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CONCEALING COLORATION AGAIN.

BY THOMAS BARBOUR AND JOHN C. PHILLIPS.

MR. ABBOT H. THAYER'S book on 'Concealing Coloration,' and his various contributions to the subject which have appeared published in scattered articles, have awakened an interest in this fascinating field of observation which has never been known before this time. If Mr. Thayer's notices had been confined to studies of countershading, which he has so excellently demonstrated, and of similar phenomena, we should have been glad to subscribe most heartily to the immense importance of what he has shown us. Mr. Thayer, however, along with most other enthusiasts in a field with which they can be but partially familiar, has gone too far and claimed too much.

In his book we have the view elaborated that all organisms, or nearly all, are adapted exclusively as far as external features go to concealment in the environment in which they are found. Mr. Thayer does not even touch on the evolution of color and patterns. He simply says (page 36), "We ourselves attribute all such work (meaning here color patterns and normal backgrounds) to natural selection, pure, simple, and omnipotent."

Of the several notices which have appeared reviewing Mr. Thayer's work, only two have been in any way critical. Messrs. Dewar and Finn, on page 184 of their book, 'The Making of Species,' comment at length, saying "even as Wallace out-Darwins Darwin, so does Mr. Abbot Thayer...out-Wallace Wallace. That gentleman seems to be of opinion that *all* animals are cryptically, or, as he calls it, concealingly or obliteratively colored. Even those schemes of color which have hitherto been called conspicuous are, he asserts, 'purely and potently concealing' when looked at properly, that is to say, with the eye of an artist." They continue, after taking up one or two of Thayer's special cases: "There is something in this theory of oblitative coloration. Anyone can see, by paying a visit to the South Kensington Museum, that an animal which is of a lighter coloration below than above is less conspicuous in a poor light than it would be were it uniformly

colored . . . To this extent has Mr. Thayer made a valuable contribution to zoölogical science. But when he informs us that obliterative coloration is a universal attribute of animal life, we feel sorely tempted to poke fun at him. We would ask all those who believe in the universality of obliterative coloration to observe a flock of rooks wending their way to their dormitories at sunset."

Mr. Roosevelt, in Appendix E of his 'African Game Trails,' has disposed effectually of the dicta regarding the invisibility of the giraffe, zebra, and a host of other conspicuous beasts which have only to fear destruction from animals that hunt by scent alone.

Without any desire, however, to poke fun at Mr. Thayer, we may now consider a few of his important cases. We do this seriously, knowing full well that we see not with the eye of an artist, and that we shall probably be more pitied than blamed for what we write. We are, however, far from convinced as to how valuable an attribute this artistic eye really is; and are inclined to wonder whether, from a scientific point of view, a more open-minded conservatism would not be more persuasive in the end.

When Mr. Thayer says: "The color relations of earth, sky, water, and vegetation are practically the same the world over, and one may read in any animal's coat the main facts of his habits and habitat without ever seeing him in his home," it is in just this sort of thing that he has gone furthest wrong. The Peacock which he depicts merged in a jungle of varied greenery and blue sky is, as every field naturalist who has seen the Peacock at home well knows, a bird quite as often of the open fields and bare hillsides as of the jungle. The bird, for all his supposed protective mimicry, is safer in the open land, or sitting, as one so often sees him, on the dry top of a dead tree. Here he can see clearly all about him, better than if he were in the jungle, where prowling beasts of prey might follow him by scent — which they probably do far more often than by sight — and so quite easily find and destroy him.

Again, Birds of Paradise are shown in Plate VI as disporting themselves in a forest of waving palms, and amidst a general environment which it is hard to believe a visitor to the jungle has ever drawn. In Papua the male Birds of Paradise may usually be seen, — and heard too, — from bare tops among the tallest

forest trees. They may be followed and discovered with the greatest ease, and make no efforts at concealment by placing themselves in the proper position, or by remaining motionless so as to deceive one, as do Bitterns, for instance, which use a real protective coloration. The females, of course, as has always been known, are inconspicuously colored; and for this reason they are difficult to observe.

We would protest gently against the slightly patronizing way in which the effective concealment of many birds is pointed out which has been known and recognized since ornithology began to be studied at all. There is nothing new in the statement that the Woodcock, or any of the horde of Grouse and their allies, have taken on a color which affords them excellent protection. In the Amazonian forests and elsewhere in Tropical America, snow-white Cotingas occur, which coloration might, to be sure, be useful in the Andes; but, when it is accompanied by the characteristic voice of the *Campañero*, it is hardly concealing.

The Flamingoes which we find in Mr. Thayer's book depicted as rosey clouds floating against the sky at sunset would, it seems to one who is not versed in optics, but who has seen Flamingoes, more probably appear as dark blotches against this same sky, when seen by an animal in the water in which the Flamingoes may be standing. The crocodile approaching one of the birds from the westward at evening would, we should imagine, be unlikely to see the Flamingo tinted rosily, but rather as a body cutting off the light rays from the afterglow; and such a body might be tinted any color, and still appear dark. Seen from the opposite direction it would be the only pink thing in the sky. Flamingoes hardly need this carefully arranged protection that is of value but a few minutes each day, and to be sure we see the curious cloud arrangement depicted on but very few days of the year — if ever. As for food, small gastropod molluscs, the sole food of the Flamingo, are not shy; and may be taken easily by any bird that feeds on them, whatever the color of the bird may be. Over the greater part of the American Flamingoes' range, at any rate, the anacondas and alligators of which Mr. Thayer speaks are not dangerous to him. In the Bahamas there are none of either of these enemies; and crocodiles are very scarce, and anacondas non-existent, throughout the whole

West Indian area. The two species of Andean Flamingo—*Phaenicoptarrus andenus* and *P. jamesi*—as well as also *Phaenicopterus chilensis*, would be even less likely to meet with enemies of this sort. This leaves only the small African Flamingoes, *Phaeniconaias minor* and *Phaenicopterus roseus* to be mentioned. Of course there are no water snakes in the Old World capable of swallowing a flamingo, and crocodiles would be dangerous over only a comparatively small part of the range of these birds. So that taking the group of Flamingoes as a whole, and their geographic distribution as a whole, we see that these two elements of danger would only be likely to affect a couple of species, and that over only a small part of their range. This is assuming that there are Flamingoes which would not *see* the coming enemy first, which is very improbable indeed. The fact that Flamingoes, Spoonbills and Scarlet Ibis lose the pink of their plumage almost at once with change of food in captivity shows that this characteristic is probably not one which has been fixed by organic evolution but is, as is probably often the case, a purely physiologic result from their mode of life.

This same method of analysis might be followed out for many of the other examples which Mr. Thayer uses. It is somewhat enlightening to match the Flamingo and the Roseate Spoonbill drawn in Plate IX with actual skins of the species. One would hardly believe it possible that they could have been drawn from specimens.

Mr. Thayer has devoted a number of pages (66–71) to the consideration of the exquisite plumage of the Wood Duck, in which he discovers a veritable picture-puzzle of water, forest-pools, cow-lily flowers, grass, reflections, window effects due to speculum, etc. In other words, the plumage is said to be “ruptive,” “counter-shaded,” “secant-marked,” etc.

We must say that we admire the Wood Duck, we hope as much as Mr. Thayer does. We have seen him wild from New Brunswick to Florida, and have bred him in captivity in some numbers. Perhaps our imagination is at fault, perhaps our artistic education has been somewhat neglected; but we are content to look upon *Aix sponsa* as a beautiful bird with a strongly developed and pleasingly constructed dimorphism of plumage.

Mr. Thayer has made this duck the subject of some beautiful

plates. We should like only to call attention to the fact that during nearly the whole season of greatest luxuriance of aquatic foliage the male Wood Duck, and other species as well, assume a nearly perfect "eclipse" plumage. The feathers are most brilliant during the late autumn, winter, and early spring, when their surroundings are of a dead and monotonous color. Hence, if we attributed any protective importance to such color patterns, we should be inclined to consider this of distinct disadvantage.

We believe the Caprimulgidæ, to take one of Mr. Thayer's first examples, to be a family with wonderfully adapted coloration. But here again we cannot but emphasize the enormous value of habit, which seems to us of far more value than color. We have, for instance, found a new white tennis ball an exceedingly difficult object to find, even in short grass; and chiefly for one reason — its habit of keeping still; yet we know approximately where to look for it.

It must seem that the premise which claims that this subject is one eminently fitted for investigation by an artist, and that it has wrongly been considered a part of the zoölogist's province, would need some revision. We are told that "it has waited for an artist in the last years of the nineteenth century not only to recognize the basic working laws of protective coloration, but to perceive that the many animals of supposed conspicuous attire are almost all colored and marked in a way most potent to conceal them." It would seem almost necessary that the painter should have a really wide knowledge of the varying forms and colorations of organisms of several classes of the animal kingdom before such broad statements were made. We have been shown in many cases that the female of a species having one type of coloration is protectively colored; and again that the male of the same species, with perhaps an enormously different type of coloration, is protectively colored also. We get, however, no suggestion as to how this was brought about. We must assume that primitive birds, indeed all birds, started originally with similarly colored males and females. The coloration of the Black Duck as compared to that of the Mallard is a case in point. Now, how and why should such a change have occurred except by sexual selection, or some process directly akin to it, pure and simple?

We think we can account for the way in which secondary sex characters are perpetuated, or perhaps even increased, on the assumption (in polygamous forms at least) that those males with the most marked sexual characters would tend to be the most vigorous in a struggle for the other sex. But this assumption leaves us completely in the dark as to the fundamental significance of sexual dimorphism, and further speculation is out of place in the present paper. We merely mention it to point out one of the biological problems which Mr. Thayer, in his enthusiasm, has ignored or glossed over with an artistic haze.

Another phase of the question which Mr. Thayer ignores is the question as to whether or not the habits of an animal demand protection. By skilful jugglings we are shown how anything and everything may be rendered inconspicuous, usually by artificial means, or under artificial conditions. The processes and steps by which these phases of coloration have been reached are ignored. The black and white skunk, the black and white zorilla of South Africa, and the curious, badger-like *Mydaus javanensis* of Java and Sumatra, have all independently taken on what we may call skunk coloration, and have all developed the well-known skunk smell. The line of demarcation between black and white as seen against the sky-line by a cringing grasshopper, or some other sort of puny prey, may in extremely rare cases aid the animal in getting food; but ordinarily speaking, the skunk would only be preyed on from animals which swooped upon it from above; and the fact that its insect prey surely has not eyes of the same image-forming powers as our own makes us believe, as other naturalists have, that this classic example of warning coloration is just as conspicuous as we have always supposed it to be.

Such creatures as Crows live by their wits, their wits are their protection; and skill in escaping an enemy is surely a character subject to evolution, and capable of considerable development. We know that a savage sees a green parrot in a green tree almost as easily as we see a hen strolling across a barnyard; and a hawk sees a mouse running in the grass, while circling high in the air, quite as easily. The hawk sees small birds in the same way; and we believe that the bird which can dodge most skilfully is the one that survives in the long run. Cases of the extermination

of birds well protected by coloration are not rare. *Bowdleria rufescens*, from the Chatham Islands, has become completely extinct through the introduction of cats and possibly of weasels. Yet an examination of the two skins of this species preserved in the Museum here in Cambridge show us a bird rich brown above, streaked with darker brown, fading to white below — an ideal type of concealing coloration for a bird which lived in the reed beds or wild-flax fields of the desolate Chatham Islands. These birds disappeared because they could not use their wits, just as other birds disappear with the introduction of the mongoose. A hundred examples of such extermination could easily be cited. Yet birds colored in the same way live on in spite of the presence of many *Herpestes* in India, where they have always been indigenous.

Mr. Thayer, in a recent number of 'The Auk,' tells us that he has painted a Himalayan Mountain gorge from the colored feathers taken from the plumage of the male Monal,— why not female? He fails to add that he might have accomplished the same result with the colors seen in a polished agate, or taking the varied tints seen on the skin of a baboon's nose. This method of persuasion, while it does appeal to the public, is — there is no other word — simply charlatany however unwitting. We are also informed that the colors taken from a flamingo, or rather the actual plumage of the bird, has been used to paint a splendid sunset. What would Mr. Thayer use to paint a rainy day,— may we perhaps suppose the colors of the bird's feet and bill? For rain does fall even where there are flamingoes.

The Papuasian forests of New Guinea and the Cape York Peninsula of Australia support a host of pigeons. These vary in form and hue from the great stupid Blue-gray Goura to the small lively doves of what we may conveniently term the genus *Ptilopus*. Among these arboreal pigeons we find some birds almost entirely pure white, and some solid green; others with the most bizarre arrangement of pink, and yellow, magenta, red, blue, and indeed almost every color. Are these birds of similar habits all equally protected in the same forest; or do they have so few natural enemies that they need less protection than usual?

If Mr. Thayer had handled a large museum collection of birds, and if he had happened to see any considerable number of them in

their native haunts in more than one zoölogical region, he would probably realize, as other naturalists have realized, that amongst many groups of birds color appears to be absolutely haphazard, the result of selections of various sorts concerning which we have as yet but little understanding. The fact that a red tanager, for instance, is protected in a forest of green, because the colors are complementary and because red occurs in the small areas of light produced by sunshine coming through green foliage may be so, although we doubt it. Nevertheless we do know that a vast majority of the birds of that same forest are not colored red but some or indeed almost any other color!

Again we ourselves see in the origin of counter shading only a manifestation of the direct influence of light rays. The condition is not one which we can suppose to have been derived by selection of any sort. The white ventral surface of a flounder can be darkened by the action of light and pigmented fishes which have taken to living in caves have descendants which are pigmentless. Mr. Roosevelt has raised the question of why a counter-shaded creature covers its important white belly by squatting when it most needs any protection which counter shading might give. This question remains unanswered. So that suggestive as it is we cannot as yet quite swallow the theory of counter shading in its entirety.

We see in the vast variation of color which many closely related species exhibit, the operation perhaps of chance germinal variations, perpetuated because, on account of their relative unimportance, they cease to become an object of special selectional value to the individual. This is perhaps akin to variations seen in degenerated organs and tissues, which, no longer subject to selection, are apt to show marked individual variation.

The very wealth of variety of external coloration and pattern, as against the extraordinary stability of the more important organs and tissues, would tend in our eyes to lower its immediate protective importance.

Acquiescence in Mr. Thayer's views throws a pall over the entire subject of animal coloration. Investigation is discouraged; and we find jumbled together, a great mass of fascinating and extremely complicated data, all simply explained by

one dogmatic assertion. For we are asked to believe that an animal is protectively clothed whether he is like his surroundings, or whether he is very unlike them (obliteratively marked); or, on the other hand, if he falls between these two classes, there is still plenty of space to receive him.

We cannot always presuppose so intense and bitter a struggle among all forms of life that an extremely slight favorable variation turns the balance, or that the constantly recurring momentary crises safely passed by the instant action of some color feature preserves one breeding individual in preference to another. The struggle exists, but is it quite so bitter as we would seem to have to believe? We are inclined to temper it with the spirit of altruism which Hanseman has so well discussed in his book, 'Heredity and Pathology.' Here the word altruism is used in a strictly biological sense as "the reciprocal relation between individuals and between species for the purpose of producing a more favorable *modus vivendi* for all"; and the idea is developed that annihilation cannot have been the underlying principle of evolution. Indeed, we think that nature is not always bitter. It is hard to find instances of a predatory animal surrounded by its normal environment causing the extinction of any species on which it lives. We do not believe this condition of affairs to be due to protective coloration, either.

We owe Mr. Thayer a debt of gratitude. He has brought a fascinating subject to a prominence that it has long deserved, but which it has not had. Much of what he shows us, where his illustrations are applicable to natural conditions, and where they are not specially arranged to illustrate some supposed state of affairs which may be capable at least of double interpretation, are of great value. We do not wish to seem destructive, and we have purposely omitted calling special attention to the strong features of the book. This has been done, and well done, by more able reviewers than ourselves. We have chanced to have, one or the other of us, opportunities for observation in the field in almost every part of the world; and for this reason, if for no other, we have felt emboldened to offer these critical notes; and we can but hope that Mr. Thayer and his followers will read them and interpret them in the spirit in which they are written. They are simply

the impressions made upon open-minded observers who have no axe to grind, and who have no reason to take sides on the question, one way or another. They have been written in a friendly spirit, and we hope they will be received in the same way.

TEN YEARS OF OBSERVATION ON THE MIGRATION OF ANATIDÆ AT WENHAM LAKE, MASSA- CHUSETTS.

BY J. C. PHILLIPS.

WENHAM LAKE is 20 miles northeast of Boston in the town of Beverly and Wenham. It is one and one third miles in length, and is divided into an upper and a lower basin. The lower basin is larger and very much deeper, averaging across its middle portion over fifty feet, with several deeper spots. The upper basin is somewhat shallow with one very long cove, attractive to the surface feeders. The pond is situated in a thickly settled region. Along the eastern shore is a brightly lighted main road — Main Street. At the south end are two large pumping stations, with tall chimneys and numerous cottages. At the southeast corner and at the north end are ice-houses. The whole western shore is wild, mostly high land with white oak forest. In the fall the pumping operations often lower the level of the lake ten or twelve feet.

The pond weeds common to the lake, very kindly identified for me by Mr. W. L. McAtee of the U. S. Biological Survey, are quillwort (*Isoëtes echinospora*, var. *braunii*); pondweed (*Potamogeton lucens* and *P. perfoliatus*), the "red head grass" of Currituck Sound; *Najas flexilis*; *Sagittaria teres*; wild celery (*Vallisneria spirilis*). This sheet of water is therefore well supplied with foods attractive to ducks.

The following list of Anatidæ represents ten consecutive years of gunning and of careful records at a point on the western shore of the lake.