

Trio and Stephens Islands: Home of the Tuatara

J. W. Dawson

THE Tuatara has attracted the interest of biologists throughout the world and it is partly with this ancient reptile and its bird companions and more particularly with its plant background that the present article is concerned.

The tuatara is not, strictly speaking, a lizard, but is the sole survivor of the grotesque dinosaur family which dominated the world millions of years ago. At one time this reptile occurred on the mainland of New Zealand but it did not survive settlement and is now found only in the security of a few coastal islands. It is found in greatest numbers on three specks of land within 50 miles of Wellington—the Brothers Islands near the entrance to Queen Charlotte Sound, the Trio Islands to the east of the much larger D'Urville Island, and Stephens Island off the latter's northernmost tip. For some years now Mr. W. H. Dawbin of the Zoology Department at Victoria University College has been taking parties to this area. At the present time these parties leave from Paremata in the launch "Regina", and if the weather is not too stormy they cross directly to the Trio Islands or Stephens Island. Most often the first landing is made at the Trio Islands, and as these still carry their natural vegetation they are of particular interest to a botanist.

The main island is roughly triangular in shape, about a quarter of a mile long, and about 300 feet high. The other two islands in the group are little more than large rocks standing to the north and south of the main island. A night spent on Middle Trio, as it is called, is not easily forgotten for as well as the tuataras, which are common, there are blue penguins and four types of petrel—mutton bird, dove petrel, diving petrel, and fluttering shearwater. From dusk, when the returning petrels plummet clumsily through the foliage, till dawn, the night-long clamour and activity is quite indescribable, with the kookaburra-calls of the fluttering shearwaters, the baby-like wails of the mutton birds and the cooing of the dove petrels merging into a confused uproar. All these birds and the tuatara live in burrows, a habit which results in a virtual absence of ground cover and a soil which yields to the tread like newly dug ground. It is difficult to understand how the forest replaces itself under such conditions.

On the more gradual slope above its coastal cliff the south-east side supports forest, whereas the north-east and north-west sides are scrub-covered. In its uppermost part the south-east forest consists almost entirely of *Olearia paniculata* which forms a close canopy at a height of 20 feet. An under-story is formed by

trees of *Suttonia australis*, five-finger (*Nothopanax arboreum*) and *Hymenanthera novae-zelandiae*. About 60 feet down the slope trees of mahoe (*Melicytus ramiflorus*), ngaio (*Myoporum laetum*) and taupata (*Coprosma repens*) begin to appear; on the lower parts mahoe becomes dominant, interspersed with olearia and scattered trees of ngaio and taupata. Bushy hymenantheras are found throughout and although much of their foliage is sub-canopy the upper branches frequently reach the full light. An interesting feature of this forest is the absence, or virtual absence, of many familiar coastal trees such as kohekohe (*Dysoxylum spectabile*), karaka (*Corynocarpus laevigata*) and *Paratrophis opaca*, each of which is represented for the most part by only a few slender saplings. Plants of *Macropiper excelsum* are also rare and they are usually slender and of no great age (two gnarled and shrubby individuals at the south fringe are an exception). Pigeonwood (*Hedycarya arborea*) appears to be absent. As already mentioned, there is virtually no ground-cover; only a few plants of the ferns *Asplenium lucidum* and *Polystichum richardi* and a few seedlings were seen. The cliff at the foot of the slope supports low-growing taupata and *Hymenanthera obovata*.

The south-west ridge possesses an interesting feature near the top—a grove of manuka (*Leptospermum scoparium*) through which olearia trees are scattered. The trees in the grove stand about 15 feet high and under them taupata, two to five feet high, has become established. This community is the last indication of a fire that occurred on the north-west cliffs in 1918. Further down the ridge the manuka gives way to densely branching bushes of hymenanthera which form a pure association thence to a point near the south end of the island. The south point itself is open and rocky, supporting such common coastal herbs as *Mesembryanthemum australe*, *Agropyron scabrum*, *Linum monogynum* and *Senecio lautus*. The introduced grass *Bromus catharticus* and a winged thistle are also common.

The vegetation pattern on the scrub-covered north-east and north-west slopes is rather uniform. Near the sea low-growing taupata forms a dark green fringe which grades into a hymenanthera-dominant region on the higher levels of each slope and on their common ridge. Growth habit in the hymenanthera community is both uniform and characteristic: from the base of each plant numerous slender stems arise, each bearing closely overlapping leaves. The general appearance of uniformity is such that it would be easy to assume that all plants belong to one species. A closer inspection, however, reveals differences in leaf-size and colour. On the basis of these characters it is possible to separate the plants into two main categories: (1) a form with yellow-green leaves averaging one and a half inches in length by three-quarters in breadth; and (2) a form with dark-green leaves averaging one inch by half an inch. By comparison with the sun leaves of *Hymenanthera novae-zelandiae* growing in the forest the first form is determined as an open-habitat form of that species; the second is

identifiable as *H. obovata*. The two species are intermingled at random and in view of their close similarity the occurrence of hybrids would not be surprising; a suite of specimens collected by Mr. Dawbin near the summit on the north-east cliffs has been identified as such by Dr. H. H. Allan. The occurrence of *H. novae-zelandiae* here is of interest in itself, for in Cheeseman's Manual it is recorded only from the Auckland province.

On the lower part of the ridge just considered, there is an area free from scrub where the following plants have been observed: *Solanum ariculare*, *S. nigrum*, *Haloragis erecta*, *Muehlenbeckia complexa*, *Linum monogynum* and the scrambling *Tetragonia trigyna*. The ridge ends in a moderately high, triangular peninsula—virtually an island—which supports a mosaic of scrub and herbaceous vegetation. The scrub consists of taupata and hymenanthera as before, as well as patches of ngaio. The herbaceous vegetation includes *Phormium colensoi*, *Agropyron scabrum*, *Linum monogynum*, *Salicornia australis*, *Mesembryanthemum australe*, *Clematis colensoi*, *Tetragonia trigyna*, *Senecio lautus* and two plants of the prostrate, small-leaved *Hymenanthera crassifolia*.

Of the two smaller islands in the group, I have landed only on North Trio where there is a colony of the king shag. This large rock is steep on all sides and rises to a height of about 100 feet above sea-level. Scrub in which taupata and olearia predominate is common; growing with it are *Muehlenbeckia complexa* and the sparse-leaved, semi-climbing *Angelica geniculata*. In other places *Lepidium oleraceum*, *Agropyron scabrum*, *Tetragonia trigyna* and *Senecio lautus* are common. A lane of *Hymenanthera obovata* occurs on the eastern side.

The launch journey from the Trio Islands to Stephens Island takes about one and a half hours and on the way the three Rangitoto Islands are passed quite close at hand. These are farmed and there appears to be very little natural vegetation left.

Seen from the sea Stephen Island is an impressive sight, its height of almost 1000 feet making up for a length of less than a mile and a breadth of half a mile. On the western side cliffs reach almost to the summit; on the east, steep slopes end in even steeper cliffs averaging 250 feet in height. The landing place is on this eastern side and as there is no jetty, getting ashore is a matter of jumping on to the rocks at the foot of a flight of concrete steps. These lead to the beginning of a cable tramway (for luggage only) which runs steeply and directly to about 700 feet above sea level. From the winch-house at the top the tramway takes a winding course to the lighthouse at the northern end of the island, passing on the way three houses, a deserted navy barracks, a bach, and the lighthouse buildings themselves.

In spite of the almost complete disappearance of the natural forest cover the animal life on Stephens Island is fully equal in variety

and abundance to that on Middle Trio. The tuataras are estimated by Mr. Dawbin to number at least 3000 and after dusk hundreds of thousands of petrels crowd onto the island. The one rare and unusual animal on the island is the Stephens Island frog. This frog is known only from a boulder-bank near the crest of the island, where it inhabits a relatively moist habitat about two feet below the angular rocks at the surface. As only a handful of specimens have been seen this must be one of the rarest animals in the world.

According to past records a coastal forest, dominated by kohekohe, was at one time a prominent feature of the island. This forest is now represented by a few scattered remnants only; its destruction is thought to have been caused by the browsing of sheep and cattle introduced late last century. Prior to human interference the forest would be continually subjected to strong winds, as is testified by the wind-scorched appearance of the remaining trees. Major gales would probably blow trees over in places, and the openings formed would be colonised by tussocks of *Carex forsteri* and bushes of the large native nettle *Urtica ferox*. In the shelter provided by these plants basal shoots would arise from the fallen trunks, and tree-seedlings become established. These would eventually close the gap in the canopy and the regeneration cycle would be complete. With the advent of sheep and cattle this cycle would be broken at its weakest point, for both seedlings and basal shoots would be heavily browsed. As a consequence the breaks in the canopy would remain, and with the passage of time clearings would become a prominent feature, affording the wind easy access to the forest interior thereby accelerating the process of degeneration.

The part played by *Carex forsteri* and *Urtica ferox* in the normal regeneration cycle was suggested by the present association of these plants with forest remnants. In the remnant below the upper winch-house they occur only at the periphery, where the canopy has been broken. In an area of similar extent near the summit of the island living trees are scattered among dead trunks and the canopy is nowhere continuous; here they form a luxuriant ground cover throughout. In a few other, very small remnants, the two species extend beyond the present forest margin in tongue-like extensions. This suggests that they are able to survive for a time after the trees have disappeared; scattered brown patches of the carex on the treeless lower slopes lend weight to this view.

The various forest remnants have most of their tree species in common, but there are considerable differences in their relative abundance from place to place. The tree species comprising the remnant below the winch-house are: kohekohe, mahoe, ngaio (mainly on the periphery), macropiper (sub-canopy), pigeonwood, and paratrophis. All of these, except the last two, are common. The summit remnant appears to have a somewhat different composition. Large nikau (*Rhopalostylis sapida*) are prominent and the most common tree is

mahoe, with pigeonwood, macropiper and taupata rather less common. Kohekohe is represented by only one small specimen. The macropipers are all very gnarled and the trunks of a few of them are as much as one foot in diameter. There are a number of large dead trees, some of which may have been kohekohe. The three remnants below the summit and to the south of the winch-house remnant exhibit two further variations. In that nearest the winch-house paratrophis is the most common tree, with mahoe, kohekohe, macropiper and ngaio in smaller numbers. In the other two remnants ngaio is dominant, with taupata almost as common. Occasional trees of mahoe, suttonia and paratrophis are scattered throughout and one plant of *Melicope ternata* was noted. *Solanum aviculare*, *Urtica ferox* and tangles of *Muehlenbeckia australis* are common. These rather marked differences between remnants suggest that the original forest was by no means uniform throughout.

Early in 1951 a fence was put across the island and the sheep in the southern part were transferred to the northern part containing the lighthouse and other buildings. The fence runs through the patch of closed forest below the upper winch-house, and in December 1951, six months after its erection, a marked contrast in ground-cover between the grazed and ungrazed parts could already be observed. On the side of the fence where the sheep could still enter the forest there were no seedlings and the basal shoots on a few showed signs of recent browsing. On the side free from sheep many hundreds of very young tree seedlings were noted. In May 1952 two adjacent 5 x 5 metre quadrats were marked out, one on either side of the fenceline, and on that occasion and in April and November 1953 the seedlings were identified and counted. A comparison of the figures for the last two occasions in the protected quadrat shows that between autumn and the following spring a significant number of seedlings died. The counts are as follows (autumn first, spring second): macropiper, 463, 377; kohekohe, 170, 49; pigeonwood, 11, 6; taupata, 15, 8; nikau, 7, 9; mahoe, 12, 6; ngaio, 3, 1. In this quadrat also, basal shoots have become prominent on the trunks of kohekohe, pigeonwood and macropiper.

In the summit remnant, after the removal of the sheep, numerous seedlings of nikau were noted in two open places sheltered by trees. Seedlings of pigeonwood were common at one of these spots, and both species were represented less abundantly in the spaces between tussocks. Seedlings of macropiper and taupata were rare. In the remaining three remnants bird-burrows are frequent; the only seedlings noted were from the single tree of *Melicope ternata*.

Another form of regeneration is now found in areas of widely spaced, apparently dead, tree-trunks and stumps. There is an extensive area of this type above the fence near the upper winch-house and another, smaller one fringing the quadrat remnant along its south-east border. In both areas the stumps have become surrounded by a

luxuriant growth of introduced grasses, through which basal shoots are appearing as dense bushes. The majority of trees regenerating in this way are mahoe or ngaio.

On the last visit to the island the vegetation of the western cliffs was examined near the north end and below the summit. In general it can be said that lanes of scrub alternate with herbaceous vegetation. At the northern end the scrub consists of low-growing taupata, ngaio, and olearia, with occasional macropiper and kowhai. Scattered throughout are the climbers *Parsonsia heterophylla*, *Muehlenbeckia australis*, *M. complexa*, and in places, *Angelica geniculata*. In rocky parts *Senecio lautus*, *Asplenium* sp., *Tetragonia trigyna* and *Rhagodia triandra* are common; *Peperomia urvilleana* is also present in a few places. The hollows contain grasses of various kinds, mostly introduced but including *Agropyron scabrum*. Below the summit the species are the same, but kowhai is far more abundant in the scrub, being the dominant species in many places. The sheer-sided razor-back at the south end of the island was also visited; a number of common coastal herbs were noted on rocky parts, including *Samolus repens*, *Selliera radicans*, *Salicornia australis*, *Suaeda australis* var. *nova zelandica*, *Mesembryanthemum australe*, *Senecio lautus*, and at a higher level, a few plants of *Hymenanthera obovata*.

Immediately to the east of the ridge leading to the south razor-back there is a long and deep valley which has its head near the summit forest-remnant. Within this there is the nearest approach to a stream on the island, its position being clearly marked by a line of *Carex trifida*. The slopes of this valley are clothed with evenly spaced tussocks of *Poa caespitosa*, and it is possible that this is the original vegetation of the southern extremity. In the lower part of the valley bird-burrows are common between the tussocks, and large plants of *Senecio lautus* are numerous and widespread. Fifty yards up the eastward slope a patch of the native dandelion, *Microseris scapigera*, was seen. Further up this same slope there are patches of scrub consisting of prostrate ngaio, taupata, and occasional bushes of mahoe. Within and beyond these scrub patches dense entanglements of *Muehlenbeckia complexa* and *Tetragonia trigyna* occur.

Although the natural vegetation of Stephens Island has suffered greatly from human interference, it is still of considerable interest, especially since regeneration has been made possible. There is ample evidence to suggest that this has begun and it seems that development, in the initial stages at least, will be rapid. It is anticipated that the present remnants will act as centres for the recolonisation of the far more extensive grassland.

Before concluding this article reference should be made to the plant cover of the Jag Rocks and Sentinel Rock, which were visited in November 1953. The former are opposite Stephens and in line with the Trio Islands. Their name describes them well, for they are very precipitous and consist of two separate, but adjacent, rocks with

an overall length of a few hundred yards and a height of about 50 feet. There are only twelve species present, of which two are woody (ngaio and taupata) and the remainder herbaceous (*Phormium colensoi* and *Agropyron scabrum* among them). Sentinel Rock is the northern outlier of the Chetwode Group and is very similar in height and steepness to North Trio. Ngaio and taupata are again present but *Phormium colensoi* and *Agropyron scabrum* are not represented. The total number of species is eleven.

Vegetation of the Middle Clarence Valley

D. R. McQueen

THE Clarence River flows for 125 miles on one of the most circuitous courses in the South Island. Rising in the Spenser Mountains, it runs south to St. James, just north of Hanmer, turns east around the large bend to the Acheron junction, then runs north-east between the Inland and Seaward Kaikoura Ranges, finally cutting across the Seaward Range to the sea north of Kaikoura. It traverses very little forested country and its sudden floods are well known to the few people living along its banks. The following account is of the middle part of the Clarence Valley, extending from the Gore River to the headwaters of the Ouse River, and lying between the two Kaikoura Ranges. The middle valley has two out-stations in it. 'Quail Flat', near the Seymour River, is inhabited only at intervals during the summer and is reached by pack-horse over the Kahutara Saddle, 3900 feet. The 'Bluff' is permanently inhabited and is reached either by intermittent plane service, or by pack-track from Quail Flat or Kekerangu along the north-west bank of the Clarence.

Geology. The valley is not a simple glacial or river-eroded trough but a complex structural depression with varying rock types. The high ranges on either side are made of strongly jointed greywackes which often form screes. A ridge of calcareous and flinty rocks, of Eocene and Oligocene age, is a feature of the area and rises to 3500 feet at the Chalk Range. This is thinly overlaid by later Tertiary mudstones and conglomerates. Below the limestone and flint beds as far north as Bluff there is a thick series of easily-eroded alternating sandstones and mudstones of Cretaceous age. In the vicinity and south-east of Quail Flat these Cretaceous rocks are replaced by