

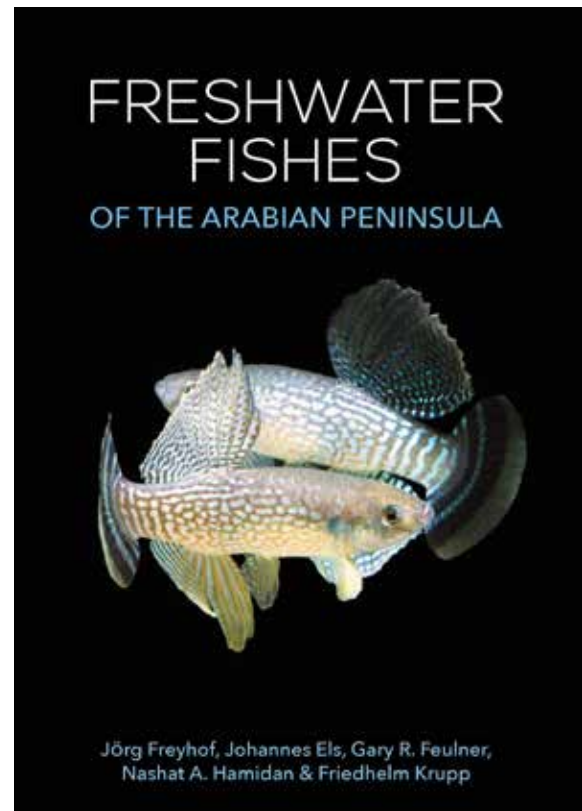
## Book Review

**The Freshwater Fishes of the Arabian Peninsula. Publishers. Dubai Motivate Media Group. 272 pp.**

Freyhof, J., Els, J., Feulner, G.R., Hamidan, N.A., and Krupp, F. 2020.

**Welcome** to the world of fish biology (ichthyology), ecology and conservation (Lagler *et al.*, 1962; Wootton, 1990). This book, first published in 2020, provides an up-to-date account of all the freshwater fish that have so far been recorded from across the Arabian Peninsula (AP) since records began. The project area (3.2 million km<sup>2</sup>) includes at least seven different countries as well as a number of offshore islands within the Red Sea. Although the marine fish fauna of the AP is relatively well-known (Klausewitz, 1989; Gladstone *et al.*, 2003) currently, there are few if any general books available which describe the freshwater fish present across the peninsula and how to identify them in better ways. However, where present, fish make an important contribution to the fauna of a region and deserve consideration in **biodiversity** and conservation assessments, post Rio (1992) (Abu-Zinada *et al.*, 1989; Thouless, 1991).

Reasons for this apparent lack of information are complex, but probably include a general unfamiliarity with freshwaters across the AP and limited access to some of the more remote areas where such sites occur. There is also little general interest in sport fishing (angling) across the region, a factor which elsewhere can often drive interest in fisheries ecology and welfare. Previously, information of freshwater fish has largely been confined to technical journals unavailable to the general reader (Banister and Clarke 1977; Krupp, 1983; Hamidan and Shobrak, 2019). Thus, the main **aim** of this book is to develop a general interest in the theory and practice of fish biology and generate a greater appreciation and pride in the native fish fauna of the region and its '**natural heritage**' (page 18). The book was written by five main authors all well-known to science



and experts in the fields of taxonomy and ecology, although many other people (fully acknowledged in the text) have contributed to the book especially in the production of the **distribution maps**.

In the distant geological past (ca. 100 million years), much of the region of the AP was covered by a network of river channels. Today most surviving freshwaters are largely confined to isolated wadis, mountain streams, lowland wetlands, and small reservoirs some of which continue to contain fish populations. Unfortunately, due to their isolation and small population size, many species have become threatened (endemic) with extinction due to a loss of habitat, reduced genetic diversity, limited 'connectance', high temperatures, seasonal drought, and climate change. Nevertheless, where present, fish play an important role

in the ecology (structure and function) of freshwaters (Odum, 1959) even though they are rarely exploited for food or sport. Much of the book is designed to provide easily accessible identification keys for all those fish represented in the fauna (e.g., Maitland, 2004). Each fish species is illustrated in colour and is supported by distribution maps which help identify the local 'hotspots' of diversity and or endemism (Vitule, *et al.*, 2019).

The general structure of the book follows the regular format often used in similar guides (Lowe-McConnell, 1987; Maitland and Campbell, 1992; Skelton 1993; Davies *et al.*, 2004). It also includes an assessment of the conservation status of each of the species described (Jézéquel *et al.*, 2020). These **unique** assessments are based on criteria developed by the International Union for the Conservation of Nature (IUCN) situated in Switzerland, which is a respected non-governmental organisation (NGO formed in 1964) noted for the production of Red Data lists (de Nie, 1996) of threatened species. These lists (<http://www.iucnredlist.org>) can be used for the development of Management Plans for Species and Habitats throughout the world (Action Plans). Until recently (2004) however, fish were often excluded from such assessments due to a lack of affinity for this taxonomic group (amongst conservation agencies) and the difficulties of selecting suitable candidate species (charismatic 'flagship species') for funding initiatives. Happily, such disparities have now been overcome by the formation of a Fish Specialist Group within the IUCN which now actively promotes the status of fish throughout the world (e.g., Kottelat and Freyhof, 2007).

The book is divided into four main sections. Section One describes the methods used to sample fish in the field and the best ways of preserving them for later analysis in the laboratory. This also includes the collection and storage of DNA samples although no further details of molecular analyses are given (Carvalho and Pitcher, 1996). The introduction is followed by a description of

the anatomy of fish and the main characters used in their identification. These include fin-ray counts and scale counts. This is followed by a brief review of the principles and protocols of fish taxonomy and systematics. Section Two provides a review of the main theories which underpin the science of fish biology and the increasing importance of conservation. This includes a review of the geological history and plate tectonics of the region, and their collective role in shaping the origins and subsequent developments of the fish fauna, as well as the formation of the Red Sea. This review is particularly useful for readers unfamiliar with the region as many of the processes include species gains and losses from or to regions outside the AP including the 'mysterious' Levant to the north (Krupp and Schneider, 1989). Section Two concludes with a 'preliminary' assessment of the conservation status of each fish represented in the fauna (Table 1, page 100). This shows that approximately 50% of the fish fauna is currently directly threatened in a way that is sometimes linked to lack of data (being data deficient).

Most of the remaining sections (Three and Four) are given over to a detailed description of all the fish species represented in the fauna, sorted according to their assumed origins. Out of the total number of the forty-one species listed, thirty-one are conserved to be native. The remaining ten species are all thought to have been introduced to control disease vectors or in a few cases as a source of food. Non-native species can often pose serious threats to native species through competition (Copp and Fox, 2020). Collectively, the fish fauna consists of an eclectic mix of species and families probably caused by the turbulent history of colonisation and extinctions as explained above. Eleven different families are represented in the fauna; seven as natives and the other four as aliens or non-natives (See FishBase for listings of Fish Families). Of all the fish families represented, the cyprinids (Cyprinidae) are the most diverse. Twenty different species are listed (Appendix 1, page 254) and include three species of Lotak (Genus *Cyprinion*), five species of

Barb and thirteen species of the Genus *Garra*. Barbs are often noted for increased sets of chromosomes or polyploidy. The *Garra* Genus is a complex group of fish widely distributed across the region and is highly adapted to the arid and unpredictable conditions found across the AP. Some have a 'mental' disc (Hashemzadeh-Segherloo, *et al.*, 2017) under their lower jaw which provides attachment to the substrate. These fish often have extended breeding seasons which enable them to vary their spawning times to match the unpredictable nature of the seasons, an essential component of their life-history strategy. However, their taxonomy is complex and largely unresolved (see FishBase). The remaining families in the non-native fish group are the Anguillidae (two species), Leuciscidae (one species), Mugilidae (three species), Gobiidae (two species), Terapontidae (one species), and the Aphaniidae (three species of Killifish). The Killifish are perhaps the most well-known because they are often exhibited in commercial aquaria because of their unusual behaviours, bright colouration and sexual dimorphism (illustrated on the front cover of the book).

Fish within the non-native group include the cichlids Cichlidae (three species), Clariidae (one species), Loricariidae (one species) and the Poeciliidae (five species). The book concludes with a glossary of technical terms, a bibliography with 128 references, and an index.

### In conclusion,

This book ticks most of the **aims** listed in the general introduction to the project. It provides an excellent overview of the science of fish biology and its relevance to the conservation and management of freshwater fish. Although currently, only forty-one species of fish occur across the AP, the book makes an important and **timely** contribution to the fauna of the region and its biodiversity. The authors are to be congratulated on the enormity of the project and their ability to establish cooperation amongst the various

conservation agencies across the region. The book is richly illustrated and easy to read. It makes an excellent teaching resource with examples illustrating the complexities of **biogeography** and conservation.

In some ways however, the project remains incomplete as little information is presented on proposals for future research and the **management** of those sites which are found to be high in species diversity and endemism. Although much progress has been made in the research on some individual species (Ahmad *et al.*, 2013; Borkenhagen, 2014; Alharthi 2020; Keivany *et al.*, 2015; Abedi *et al.*, 2011), there is an urgent need to revisit many of the sites listed to establish the current presence or absence of individual species and to better describe their status in terms of population numbers, disease profiles and **life-history traits** (Blanke *et al.*, 2007; Mims *et al.*, 2010). Without quantitative data of this kind, it is impossible to carry out long-term population viability analyses (PVAs) and make predictions about their ability to respond effectively to the future challenges posed by climate change and non-native species to name but two (Shuter and Post, 1990; Yamamoto *et al.*, 2007). Long-term management over such large areas will obviously present significant logistical and political challenges.

Whilst the book provides essential reading for anyone considering a career in fish biology or conservation, many details in the book can also be useful for general consumption by colleges, schools, and interested naturalists. Fish are increasingly used as tools for a better understanding of the mechanisms by which species respond to changes in their environment through natural selection (Skelton, 1993). Such adaptations often involve variations in reproduction, behaviour, physiology, and genetic composition. Common examples are often drawn from tropical species including cichlids (mouth-brooders) and barbs (species flocks) where selection pressures can be particularly acute (Lévêque, C. 1997; de-Graaf, 2003; Skelton, 1993; Hauser *et al.*, 2005). Similar extreme pressures undoubtedly occur across the AP

region and await further description and analysis with respect to fish.

Therefore, we look forward to the second edition of the book which is likely to include several additional fish species identified through the application of more rigorous molecular screening techniques and further information on **management** schedules proposed for those regions which particularly have high levels of species richness and or endemism. In some cases, however, it may be necessary to develop Ex-Situ breeding programmes for critically endangered species using facilities as described in the United Arab Emirates (page 102) (e.g., McGregor-Reid 1995). Sadly, some of the most diverse regions are also located in politically sensitive areas of the world. This is where science can help to promote better understanding and communication through collaborative research projects.

In the second edition, one would also expect to see some reference to the risks of working in such remote areas of the world (risk assessment) and some tweaking of the index which in this edition rarely directs the reader to the correct page! On a positive note, it is wonderful to see that there are still areas of the world worthy of further exploration and discovery especially for younger members of the research community (e.g., McGregor-Reid, 1995).

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- <https://www.unep-wcmc.org/about-us> World Conservation Monitoring Centre Cambridge.



By: Chris Goldspink

The author (with hat) visiting one of the last artisanal pearl fisheries in the southern Red Sea, Saudi Arabia.