
(1990) 3 (3) : 95-117

AQUATIC INVERTEBRATE FAUNA OF AN UPLAND RESERVOIR SYSTEM, CO—WICKLOW, IRELAND

J. J. Bracken* and Hussain A. M. Dauod**

* Department of Zoology, University College- Dublin, Belfield, Dublin 4, Ireland.

** Department of Biology, Education College (Ibn AL-Halitham), Adhamia, Baghdad, Iraq

ABSTRACT

Littoral and benthic invertebrates from Roundwood Reservoir System were sampled. Oligochaetes and molluscs were the dominant organisms in the littoral and benthic areas. Trichopterans and chironomids were the most abundant insect groups. Scuba diving samples reinforced that view. Other groups of macroinvertebrates were poorly represented.

Vertical and horizontal hauls of zooplankton revealed that there were twelve species of zooplankton present. Daphnia hyalina Leydig and Bosmina coregoni Baird were the two dominant species.

INTRODUCTION

In recent years catches of brown trout, Salmo trutta L., taken on rod and line in the Roundwood System Co—Wicklow, have shown a marked decline, which caused anxiety among anglers who have fished these waters for fifty years. The system is composed of two man-made impoundments known locally as the North and South lakes. They are subjected annually to marked water level fluctuations which lead to a detrimental affects on aquatic plants and animals (Hynes, 1961; Grimas 1962, 1964, 1965 a, b, c; Hunt and Jones 1972, Kaster and Jacobi 1978. inter alia) in most cases the littoral fauna suffer the inshore habitats and causes many problems for the aquatic organisms. Some species can adapt to the changes and survive but many are unable to adjust and perish. Over period of the time physical
Aquatic invertebrate fauna in Roundwood Reservoir changes in the nature of substratum may also occur which in turn affect the macrovegetation. New species may dominate the faunal communities.

The present paper reports part of an extensive study which has been carried out in an attempt to explain the poor catches (Dauod, 1985).

One of the major drawbacks with the current investigation was the almost complete lack of scientific data prior to 1982. It is not possible to say how much damage has been caused to the flora and fauna by the fluctuating water levels, nor is it possible to surmise whether or not community structures have altered.

MATERIALS AND METHODS

The Study Area

The Roundwood Reservoir System is composed of two reservoirs which lie approximately 200 m above sea level. These are known as the North and South lakes and their location is indicated in Fig. (1). The South lake, which is larger of the two (surface area: 165.52 ha), was constructed in 1866. Increased demand led to the construction if the North lake (surface area: 122.62 ha) which came into operation in 1922. The physical parameters of each are listed in Table (1). Water level fluctuations for the period June 1982 to December 1984 are given in Fig (2).

The geology of the area is Middle Cambrian Rock underlying a granite based boulder clay Fig (3). The annual average precipitation for the 1951—1980 period was 1216 mm (Figures supplied by Metereological Service). December shows the highest average rainfall at 148 mm. while the lowest values occur in June at 63mm.

Five species of fish occur in the system, brown trout, Salmo trutta L., minnow, Phoxinus phoxinus (L.), three-spined stickleback, Gasterosteus aculeatus L., stone loach, Nemacheilus berbatula (L.) and eel Anguilla anguilla (L.).

The dominant aquatic macrophytes in both lakes were Elodea, palustris R. and S., Ranunculus flammula L., Polygonum amphibium L., Littorella uniflora Asch., Mentha aquatica L., Hydrocotyle vulgaris L., Utricularis intermedia Hayne and Ranunculus sp.

Analysis of Invertebrates Populations
Table (1) Physical parameters of the North and South lakes, Roundwood, Co. Wicklow

<table>
<thead>
<tr>
<th>Parameter</th>
<th>North Lake</th>
<th>South Lake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Volume (m³)</td>
<td>5,632,494</td>
<td>11,283,172</td>
</tr>
<tr>
<td>Maximum Depth (m)</td>
<td>13.41</td>
<td>18.59</td>
</tr>
<tr>
<td>Maximum Length (km)</td>
<td>2.82</td>
<td>2.42</td>
</tr>
<tr>
<td>Maximum Width (km)</td>
<td>0.49</td>
<td>0.60</td>
</tr>
<tr>
<td>Area (hectares)</td>
<td>122.62</td>
<td>165.52</td>
</tr>
<tr>
<td>Tropic Status</td>
<td>Oligotrophic</td>
<td>Oligotrophic</td>
</tr>
<tr>
<td>PH</td>
<td>6.4—7.6</td>
<td>6.4—7.6</td>
</tr>
<tr>
<td>Conductivity (mhos)</td>
<td>69—114</td>
<td>69—114</td>
</tr>
<tr>
<td>Height a.s.L. (m)</td>
<td>226.77</td>
<td>213.36</td>
</tr>
</tbody>
</table>
Aquatic invertebrate fauna in Roundwood Reservoir

Littoral samples were collected from September 1982 to September 1985. In the North lake low water levels made it impossible to take littoral samples during September 1984. A surber sampler (0.0625 m²) was used to collect these samples from five stations in the North lake and four in the South lake. A range of station types was selected to cover the different types of habitat available. Four replicate samples were taken at each. The range included (i) macrophytic vegetation, (ii) a mixture of sand, gravel and stone substrate, (iii) mud and (iv) stones only. All material was preserved in 5% formalin in the field.

Benthic macroinvertebrates were also sampled on the same period using an Eckmann grab (0.02 m²). Four stations were selected: (i) in the deepest sector of each reservoir, (ii) close to the dam walls, (iii) approximately at the centre of the widest transect and (iv) in the shallow inshore bays. Six replicates were taken at each station.

Scuba diving was made to investigate the distribution of the dominant species of macroinvertebrates in the littoral and sub-littoral regions of the North lake.

Finally, samples of zooplankton were collected at four stations in each reservoir using plankton nets (mesh- 0.515 mm). Vertical and horizontal hauls were taken during June and September 1983 and 1984.

RESULTS

(A.) Littoral and Benthic Samples

In the present study, an attempt was made to describe the fauna of the Roundwood Reservoir (North and South lakes) and to indicate the relative importance of the component taxa. The littoral fauna of the South lake was richer than the North lake. Molluscs, oligochaetes and chironomid larvae were the most abundant groups in both lakes. In the case of the benthic fauna, the North lake samples showed the greatest diversity.

A total of 35 littoral species were recorded for each lake and 34 species were common to both lakes. On the other hand a total of 35 (North lake) and 30 (South lake) benthic species were recorded. A list of species is presented in Table (2).
J. J. Bracken and Hussain A. M. Dauod

(a.) Tricladida

Few specimens of Polycelis nigra (Müller) were recorded from the littoral samples in the South lake during September 1982 and 1983.

(b.) Mollusca

This group was dominant in both littoral and benthic samples. Eight species were recorded from lakes, Potamopyrgus jenkinsi Smith, Lymnaea peregra Müller and Sparium corneum L. were the most abundant species, particularly in the benthic area. Lymnaea peregra occurred irregularly in the benthic zone. These four species represented about 80% of the molluscs.

(c.) Oligochaeta

Oligochaetes were another abundant group of macroinvertebrates in the littoral and benthic areas of both lakes. Seven species of oligochaetes were found. Two species belonging to the family lumbriculidae, Lumbriculus variegatus (Müll) and Stylodrillus heringianus Clap. were dominant particularly in the littoral area. Immature tubificidae were also abundant, especially in the littoral samples.

(d.) Hirudinea

This group included two species, Glossiphonia complanata (L.) and Helobdella stagnalis (L.). Both of them were rarely taken in either lake.

(e.) Isopoda

Asellus meridianus Racovitza was rare and the only Isopod species recorded from Roundwood. It was found sporadically in the littoral and benthic areas of the South lake. It was only present in the littoral area of the North lake.

(f.) Amphipoda

Gammarus duebeni Lilj was common in the littoral samples of the South lake but appeared to be scarer in the North lake.

(g.) Ephemeroptera

Six species of ephemeropteran nymphs were recorded from the North lake and four species from the South lake. Caenis spp. were
Aquatic invertebrate fauna in Roundwood Reservoir

ae dominant species, *Bactis rhodani* Pict and *Leptophlebia vespertina* L. were rarely recorded in the North lake.

(h.) Trichoptera

This is probably the most abundant insect group available at Roundwood. Ten species of larvae were recorded at both lakes, most of which were littoral species. *Limnephilus vittatus* Fbr. was the dominant species. Since the main emergence period for *L. vittatus* is June most of them were on the wing when the sampling programme was carried out. *Mystacides* spp. were recorded from both lakes after the emergence of the *L. vittatus* especially in the South lake. The latter species occurred irregularly in the benthic samples.

*L. vittatus* and *L. lunatus* were the only trichopteran pupae recorded from the littoral samples.

(i.) Chaoboridae

*Chaoborus* sp. was recorded in reasonable numbers in the deepest sector of each lake.

(j.) Chironomidae

Chironomid larvae represented one of the most important groups in the fauna of both lakes. More species were recorded from benthic areas of both lakes. The most abundant species were *Procladius* sp., *Orthocladius* sp., *Endochironomus* sp., and *Microtendipes* sp.

The most abundant adult insect species belonged to the Coleoptera *Galerucella nymphaeae* (L.) which was found in relatively good numbers on *Polygonum amphibium* L. Two Hemipteran species *Corixa lateralis* jLeachi and *Notoneota glauca* Linn. were also common-

(B.) Scuba Diving

The cinnamon Sedge *Limnephilus vittatus* Fbr. was the most abundant food organism found in the guts of the brown trout, minnow and three-spined stickleback at Roundwood Reservoir. In addition, *Potamopyrgus jenkinsi* Smith and *Endochironomus* sp. larvae were also dominant in the gut of the above fish species. The distribution of these species was examined by Scuba diving through
J. J. Bracken and Hussain A. M. Dauod

...the littoral and sub-littoral regions of the North lake. The data reveal that *L. vittatus* was present in large numbers only at the mud interface. It was totally absent from the weed. High numbers occurred at depth 6—7 m (10—20 per m²) but they were absent from 9 m onwards. The numbers tapered off with depth. Low numbers of *L. vittatus* occurred on the gravel and stones (2—10 Per m) but the numbers of *P. jenkinsi* were quite high (> 50 Per m²). Similar results were obtained from the littoral samples where over 70% of molluscs were *P. jenkinsi* & *S. corneum*. *L. vittatus* accounted for more than 80% of the trichopteran larvae and *nachromonomus* sp. and *Orthocladius* sp. made up 70% of the littoral chironomids.

(C.) Zooplankton

Qualitative analysis of the zooplankton samples reveal that twelve species of zooplankton were recorded from the lakes. These are listed in Table (3). All twelve species were found in the North lake, but only eight species occurred in the South lake. The most abundant species in the community were *Daphnia hottingera* Leydig and *Bosmina coregoni* Baird. They made up 52% and 21% respectively of the plankton present. Copepods were less important but the most abundant species was *Diaptomus gracilis* Sars which represented 9.95%.

**DISCUSSION**

The present study on the invertebrates fauna in the Roundwood Reservoir System is a part of an extensive study which has been undertaken to examine the reasons which lead to a marked decline in the number of brown trout present.

The system is subject to the severe water level fluctuations which occur annually in both reservoirs. These fluctuations adversely affect the productivity of invertebrates. Much has been written on this topic. Rawson (1958), Grimas (1961), Hynes (1961), Fillion (1967) Hunt and Jones (1972) and Miller and Paetz (1972) have commented on major changes in the community structure of the littoral and benthic fauna resulting from such fluctuations. The severity of the damage depends on the morphology of the lake basin. Small changes in water level may sometimes uncover large stretches of the littoral zone.
Aquatic invertebrate fauna in Roundwood Reservoir

This in turn causes extensive damage to the macrophytes thus reducing the amount of available habitat for the aquatic organisms. Many species, such as *Gammarus* and *Asellus* become rare or disappear, while there is an increase in the relative abundance of some chironomid larvae, oligochaetes and nematodes (Hynes 1961, Grimas 1965c and Hunt and Jones 1972). The fauna of the Roundwood System conformed to the pattern expected when such fluctuations occur. *Gammarus*, *Asellus*, flatworms and some types of chironomid larvae rare, while populations of some trichoptera, especially *L. vittatus*, molluscs, oligochaetes and other chironomids larvae flourished.

During 1983 and 1984 most stretches of the inshore areas of the Roundwood lakes were uncovered causing widespread damage to the already poor, oligotrophic fauna.

Related factors, including Physio-chemical and biological interaction, food availability, the presence or absence of predators and competitors also affect different groups or species. The paucity of flatworms and leeches in Roundwood reservoirs for example, may be largely attributed to the low calcium concentrations coupled with the humic environment (Mann, 1955; Reynoldson, 1958 a, b; Tucker, 1958; Reynoldson and Davies, 1970 a, b). Sutcliffe (1967) suggests that *Gammarus duebeni* is unable to colonise the Wicklow area encompassing Roundwood reservoirs owing to the low sodium content.

Ephemeropteran eggs and nymphs are vulnerable to predation by carnivores, omnivores and even herbivores (Macan, 1965, 1970 and Macan and Maudsley, 1968, 1969). Presumably because many of these predators (e. g. triclad, *Asellus* and *Gammarus* are either absent or scarce in both reservoirs, several species of mayfly have successfully colonised them.

Differences in the species composition of many groups must be due to their mode of colonisation. The distribution of water mites and leech (*Theromyzon tessulatum* (Müllar)) for instance is largely dependent on their methods of dispersal (Macan, 1974 and McCarthy, 1975). In Roundwood reservoirs a similar argument applies to the leeches (*Glossiphonia complanata* (L.) and *Helobdella stagnalis* (L.)).

Summarising a research carried out on European lakes, Macan (1974) suggests that insects are more abundant than non-insects in unproductive
ACKNOWLEDGMENTS

The authors are indebted to Dr. J. P. O'Connor, National Museum of Ireland, for confirming many of our identifications. We would also like to thank most sincerely, Mr. R. Ridgeon, Chairman of the Wicklow Anglers, whose enthusiasm, cooperation and assistance made our task so much easier. Special word of thanks to Dr. M. A. Al-Achami who read the manuscript.

LITERATURE CITED


Aquatic invertebrate fauna in Roundwood Reservoir


Rawson, D. S. 1958. Indices to lake productivity and their significance in predicting conditions in reservoirs and lakes with disturbed water levels. Investigation of fish power problems (H. R. MacMillan Lectures in fisheries.) University of British Columbia, pp. 27–42.
J. J. Bracken and Hussain A. M. Dauod


لافيقاريات المائية في خزان روندودود (Roundwood Reservoir) في منطقة وكلو (Co. Wicklow)

ج. حسن عبدالمتمم داود، و حسن. ج. بريك، قسم الحيوان، جامعة دبلن، قسم علوم الحياة – كلية التربية (إبن الهينم) - بغداد

تُعتبر الدراسة الحالية محاولة للتعرف على لافيقاريات المائية في خزان روندودود (Roundwood Reservoir) وهي جزء من دراسة موسمية كان الغرض منها التعرف على الأسباب التي أدت إلى تفاصيل واضح في إعداد أسماك النراوت (Salmo trutta L.) في الخزان والإنهيار أو الجداول المغذية.

تمت الدراسة ما يلي:

1. اخذ عينات من قياع المناطق الضحلة والعميقة من البحر الأصطناعي في روندودود، وتمت تحليل الأحياء السائدة في كل المنطقة الضحلة والعميقة (Mollusca) بتحليل الأهلاب والمواد (Trichoptera) وتوزيع الأحياء السائدة.

2. جمع الحشرات السائدة في كل البيئات المائية والجبلي، وتمت الدراسة التي اجريت عن طريق الفحص هذه النتيجة، وكانت الأحياء الأخرى من لافيقاريات قليلة.

3. فحص عينات للهئيات الحيوانية جمعت أفقية وعموديا وقد اشار الفحص إلى وجود اثنتي عشر نوعاً من الهئيات الحيوائية، وكانت ترتبط ببعض الماء، لبسمينا corigoni Baird Daphnia hyalina Leydig.
Figure 1. Roundwood Reservoir showing sampling stations.
- Benthic and Planktonic sampling sites
- Littoral sampling sites

Figure 2. Water level fluctuations for the period June 1982 to December 1984.
Figure 3. Geological map of the study area.
Table 3: Percentage of the zooplankton of the North and South Lakes, Roundwood Reservoir

<table>
<thead>
<tr>
<th>Taxa</th>
<th>North Lake</th>
<th>South Lake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cladocera</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acroperus angustatus Sars</td>
<td>-</td>
<td>1.111</td>
</tr>
<tr>
<td>Alona quadrangularis (O.F. Müller)</td>
<td>-</td>
<td>0.555</td>
</tr>
<tr>
<td>Alona affinis (Leydig)</td>
<td>0.611</td>
<td>2.033</td>
</tr>
<tr>
<td>Alona guttata Sars</td>
<td>-</td>
<td>1.111</td>
</tr>
<tr>
<td>Alona intermedia Sars</td>
<td>0.917</td>
<td>0.555</td>
</tr>
<tr>
<td>Alonella nana (Baird)</td>
<td>-</td>
<td>1.016</td>
</tr>
<tr>
<td>Daphnia hyalina Leydig</td>
<td>51.907</td>
<td>50.333</td>
</tr>
<tr>
<td>Copepoda</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyclops vicinus Uljanin</td>
<td>4.992</td>
<td>4.444</td>
</tr>
<tr>
<td>Cyclops minutus (CTaue)</td>
<td>2.446</td>
<td>3.888</td>
</tr>
</tbody>
</table>

117