

BIRD-BANDING

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BANDING AND MARKING PENGUINS

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This paper has been prompted by enquiries from overseas, particularly from workers who have experienced penguin marking difficulties in the field, relative to my methods of banding penguins. Admittedly, the banding of penguins in a way that will allow results to be followed up is not easy. The ensuing text, therefore, will be more than just a statement of the finally evolved end results of my banding and marking technique. It will give also some account of the difficulties encountered in the period of research and of the several unsuccessful banding methods tried, a procedure which should be of greater value to a worker grappling with penguin marking difficulties. Finally, in order that the reader may glean further ideas of the results of the banding and marking, a list of my published penguin papers is appended.

EARLY BANDING EFFORTS

Shortly after I commenced my detailed study of the Yellow-eyed Penguin, *Megadyptes antipodes* (Hombron and Jacquinot), on August 25, 1936, it became apparent that the birds had to be marked in some way. At that time, I was unaware that wild birds were being banded in America and in Europe. Further, enquiries from authorities in New Zealand on how to band or mark wild birds led to nothing, so that I began to realize that no one within my orbit knew anything about the problem.

By October, 1936, whilst the penguins were incubating, I managed to purchase locally several coloured celluloid bands. Eight mated pairs of incubating birds, all that were under observation that season, were banded. So in that way was launched the first systematic banding of wild birds in New Zealand. It may be of interest to state that one of the foregoing 16 birds banded is still with me at time of writing (January, 1949) which means that, assuming he was at least three years old in November, 1936, this male penguin is at least 15 years old.

It was not long, however, before I began to realize that the celluloid bands would probably not stay on for a year, so in the moulting period in March, 1937, I re-banded all 16 mated birds with bands made from very thin aluminum (standard wire gauge 25). In addition, that season's fledglings and several juveniles hatched in the 1935-36 season, were banded. One of these juveniles is still with me, now a little more than 13 years old, making the oldest bird whose exact age is known.

By the beginning of the 1937-38 season, it was obvious that my banding methods had little scientific value and that, if the identity of the penguins already banded was not to be lost, some alternative system of marking would have to be devised. Necessity seems ever the mother

of invention. Eventually, a footmarking scheme was evolved, and on October 2, 1937, the first six penguins were footmarked.

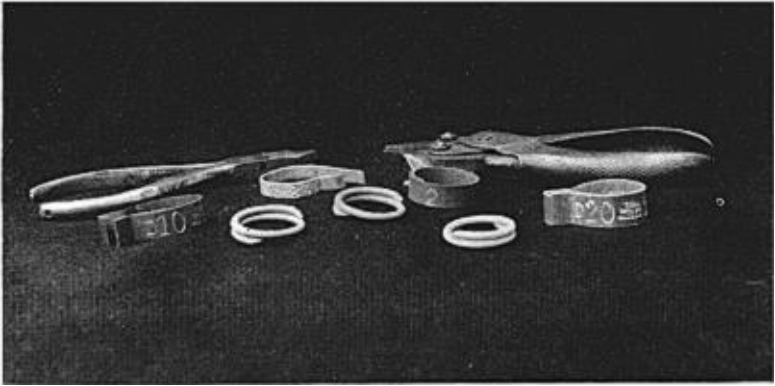


Figure 1. The tools of banding. At back, two types of pliers; in front, three coil bands; at each end, two aluminum bands like those in present use; behind coil bands, a narrow aluminum band and a celluloid band.



Figure 2. Feeding time. The parent is wearing an aluminum band on right leg and a celluloid band on left leg.

CELLULOID BANDS

The use of celluloid bands for any long term policy was not a success for the best band evolved would not stay on longer than from 10 to 12 months. For the sake of visibility all bands, whether celluloid or aluminum, were placed on the tarsus. If put on the leg, the bands would stay on for a much longer period, but the reading of the band was possible only by catching the penguin and searching among the feathers, a procedure that is better avoided.

My aim in persisting with the coloured celluloid bands was to devise a system whereby individual penguins could be recognized in the winter from a blind as they landed from the sea, and also so that their identity could be established more quickly at the nest, especially at the pre-egg stage. Many kinds of bands were tried, including bands that were flat when unwound (flat bands) and others that were like a small knitting needle when unwound (coil bands). Bands of varying diameters were tried; some had to be stretched to make them fit the tarsus, whilst others just hung loosely.

It was next found that the bands stretched and either broke in two or else slid off the tarsus and toes. This meant that some method of fastening the ends of a band had to be devised. Coil bands could not be treated in this way, so their use was abandoned early. Eventually, after several methods were tried, a hole was bored through the ends of the flat bands and a galvanised bolt was pushed through and made fast with a nut. This method of fastening was most successful for not once, to my knowledge, did this bolt and nut ever come apart. The bands, however, lasted only three or four months after which they broke across the flat strip where there was only one thickness of celluloid. Next, bands were made so that there were at least two thicknesses of material all the way around. These bands lasted from 10 to 12 months and were used extensively in 1938-39, after which, except for a special project in 1939-40, the use of celluloid bands was abandoned.

An extremely important point in penguin bands (celluloid or aluminum) is the width of the flat material which makes the band. The wider this material the stronger is the band and the longer it will stay on. Strips 14 and 12 millimetres wide were tried but the bands cut the tarsus so that these widths had to be abandoned. Eventually, a width of 10 millimetres was found to be the most practical dimension; anything narrower only weakened the band and hence shortened its life.

ALUMINUM BANDS

While I was struggling with the problem of the celluloid bands, it occurred to me that if a suitable aluminum band could be obtained the penguins would be marked permanently (disillusionment came later). Nothing was available in New Zealand, so early in 1938 I placed an order in England. In June, the bands arrived. All were made from aluminum, number 18 standard wire gauge in thickness, and all were 25 millimetres in diameter. Some were of strip material 12 millimetres wide and others from material only 5 millimetres wide.

The bands made from the narrow material proved useless as the metal was not strong enough to resist the weight of the bird when lying down. The 12 millimetre strip was too wide and tended to injure the tarsus so that the bands had to be removed. Further, the fixed diameter of 25 millimetres brought trouble for on some birds the bands were far too tight and caused the tarsus to swell. Finally, the makers refused to inscribe the legend and numbers on the bands, according to my specifications, stating that I was asking too much.

In the face of all these difficulties, I decided, at the end of 1938, to make my own bands and I have continued to do so ever since even though the cost in time is considerable (it takes me 15 minutes to make one penguin band). The new bands were made of aluminum, number 18 standard gauge in thickness, and from strip material 10 millimetres wide. All bands had the fixed diameter of 28 millimetres.

With the comparative failure of the celluloid bands for quick identification, the idea was conceived of reading the band numbers either with binoculars or telescope. The number had to be large and be placed on the band several times. Accordingly, stamps with numbers 9 millimetres high were made and single and dual numbers were stamped on the metal in four places. It was immaterial, therefore, which way the bird was standing, for one of the numbers would always face the observer. Then, with the aid of a 20X telescope, the number could be read as far away as 40 metres. *The use of numbers in four places was a far-reaching and most important decision.* Without it much research could not have been accomplished and other work would have been made more difficult. The legend *Tell Otago Museum* with one word in each of three rows was stamped in between the numbers and, consequently, appeared three times on the band.

The identification qualities of this band proved highly efficient—qualities which have been retained ever since. Except for most unusual cases, as for example, recognizing individual penguins more than 40 metres away, this type of band has rendered superfluous the use of the celluloid type.

These latest bands, however, began to display other faults. (1) The diameter was too wide for the small birds and the bands fell off. To overcome this trouble, all bands were made from a strip 125 millimetres long which is somewhat longer than would be necessary to make the widest ring required. After a little practice, it was possible to estimate the size of band required and to shorten the band accordingly with pliers while the penguin concerned was in my hands. (2) When the 1939-40 season arrived, although the aluminum bands were all still in place, some of them showed signs of considerable wear and had to be replaced after an average period of 12 months on the penguin.

From the foregoing experience emerged the final type of aluminum band. Aluminum with a thickness of standard wire gauges 16 and 14 was tried and eventually number 16 gauge, which is the thickness that has been used ever since, was chosen. Bands carried over the most rocky landing grounds will stay on for at least two seasons and have to be renewed every third season. Where the breeding areas consist only of sand, the bands may remain servicable for five seasons. No

further attempt has been made to improve the lasting qualities of the bands. For all practical purposes, as far as I am concerned, the point reached is reasonably satisfactory.

To fasten the band on the tarsus, one end of the band, 10 millimetres from the end, is bent in a vice to make an inverted V. The other end, 5 millimetres from the end, is bent up at 45°. The strip is then bent into a band and the two ends may then be clasped together with pliers after the second bend has been placed inside the V bend.

A final point concerns the numbering. Naturally, it was not long before single and dual numbers were exhausted. Triple numbers up to 999 and dual numbers prefixed by a letter (*e.g.* A64) were then used, but could be placed only three times on the band. These combinations are a little more troublesome to read and are not suitable for work with the telescope as the three components of the number cannot be seen at the same time. Quadruple numbers I have not used and do not intend to.

In summary, the most suitable band so far devised by me is made from strip aluminum 125 x 10 millimetres and numbered 16 standard wire gauge in thickness. The band is marked in as many places as possible with numbers of not more than three components. The diameter of the band is adjustable in the field.

FOOTMARKING

Owing to the defects in the banding scheme the device of footmarking has proved invaluable and without it my records would not be as complete as they are. Its operation is simple. The operator sits on the ground with his legs straight out in front; the penguin is then placed on its breast between the legs of the operator and with head facing away so that the bird's feet point toward the operator. The feet, of course, are soles up. A penguin has four webs, two on each foot. By puncturing the holes in three precise places in each web with a leather punch, it is possible to make 12 holes altogether; and by using combinations of these holes it is possible to mark a large number of birds. For example, a total of 1103 penguins, including adults and fledglings, has been footmarked up to the end of the 1948-49 season.

The footholes are numbered from 1 to 12. Number 1 is just near the left claw of the left foot and near the edge of the web; number 2 is high up the web between the left and middle toes; and number 3 is near the middle claw and near the edge of the web, and so on for the other webs. Number 7 is near the left claw of the right foot and near the edge of the web.

Difficulties, of course, occur but are not nearly so troublesome as the deficiencies with the bands. Sometimes a bird's foot is injured and a web may be split, thereby upsetting the marking scheme. The holes high up the web sometimes grow over and those on the edge of the webs may split. If these changes occur while the bird is still banded (I check the footholes of the breeding birds each year) the fact is noted in the records. The loss of the identity of birds through this cause is negligible and occurs in breeding areas not visited annually. To read the footholes, the penguin has to be caught, which is an unavoidable disadvantage.

TECHNIQUE IN USING BANDS AND MARKS

Numbers from 1 to 99 have been used for the most important breeding birds encountered in the early seasons particularly when quick recognition of an individual was essential in studying behaviour. Triple numbers from 200 to 299, and from 850 to 999 have been reserved for fledglings that have been recovered after having left the breeding areas. Finally, dual numbers, prefixed by a letter, are placed on any remaining birds according to the breeding area in which they are first found. For example, one bird caught in B breeding area has been banded 'B23' and so on for M, S, W, X, and Z breeding areas. This method has proved of considerable value in the field.

Up until the 1942-43 season, all chicks were footmarked and banded as fledglings just before they entered the sea. A record was made, showing the footmark, parents, and band of each chick, in such a way that it could be carried with me in the field. When a fledgling was met subsequently, after it had entered the water, the fact was noted, with pertinent remarks, in this record. From 1943-44, however, the chicks were not banded as fledglings, but were footmarked only at the peak of the down stage (third week in December). When such a chick was met later after having entered the sea, it was banded on recovery; the band number and appropriate remarks were then placed in the field record. This method has many advantages which there is no need to mention here. Juveniles found without footmarks and hence strangers to me have been footmarked on recovery and, in later years, banded with dual numbers prefixed by the letter "T" (e.g. T70).

The footmarks are listed in consecutive order in a file with the band number of the penguin alongside, so that once a footmark is read it is easy to find the band number. The list of the footmarks is not taken into the field.

When a bird is found with a band missing, as indicated by its footmarks, or one is found with a worn band that appears as if it might come off before the next breeding season, the procedure is not to give the penguin another permanent band with a different number. This would lead to hopeless confusion in the records. If the penguin requiring attention is a breeding bird I usually leave it, make a new band at home with the proper number, and carry the band until the bird is met again. If the bird is unemployed, there is no certainty that it will be seen again that season, so the bird has to be rebanded whilst the opportunity offers. For this purpose, I always carry a number of what are known as "H" or "K" bands, which are bands with dual numbers prefixed by the letters "H" or "K" (e.g. K26). On meeting a bird with such a band, it is known at once that the bird is wearing a temporary band. A list of the "H" and "K" bands, with the permanent band number of the penguin alongside, is carried in my field book. When any reference is made in the records to an "H" or "K" bird its original number is also written alongside in parentheses.

Finally, all penguins have a personal file on a sheet of paper 7 x 10 inches. The band number is placed at the top right hand corner and the footmark record at the top left. In between are placed the bird's sex and its year of hatching, if known. Then, for each season, is re-

corded the bird's matrimonial status, its mate if any, where it was seen, and the eggs hatched if any. More detailed particulars are found in the field records, which are on loose sheets with the various breeding areas kept distinct.

CONCLUSION

The foregoing methods of banding and marking penguins suit my particular style of research and also the species of penguin studied. These methods, however, may not suit other workers and other species of birds. It may be possible to evolve a more durable band than I have succeeded in doing, but the band must be of a practical type, both as regards cost and facility of use in the field under the conditions involved.

I have also banded other species of penguins. Considerable time was spent one season in banding Little Blue Penguins, *Eudyptula minor* (Forster), with bands made of strip aluminum five millimetres wide. The bands soon became worn through as the strip was far too narrow, and, owing to the smallness of the penguin's tarsus, a wider strip could not be used. Further attempts were therefore abandoned. Another species banded was the Erect-crested Penguin, *Eudyptes sclateri* Buller. Three individuals were banded with bands as used for the Yellow-eyed Penguin. Two of the birds soon disappeared, but the third bird remained long enough to satisfy me that a band would remain in place for six years.

This experience with the Crested Penguin raises an interesting discussion. The Yellow-eyed Penguin is a sedentary species and, as far as I can ascertain, its normal mode of locomotion is to walk, except when compelled by the terrain to hop. Placing the band on the tarsus exposes the band to considerable wear as it is dragged over the rocks. The Erect-crested Penguin, on the other hand, is migratory and spends nearly six months of the year in the water. When ashore it progresses by hopping to a much greater extent than the first species. The difference in the form of locomotion and the lengthy period entirely in the sea result in much less wear on the band, so that if my methods of banding are used for migratory penguins greater success should be achieved than with the Yellow-eyed Penguin.

Finally, I have also banded in considerable numbers seven species of petrels from the Royal Albatross, *Diomedea epomophora sanfordi* Murphy, to the tiny White-faced Storm Petrel, *Pelagodroma marina* Latham. The difficulties experienced with the bands were somewhat different although the major one of how to keep the band on for a long time is common to both orders of birds. A paper on banding petrels may be written later.

SUMMARY

From 14 years' experience, the banding and marking of the Yellow-eyed Penguin, *Megadyptes antipodes* (Hombron and Jacquinot), is discussed.

Except for special projects, the use of celluloid bands is not practicable because they come off too easily.

The most serviceable metal band so far employed by me is made of

strip aluminum, number 16 standard wire gauge in thickness, and 125 x 10 millimetres in measurements. Dual numbers are stamped on four times and triple numbers, three times; the legend is stamped in between these numbers. The diameter of the band is adjustable in the field.

The bands remain serviceable from two to five years, according to the wearing propensities of the terrain, and then have to be replaced.

All penguins are footmarked by puncturing the webs according to a pre-arranged plan. Footmarking ensures that, in most cases, the identity of any given penguin is not lost and, in this way, is more efficient than bands. Bands, however, make for more speedy recognition of the bird in the field.

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23 Skibo St., Kew, Dunedin, New Zealand.

(*Ed. note:* by way of comparison, bands furnished by the Fish and Wildlife Service in sizes 5 and 6 are of number 18 gauge, while sizes 7A and 7B are of number 16 and sizes 8 and 9 are of number 14. Widths are 6/16 inches for sizes 5 and 6, 7/16 for sizes 7A and 7B, and 8/16 for sizes 8 and 9. These are in terms of the American Standard Wire Gauge while Mr. Richdale's are in the Imperial Standard Wire Gauge. Number 14 American Gauge is about equal to number 16 Imperial Gauge, number 16 to number 18, and number 18 to number 19.)

THE SOUTH WINDSOR BANK SWALLOW COLONY

By E. ALEXANDER BERGSTROM

This paper represents the preliminary results of the banding of Bank Swallows (*Riparia r. riparia* Linnaeus) at a single colony in South Windsor, Conn., in the seasons of 1945 through 1950. The site is a long-established one, on the east side of the Connecticut River where the river keeps eroding the meadow, and at least half a mile from any house.