In Nature's Workshop.

V.—SOME STRANGE NURSERIES.

By Grant Allen.

YOU could hardly find a better rough test of relative development in the animal (or vegetable) world than the number of young produced and the care bestowed upon them. The fewer the offspring, the higher the type. Very low animals turn out thousands of eggs with reckless profusion; but they let them look after themselves, or be devoured by enemies, as chance will have it. The higher you go in the scale of being, the smaller the families, but the greater the amount of pains expended upon the rearing and upbringing of the young. Large broods mean low organization; small broods imply higher types and more care in the nurture and education of the offspring. Primitive kinds produce eggs wholesale, on the off chance that some two or three among them may perhaps survive an infant mortality of 99 per cent., so as to replace their parents: advanced kinds produce half-a-dozen young, or less, but bring a large proportion of these on an average up to years of discretion.

Without taking into account insects and such other small deer, this fundamental principle of population will become at once apparent if we examine merely familiar instances of back-boned or vertebrate animals. The lowest vertebrates are clearly the fishes: and fish have almost invariably gigantic families, especially in the lower orders of the race. A single cod, for example, is said to produce, roughly speaking, nine million eggs at a birth (I cannot pretend I have checked this calculation); but supposing they were only a million, and that one-tenth of those eggs alone ever came to maturity, there would still be a hundred thousand codfish in the sea this year for every pair that swam in it last year: and these would increase to a hundred thousand times that number next year: and so on, till in four or five years' time the whole sea would be but one solid mass of closely-packed cod-banks. We can see for ourselves that nothing of the sort actually occurs—practically speaking, there are about the same number of cod one year as another. In spite of this enormous birth-rate, therefore, the cod population is not increasing—it is at a standstill. What does that imply? Why, that taking one brood and one year with another, only a pair of cod, roughly speaking, survive to maturity out of each eight or nine million eggs. The mother cod lays its millions, in order that two may arrive at the period of spawning. All the rest get devoured as eggs, or snapped up as young fry, or else die of starvation, or are otherwise unaccounted for. It seems to us a wasteful way of replenishing the earth: but it is nature's way; we can only bow respectfully to her final decision.

Frogs and other amphibians stand higher in the scale of life than fish: they have acquired legs in place of fins, and lungs instead of gills; they can hop about on shore with perfect freedom. Now, frogs still produce a great deal of spawn, as everyone knows: but the eggs in each brood are numbered in their case by hundreds, or at most by a thousand or two, not by millions as with many fishes. The spawn hatches out as a rule in ponds, and we have all seen the little black tadpoles crowding the edges of the water in such innumerable masses that one would suppose the frogs to be developed from them must cover the length and breadth of England. Yet what becomes of them all? Hundreds are destroyed in the early tadpole stage—eaten up or starved, or crowded out for want of air and space and water: a few alone survive to develop four legs and absorb their tails and hop on shore as tiny froglins. Even then the massacre of the innocents continues: only a tithe of those which succeed in quitting their native pond ever return to it full grown to spawn in due time and become the parents of further generations.

Lizards and other reptiles make an obvious advance on the frog type: they lay relatively few eggs, but they begin to care for their young: the family is not here abandoned at

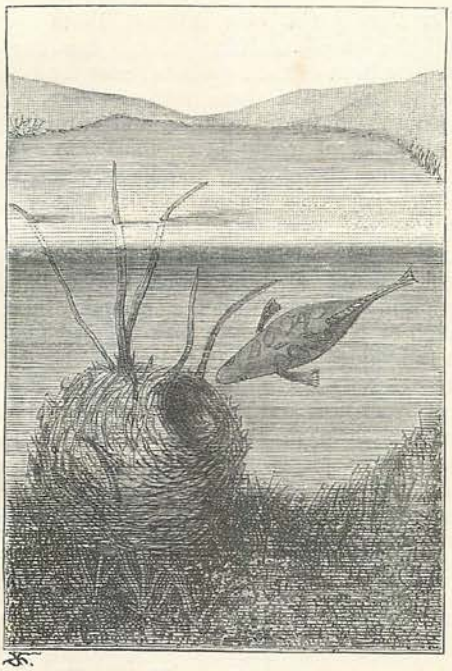
birth, as among frogs, but is frequently tended and fed and overlooked by the mother. In birds we have a still higher development of the same marked parental tendency; only three or four eggs are laid each year, as a rule, and on these eggs the mother sits, while both parents feed the callow nestlings till such time as they are able to take care of themselves and pick up their own living. Among mammals, which stand undoubtedly at the head of created nature, the lower types, like mice and rabbits, have frequent broods of many young at a time; but the more advanced groups, such as the horses, cows, deer, and elephants, have usually one foal or calf at a birth, and seldom produce more than a couple. Moreover, in all these higher cases alike, the young are fed with milk by the mother, and so spared the trouble of providing for themselves in their early days, like the young codfish or the baby tadpole. Starvation at the outset is reduced to a minimum.

It is interesting to note, too, that anticipations of higher types, so to speak, often occur among lower races. An animal here and there among the simpler forms hits upon some device essentially similar to that of some higher group with which it is really quite unrelated. For example, those who have read my account of the common earwig in a former number of this Magazine (now republished in "Flashlights on Nature") will recollect how that lowly insect sits on her eggs exactly like a hen, and brings up her brood of callow grubs as if they were chickens. In much the same way, anticipations of the mammalian type occur pretty frequently among lower animals. Our commonest English lizard, for example, which frequents moors and sandhills, does not lay or deposit its eggs at all, but hatches them out in its own body, and so apparently brings them forth alive: while among snakes, the same habit occurs in the adder or viper. The very name *viper*, indeed, is a corruption of *vivipara*, the snake which produces living young. Still more closely do some birds resemble mammals in the habit of secreting a sort of milk for the sustenance of their nestlings. Most people think the phrase "pigeon's milk" is much like the phrase "the horse-marines"—a burlesque name for an absurd and impossible monstrosity. But it is nothing of the sort: it answers to a real fact in the economy of certain doves, which eat grain or seeds, grind and digest it in their own gizzards into a fine soft pulp or porridge, and then feed their young with it from their crops and beaks. This is thus a sort of bird-like imitation of milk. Only, the cow or the goat takes grass or leaves, chews, swallows, and digests them, and manufactures from them in her own body that much more nutritive substance, milk, with which all mammals feed their infant offspring.

Now, after this rather long preamble, I am going to show you in this present article a few other examples of special care taken of the young in certain quarters where it might be least expected. Fish are not creatures from which we look for marked domestic virtues: yet we may find them there abundantly. Let us begin with that familiar friend of our childhood, the common English stickleback.

Which of us cannot look back in youth to the mysteries of the stickleback fisheries? Captains courageous, we sallied forth with bent pin and piece of thread, to woo the wily quarry with half an inch of chopped earthworm. For stickleback abound in every running stream and pond in England. They are beautiful little creatures, too, when you come to examine them, great favourites in the freshwater aquarium; the male in particular is exquisitely coloured, his hues growing brighter and his sheen more conspicuous at the pairing season. There are many species of sticklebacks—in England we have three very different kinds—but all are alike in the one point which gives them their common name, that is to say, in their aggressive and protective prickliness. They are armed against all comers. The dorsal fin is partly replaced in the whole family by strong spines or "stickles," which differ in number in the different species. One of our English sorts is a lover of salt water: he lives in the sea, especially off the Cornish coast, and has fifteen stickles or spines: on which account he is commonly known as the Fifteen-spined Stickleback: our other two sorts belong to fresher waters, and are known as the Ten-spined and the Three-spined respectively.

The special peculiarity of the male stickleback consists in the fact that he is, above all things, a model father. In his acute sense of parental responsibility he has few equals. When spring comes round, he first exhibits his consciousness of his coming charge by suddenly enduing himself in a glowing coat of many colours and of iridescent brilliancy. That is in order to charm the eyes of his prospective mate, or rather mates, for I may as well confess the sad truth at once that our amiable friend is a good parent but an

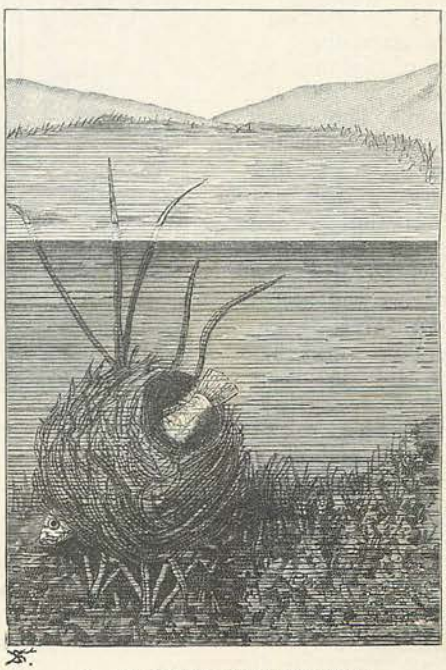


1.—STICKLEBACK'S NEST: THE MOTHER ABOUT TO ENTER.

abandoned polygamist. We all know that "In the spring a fuller crimson comes upon the robin's breast; In the spring the wanton lapwing gets himself another crest; In the spring a livelier iris changes on the burnish'd dove; In the spring a young man's fancy lightly turns to thoughts of love." Not to be out of the fashion, therefore, the romantic stickleback does precisely the same thing as all these distinguished and poetical compeers. And he does it for the same reason too: because he wants to get himself an appropriate partner. "There is a great deal of human nature in man," it has been said: I am always inclined to add, "And there is a great deal of human nature in plants and animals." The more we know of our dumb relations, the more closely do we realize the kinship between us. Fish in spring are like young men at a fair—all eager for the attention of their prospective partners.

The first care of the male stickleback, when he has acquired his courting suit, is to build a suitable home for his future wives and children. So he picks up stems of grass and water-weeds with his mouth, and weaves them deftly into a compact nest as perfect as a bird's, though somewhat different in shape and pattern. It rather resembles a barrel, open at both ends, as though the bottom were knocked out: this form is rendered necessary because the eggs, when laid, have to be constantly aërated by passing a current of water through the nest, as I shall describe hereafter. No. 1 shows us such a nest when completed, with the female stickleback loitering about undecided as to whether or not she shall plunge and enter it. You will observe that the fabric is woven round a fixed support of some waving water-weeds; but the cunning little architect does not trust in this matter to his textile skill alone; he cements the straws and other materials together with a gummy mortar of mucous threads, secreted for the purpose by his internal organs.

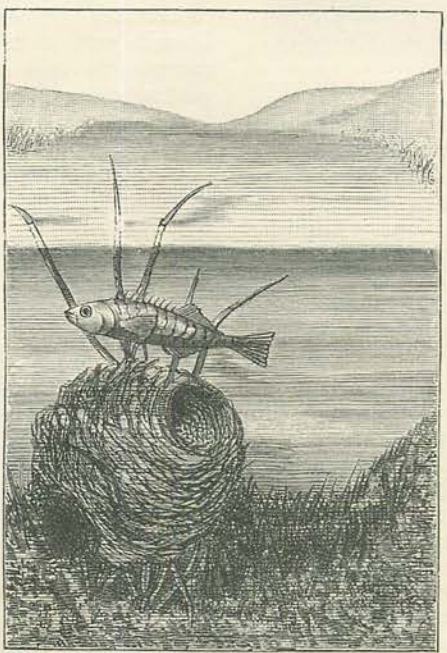
As soon as the building operations are fully completed, the eager little householder sallies forth into his pond or brook in search of a mate who will come and stock his neatly-built home for him. At this stage of the proceedings, his wedding garment becomes even more brilliant and glancing than ever; he gleams in silver and changeful gems: when he finds his lady-love, he dances round her, "mad with excitement," as Darwin well phrased it, looking his handsomest and best with his lustrous colours glistening like an opal. If she will listen to his suit, he grows wild with delight, and coaxes her into the nest with most affectionate endearments. In No. 2, as you perceive, the mate of his choice has been induced to enter, and is laying her eggs in



2.—THE MOTHER LAYING THE EGGS.

the dainty home his care has provided for her. The father fish, meanwhile, dances and capers around, in a *pas de triomphe* at the success of his endeavours.

One wife, however, does not suffice to fill the nest with eggs: and the stickleback is a firm believer in the advantages of large families. So, as soon as his first mate has laid all her spawn, he sets out once more in search of another. Thus he goes on until the home is quite full of eggs, bringing back one wife after another, in proportion to his success in wooing and fighting. For, like almost all polygamists, your stickleback is a terrible fighter. The males join wager of battle with one another for possession of their mates; in their fierce duels they make fearful use of the formidable spines on their backs, sometimes entirely ripping up and cutting to pieces their ill-fated adversary. The spines thus answer to the spurs of the game-cock or the antlers of the deer; they are masculine weapons in the struggle for mates. Indeed, you may take it for granted that brilliant colours and decorative adjuncts in animals almost invariably go with irascible tempers, pugnacious habits, and the practice of fighting for possession of the harem. The consequence is, with the sticklebacks, that many males get killed during the struggle for supremacy, so that the survivors wed half-a-dozen wives each, like little Turks that they are in their watery seraglios. Only the most beautiful and courageous fish succeed in gaining a harem of their own: and thus the wager of battle tells in the end for the advantage of the race, by eliminating the maimed, the ugly, and the cowardly, and encouraging the strong, the handsome, the enterprising, and the valiant. This is nature's way of preventing degeneracy.



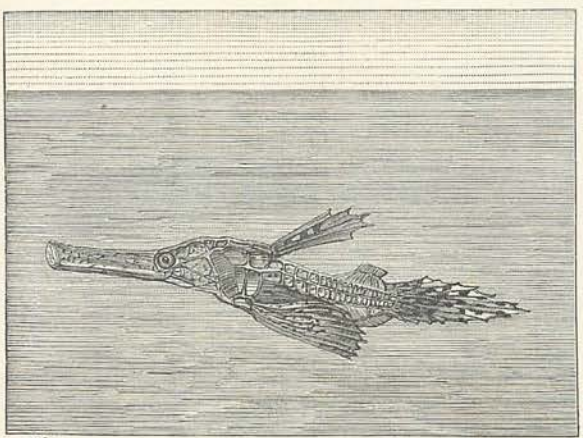
3.—THE FATHER STICKLEBACK AIRING THE EGGS.

In No. 3 the nest is seen full of eggs, and the excellent father now comes out in his best light as their guardian and protector. He watches over them with ceaseless care, freeing them from parasites, and warding off the attacks of would-be enemies who desire to devour them, even though the intruder be several times his own size. The spines on his back here stand him once more in good stead: for small as he is, the stickleback is not an antagonist to be lightly despised: he can inflict a wound which a perch or a trout knows how to estimate at its full value. But that is not all the good parent's duty. He takes the eggs out of the nest every now and then with his snout, airs them a little in the fresh water outside, and then replaces and rearranges them, so that all may get a fair share of oxygen and may hatch out about simultaneously. It is this question of oxygen, indeed, which gives the father fish the greatest trouble. That necessary of life is dissolved in water in very small quantities: and it is absolutely needed by every egg in order to enable it to undergo those vital changes which we know as hatching. To keep up a due supply of oxygen, therefore, the father stickleback ungrudgingly devotes laborious days to poising himself delicately just above the nest, as you see in No. 3, and fanning the eggs with his fins and tail, so as to set up a constant current of water through the centre of the barrel. He sits upon the eggs just as truly as a hen does: only, he sits upon them, not for warmth, but for aëration.

For weeks together this exemplary parent continues his monotonous task, ventilating the spawn many times every day, till the time comes for hatching. It takes about a month for the eggs to develop; and then the proud father's position grows more

arduous than ever. He has to rock a thousand cradles at once, so to speak, and to pacify a thousand crying babies. On the one hand, enemies hover about, trying to eat the tender transparent glass-like little fry, and these he must drive off: on the other hand, the good nurse must take care that the active young fish do not stray far from the nest, and so expose themselves prematurely to the manifold dangers of the outer world. Till they are big enough and strong enough to take care of themselves, he watches with incessant vigilance over their safety; as soon as they can go forth with tolerable security upon the world of their brook or pond, he takes at last a well-merited holiday.

It is not surprising under these circumstances to learn that sticklebacks are successful and increasing animals. Their numbers are enormous, wherever they get a fair chance in life, because they multiply rapidly up to the extreme limit of the means of subsistence, and develop as fast as food remains for them. There the inexorable Malthusian law at last steps in: when there is not food enough for all some must starve: that is the long and the short of the great population question. But while provender is forthcoming they increase gaily. Sticklebacks live mainly on the spawn of other fish, though they are so careful of their own, and they are therefore naturally hated by trout-preservers and owners of fisheries in general. Thousands and thousands are caught each year; in some places, indeed, they are so numerous that they are used as manure. It is their numbers, of course, that make them formidable: they are the locusts of the streams, well armed and pugnacious, and provided with most remarkable parental instincts of a protective character, which enable them to fill up all vacancies in their ranks as fast as they occur with astonishing promptitude.



4.—THE MOTHER TUBE-MOUTH CARRYING HER EGGS IN A POUCH.

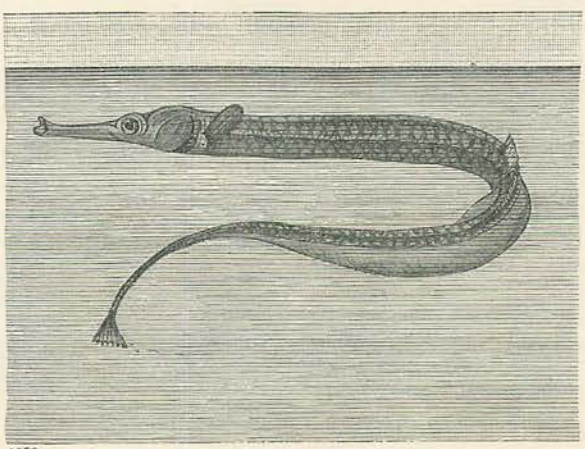
To those whose acquaintance with fish is mainly culinary, it may seem odd to hear that the father stickleback alone takes part in the care of the nursery. But this is *really* the rule among the whole class of fish: wherever the young are tended, it is almost always the father, not the mother, who undertakes the duty of incubation. Only two instances occur where the female fish assumes maternal functions towards her young: about these I shall have more to say a little later on. We must remember that reptiles, birds, and mammals are in all probability descended from fish as ancestors, and it is therefore clear that the habit of handing over the care of the young to the female alone belongs to the higher grades of vertebrates—in other words, is of later origin. We need not be astonished, therefore, to find that in many cases among birds and other advanced vertebrates a partial reversion to the earlier habit not infrequently takes place. With doves, for example, the cock and hen birds sit equally on the eggs, taking turns about at the nest; and as for the ostriches, the male bird there does most of the incubation, for he accepts the whole of the night duty, and also assists at intervals during the daytime. There are numerous other cases where the father bird shares the tasks of the nursery at least equally with the mother. I will glance first, however, at one of the rare exceptions among fish where the main duty does not devolve on the devoted father.

In No. 4 we have an illustration of the tube-mouth or Solenostoma, one of the two known kinds of fish in which the female shows a due sense of her position as a mother. The tube-mouth, as you can see at a glance, is a close relation of our old friend the sea-horse, whose disguised and undisguised forms in Australia and the Mediterranean we have already observed when dealing with the question of animal masqueraders. Solenostoma is a native

of the Indian Ocean, from Zanzibar to China, and in real life is about double the size of Mr. Enock's drawing. In the male, the lower pair of fins are separate, as is usual among fish: but in the female, represented in the accompanying sketch, they are lightly joined at the edge, so as to form a sort of pouch like a kangaroo's, in which the eggs are deposited after being laid, and thus carried about in the mother's safe keeping. No. 5 shows the arrangement of this pouch in detail, with the eggs inside it. The mother Solenostoma not only takes charge of the spawn while it is hatching in this receptacle, but also looks after the young fry, like the father stickleback, till they are of an age to go off on their own account in quest of adventures. The most frequent adventure that happens to them on the way is, of course, being eaten.

5.—THE POUCH, WITH THE EGGS INSIDE IT.

Our own common English pipe-fish is a good example of the other and much more usual case in which the father alone is actuated by a proper sense of parental responsibility. The pipe-fish, indeed, might almost be described as a pure and blameless ratepayer. No. 6 shows you the outer form of this familiar creature, whom you will recognise at a glance as still more nearly allied to the sea-horses than even the tube-mouth. Pipe-fishes are timid and skulking creatures. Like their horse-headed relations, they lurk for the most part among seaweed for protection, and, being but poor swimmers, never venture far from the covering shelter of their native thicket. But the curious part of them is that in this family the father fish is provided with a pouch even more perfect than that of the female tube-mouth, and that he himself, not his mate, takes sole charge of the young, incubates them in his sack, and escorts them about for some time after hatching. The pouch, which is more fully represented in No. 7, is formed by a loose fold of skin arising from either side of the creature. In the illustration this fold is partly withdrawn, so as to show the young pipe-fish within their safe retreat after hatching out. It is said, I know not how truly, that the young fry will stroll out for an occasional swim on their own account, but will return at any threat of danger to their father's bosom, for a considerable time after the first hatching. This is just like what one knows of kangaroos and many other pouched mammals, where the mother's pouch becomes a sort of nursery, or place of refuge, to which the little ones return for warmth or safety after every excursion.

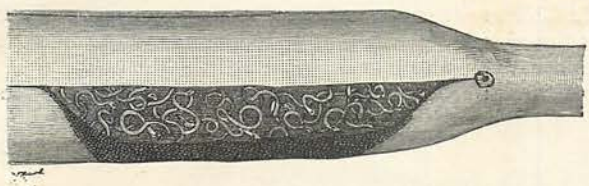


6.—THE FATHER PIPE-FISH, CARRYING HIS YOUNG IN A POUCH.

The sea-horses and many other fish have similar pouches; but, oddly enough, in every case it is the male fish which bears it, and which undertakes the arduous duty of nurse for his infant offspring.

A few female fish, on the other hand, even hatch the eggs within their own bodies, and so apparently bring forth their young alive, like the English lizard among reptiles. This, however, is far from a common case: indeed, in an immense number of instances, neither parent pays the slightest attention to the eggs after they are once laid and got rid of: the spawn is left to lie on the bottom and be eaten or spared as chance directs, while the young fry have to take care of themselves, without the aid of parental advice and educa-

tion. But exceptions occur where both parents show signs of realizing the responsibilities of their position. In some little South American river fish, for instance, the father and mother together build a nest of dead leaves for the spawn, and watch over it in unison till the young are hatched. This case is exactly analogous to that of the doves among birds: I may add that wherever such instances occur they always seem to be accompanied by a markedly gentle and affectionate nature. Brilliantly-coloured fighting polygamous fishes are fierce and cruel: monogamous and faithful animals are seldom bright-hued, but they mate for life and are usually remarkable for their domestic felicity. The doves and love-birds are familiar instances.



7.—THE POUCH HALF OPENED TO SHOW THE YOUNG.

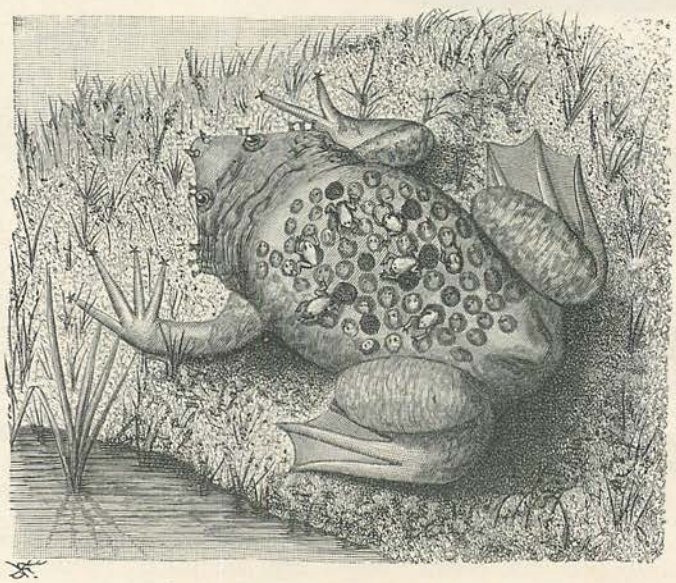
Frogs are very closely allied to fish: indeed, one may almost say that every frog begins life as a fish, limbless, gill-bearing, and aquatic, and ends it as something very like a reptile, four-legged, lung-bearing, and more or less terrestrial. For the tadpole is practically in all essentials a fish. It is not odd, therefore, to find that certain frogs reproduce, in a very marked manner, the fatherly traits of their fish-like ancestors. There is a common kind of frog in France, Belgium, and Switzerland, which does not extend to England, but which closely recalls the habits of the stickleback and the pipe-fish. Among these eminently moral amphibians, it is the father, not the mother, who takes entire charge of the family—wheels the perambulator, so to speak. The female lays her spawn in the shape of long strings or rolls of eggs, looking at first sight like slimy necklaces. I have seen them as much as a couple of yards long, lying loose on the grass where the frog lays them. As soon as she has deposited them, however, the father frog hops up, twists the garlands dexterously in loose festoons round his legs and thighs, and then retires with his precious burden to some hole in the bank of his native pond, where he lurks in seclusion till the eggs develop. Frogs do not need frequent doses of food—their meals are often few and far between—and during the six or eight weeks that the eggs take to mature the father probably eats very little, though he may possibly sally forth at night, unobserved, in search of provender. At the end of that time the devoted parent, foreseeing developments, takes to the water once more, so that the tadpoles may be hatched in their proper element. I may add that this frog is a great musician in the breeding season, but that as soon as the tadpoles have hatched out he loses his voice entirely, and does not recover his manly croak till the succeeding spring. This is also the case with the song of many birds, the crest of the newt, the plumes of certain highly-decorated trogons and nightjars, and, roughly speaking, the decorative and attractive features of the male sex in general. Such features are given them during the mating period as allurements for their consorts: they disappear, for the time at least, like a ball-dress after a ball, as soon as no immediate use can any longer be made of them.

Some American tree-frogs, on the other hand, imitate rather the motherly Solenostoma than the fatherly instincts of the pipe-fish or the stickleback. These pretty little creatures have a pouch like the kangaroo, but in their case (as in the kangaroo's) it is the female who bears it. Within this safe receptacle the eggs are placed by the male, who pushes them in with his hind feet; and they not only undergo their hatching in the pouch, but also pass through their whole tadpole development in the same place. Owing to the care which is thus extended to the eggs and young, these advanced tree-frogs are enabled to lay only about a dozen to fifteen eggs at a time, instead of the countless hundreds often produced by many of their relations.

Tree-frogs have, of course, in most circumstances much greater difficulty in getting at water than pond-frogs; and this is especially true in certain tropical or desert districts. Hence most of the frogs which inhabit such regions have had to find out or invent some ingenious plan for passing through the tadpole stage with a minimum of moisture. The devices they have hit upon are very curious. Some of them make use of the little pools

collected at the bases of huge tropical leaf-stalks, like those of the banana plant; others dispense with the aid of water altogether, and glue their new-laid eggs on their own backs, where the fry pass through the tadpole stage in the slimy mucus which surrounds them. Nature always discovers such cunning schemes to get over apparent difficulties in her way: and the tree-frogs have solved the problem for themselves in half-a-dozen manners in different localities. Oddest of all, perhaps, is the dodge invented by "Darwin's frog," a Chilian species, in which the male swallows the eggs as soon as laid, and gulps them into the throat-pouch beneath his capacious neck: into a bed of the soft skin, which soon closes over it automatically, thus burying each in a little cell or niche, where it undergoes its further development. The tadpoles pass through their larval stage within the cell, and then hop out, as the illustration shows, in the four-legged condition. As soon as they have gone off to shift for themselves, the mother toad finds herself with a ragged and honeycombed skin, which must be very uncomfortable. So she rubs the remnant of it off against stones or the bark of trees, and redevelops a similar back afresh at the next breeding season.

Almost never do we find a device in



8.—SURINAM TOAD, CARRVING HER FAMILY.

there they hatch out and pass through their tadpole stage: and when at last they arrive at frogly maturity, they escape into the world through the mouth of their father.

The Surinam toad, represented in No. 8, is also the possessor of one of the strangest nurseries known to science. It lives in the dense tropical forests of Guiana and Brazil, and is a true water-haunter. But at the breeding season the female undergoes a curious change of integument. The skin on her back grows pulpy, soft, and jelly-like. She lays her eggs in the water: but as soon as she has laid them, her lord and master plasters them on to her impressionable back with his feet, so as to secure them from all assaults of enemies. Every egg is pressed separately

nature which occurs once only. The unique hardly exists: nature is a great copyist. At least two animals of wholly unlike kinds are all but sure to hit independently upon the self-same mechanism. So it is not surprising to learn that a cat-fish has invented an exactly similar mode of carrying its young to that adopted by the Surinam toad: only, here it is on the under surface, not the upper one, that the spawn is plastered. The eggs of this cat-fish, whose scientific name is Aspredo, are pressed into the skin below the body, and so borne about by the mother till they hatch. This is the second instance, of which I spoke above, where the female fish herself assumes the care of her offspring, instead of leaving it entirely to her excellent partner.

Higher up in the scale of life, we get many instances which show various stages in the same progressive development towards greater care for the safety and education of the young. Among the larger lizards, for example, a distinct advance may be traced between the comparatively uncivilized American alligator and his near ally, the much more cultivated African crocodile. On the banks of the Mississippi, the alligator lays a hundred eggs or thereabouts, which she deposits in a nest near the water's edge, and then covers them up with leaves and other decaying vegetable matter. The fermentation of these leaves produces heat, and so does for the alligator's eggs what sitting does for those of hens and other birds: the mother deputes her maternal functions, so to speak, to a festering heap of decomposing plant-refuse. Nevertheless, she loiters about all the time, like Miriam round the ark which contained Moses, to see what happens; and when the eggs hatch out, she leads her little ones down to the river, and there makes alligators of them. This is a simple and relatively low stage in the nursery arrangements of the big lizards.

The African crocodile, on the other hand, goes a stage higher. It lays only about thirty eggs, but these it buries in warm sand, and then lies on top of them at night, both to protect them from attack and to keep them warm during the cooler hours. In short, it sits upon them. When the young crocodiles within the egg are ready to hatch, they utter an acute cry. The mother then digs down to the eggs, and lays them freely on the surface, so that the little reptiles may have space to work their way out unimpeded. This they do by biting at the shell with a specially developed tooth; at the end of two hours' nibbling they are free, and are led down to the water by their affectionate parent. In these two cases we see the beginnings of the instinct of hatching, which in birds, the next in order in the scale of being, has become almost universal.

I say *almost* universal, because even among birds there are a few kinds which have not to this day progressed beyond the alligator level. Australia is the happy hunting-ground of the zoologist in search of antiquated forms, elsewhere extinct; and several Australian birds, such as the brush-turkeys, still treat their eggs essentially on the alligator method. The cock birds heap up huge mounds of earth and decaying vegetable matter, as much as would represent several cartloads of mould; and in this natural hot-bed the hens lay their eggs, burying each separately with a good stock of leaves around it. The heat of the sun and the fermenting mould hatch them out between them; to expedite the process, the birds uncover the eggs during the warmer part of the day, expose them to the sun, and bury them again in the hot-bed towards evening. Several intermediate steps may also be found between this early stage of communal nesting by proxy and the true hatching instinct; a good one is supplied by the ostrich, which partially buries its eggs in hot sand, but sits on them at intervals, both father and mother birds taking shares by turn in the duties of incubation.

The vast subject which I have thus lightly skimmed is not without interest, again, from its human implications. Savages as a rule produce enormous families; but then, the infant mortality in savage tribes is proportionately great. Among civilized races, families are smaller, and deaths in infancy are far less numerous. The higher the class or the natural grade of a stock, the larger as a rule the proportion of children safely reared to the adult age. The goal towards which humanity is slowly moving would thus seem to be one where families in most cases will be relatively small—perhaps not more on an average than three to a household—but where most or all of the children brought into the world will be safely reared to full maturity. This is already becoming the rule in certain favoured ranks of European society.