Criteria for ageing embryos of the Eider

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Introduction

It is often important, in the study of wildfowl breeding ecology, to be able to determine how long individual birds have been incubating. This can be estimated by shining a bright light through eggs from the bird's clutch (Hanson, 1954; Weller, 1956). However, the accuracy with which the embryos within can be aged through such 'candling' becomes progressively lower the further incubation is advanced. By opening the egg and examining the external appearance of the embryo much more precise estimates can be made. These require comparisons with a series of embryos of known age, and the necessary descriptions for the Eider *Somateria mollissima* are presented in this paper.

Material and methods

The data were collected during a study of the breeding biology of a population associated with the Sands of Forvie Nature Reserve, Scotland.

The data are from two sources; eggs from nests which had been incubated for a known period; and freshly laid eggs removed to an artificial incubator maintained at 38°C.

The mean length of time to hatch eggs does not differ significantly between eggs in nests and in artificial incubators and thus the rate of development is comparable between the two sets of eggs. In the case of eggs incubated in the nest, development was timed from the date on which the last egg of the clutch was laid. The female remains at the nest after laying the penultimate or prepenultimate egg of the clutch. Proper incubation does not begin, however, until the last egg is laid; in this way all the eggs develop together and indeed usually hatch within twelve hours of each other.

The embryos were carefully removed from the eggs and embryonic membranes and placed in 70% ethanol for 3 weeks. They were then gradually dehydrated in an ascending series of ethanols and finally stored in absolute ethanol. This technique led to some shrinkage of tissues, but it had the advantage of hardening the specimens and rendering them resistant to handling.

Stages of development

Representative stages are illustrated in Figures 1 and 2.

24 *hours*

By the end of the first 24 hours of incubation the head fold is pronounced with the primitive knot about one third of the way back from the anterior margin of the area pellucida. The first one or two pairs of somites are recognizable as cellular condensations on either side of the primitive knot.

48 *hours*

By the end of 48 hours, the first signs of cranial flexure are apparent, the fore-brain lying at an angle to the hind-brain. The rudiments of the eye-lens, optic cup and auditory placode are recognizable. There are up to sixteen pairs of somites. In the live specimen the heart can be seen to be beating.

5 *days*

A superficial auditory pit can be seen. The limbs are apparent, the fore-limbs showing flexion at the elbow. The eye is pigmented, while a ridge of tissue representing the eyelids circles the eyes. The whole embryo is curved with the tail almost in contact with the head.

6 *days*

The auditory pit is deep and obvious. The limbs show signs of digitation, the fore-limb having a protuberance on its leading edge, the future alula. The upper mandible is apparent as a knob-like process.

7–8 *days*

The raised eyelid primordia are beginning to grow over the eye which now has up to eighteen scleral papillae. Digits are clearly defined in the hind-limbs with webbing between them. The fore-limb has two ridges representing the incipient radius and ulna. The primordia of the retrices are clearly defined although feathers are not yet to be

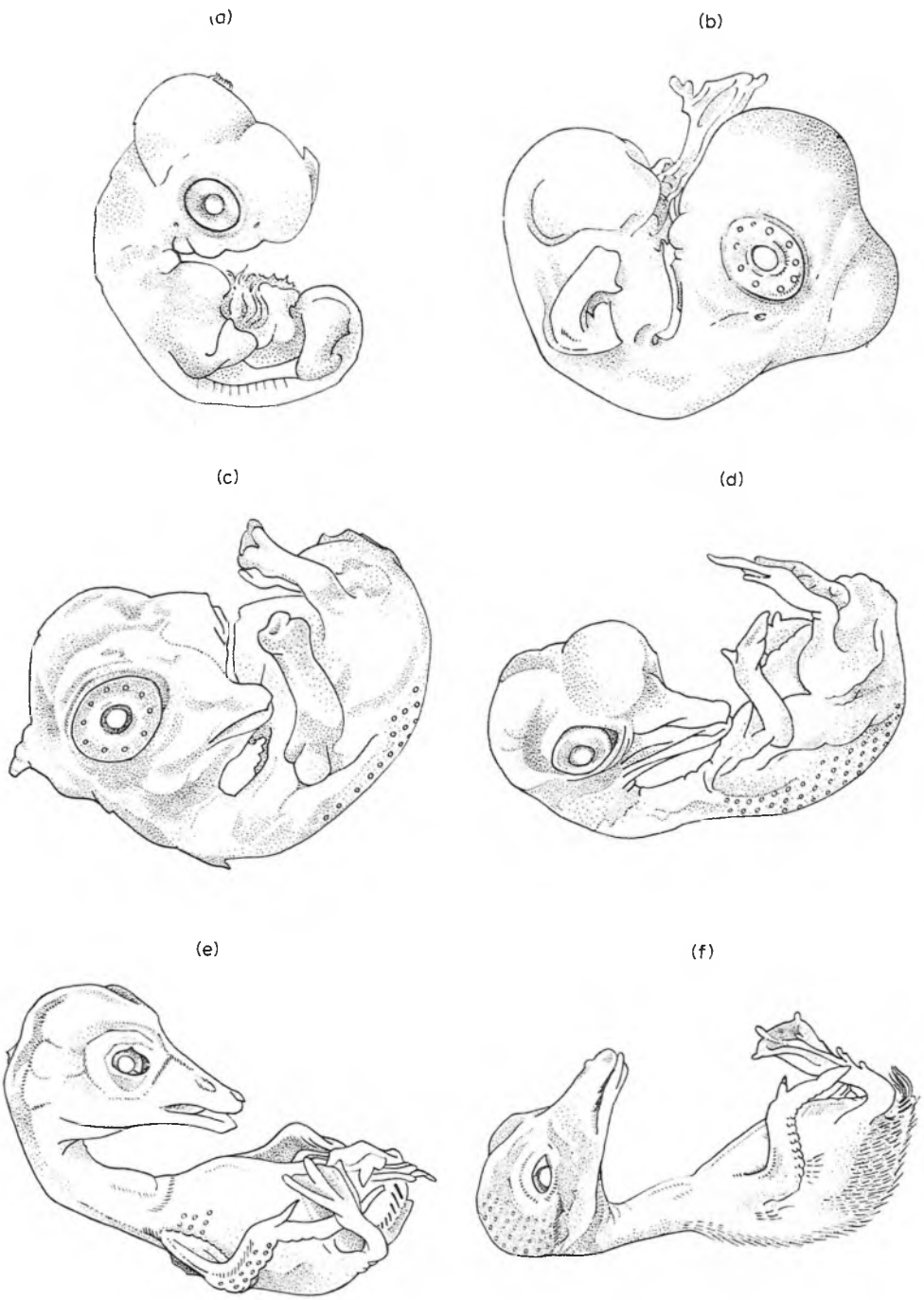

Figure 1. Stages of development. (a) 5 days incubation; (b) 6 days incubation; (c) 8 days incubation; (d) 10 days incubation; (e) 12 days incubation; (f) 13 days incubation.

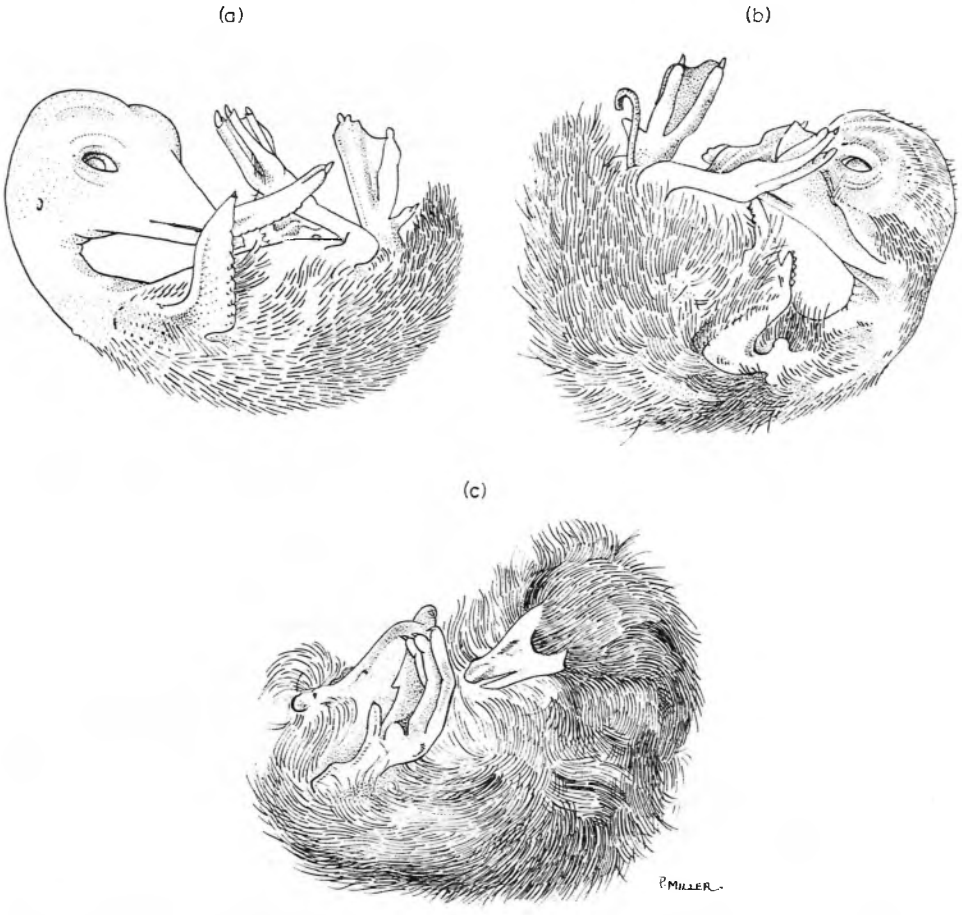

Figure 2. Stages of development. (a) 14 days incubation; (b) 15 days incubation; (c) 18 days incubation.

seen. The cerebral hemispheres and the mesencephalon are relatively less pronounced.

10 *days*

The fore-limb is well differentiated with the alula completely formed. The upper and lower mandibles are extended and form a recognizable beak. The nictitating membrane is apparent, while the eyelids have grown over the eyes to such an extent that the scleral papillae are almost obscured from view. The retrices may be pigmented. Pterylae are situated on the tail, lumbar regions and along the spine.

12 *days*

The nostrils are well developed. The retrices are pigmented and well developed, while pterylae cover the whole body apart from the head. Pigmented feather germs are just apparent on the thighs and lumbar-regions. The egg tooth is obvious. The eyelids continue to grow, the space between them now being oval in outline.

13 *days*

Pigmented feathers are present on the back, thighs and shoulders. Pterylae are visible on the head. The opening between the eyelids is now nearly the normal adult shape.

14 *days*

Growth of feathers continues. The head and neck pterylae show the beginnings of pigmentation. The claws of the hind digits are well developed.

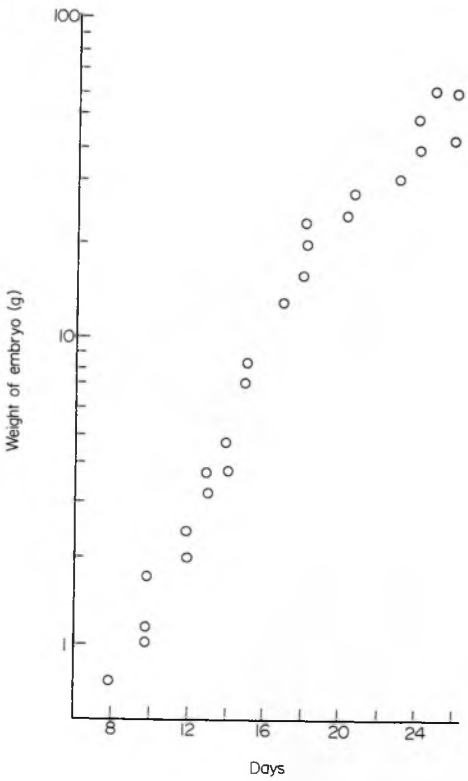

Figure 3. The growth of the embryo. Each point represents the preserved weight of one embryo, without the yolk sac.

15 *days*

The feathers of the head and neck are more highly pigmented and developed. The trailing edge of the wing is feathered although the rest of the wing is still devoid of feathers.

17 *days*

The tip of the beak, which is now obviously 'eider' in shape, is keratinized and distinct. The whole embryo is now covered in down.

18 *days to hatching*

Development from 18 days onwards consists largely of growth, little external change in morphology taking place. During this period age is best assessed from the size of the embryo (Figure 3).

Acknowledgments

This work was carried out while I was a Senior Kilgour Scholar at the University of Aberdeen. I am grateful to the Nature Conservancy for permission to work on the Sands of Forvie Nature Reserve. Finally, I am indebted to Mrs P. R. (Miller) Vander Meer for her excellent drawings.

Summary

Drawings and descriptions of various stages of development of the embryo of the Eider *Somateria mollissima* are presented.

References

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