Food and Feeding Relations of Three Species of Triturus (Amphibia Urodela) during the Aquatic Phases

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Food and feeding relations of three species of Triturus (Amphibia Urodela) during the aquatic phases

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1. Introduction

Three species of newts (Urodela) are found in the British Isles. They are the large crested newt *Triturus cristatus* (Laurenti), the smaller palmate newt *T. helveticus* (Razoumowsky), and the smooth newt *T. vulgaris* (L.). The females of the two latter are very similar, but the males have distinctive patterns associated with courtship display. All three species are known to feed on a wide range of invertebrates both in the water and on land (Smith 1964) but there has been no detailed study of their feeding habits. The present work was undertaken to determine whether there are any differences in the diets of the three species when they co-exist in the same ponds, and records the food found in the stomachs of 525 adult newts and tadpoles caught in two different ponds in the West of England.

2. Methods

Adult newts and tadpoles were caught at both ponds by handnetting. Pond 1 is at an altitude of 30 m in the village of Evercreech, and supports populations of all three newt species during the breeding season from March to July. All the specimens used in this study were caught in April.

Pond 2 is an upland pond at an altitude of 270 m near Priddy on the Mendip Hills. It supports populations of *T. helveticus* and *T. vulgaris*, but not *T. cristatus*. Newts were found in this pond throughout the year. It was not possible to distinguish the tadpoles of *T. helveticus* and *T. vulgaris*: the criteria given by Mertens (1960) did not give adequate differentiation.

All newts were chloroformed within six hours of capture and stored in deepfreeze. They were thawed out later and measured, weighed and dissected. Invertebrates in the stomach of each newt were counted and identified. Many of these food items were fragmented, so no attempt could be made to make identifications to the specific level, or to assess the weight or volume of different food categories.

In order to compare the stomach contents with the availability of food in the habitat, the proportional abundance of different invertebrates present in pond 2 was estimated in July by making eight sweeps, 1 m in length, with a net having an opening 225 cm^2: care was taken that at each sweep the debris at the bottom of the pond was sampled to a depth of about 3 cm. The contents of the net after each sweep were emptied into a white dish and the total numbers of each invertebrate group were counted.

Pond 2 also contained a population of sticklebacks *Gasterosteus aculeatus* L., and a sample of 20 was caught in July to compare their food with that of the newts.

3. Stomach contents

The mean numbers of invertebrates of different groups found in stomachs of newts from pond 1 in April and of newts from pond 2 throughout the year, are shown in Tab. 1. The same

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Tab. 1. Mean numbers of invertebrates of various kinds found in newt stomachs.

	Number examined	Diptera larvae & pupae	Copepoda	Cladocera	Ostracoda	*Asellus*	Gastropoda	Ephemeroptera nymphs	Odonata nymphs	Coleoptera larvae	Hemiptera	Coleoptera	Oligochaeta	Trichoptera larvae	Lamellibranchia	Hydrachnellae	Newt egg	Cestode *Schistocephalus*
Pond 1 (April)																		
T. cristatus adults..........	16	5.3	1.4	0.6	2.5	9.1	7.0	0.4	0.2	0.1	–	–	–	–	–	–	0.1	–
T. helveticus adults.........	29	6.0	0.4	0.4	1.8	1.1	0.1	0.2	0.1	0.1	–	–	–	0.1	–	–	–	–
T. vulgaris adults	32	10.2	0.4	0.1	1.8	0.7	1.5	0.3	0.1	0.3	0.3	0.1	–	–	–	–	–	–
T. cristatus tadpoles........	5	5.0	3.0	–	11.0	0.3	0.7	–	–	–	–	–	–	–	–	–	–	–
T. helveticus/vulgaris tadpoles	31	3.1	2.3	1.2	5.0	0.2	0.1	0.2	–	–	–	–	–	–	–	–	–	–
Pond 2 (Throughout the year)																		
T. helveticus adults.........	144	0.6	0.4	0.1	0.3	0.3	0.1	0.1	0.2	–	0.1	0.1	0.1	0.1	–	–	0.1	0.1
T. vulgaris adults	53	0.9	0.5	0.4	0.2	0.3	–	–	0.1	0.1	0.1	–	–	–	–	0.1	–	–
T. helveticus/vulgaris tadpoles	215	0.7	1.3	5.3	0.5	0.1	0.1	0.1	–	–	0.1	–	0.1	–	–	–	–	–

kinds of food were eaten by all three species. The larvae and pupae of Diptera Nematocera (mainly Chironomidae) were numerically the most important items, followed by Copepoda, Cladocera, *Asellus*, Ostracoda and Gastropoda. Eleven other categories of food were recorded but were found in only small numbers.

In both ponds the diets of *T. helveticus* and *T. vulgaris* were identical; means for each category of food were not significantly different when tested by Student's *t* test ($P < 0.05$). Larvae of Chironomidae formed a higher proportion of the diet in pond 1 than in pond 2. The larger *T. cristatus* in pond 1 took more of the larger kinds of food, eating significantly more *Asellus* and Gastropoda ($P < 0.001$ in both cases). Tadpoles ate more of the smaller kinds of food: in pond 1 the tadpoles of *T. cristatus* and *T. helveticus/vulgaris* ate significantly more Copepoda and Ostracoda than the adults, and fewer *Asellus* and Gastropoda ($P < 0.05$ in all cases). A similar tendency was seen in pond 2, where the tadpoles of *T. helveticus/vulgaris* ate more Copepoda and Cladocera ($P < 0.001$), and fewer *Asellus* ($P < 0.05$) than the adults.

4. Selection of food by newts and sticklebacks

The composition of the invertebrate fauna of pond 2 in July is shown in Fig. 1 A; Copepoda

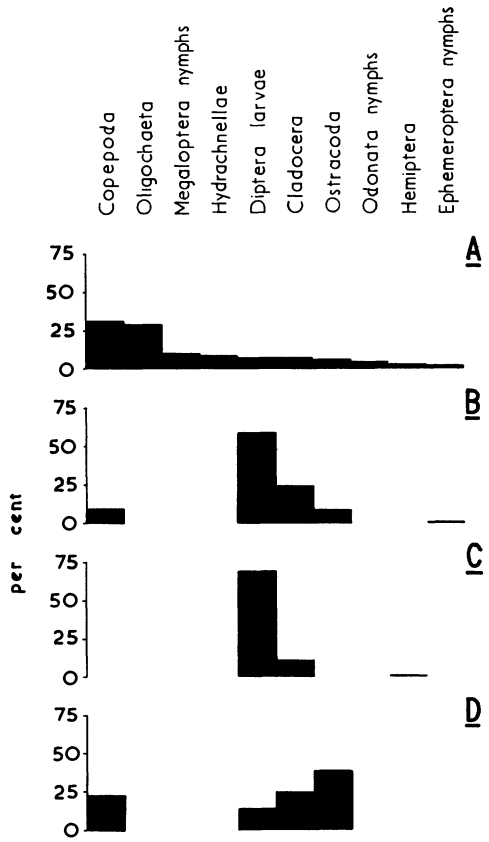

Fig. 1. The kinds of invertebrates found in pond 2 in July (A), together with the kinds of food found in stomachs of sticklebacks *Gasterosteus aculeatus* (B), adult *T. helveticus* (C) and tadpoles of *T. helveticus/vulgaris* (D) caught in the pond in the same month. All are expressed as percentages of the total numbers found.

and Oligochaeta were the most abundant organisms, both comprising more than 25% of the invertebrates captured. Sticklebacks and adult *T. helveticus*, which fed mainly on larvae of Diptera (Fig. 1 B, C) and tadpoles of *T. helveticus/vulgaris* which fed mainly on small Crustacea (Fig. 1 D), were clearly exercising a choice in their selection of food from the invertebrates available in the pond.

5. Discussion

The results of this study show that the newts feed on a wide range of invertebrates whilst they are in the water, but that there is some selection of the food eaten. This is partly on the basis of its size, larger newts taking a bigger proportion of bigger organisms. Some kinds of invertebrates were not eaten at all, presumably because they are distasteful. Such animals included the nymphs of Megaloptera (*Sialis* spp.) and Hydrachnellae (Fig. 1.) Others, for example adult Corixidae, nymphs of Odonata and Oligochaeta, were eaten occasionally but not in proportion to their abundance in the habitat. Some of these may be distasteful, or they may be too large or too hard to be dealt with satisfactorily (e.g. large dragonfly nymphs), or they may be available for only part of the time (e.g. Oligochaeta, which are usually buried in the detritus at the bottom of the pond).

It is a commonly accepted principle that no two species of animals share the same ecological requirements. The similarity of the diets of adult *T. helveticus* and adult *T. vulgaris* does not refute this principle, since food is only one of the factors defining the ecological niches of the species. There is evidence for example that the temperature relations of the species are different, and it is known that *T. helveticus* is found at higher altitudes in mountain regions. There are also considerable differences in the courtship behaviour of the species (Smith 1964). Hynes (1950) has shown that the closely-related fishes *Gasterosteus aculeatus* and *Pygosteus pungitius* L. have similar diets but different breeding habits.

The feeding relations of newts during the aquatic phase are similar to those of unspecialised freshwater fishes, in which different species in the same area may also show considerable overlap in their diets (Hartley 1948, Maitland 1965). There may be competition at times between the different species of newts, and between newts and sticklebacks. The extent to which this may determine the distribution of the newt species is not known.

The presence of plerocercoid larvae of the cestode *Schistocephalus solidus* Creplin in three stomachs is interesting. The larvae were several times found free on the bottom at the Priddy pond, and in captivity a female *T. cristatus* was maintained in a healthy state for more than a month on an exclusive diet of living larvae of this cestode.

6. Acknowledgements

I am grateful to several of my colleagues for identifying fragments of invertebrates, and to Mr. D. J. Small, who showed me the pond at Evercreech.

7. Abstract

The food in the stomachs of 525 *Triturus cristatus*, *T. helveticus* and *T. vulgaris* caught at two different ponds is listed. The diets of adult *T. helveticus* and *T. vulgaris* were similar, and comprised mostly the larvae and pupae of Diptera Nematocera, although a wide range of other aquatic invertebrates was taken. Adult *T. cristatus* ate the same food, and in addition large numbers of *Asellus* and Gastropoda. The tadpoles of all three species fed mainly on small Crustacea. It was concluded that each group selected the food most appropriate to its size.

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