

## PALMATE NEWTS (*TRITURUS HELVETICUS*) ON THE ISLAND OF RHUM

R. V. COLLIER

*Nature Conservancy Council, Inverness IV2 4AG, UK*

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### ABSTRACT

Two populations of palmate newts were studied on the Island of Rhum in terms of biometrics, colour form, behaviour, predation and site characteristics. Measurements were compared with data from other workers in different parts of Britain.

### INTRODUCTION

The Island of Rhum is one of the larger islands (10,684 hectares) of the Inner Hebrides and lies fifteen miles due west of Mallaig in Invernessshire (Grid. Ref. NM 365980). It was recommended as a Nature Conservation Area by the Scottish Wildlife Conservation Committee in 1949 under Command 7814 which stated "isolated, yet within easy reach of the mainland, it would make an outstanding station for research and indeed is the most suitable island for this purpose in Scotland".

Rhum was acquired by the Nature Conservancy by purchase and declared a National Nature Reserve in 1957. Since then a considerable amount of habitat management, research and interpretation has taken place. On the research side many groups have been studied such as birds (Love 1980), Lepidoptera (Wormell 1962) and red deer (Clutton-Brock 1981). However very few observations have been carried out on newts (*Triturus* sp) and the Nature Conservancy Council's Handbook (1974) states:

"Palmate Newt (*Triturus helveticus*). Abundant, particularly in the northern half of the island. Very common in the breeding season in lochans and pools which do not contain trout. Found up to 2,200 ft on Hallival. Although the smooth newt (*T. vulgaris*) was reported on one occasion there has been no sign of its occurrence since, despite special search; a mis-identification is suspected."

The comment concerning the occurrence of smooth newts has been supported by further observation since 1974. The broad statement concerning the distribution of palmate newts and trout must be treated with caution. At Loch Sgaorishal, one of the sites covered by the present study, both brown trout (*Salmo trutta*) and palmate newts are common.

The island is ideal for newts with numerous water bodies exhibiting a wide range of characteristics. It is likely that most water bodies contain palmate newts and relative to the mainland there are few predators of even fewer species.

### METHODS

In the week beginning 12th July 1982 observations were carried out on two population of palmate newts, one at Loch Sgaorishal (Grid Ref. NG 349022) and the other at Harris Pool (Grid Ref. NM 340955). The sites were 7 kilometres apart and differed in altitude by 200 metres.

At the Harris Pool sampling of adults was carried out by surveying silt and/or macrophytes using a pond net. Others were caught by hand when individuals could be seen resting in the open. Larvae were taken solely by netting in silt or macrophytes. At Loch Sgaorishal most adults were sampled by catching individuals in the hand when stones were slowly overturned. A small sample were caught by hand when seeing newts resting on top of stones or by sweeping the sparse macrophytes with a net.

Lengths of the body and the tail were taken in adults and the weight recorded using a digital balance accurate to  $\pm 0.1$  g. Before weighing, each individual was placed on the grass for a short time to dispel body moisture. The belly pattern of each individual was recorded under three categories, namely without markings, with dots or blotches.

Particular site characteristics were noted including size of water body, pH, and altitude. Notes and observations were made of the behaviour patterns of the two populations.

### SITE CHARACTERISTICS

Loch Sgaorishal is set in a hollow on open moorland with some shelter from the surrounding topography. It lies at an altitude of 225 m and is 1,300 metres from the sea.

|                         |                                      |
|-------------------------|--------------------------------------|
| Maximum length:         | 400 metres                           |
| Maximum width:          | 210 metres                           |
| Maximum depth of water: | unknown, exceeds 2 metres            |
| Maximum depth of silt:  | unknown, at margins less than 15 cms |

pH: 5.5

Most margins are stony with small angular stones <15.0 cm across overlain by larger stones generally <35.0 cm across. Occasional margins of silt are present with very few of the smaller type angular stones.

Vegetation: macrophytes are infrequent with large areas devoid of plants.

|                                   |              |
|-----------------------------------|--------------|
| <i>Lobelia dortmana</i>           | — occasional |
| <i>Sparganium angustifolium</i>   | — rare       |
| <i>Myriophyllum alterniflorum</i> | — occasional |
| <i>Potamogeton natans</i>         | — rare       |

A very small inlet at one end of the loch has an abundance of *Potamogeton natans* and *Nymphaea alba*.

Harris Pool is set in grassland immediately behind a storm beach at the lower end of Glen Harris. It lies at an altitude of 75 ft and is 200 metres from the sea.

|                         |             |
|-------------------------|-------------|
| Maximum length:         | 96 metres   |
| Maximum width:          | 15.5 metres |
| Maximum depth of water: | 24 cms      |
| Maximum depth of silt:  | 39 cms      |
| pH:                     | 5.5         |

Silt is dominant but in a few areas well rounded stones less than 30.0 cms in diameter are scattered. The pool is frequently used by Highland cattle to drink from and wade out into to avoid flies.

There is no doubt that at certain periods and times of the year the site is subjected to a certain amount of salinity. The author has seen westerly gales sending spray that drenches the site. However during the period of this study titration tests revealed no salinity. It would seem that water run off and precipitation counteracts salinity for most of the year.

Vegetation: macrophytes are frequent with scattered emergents covering about 50 per cent of the water surface. These include:

|                              |            |
|------------------------------|------------|
| <i>Juncus articulatus</i>    | — frequent |
| <i>Juncus effusus</i>        | — frequent |
| <i>Sparganium</i> sp         | — rare     |
| <i>Eleocharis acicularis</i> | — dominant |

Occasional floating and submergent species include *Ranunculus aquatilis*, *Menyanthes trifoliata*, *Carex acuta* and rare species are *Potamogeton acutifolius* and *Utricularia minor*.

## RESULTS

### SIZE AND COLOUR

Data on body length and tail length of males and females were compared between the two sites using the Mann-Whitney U test. There was no significant differences between the two data sets at the 95 per cent confidence limit. (See Table 1). Therefore the data were combined.

Data for total length of males and females were compared for each site, again using the Mann-Whitney U test. Males were significantly shorter in both cases at the 99.99 per cent confidence limit. In the case of Harris Pool, males weighed significantly less than females again at the 99.99 per cent confidence limit. (See Table 1)

|              | Loch Sgaorishal |         | Harris Pool |         |
|--------------|-----------------|---------|-------------|---------|
|              | Males           | Females | Males       | Females |
| Total length |                 |         |             |         |
| Mean         | 66.82           | 73.68   | 64.43       | 74.22   |
| S.D.         | ±3.93           | ±3.93   | ±4.92       | ±7.25   |
| Body Length  |                 |         |             |         |
| Mean         | 36.23           | 39.57   | 36.64       | 40.11   |
| S.D.         | ±1.79           | ±3.4    | ±1.93       | ±2.71   |
| Tail Length  |                 |         |             |         |
| Mean         | 30.64           | 34.04   | 27.86       | 34.80   |
| S.D.         | ±2.23           | ±3.67   | ±3.81       | ±3.62   |

TABLE 1: Newt sizes

Table 2 indicates the number of individuals under the three categories of belly pattern. Use of the  $\chi^2$  statistic revealed that there was no significant difference at the 95 per cent confidence level between the presence and absence of markings at the two sites. However, a similar analysis showed that the form of marking, i.e. whether dots or blotches was significantly different at the 98 per cent confidence level. The population at Loch Sgaorishal had a predominance of individuals with dots.

|                  | Pool       |        |
|------------------|------------|--------|
|                  | Sgaorishal | Harris |
| Without marking  | 10         | 16     |
| With dots        | 31         | 18     |
| With blotches    | 9          | 16     |
| Without markings | 10         | 16     |
| With marking     | 40         | 34     |

TABLE 2: Newt markings

### BEHAVIOUR PATTERNS

The two populations showed differing behaviour patterns that are probably related to differing habitats and predation levels.

#### (1) Adults

Loch Sgaorishal: Adult newts generally hid under larger stones overlying smaller stones. On disturbance they either swam quickly to the underside of other large stones or dived between smaller stones. Reaction was generally instantaneous and purposeful. A few individuals were seen in the open on top of larger stones but on disturbance these swam quickly under stones. Most individuals were solitary with two newts rarely found under the same stone.

Harris Pool: Far more adults seen in the open — up to 50 per cent of adults caught. Visible adults were normally resting on top of the fine silt, sometimes associated with macrophytes sometimes not. On disturbance they would dive into the silt and disappear from view. Generally this rapid movement was into silt at the base of macrophytes such as *Eleocharis acicularis* to seek shelter. If away from macrophytes however the newts would dive into the silt.

(2) Larvae

Loch Sgaorishal: Very few larvae were seen and all were under large or small stones.

Harris Pool: All the larvae were caught from silt and/or macrophytes by netting. Considerable numbers were seen and in optimum areas up to twenty individuals were taken with one sweep of the net.

On disturbance or handling the larva curled its body round in a similar behaviour pattern to *Zygoptera* nymphs and lay motionless for a short period.

PREDATION

Predators of palmate newts are generally numerous. Smith (1951) lists aquatic birds, snakes, fish, hedgehogs, stoats, weasels and rats. However, relatively few of these predators are present on Rhum. There are no snakes, hedgehogs, stoats or weasels. Brown rats (*Rattus norvegicus*) are present and birds include heron (*Ardea cinerea*) and red-throated diver (*Gavia stellata*). The brown trout (*Salmo trutta*) is common throughout the lochs on the island whilst the three-spined stickleback (*Gasterosteus aculeatus*) is very localised. The differing behaviour between the two populations may be related to the level and type of predation. Adult newts are much more obvious in the Harris Pool as they lie on the top of the silt. In this water body there are no brown trout or sticklebacks and no red-throated divers. At Loch Sgaorishal the

DISCUSSION

Boulenger (1894) gives the measurements of the palmate newts he found in Cornwall. Evans (1894) gives similar data for specimens collected around Edinburgh and Bell (1966) from Leicestershire sites. These data are compared with Rhum as shown in Table 3.

Creed (1964) considered that in adult newts, body length exceeds tail length, however Smith (1954) thought the opposite. Bell (1966) stated that for most adult newts in his Leicestershire sample the length of the body exceeded the length of the tail. From a sample of 38 females and 11 males the percentages were 98 per cent and 100 per cent respectively. This study found from the sample of 36 males and 64 females that all except one female had body length longer than tail. One individual had body and tail measurement the same.

Creed (1964) gives a short series of weights for palmate newts in the New Forest, males 1.5-2.1g and females 2.1-2.4g. Bell (1966) gives data from a larger sample (16 females and 20 males). The lightness of individuals and the percentage water problem is difficult to overcome accurately. However, Bell's figures are compared with Rhum (sample of 13 males and seven females) in Table 4.

|                              | Cornwall<br>(Boulenger 1894) |        | Edinburgh*<br>(Evans 1894) |        | Leicestershire<br>(Bell 1966) |        | Rhum |        |
|------------------------------|------------------------------|--------|----------------------------|--------|-------------------------------|--------|------|--------|
|                              | Male                         | Female | Male                       | Female | Male                          | Female | Male | Female |
| Total length (mm)            |                              |        |                            |        |                               |        |      |        |
| Maximum                      | 80                           | 85     | 83                         | 88     | 140                           | 90     | 76   | 87     |
| Mean                         | —                            | —      | 75.2                       | 79.7   | 69.3                          | 76.1   | 66   | 71     |
| Head and body<br>length (mm) |                              |        |                            |        |                               |        |      |        |
| Maximum                      | 36                           | 42     | 38                         | 43     | —                             | —      | 41   | 46     |
| Mean                         | —                            | —      | 35                         | 38     | —                             | —      | 36   | 39.8   |
| Tail length (mm)             |                              |        |                            |        |                               |        |      |        |
| Maximum                      | 44                           | 43     | 45                         | 45     | —                             | —      | 41   | 34     |
| Mean                         |                              |        | 40                         | 41     | —                             | —      | 30   | 33     |

\*Evans included caudal filament that can vary from 2-7 mm in adult males (Bell 1966).

TABLE 3: Newt Size Comparison

brown trout is frequent (at least up to 1 kg in weight) and red-throated divers are common. Herons occasionally visit both sites and brown rats are present.

*Odonata*, whose nymphs will feed on newt larvae, are present at both sites but to varying degrees of numbers and species. At Loch Sgaorishal the numbers and species are low with only two species of *Zygoptera*, namely *Enallagma cyathigerum* and *Pyrrosoma nymphula*. In contrast, at Harris Pool there are four species of *Zygoptera*, *Enallagma cyathigerum*, *Pyrrosoma nymphula*, *Lestes sponsa* and *Ishmura elegans* and also, three species of *Anisoptera*, *Sympetrum danae*, *Sympetrum nigrescens* and *Libellula quadrimaculata*.

At Loch Sgaorishal six adult newts were found dead under stones but no reason for death was established. The only limb/tail damage from the specimens handled was a small end section of a tail of one adult and similar damage of one larva.

|         |      | Leicestershire | Rhum |
|---------|------|----------------|------|
| Females | Mean | 3.7            | 2.0  |
|         | Max  | 5.5            | 2.5  |
|         | Min  | 2.0            | 1.5  |
| Males   | Mean | 2.2            | 1.4  |
|         | Max  | 3.5            | 1.7  |
|         | Min  | 1.0            | 1.1  |

Weights are in grammes

TABLE 4: Newt Weight Comparisons

## CONCLUSIONS

Comparable data on biometrics between populations of palmate newts in different parts of Britain indicate that the island populations of Rhum have a shorter mean total length than those found in Cornwall by Evans (1894) or in Leicestershire by Bell (1966). Males were shorter than females in the Rhum populations which is supported by Evans (1894) but the converse is true in Bell (1966). In 98 per cent of the total sample on Rhum the head and body length was longer than the tail length. This is supported by Creed (1964) and Bell (1966) but not by Smith (1954).

Bell's (1966) data indicate that males are heavier than females. The converse is true for those newts sampled on Rhum. However, values lie in the same range as those given by Creed (1964).

Colour and pattern of belly markings varied between the two sites on Rhum. Although the presence or absence of markings did not differ significantly the form of pattern was distinctive with three dominant groups.

The behaviour of newts differed between the two Rhum colonies and can be related to varying site characteristics and also possibly to predation levels. Predation is lower on Rhum than on mainland Britain in terms of numbers of predators and species.

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