Adv. Odonatol. 1: 243-249 *December 31, 1982*

MAN-INDUCED CHANGES IN THE DRAGONFLY FAUNA OF THE JORDAN VALLEY[1]

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During a one-year stay in Jordan the eastern affluents of the Jordan River were visited regularly in order to collect dragonflies. Compared with earlier faunistic data, an improverishment in the Transjordan dragonfly fauna was established. These changes are attributed to an increasing number of irrigation projects which cuase a lowering of the water level (or even a drying-up) in the lower courses of perennial wadis. As a result, the vegetation of the river banks and therewith the habitats of many dragonfly species are destroyed.

INTRODUCTION

The relief structure of the Levant is dominated by a rift valley which extends from the Taurus mountains in southern Turkey to the Gulf of Aqaba. It runs more or less parallel to the east Mediterranean coast. Geologically three major sections can be distinguished from north to south. Hydrogeographically this division is reflected by the main drainage pattern of the region: the catchment basins of the Orontes and Litani are situated in the northern sections of the Levantine rift system, namely the Ġāb Valley in Syria and the Baqaᶜa in Lebanon. Both rivers discharge into the Mediterranean.

The endoreic catchment basin of the River Jordan runs in the third and southernmost section, the Jordan-Dead-Sea rift Valley. It is the deepest continental depression on earth and contains an inland sea, the Dead Sea, the level of which is about 400 m below that of the Mediterranean. The surface of the Dead Sea drainage area is 40 000 km^2 (SCHATTER, 1973). The second largest water body is

[1] Results of the travels of R. KINZELBACH to the countries of the Middle East No. 38.

Lake Tiberias (or Lake Kinneret or Sea of Galilee), the lowest freshwater body on earth, which lies about 200 m below sea level. The topographical conditions are also the major reason for the generally extreme temperatures. With a mean annual value of 25°C and mean summer maxima of 40°C the temperatures in the Dead Sea depression are subtropical. As the mean annual rainfall does not exceed 50 mm around the shores of the Dead Sea, the climate can be characterised as subtropical-arid (ASHBEL 1973).

The main problem of the area is therefore water shortage. The River Jordan derives its freshwater from the melting snow and winter rains in the mountains of Lebanon and Mt Hermon. Very little is contributed to the River Jordan by the perennial tributaries, the most important of which are the Nahr al-Yarmouk (80 million m^3/year) and the Nahr az-Zarqa (45 million m^3/year) (WOLFART 1962). The situation is aggravated by the fact that the entire annual rainfall occurs in a period of only 40 to 60 days during the winter season (ASHBEL 1973). The winter flash floods therefore discharge unused into the Dead Sea.

METHODS

To obtain a fairly exact picture of the composition of dragonfly species and their seasonal fluctuations, 25 collecting stations in the Jordan Valley were visited on a regular basis throughout the year (1980). Four representative collecting stations were chosen to demonstrate the effect of water engineering on the dragonfly fauna.

RESULTS

To meet the needs of an increasing population the Jordanian government worked out plans for intensive agricultural use of the fertile Jordan Valley. These plans are currently implemented under the direction of the "Jordan Valley Development Authority". In order to store the winter rainfall and to supply the farmland and the growing number of communities with water during the dry summer period, some of the perennial tributaries of the River Jordan were dammed up in their lower or central course. The location of the dams that have been constructed so far are shown in Figure 1. The water of these dams is conducted into irrigation channels, the largest of which is the East Ghor Canal. As a consequence of these measures the lower courses of some wadis dry up completely, as Wadi Shuᶜaib and Wadi Rağib, others like Nahr az-Zarqa, Wadi Yabis and Wadi Ku-

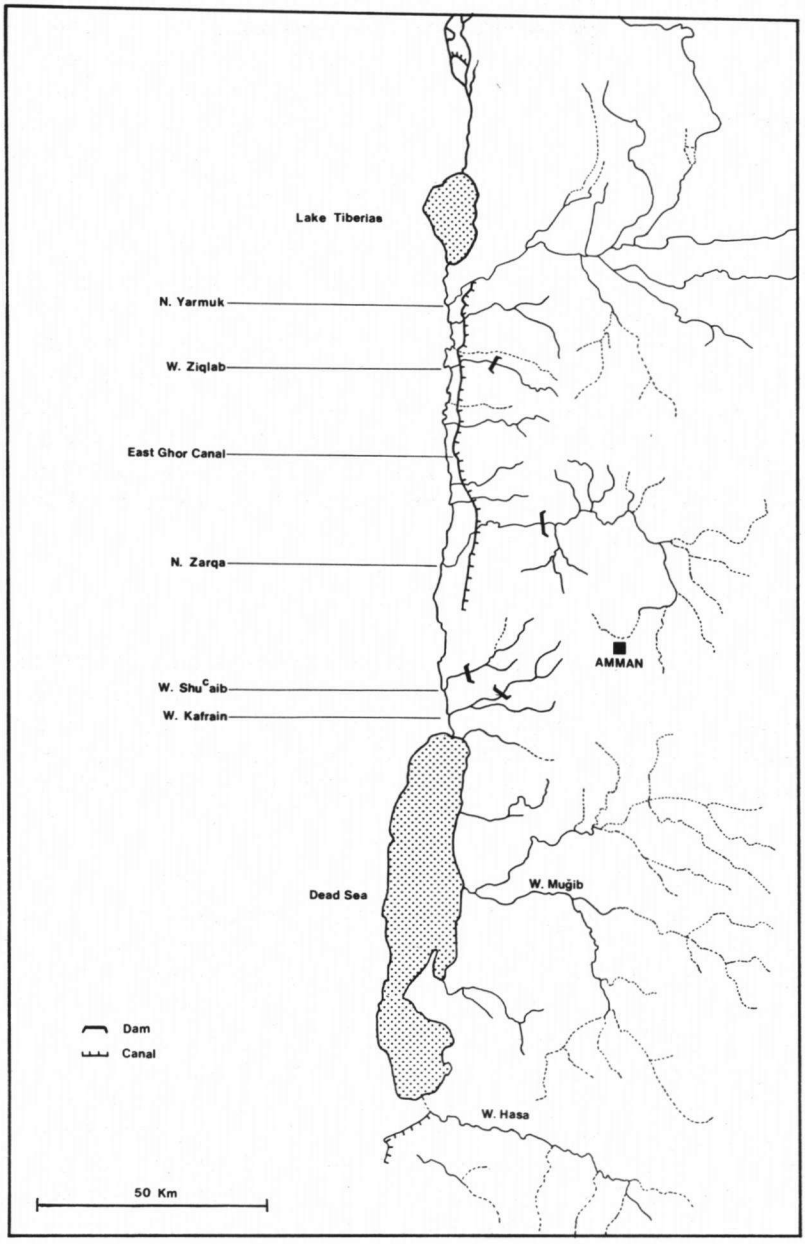

Fig. 1. The East Ghor Canal and dams in the Jordan Valley.

frainiya only persist as streamlets.

The situation is aggravated by a permanent increase in population. The foundation of new settlements results in an increasing amount of waste water. Together with a decrease of water level the absolute amount of water wasted increases steeply.

The results of our collections at the above mentioned localities are shown in Figure 2.

DISCUSSION

The changes described above are not without influence on the composition of the freshwater fauna. The lowering of the water level in the wadis leads to the destruction of the river bank vegetation, and the habitats of dragonflies with endophytic oviposition are thereby destroyed. One should also note that what is called a 'perennial river' in this region is often only a rivulet which can dry up completely in years of extreme drought. During such dry periods the populations of many zygopterous species may break down completely when no waterpools remain. Recolonization from the River Jordan can almost be excluded, especially in the case of those wadis whose lower courses are dried up as a consequence of the construction of dams. All this leads to an impoverishment in the composition of the dragonfly fauna.

Consequently only very few dragonfly species are to be found along the course of the canal; the ubiquitous *Brachythemis leucosticta* (Burmeister, 1839), some *Orthetrum* species, and the universal *Ischnura elegans* (Vander Linden, 1820) as well as *Platycnemis dealbata* (Selys, 1863) (Fig. 2).

B. leucosticta and *Crocothemis erythraea* (Brullé, 1842) are the only species which were recorded in the artificial lacustrine environment created by the King Talal Dam. The shores of this lake are bare of any vegetation. The sea itself is on a very low level of ecological succession. The zoobenthic community mainly consists of the snail *Bulinus* sp. WITENBERG & SALITERNIK (1957) report that larvae of *Crocothemis* sp. (probably *C. erythraea)* feed on *Bulinus* snails.

Only Wadi Yabis and Wadi Kafrain show a larger variety of species which is due to a higher diversity in habitats. For W. Kafrain the construction of a dam did not have the severe consequences as for example for W. Shuᶜaib. In addition to a permanent outflow from the storage lake a number of springs below the dam supply the lower course of the river with water.

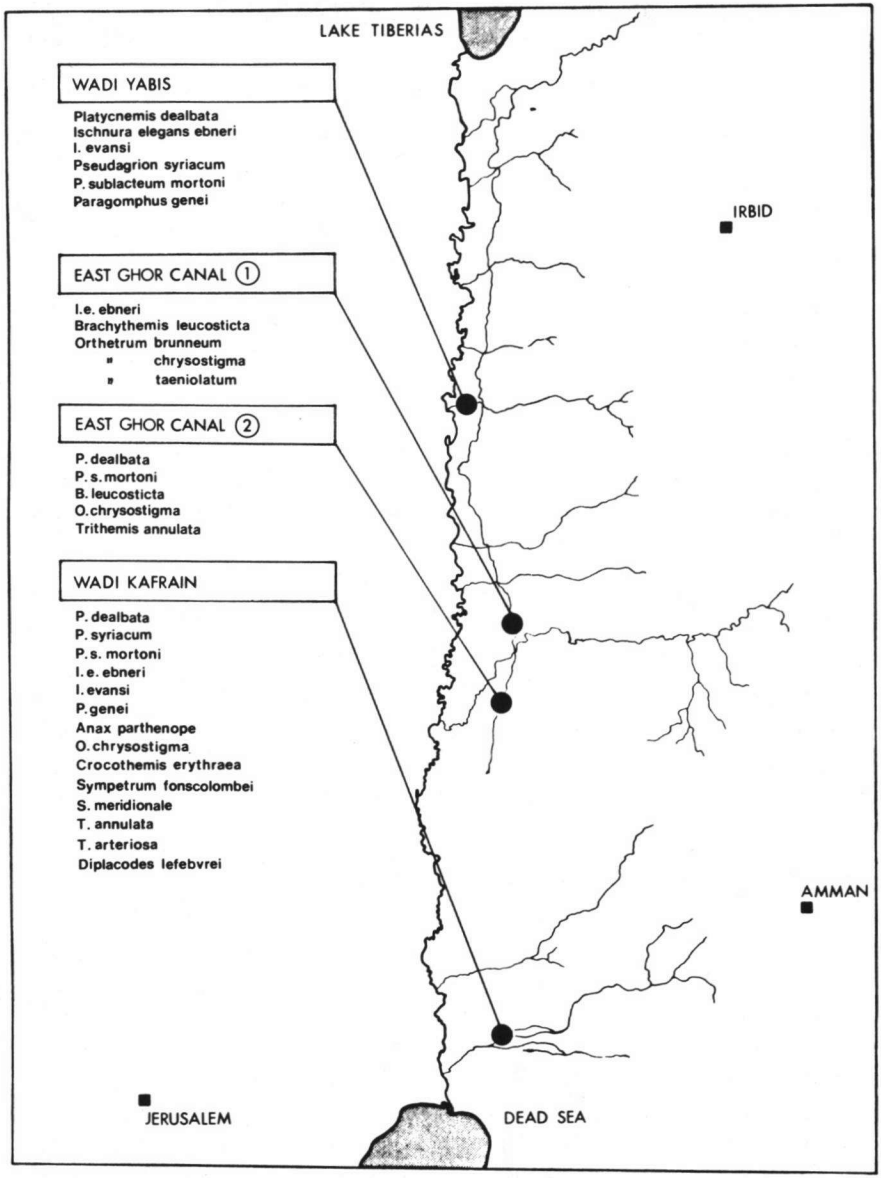

Fig. 2. Listing of the dragonfly species of four typical collecting stations in the Jordan Valley.

Despite the fact that some wadis still show a certain diversity in their dragonfly fauna, several species, reported for Palestine and the Jordan drainage area by earlier investigators like MORTON (1924) and SCHMIDT (1938), were not found any more. The same is true for the Transjordan side of the Dead Sea drainage.

The Zygoptera seem to be specially endangered. Despite intensive search not a single specimen of *Calopteryx syriaca* Rambur, 1812 was found. Only a small population was seen in Muzairib, one of the headwaters of the Yarmouk River, already on Syrian territory. In 1918 SCHWABEL collected a number of specimens, now in the Ris collection, from wadis around the Dead Sea.

In 1981 only two individuals of *Epallage fatime* Charp., 1840 which had formerly been recorded in all parts of the Jordan Valley were collected in W. Karak.

Among the Coenagrionidae *Coenagrion puella syriaca* (Morton, 1924), *Coenagrion lindeni zernyi* (Schmidt, 1938) and *Agriocnemis sania* Nielsen, 1959 are missing. DUMONT (1974) reports that the latter is still fairly abundant in Israel. As far as the two endemic species of *Pseudagrion* which occur on the eastern tributaries to the River Jordan are concerned, the survival of *P. syriacum* Selys, 1887, is endangered. In contrast to *P. sublacteum mortoni* Schmidt, 1938, this species needs slow flowing waters which must show a strong and shady vegetation. It seems that *P. sublacteum mortoni* is more likely to adapt to different ecological conditions. The latter was recorded at almost all collecting stations though often in small numbers of individuals.

In this paper nothing can be said about the situation in Israel, the West Bank and the River Jordan itself. Nevertheless since the exploitation of freshwater resources is even more intensive and sophisticated in Israel, the situation may be very similar. Since the drainage of the swampy Hula region (north of Lake Tiberias) in the early 1950s an important and unique dragonfly refuge has been destroyed. According to DUMONT (1972, 1975), the libellulids *Brachythemis fuscopalliata* (Selys, 1887) and *Rhyothemis semihyalina syriaca* Selys, 1850, must be considered as eradicated in this region. This seems to be true for the whole Jordan Valley. Dumont has also described a new dragonfly taxon, *Urothemis edwardsi hulae* Dumont, 1975, after it had become extinct.

From the anthropological and historical point of view the rift valley has proved a rather disuniting element. Characteristically the scarce freshwater resources have caused many of the historical conflicts. From the biological and biogeographical point of view this is

not true: The Levant, especially the Jordan Valley, is a transition area, a nodal point of three faunal regions, namely the palaearctic, the ethiopian and the oriental region. Out of this variety, due to its unique geological and climatical conditions, it has developed a number of characteristic faunal elements that are to be found nowhere else. Only the implementation of protection measures in the near future will save a number of endemic dragonfly species from complete eradication.

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