| Waldökologie, Landschaftsforschung und Naturschutz | Heft 10 (2010) | S. 67–75 | 2 Fig., 4 Tab. | urn:nbn:de:0041-afsv-01087 |
|---|---|---|---|---|

# Ecological assessment of streams on La Gomera and Tenerife (Spain) – an approach for an evaluation and restoration tool based on the EU-Water Framework Directive

*Ökologische Bewertung von Bächen auf La Gomera und Teneriffa (Spanien) – Ein methodischer Ansatz zur Einschätzung von Renaturierungsmaßnahmen bei der Umsetzung der EU-Wasserrahmenrichtlinie*

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***Abstract***

*In recent decades, the number of streams on the Canary Islands has decreased dramatically due to the non-sustainable consumption of water for agriculture and tourism. Natural reaches of streams with an endemic macroinvertebrate fauna do, however, still exist in protected areas of Tenerife and La Gomera. Those reaches serve as a reference to develop an assessment method for streams on islands. This method takes into account common parameters such as water quality and hydromorphology, while emphasizing biodiversity and endemism. The latter concepts as they relate to stream conservation are important in both nature conservation and protection of species as many endemic aquatic organisms are endangered.*

***Keywords:*** *Canary Islands, streams, assessment, macroinvertebrates, endemics*

**Zusammenfassung**

In den letzten Jahrzehnten ist die Zahl der Fließgewässer auf den Kanarischen Inseln drastisch zurückgegangen. Ursache dafür ist eine sehr hohe Wasserentnahme für Landwirtschaft und Tourismus, die das nachhaltig nutzbare Dargebot bei weitem überschreitet. Dennoch existieren in besonders geschützten Bereichen der Inseln Teneriffa und La Gomera noch naturnahe Abschnitte von Fließgewässern mit Elementen endemischer Makroinvertebraten-Fauna. Diese Abschnitte dienen als Referenzgewässer für die Entwicklung eines spezifischen Bewertungssystems für Fließgewässer auf Inseln. Dieses System berücksichtigt die üblichen Qualitätsparameter wie Wassergüte und Hydromorphologie, hebt aber die Biodiversität und den inseltypischen Endemismus besonders hervor. Die daraus resultierenden Gewässerentwicklungskonzepte stellen ein entscheidendes Instrument des Natur- und Artenschutzes dar, da viele der endemischen Gewässerorganismen vom Aussterben bedroht sind.

**Schlüsselwörter:** Kanarische Inseln, Bäche, Bewertung, Makroinvertebraten, Endemiten

## 1 Introduction

One of the main objectives of the EU Water Framework Directive (WFD) is for all European bodies of water to meet the criteria for ‘good ecological status’ or a ‘good ecological potential’ by the end of 2015. The requirements of this directive, which include the prevention of further deterioration, offer a good basis for implementing integrated strategies to protect water bodies while taking into account the complexity of anthropogenic influences and defining quantitative environmental quality goals.

The small streams on the Canary Islands support an interesting and surprisingly diverse fauna (Malmqvist et al. 1993, Beyer 1993, Malmqvist et al. 1995). Unfortunately, these water bodies are subject to heavy disturbance and loading.

The number of perennial streams has steadily dropped on both Tenerife and Gran Canaria. Between 1933 and 1973, the number of perennial streams on Gran Canaria decreased from 285 to 20 and on Tenerife fewer than 10 streams are recorded now (Nilsson et al 1998).

Threats to the freshwater ecosystems include the decrease in forested areas, the use of subterranean and surface water reservoirs for agricultural irrigation and for tourism, and water pollution by point and non-point sources. To supply irrigation, most streams have been heavily canalized. Nevertheless, the objectives and requirements of the WFD are also valid for the Canary Islands. To support its implementation, detailed planning of restoration measures and renaturalization is necessary. A holistic method of stream assessment is urgently needed to contribute to these requirements (Lüderitz 2004). For the chemical assessment, continental standards can be used, but biological methods should be adjusted for the unique situation of island ecosystems.

Compared to the species diversity on the continent and on large islands such as the British Isles, the number of aquatic species on relatively small islands is limited as is the number of streams themselves. Thus, assessment systems such as the AQEM (**A**ssessment System for the Ecological **Q**uality of Streams and Rivers throughout **E**urope using Benthic **M**acroinvertebrates), which depend on a relatively high species number (Hering et al. 2003, Lorenz et al. 2004), are only suitable to a limited extent.

Island macroinvertebrate assemblages often include a considerable number of endemic species and subspecies. The disappearance of streams and their ongoing canalization can lead to the extinction of such organisms. Thus, endemic taxa in particular have to be considered in every assessment approach.

This paper presents an assessment system based on the occurrence and distribution of aquatic macroinvertebrates improved by hydromorphologic parameters. It was developed

by sampling streams on La Gomera and Tenerife and analyzing data published by other authors (Beyer 1993, Malmqvist et al. 1993, Malmqvist et al. 1995, Nilsson et al. 1998).

## 2 Materials and Methods

From November 2006 until March 2009, macroinvertebrates were sampled in eight reaches of streams on La Gomera (Fig. 1) and in five reaches of streams on Tenerife (Fig. 2). Four of the reaches on La Gomera are located in or very near to the Garajonay National Park. This National Park is the best remnant of ancient Canary laurel forest (a partial relict of the Tertiary Age forests that have become extinct in Europe due to climatic change) in the Canary archipelago, and several undisturbed permanent streams are still present together with their forest canopy. On Tenerife one reach belongs to a nature reserve. The others are disturbed to some degree by anthropogenic influences, e. g. intensive agriculture, canalization, and damming (Tab. 1).

The reaches were sampled twice (spring and fall). Sampling was conducted over a length of 100 m by means of an extended version of the multi-habitat-sampling technique (Hering et al. 2003, Lüderitz et al. 2004). This method includes all microhabitats (mineral and organic bed substrates, submerged and emergent aquatic plants) within the stretches. An area of 40 $m^2$ at each site was sampled using a hand net with a mesh size of 0.5 mm. The organisms (except easily identifiable species) were fixed in 70 % ethyl alcohol and identified according to Balke et al. (1990), Bellmann (1993), Freude et al. (1971/1979), Müller-Liebenau (1971), Nybom (1948), Machado (1987), Crosskey (1988) and Waringer & Graf (1997).

Hydromorphological assessment was accomplished by the mapping method of LAWA (2000) and the suggestions by Raven et al. (2002) after an adaptation and calibration to the natural conditions of the Canary Islands (Kumm 2008). The following main parameters were recorded: stream course development, longitudinal profile, cross profile, bed structure, bank structure, and riparian area. These six main parameters were broken down into 25 individual parameters.

The hydromorphological status (*Strukturgüteindex*) was classified into seven quality classes:

- Class 1: unchanged; natural morphology
- Class 2: slightly changed; unimportant changes that clearly do not influence the functionality of the water body
- Class 3: moderately changed; changes in morphology are obvious and have a significant impact on the ecology of the water body
- Class 4: clearly changed; water body shows a clear deviation from its natural status and is straightened and lined up to 50 %
- Class 5: markedly changed; straightening and lining approach 100 %
- Class 6: heavily changed; natural dynamics are prevented by paving and lining of the bank
- Class 7: excessively changed; completely canalized

The morphology was assessed by comparing undisturbed stream reaches in the same landscape unit with the mapped sites.

## 3 Results

During sampling campaigns from November 2006 to March 2009, a total of 64 macroinvertebrate species were found at 13 sampling sites (Tab. 2). Altogether, 74 species from the investigated groups have been documented in former studies

**Tab. 1:** Location and characteristics of sampled streams on La Gomera (1–8) and Tenerife (9–13).

***Tab. 1:*** *Lage und Besonderheiten der untersuchten Bäche auf La Gomera (1–8) und Teneriffa (9–13).*

| Site | Name/Location | Altitude (m) | Site characteristics and disturbances |
|---|---|---|---|
| 1 | La Laja | 590 | Garajonay National Park, natural pine forest, supplies a reservoir |
| 2 | La Laja | 450 | Several small dams, extensive agriculture |
| 3 | Chejelipes | 250 | Several dams and reservoirs upstream |
| 4 | El Cedro | 910 | Garajonay National Park, laurel forest |
| 5 | El Cedro | 540 | Downstream of a waterfall, influenced by agriculture, water scarcity |
| 6 | Barranco del Aqua | 410 | Influenced by agriculture, stream course partially paved and straightened |
| 7 | Meriga | 970 | Small stream in Garajonay National Park, laurel forest; downstream of the site piping of the whole stream |
| 8 | El Rejo | 650 | Small stream in Garajonay National Park, laurel forest |
| 9 | Taganana | 200 | Agriculture and urban sewage loading, partially paved and straightened |
| 10 | Igueste | 400 | Extensive agriculture, water scarcity, low flow rates |
| 11 | Masca | 450 | Intensive tourism, water scarcity |
| 12 | Afur | 300 | Agriculture, low flow rates |
| 13 | Barranco del Infierno | 500 | In the nature reserve, natural morphology over a flowing distance of ~ 1 km, than total canalization |

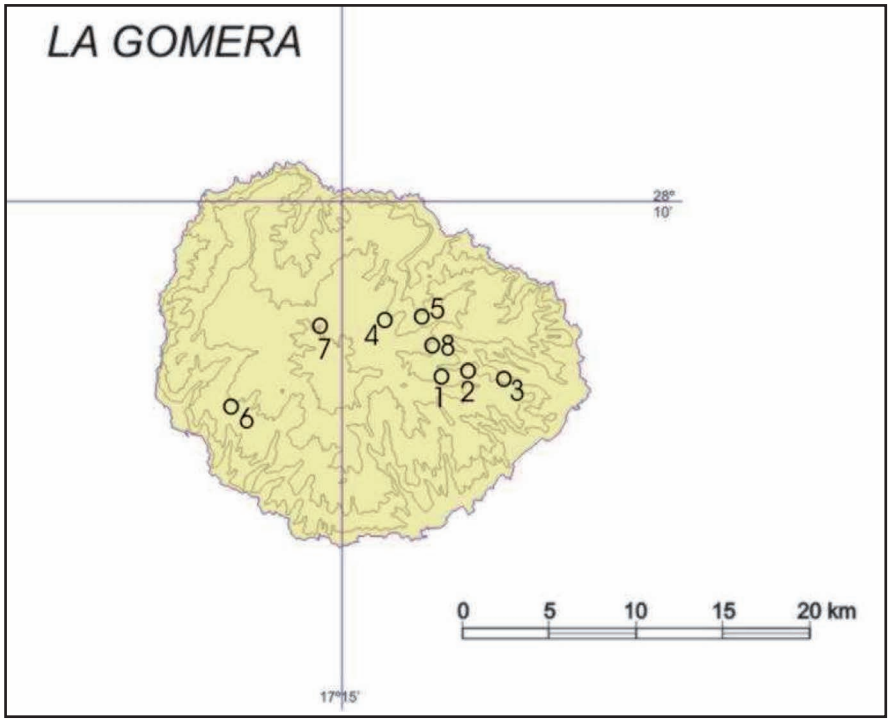


**Fig. 1:** Sampling sites in streams on La Gomera (Map: Agustin Naranjo Cigala).

***Abb. 1:*** *Untersuchungsabschnitte an Bächen auf La Gomera (Karte: Agustin Naranjo Cigala).*

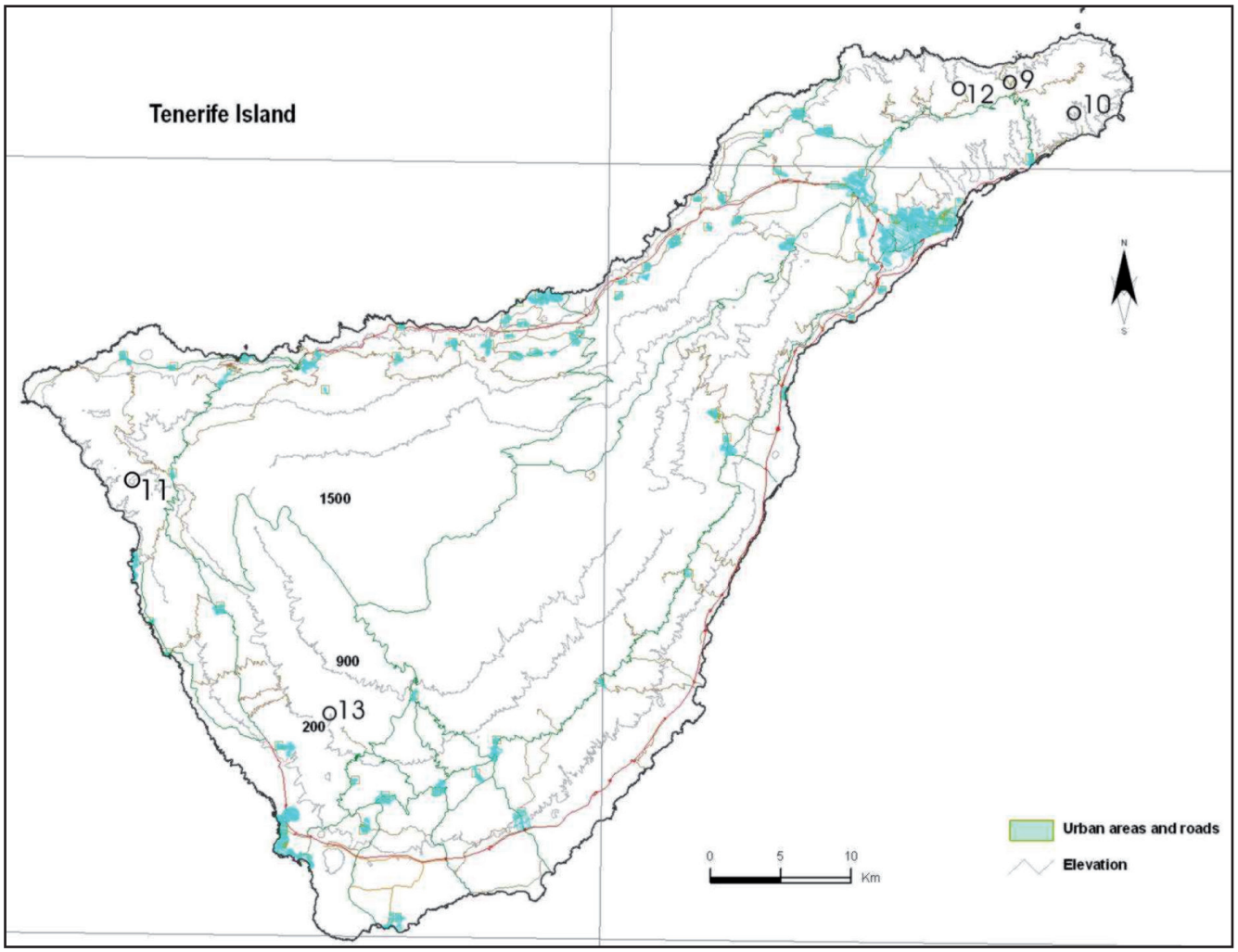


**Fig. 2:** Sampling sites on Tenerife (Map: Agustin Naranjo Cigala).

***Abb. 2:*** *Untersuchungsabschnitte an Bächen auf Teneriffa (Karte: Agustin Naranjo Cigala).*

**Tab. 2:** Abundances of macroinvertebrate species found in streams of La Gomera and Tenerife, Canary Islands (1: single individual, 2: rare, 3: not very frequent, 4: common, 5: frequent, 6: very frequent, 7: abundant).

***Tab. 2:*** *Makroinvertebraten in Bächen auf La Gomera und Teneriffa (Kanarische Inseln); Abundanzen (1: Einzelfund, 2: selten, 3: nicht häufig, 4: verbreitet, 5: häufig, 6: sehr häufig, 7: massenhaft).*

| Taxonomic group/species | Endemic species or subspecies | Sensitive species | La Gomera | | | | | | | | Tenerife | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| ***Odonata*** | | | | | | | | | | | | | | | |
| *Anax imperator* | | | 4 | 5 | | | | | | | | 4 | 4 | 4 | 4 |
| *Anax parthenope* | | | 4 | 4 | | | | | | | | 3 | 4 | | 4 |
| *Crocothemis erythrea* | | | 3 | 3 | | | | | | | | 4 | 5 | 4 | 3 |
| *Ischnura sp.* | | | | | | | | | | | | | | | 3 |
| *Orthetrum chrysostigma* | | | 5 | 5 | 3 | | | | | 2 | | | 3 | 5 | |
| *Sympetrum fonscolombei* | | | 3 | 5 | | | | | | | | | 4 | 4 | |
| *Sympetrum nigrifemur* | x | | | 3 | | | | | | | | 3 | | | 3 |
| *Zygonyx torrida* | | x | | 2 | | 2 | | | | | | | | | 5 |
| ***Trichoptera*** | | | | | | | | | | | | | | | |
| *Agapetus adejensis* | x | x | 4 | | | 4 | | | 5 | 3 | | | | | 4 |
| *Hydropsyche maroccana* | | | 3 | 3 | | 5 | | 2 | 4 | 4 | | | | | 5 |
| *Hydroptila fortunata* | x | | | | | 3 | | | 3 | 2 | | | | | |
| *Mesophylax aspersus canariensis* | x | | 3 | | | 6 | | | 6 | 6 | | | | | |
| *Orthotrichia angustella* | | x | | | | 2 | | | | | | | | | |
| *Oxyethira spinosella* | x | x | | | | 4 | | | | | | | | | |
| *Stactobia storai* | x | x | | | | 3 | | | 3 | | | | | | |
| *Tinodes canariensis* | x | x | | | | 4 | | | | 3 | | | | | 3 |
| *Wormaldia taganananа* | | x | | | | 5 | | | 4 | 5 | | | | | 3 |
| ***Ephemeroptera*** | | | | | | | | | | | | | | | |
| *Baetis canariensis* | x | x | 5 | | | 5 | | | 3 | 4 | | | | | 4 |
| *Baetis nigrescens* | | | | | | 3 | | 4 | 3 | | | | | | 3 |
| *Baetis pseudorhodani* | x | x | 3 | 3 | | 4 | | | 4 | 3 | | | | | 5 |
| *Caenis luctuosa* | | | | 3 | | | | | | | | | | 3 | |
| *Cloeon dipterum* | | | 4 | 6 | 5 | | 4 | 5 | | | 4 | 5 | 5 | 5 | 4 |

| Taxonomic group/species | Endemic species or subspecies | Sensitive species | La Gomera | | | | | | | | Tenerife | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| ***Coleoptera*** | | | | | | | | | | | | | | | |
| *Agabus biguttatus* | | | | | | 3 | | | 2 | | | | | | 4 |
| *Agabus nebulosus* | | | 5 | 4 | | | | | | | | | | | |
| *Anacaena haemorrhoa* | x | x | | | | | | | 3 | 2 | | 3 | | | |
| *Dryops gracilis* | | | 5 | 5 | | 4 | 3 | 5 | 4 | 4 | | | 5 | | 5 |
| *Enochrus politus* | | | 3 | | | | | | | 2 | | | | 3 | |
| *Enochrus bicolor* | | | | | | | | | | 2 | | | | | |
| *Gyrinus dejeani* | | | 5 | 5 | 5 | 4 | 5 | 4 | 4 | 4 | | 4 | 5 | 4 | 4 |
| *Gyrinus urinator* | | | 3 | 3 | | 3 | 3 | | | | | 4 | 3 | 4 | 3 |
| *Haliplus lineatocollis suffusus* | x | | 3 | 4 | 4 | | | | | | | | | | |
| *Hebrus pusillus canariensis* | | | | | | | | | | | | | 3 | | 3 |
| *Herophydrus musicus* | | | | 3 | | 4 | | | 3 | | | | 4 | 3 | 3 |
| *Hydraena serricollis* | x | x | | | | 3 | | | 3 | | | | | | |
| *Hydroporus errans* | x | | 3 | | | 3 | | 3 | 2 | 3 | | | | | 3 |
| *Hydroporus lucasi* | | x | | 3 | | | | | | | | 3 | | 5 | 4 |
| *Hygrotus confluens* | | | 3 | | | 2 | | | | | | | | | |
| *Laccobius canariensis* | x | | 3 | 3 | | 2 | | | | | | | | | 3 |
| *Laccophilus hyalinus* | | | 4 | 4 | | 4 | | | 4 | | | | 3 | 5 | |
| *Meladema coriacea* | | | 2 | 2 | | 2 | | | | | | 3 | 3 | 3 | |
| *Meladema imbricata* | x | x | 3 | | | 2 | | | | | | | | | 4 |
| ***Heteroptera*** | | | | | | | | | | | | | | | |
| *Gerris thoracicus* | | | | 5 | 3 | 4 | 3 | 4 | 4 | 3 | | | 6 | | |
| *Hebrus pusillus canariensis* | x | | 3 | | | 2 | | | | | | | | | |
| *Hydrometra stagnorum* | | | 4 | 5 | | 5 | 4 | 5 | 3 | 4 | | | 4 | | 4 |
| *Microvelia gracillima* | | | | | | 3 | | | 3 | | | | | | |
| *Notonecta canariensis* | x | | 4 | 4 | 3 | 3 | | | | | | | 4 | 4 | 5 |
| *Sigara lateralis* | x | | 4 | 4 | 3 | 3 | | | 2 | | | | | | 3 |
| *Velia lindbergi* | x | | 4 | 5 | 3 | 4 | 3 | 5 | 4 | 4 | | 4 | 3 | | 4 |

| Taxonomic group/species | Endemic species or subspecies | Sensitive species | La Gomera | | | | | | | | Tenerife | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| ***Mollusca*** | | | | | | | | | | | | | | | |
| *Ancylus fluviatilis striatus* | x | | 4 | 5 | | 5 | | 4 | 5 | 4 | 4 | 4 | 3 | 3 | 4 |
| *Galba truncatula* | | | | 4 | 5 | | 4 | 3 | | 4 | 4 | 4 | 5 | 5 | 4 |
| *Pisidium casertanum* | | | | | 3 | 4 | 3 | 3 | 5 | 4 | | | | | 3 |
| *Physella acuta* | | | 4 | 4 | | 2 | | 3 | | | 5 | 4 | 4 | 5 | |
| *Planorbis planorbis moquini* | | | | 3 | 5 | | | | | | | 3 | | | |
| ***Oligochaeta*** | | | | | | | | | | | | | | | |
| *Eiseniella tetraedra* | | | 3 | 3 | 3 | 3 | 3 | | 3 | 3 | 4 | 4 | 4 | | 4 |
| *Tricladida* | | | | | | | | | | | | | | | |
| *Dugesia gonocephala* | | | 4 | 4 | | 5 | | | 5 | 5 | | 4 | 4 | | 4 |
| ***Crustacea*** | | | | | | | | | | | | | | | |
| *Chaetogammarus chaetocerus* | x | x | | | | 3 | | 4 | 3 | | | | | | |
| *Rhipidogammarus gomeranus* | x | | | | | 4 | | | 3 | 3 | | | | | |
| *Rhipidogammarus rheophilus* | | | | | | | | | | | | | | | |
| ***Nematomorpha*** | | | | | | | | | | | | | | | |
| *Gordius aquaticus* | | | | | | 3 | | | | | | | | | |
| ***Diptera*** | | | | | | | | | | | | | | | |
| *Simulium* sp. | | | 3 | 4 | | 4 | | 5 | | | | | 4 | | |
| *Simulium* cf. *teneriferum* | | | | | | | | | | | | | | | 5 |
| **Total species number** | 64 | | 34 | 33 | 12 | 42 | 10 | 15 | 28 | 24 | 6 | 20 | 26 | 19 | 42 |
| **Number of endemic species** | 25 | | 14 | 9 | 4 | 20 | 1 | 4 | 15 | 11 | 1 | 5 | 4 | 3 | 17 |
| **Number of sensitive species** | | 15 | 4 | 3 | 0 | 12 | 0 | 1 | 8 | 6 | 0 | 1 | 0 | 2 | 11 |

Sampling sites on La Gomera:
1 – Stream reach upstream of the La Laja reservoir, 2 – Stream reach downstream of La Laja, 3 – Water body near Chejelipes, 4 – El Cedro stream, 5 – El Cedro stream downstream of the waterfall, 6 – Barranca del Aqua, 7 – Meriga, 8 – El Rejo

Sampling sites on Tenerife:
9 – Taganana, 10 – Igueste, 11 – Masca, 12 – Afour, 13 – Barranco de Infierno

(Malmqvist et al. 1993, Beyer 1993, Malmqvist et al. 1995). Concerning the number of endemic species, there is a ratio of 25 to 31 between the actually found and the formerly documented species. Individual sampling reaches contained 6 to 42 species, reflecting differences in hydromorphology, water quantity and water quality.

On the basis of the data, we developed a specific assessment system for the streams of the Canary Islands using five metrics:

- Water quality: assessed by calculating the saprobic index
- Diversity: total species number found in the sampling reach (length 100 m)
- Degree of naturalness: sum of abundances of sensitive species (species which occur only in streams with high water quality and nearly natural hydromorphology, Tab. 1)
- Refuge function: number of endemic species (Tab. 1)
- Hydromorphology

For each metric, a score of 1 to 5 was assigned (Tab. 3). The metrics were calibrated with reference to the rare undisturbed stream reaches (sampling sites 4, 13). The average of the five scores constituted the Ecological Integrity. Application of the system led to a well-differentiated assessment of the sampled bodies of water (Tab. 4).

It is clear that streams within and near the Garajonay National Park on La Gomera show a good or very good ecological status. On Tenerife, only one of the sampled streams (Infierno) corresponds to a reference status.

The rapid decrease in the overall water body quality at the other sampled and mapped sites is related to intensive use, canalization, and damming downstream of the natural forests. The number of endemic species and sensitive species is particularly affected. They are almost absent in the disturbed sites.

Some of the endemic and sensitive species occur only in a few streams. For example, the occurrence of the aquatic beetle *Meladema imbricata* is limited to one stream on La Gomera and two streams on Tenerife. The caddisflies *Oxyethira spinosella* and *Stactobia storai* were found only at one site and two sites respectively.

## 4 Discussion

Several studies on freshwater species of the Canary Islands have been carried out, but the most recent are between 11 and 15 years old and thus have no relation to the WFD.

The number of permanent, nearly natural streams on the Canary Islands is limited. The natural reaches of streams and brooks extend only a few kilometers or less. The significant decrease in stream numbers in the last century was caused by intensive agricultural use. Man-made canals now represent the majority of flowing-water bodies, and most former stream courses are dry, except for periods of flooding.

Before humans changed the vegetation on the islands, many streams must have been part of the *Laurisilva* ecosystem. Today only fragments of the laurel forest remain; on La Gomera, these are mostly in the Garajonay National Park. Small streams running through surroundings of this kind show a relatively poor but balanced composition of species (sites 7, 8). These small streams join with larger ones such as the El Cedro stream (site 4), which offer relatively high biodiversity and contain many endemic species. These streams and the upper part of the stream in Barranco de Infierno (site 13) can serve as reference sites although they may be disturbed, too, by changes downstream.

Overall, the number of species found in the reference streams is also low. In comparable streams in Central Europe, we found species numbers that were up to three times higher (e. g. Lüderitz et al. 2004). The reason is the absence of the typical lotic elements of continental streams, e. g. *Plecoptera* (not present) and limnephilid *Trichoptera* (only one species present).

Using the reference sites on La Gomera and Tenerife, we developed an assessment method for streams on the Atlantic islands. This method is a special adaptation of the multime-

**Tab. 3:** Metrics calibration for the assessment system for Canary Islands streams based on the requirements of the WFD.

***Tab. 3:*** *Kalibrierung der Metriks des Bewertungssystems für Fließgewässer auf den Kanarischen Inseln nach Anforderungen der EU-Wasserrahmenrichtlinie.*

| Metric | Very good / reference status | Good status | Moderate status | Poor status | Bad status |
|---|---|---|---|---|---|
| | 5 | 4 | 3 | 2 | 1 |
| Diversity | ≥ 40 | ≥ 30 | ≥ 25 | ≥ 15 | < 15 |
| Naturalness* | ≥ 20 | ≥ 15 | ≥10 | ≥ 5 | < 5 |
| Hydromorphology | 1 | 2-3 | 4 | 5-6 | 7 |
| Number of endemic species/ subspecies | ≥ 15 | ≥ 10 | ≥ 6 | ≥ 4 | < 4 |
| Water quality (SI) | < 1.8 | < 2.2 | < 2.4 | < 2.8 | > 2.8 |
| Ecological Integrity** | 5 | 4 | 3 | 2 | 1 |

SI Saprobic index
*Sum of abundances of sensitive species
**The Ecological Integrity of each site was calculated as the average of the five metrics

**Tab. 4:** Results of stream assessment for La Gomera and Tenerife streams (5 = very good/reference status; 4 = good status; 3 = moderate status; 2 = poor status; 1 = bad status).

***Tab. 4:*** *Ergebnisse der Bewertung von Fließgewässern auf La Gomera und Teneriffa (5 = sehr guter Zustand/Referenzzustand; 4 = guter Zustand; 3 = mäßiger Zustand; 2 = unbefriedigender Zustand; 1 = schlechter Zustand).*

| Metric | Assessment value of sampling site | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number | | | | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Diversity | 4 | 4 | 1 | 5 | 1 | 1 | 4 | 4 | 1 | 2 | 3 | 2 | 5 |
| Naturalness | 4 | 4 | 1 | 5 | 1 | 2 | 5 | 4 | 1 | 3 | 1 | 2 | 5 |
| Hydromorphology | 4 | 4 | 2 | 5 | 2 | 2 | 4 | 4 | 2 | 4 | 4 | 3 | 5 |
| Endemic species/ subspecies | 4 | 3 | 2 | 5 | 3 | 2 | 4 | 4 | 1 | 2 | 2 | 1 | 5 |
| Water quality (SI) | 4 | 4 | 3 | 4 | 3 | 3 | 4 | 5 | 3 | 4 | 4 | 3 | 4 |
| | (2.1) | (2.1) | (2.3) | (2.0) | (2.3) | (2.4) | (1.9) | (1.7) | (2.3) | (2.15) | (2.15) | (2.3) | (2.1) |
| Ecological Integrity | 4 | 4 | 2 | 5 | 2 | 2 | 4 | 4 | 2 | 3 | 3 | 2 | 5 |

SI Saprobic index

tric system developed for assessment of streams in Central Europe (Lüderitz et al. 2004). To assess the ecological integrity, this proposed method considers the hydromorphology, while emphasizing the biological factors biodiversity, endemism, and species sensitivity. In the case of relatively small islands with more or less small and isolated populations, such factors must receive much greater emphasis than they do at the continental scale. This method for assessing bodies of water based on the demands of the EU-WFD is also an instrument to assess conservation value and conservation needs. Our approach is able to distinguish water bodies according to the kind and degree of anthropogenic disturbances and to estimate even small differences. The method should be tested and applied to other bodies of water on other archipelagos as well.

With regard to species composition, Canarian streams showed high individuality. Thus, they are not interchangeable and none of the studied streams can be identified as being in greater need of protection than another. On the other hand, the similarity between the stream fauna of Tenerife and La Gomera is striking. The majority of species occur on both islands, but in the case of endemic species often only in small and isolated populations. Several species, especially among aquatic beetles and caddisflies, are endangered, and a number are already extinct (Nilsson et al. 1998).

As a prerequisite for conservation and restoration work, all kinds of man-made water bodies such as irrigation channels and any remaining pools in natural, intermittent streams must be included into strategies. There is no doubt that several endemic species are close to extinction and that only two factors can avoid that: more water and more natural streams.

Meanwhile as the water demand for agriculture decreases, the demand for water to support the tourism industry remains high or is even increasing. The solution is the enhanced use of desalinated seawater created with renewable energy.

There is an opportunity for stream restoration as agriculture retreats from parts of the islands. The possibility is high in the northern part of La Gomera (El Cedro) and in protected parts of Tenerife, especially in Barranco del Infierno and in the Anaga peninsula. For such selected water bodies, the authors will develop restoration concepts over the next few years. Stream restoration will also contribute to re-greening the valleys of the Canary Islands.

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