederland' expedition. Likewise does station no. T-96/19 with station 87-6/15.

## LIST OF STATIONS

- T-96/1** (see also:T-96/10,T-96/11,T-96/29)  
Date: 2.7.1996 - 8:45  
Location: 31° 25' E. long. / 36° 51' N. lat. Tributary of the Manavgat river; mainroad 400 from Antalya to Manavgat, left at crossroad Side - Sarilar (2 km west of Manavgat), left in unknown village (3 km north of Sarilar), 3 km along dustroad to small bridge over tributary.  
Topography: Tributary with clear water, 2-5 m wide, moderate to strong current; max. depth: 80 cm; bed with gravel and pebbles.  
Notes: Small fishes, many frogs, toads, a swimming snake (grass snake ?), water insects, Brachyura; loamy soil, dried out and hardened, unsuitable for pumping.  
Water: 19° C                      pH ± 6.9                      390 µS/cm  
Method: Handnet.  
Samples: **1 Brachyura.**
- T-96/2**  
Date: 3.7.1996 - 9:20  
Location: 31° 38' E. long. / 36° 41' N. lat. Seashore; mainroad 400 from Alanya to Manavgat, 4 km northwest of river Alara Çayı.  
Topography: Shore with rock plates at (parallel with) surf, covered with sand and shingle layers; small brackish stream flowing towards surf.  
Notes: No macrofauna perceptible.  
Water: Stream: 18° C                      Sea: 21° C  
Method: Handnet (sea); KCM with tea streamer (stream).  
Samples: One Nematocera-larva, whitish worms (stream).
- T-96/3**  
Date: 3.7.1996 - 18:00  
Location: 31° 27' E. long. / 36° 49' N. lat. Manavgat Selalesi; ± 4 km north of Manavgat, right at sign 'Restaurant Kleiner Wasserfall' on road from Manavgat to Oymapınar.  
Topography: River with rapids, ± 30 m wide; banks with loamy sand and pebbles.  
Notes: Brachyura; amphipods floating in longish shoal parallel with river bank, occasionally aggregations of approximately 200 individuals.  
Water: 11° C                      pH ± 7.0                      260 µS/cm  
Method: Collected with tea streamer.  
Samples: ***Echinogammarus veneris* (with young).**

**T-96/4** (see also:T-96/12,T-96/17)  
**Date:** 4.7.1996 - 9:00  
**Location:** 31° 31' E. long. / 36° 53' N. lat. Oymapınar Barajı; Manavgat river, 300 m in front of first reservoir dam, next to small bridge.  
**Topography:** Gravel bank.  
**Notes:** No macrofauna perceptible.  
**Water:** 10.5° C            pH ± 7.0            250 µS/cm  
**Method:** Handnet.  
**Samples:** Hirudinea, Copepoda, Cladocera, 2 juvenile (?) Amphipoda.

**T-96/5** (see also:T-96/8)  
**Date:** 4.7.1996 - 14:45  
**Location:** 31° 36' E. long. / 36° 41' N. lat. Seashore; mainroad 400 from Manavgat to Alanya, 5.6 km southeast of bridge over Karpuz river.  
**Topography:** Shore with fine sand and shingle strip (7 m long).  
**Notes:** -  
**Water:** 24° C  
**Method:** Pump.  
**Samples:** *Echinogammarus stocki* (1 individual, added to sample T-96/8).

**T-96/6** (see also:T-96/7)  
**Date:** 4.7.1996 - 15:30  
**Location:** 31° 38' E. long. / 36° 45' N. lat. Tributary of Karpuz river; 5.5 km on mainroad 695 to Konya, southeast of mainroad after bridge.  
**Topography:** Well (or groundwater pit) 15 m from tributary (Ø: 4 m) on gravel pit terrain; dried loamy soil with pebbles and rocks.  
**Notes:** Frogs, small fishes, insect larvae.  
**Water:** 26° C            pH ± 7.0            480 µS/cm  
**Method:** Cvetkovnet.  
**Samples:** Debris, some worms, some Trichoptera-larvae.

**T-96/7** (see also:T-96/6)  
**Date:** 4.7.1996 - 15:45  
**Location:** See:T-96/6.  
**Topography:** Partly dried up tributary; riverbed with pebbles and stones.  
**Notes:** See:T-96/6.  
**Water:** 25.5° C            pH ± 7.1            440 µS/cm  
**Method:** Handnet.  
**Samples:** Some worms, some Trichoptera-larvae.

**T-96/8** (see also:T-96/5)  
Date: 8.7.1996 - 10:30  
Location: 31° 34' E. long. / 36° 44' N. lat. Seashore; mainroad 400 from Manavgat to Alanya, 2.5 km southeast of bridge over Karpuz.  
Topography: Shore with fine sand and shingle strips; huge rock clusters behind surf.  
Notes: Snorkeling: Sea anemones, sessile filterers, fishes.  
Water: -  
Method: Pump, handnet.  
Samples: *Echinogammarus stocki*, *Parhyale eburnea*, *Melita bulla* (different specimens with both methods); 1 snail shell (collected by hand).

**T-96/9**  
Date: 9.7.1996 - 9:30  
Location: 31° 16' E. long. / 36° 55' N. lat. Peri river; mainroad 400 from Manavgat to Antalya, 10-12 km northwest of Manavgat, 1-2 km west of village Peri, next to small bridge.  
Topography: Hilly terrain with dried, hardened loamy soil (pump could not be driven into the ground); river banks and bed with sand, gravel, stones, and rocks.  
Notes: Frogs, water insects, Acari, Hirudinea, Brachyura, small fishes.  
Water: 19° C                      pH ± 6.8                      490 µS/cm  
Method: Handnet.  
Samples: -

**T-96/10** (see also:T-96/1,T-96/11,T-96/29)  
Date: 9.7.1996 - 19:00  
Location: 31° 25' E. long. / 36° 51' N. lat. Well (Ø: 1 m; water level: ± 6 m deep; water depth: 1-2 m), next to bridge at locationT-96/1.  
Topography: See:T-96/1.  
Notes: Well: probably frogs, insects.  
Water: 13° C                      pH ± 7.0                      640 µS/cm  
Method: Cvetkovnet.  
Samples: Insect larvae, 1 snail, small wormlike evertebrates.

**T-96/11** (see also:T-96/1,T-96/10,T-96/29)  
Date: 9.7.1996  
Location: See:T-96/1; same tributary, ± 600 m southeast of small bridge, stream bending 20 m northeast of dust road.  
Topography: See:T-96/1.  
Notes: Frogs, toads, turtles, water insects.  
Water: 18° C                      pH ± 6.9                      550 µS/cm  
Method: Handnet.  
Samples: Worms, insect larvae, 1 Brachyura.

**T-96/12** (see also:T-96/4,T-96/17)  
Date: 10.7.1996 - 12:45  
Location: See:T-96/4 (this time the water level was raised about 50 cm).  
Topography: See:T-96/4.  
Notes: See:T-96/4.  
Water: 11° C            pH ± 7.0            240 µS/cm  
Method: Handnet.  
Samples: Hirudinea, Copepoda, Cladocera, 1 juvenile (?) amphipod.

**T-96/13**  
Date: 10.7.1996 - 13:15  
Location: 31° 27' E. long. / 36° 51' N. lat. Tributary of Manavgat river (same tributary as at T-96/1 !?); road from Manavgat to Oymapınar, ± 3 km north of water falls, at Roman bridge ruin next to road.  
Topography: Tributary with slow current, 2-5 m wide, max. depth ± 80 cm.  
Notes: Frogs, small fishes, Copepoda.  
Water: 23° C            pH ± 7.0            640 µS/cm  
Method: Handnet.  
Samples: Detritus, 1 insect larva, 1 snail.

**T-96/14**  
Date: 11.7.1996 - 11:30  
Location: 31° 05' E. long. / 36° 31' N. lat. Seashore; mainroad 400 from Alanya to Gazipasa, 2 km southeast of river Dimçay.  
Topography: Gravel layer (20-60 cm) on rocks along the surf.  
Notes: No macrofauna perceptible.  
Water: 22° C            pH ± 7.0  
Method: Handnet, KCM, pump (did not work properly because of rock ground).  
Samples: *Parhyale eburnea* (pump), Mollusca.

**T-96/15** (see also:T-96/16)  
Date: 11.7.1996 - 14:30  
Location: 31° 50' E. long. / 36° 36' N. lat. Seashore; mainroad from Manavgat to Alanya, 6 km east of Avsallar (3 km east of Kirga river ).  
Topography: Shingle shore.  
Notes: No macrofauna perceptible.  
Water: 22° C  
Method: Pump.  
Samples: *Parhyale eburnea*, *Echinogammarus stocki*, Polychaeta.

**T-96/16** (see also:T-96/15)  
Date: 11.7.1996 - 14:45  
Location: See:T-96/15; small freshwater stream flowing out of concrete pipe, trickling away on the shore.  
Topography: Gravel bed with pebbles.  
Notes: Green eutrophic water with many insects.  
Water: 26° C                      pH ± 7.5                      1310 µS/cm  
Method: KCM.  
Samples: Various insect larvae and worms.

**T-96/17** (see also:T-96/4,T-96/12)  
Date: 12.7.1996 - 10:00  
Location: See:T-96/4.  
Topography: See:T-96/4.  
Notes: See:T-96/4.  
Water: See:T-96/4.  
Method: Handnet.  
Samples: Hirudinea, Copepoda, Cladocera.

**T-96/18** (see also:T-96/23,T-96/24,T-96/30)  
Date: 13.7.1996 - 16:00  
Location: 31° 34' E. long. / 36° 44' N. lat. Beach (at Meryem pavilion); mainroad 400 from Manavgat to Antalya, dustroad to beach on the right, ± 300 m east of Karpuz river.  
Topography: Sandy beach with shingle under sand layer along surf; huge rocks behind surf.  
Notes: Snorkeling: Fishes.  
Water: 22° C  
Method: Pump in dug pit.  
Samples: *Bogidiella arista* n.sp. (1 individual); *Bogidiella calicali* (1 male).

**T-96/19**  
Date: 14.7.1996 - 8:00  
Location: 31° (29 ± 3)' E. long. / 36° (51 ± 3)' N. lat. Well (Ø: 2 m; water level: 2,5 m deep; total depth: ± 6 m); road from Manavgat to Oymapınar lake, ± 7 km northeast of Manavgat, 50 west of road.  
Topography: Farmland with tomato, paprika, and corn.  
Notes: Well: frogs, one small turtle (!), insects.  
Water: 18° C                      pH ±7.0                      850 µS/cm  
Method: Cvetkovnet.  
Samples: Nematocera larvae, Nematoda.

**T-96/20**

Date: 14.7.1996 - 9:00

Location: 31° 31' E. long. / 36° 54' N. lat. Southeastern bank of Oymapınar reservoir lake; ± 300 m northeast of the first dam, in sight of a small village (4-6 houses) on small promontory.

Topography: Bank with solid rock plates, covered with sand, gravel, and stones.

Notes: Small fishes, frogs, floating detritus.

Water: 24° C                      pH ± 7.0                      205 µS/cm

Method: Handnet.

Samples: Nematocera larvae, worms.

**T-96/21** (see also T-96/22, T-96/26)

Date: 16.7.1996 - 7:50

Location: 31° (22 ± 2)' E. long. / 36° (48 ± 2)' N. lat. Concrete aqueduct with groundwater reservoir in Kumköy (roughly 10 km west of Manavgat), road from Kumköy to Side, dustroad on the right at Emre Apart, 80 m north of Emre Apart.

Topography: Dried loamy soil, dusty fields.

Notes: Concrete reservoir (Ø: 1.2 m; water level: 2.1 m deep; water depth: 0.4 m)

Water: 18° C                      pH ± 6.8                      250 µS/cm

Method: Cvetkovnet.

Samples: 1 Nematoda.

**T-96/22** (see also: T-96/21, T-96/26)

Date: 16.7.1996 - 7:30

Location: See T-96/21; well (Ø: 1.2 m; water level: 2.1 m deep; water depth: 0.4 m) with concrete walls, next to location T-96/21.

Topography: See: T-96/21.

Notes: See: T-96/21.

Water: 20.5° C                      pH ± 7.8                      540 µS/cm

Method: Cvetkovnet.

Samples: Cladocera, snails, Plathyelminthes.

**T-96/23** (see also: T-96/18, T-96/24, T-96/30)

Date: 18.7.1996 - 10:30

Location: See: T-96/18.

Topography: See: T-96/18.

Notes: See: T-96/18.

Water: See: T-96/18.

Method: Pump.

Samples: *Melita valesi* (1 individual).

**T-96/24** (see also:T-96/18,T-96/23,T-96/30)

**Date:** 19.7.1996 - 8:15

**Location:** See:T-96/18.

**Topography:** See:T-96/18.

**Notes:** See:T-96/18.

**Water:** See:T-96/18.

**Method:** Pump in surf zone, pump in dug pit.

**Samples:** -

**T-96/25**

**Date:** 19.7.1996 - 8:45

**Location:** See T-96/18; well (Ø: 2 m; water level: 3.7 m deep; water depth: 1.6 m) with concrete walls; next to location T-96/18, 50 m northwest of pavilion Meryem.

**Topography:** Sandy dunes.

**Notes:** Well: no macrofauna perceptible.

**Water:** 19.5° C            pH ± 6.9            1140 µS/cm

**Method:** Cvetkovnet.

**Samples:** Worms, snails, Ostracoda.

**T-96/26** (see also:T-96/21,T-96/22)

**Date:** 19.7.1996 - 16:15

**Location:** See:T-96/21; well next to concrete reservoir, walls made of stones and rocks (Ø: 1m; water level: 2.8 m; water depth: ± 4 m).

**Topography:** See:T-96/21.

**Notes:** See:T-96/21.

**Water:** See:T-96/22.

**Method:** Cvetkovnet.

**Samples:** Nematoda.

**T-96/27**

**Date:** 20.7.1996 - 18:30

**Location:** 30° 54' E. long. / 36° 57' N. lat. Aksu river; mainroad from Antalya to Manavgat, ± 25 km east of Antalya, 50 m south of bridge.

**Topography:** River 4-8 m wide with cloudy water and moderate current; banks: hard dried loamy soil with gravel strips.

**Notes:** Frogs, small fishes, one swimming snake, snails, algae.

**Water:** 25° C            pH ± 6.7            440 µS/cm

**Method:** Pump on gravel bank (did not work properly), handnet.

**Samples:** Detritus, algae, insect larvae, Copepoda, snails.

**T-96/28**

Date: 21.7.1996 - 12:00  
Location: 31° 12' E. long. / 37° (0 ± 2)' N. lat. Sagîrini river (according to farmer) or Köprü river (according to map); road from Tasagîl to Beskonak, 12 km northwest of Tasagîl (road runs parallel with river), 500 m southeast of bridge.  
Topography: Mountain region with farmland along river; river bed with stones and rocks.  
Notes: Frogs, small fishes, Brachyura, water insects; river with clear water and moderate current (6-10 m wide).  
Water: 24.5° C      pH ± 7.0      430 µS/cm  
Method: Pump in shallow water, handnet.  
Samples: Various insect larvae, algae (handnet); small whitish insect larvae and worms (pump).

**T-96/29** (see also:T-96/1,T-96/10,T-96/11)

Date: 22.7.1996 - 9:30  
Location: See:T-96/1.  
Topography: See:T-96/1.  
Notes: See:T-96/1.  
Water: See:T-96/1.  
Method: Pump in shallow water (did not work properly).  
Samples: -

**T-96/30** (see also:T-96/18,T-96/23,T-96/24)

Date: 22.7.1996 - 11:15 (- 16:00)  
Location: See:T-96/18.  
Topography: See:T-96/18.  
Notes: See:T-96/18.  
Water: See:T-96/18.  
Method: Pump at surf zone.  
Samples: *Bogidiella arista* n.sp., *Bogidiella calicali* (1 female), *Melita valesi*.

**T-96/31**

Date: 20.7.1996 - 18:30  
Location: 31° 23' E. long. / 36° 48' N. lat. Sandy beach ± 1.5 km northwest of Side.  
Topography: Single huge rock formation behind surf zone.  
Notes: -  
Water: -  
Method: Collected by hand.  
Samples: Various Mollusca.

**T-96/32**

**Date:** 10.7.1996 - 11:30

**Location:** 31° (34 ± 2)' E. long. / 36° (2 ± 2)' N. lat. Mountain cave; dusty road from Oymapınar (west bank side, near to second dam) to Ürünlü, ± 3 km south of Ürünlü (road runs parallel with dried out river), mountain cave northeast of road behind river bed.

**Topography:** Mountainforest.

**Notes:** Bone-dry mountain slope.

**Water:** -

**Method:** Collected by hand.

**Samples:** 3 snail shells.

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