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THE OTTAWA NATURALIST.

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THE PELICAN.

By PROFESSOR EDWARD E. PRINCE,
Dominion Commissioner of Fisheries, Ottawa.

Of all ungainly birds the pelican (*Pelecanus erythrorhynchos, Gmelin*) seems to be the most ungainly and awkward. Its huge beak with swollen gular pouch is so disproportionate when compared with the small size of the head, while the head and beak together appear to completely overbalance the short squat body. When seen alive in zoological gardens its actions are far from graceful. It waddles about its wire netting enclosure, clumsily moving the head from side to side, and dipping frequently into the miniature pond, hoarsely screaming, and heavily flapping its long wings, the very emblem of uncouth awkwardness. It is, indeed, difficult to realise that this solitary bird of the desert has any graceful features at all.

Such an impression is far from the truth. No doubt the pelican resorts to remote waters, and shuns the company of man. Out on the secluded lakes of the vast prairie country or along certain stretches of unfrequented rivers of the north, it makes its home. I had recently the opportunity (early in September), which few visitors to the border of the Barren Lands can forego, of shooting the Grand Rapids of the Big Saskatchewan, and saw on that occasion the pelican in its natural habitat. The Grand Rapids, it is hardly necessary to say, occur just before the noble Saskatchewan debouches into Lake Winnipeg towards the north end of that lake. As our spacious York boat, manned by four swampy Cree Indians, danced down the swift current, bouncing over boiling whirlpools, and plunging past swirling eddies, we

noticed on a distant shallow strip of bush-grown shingle an assemblage of white pelicans. They were crowded in a long line like a company of soldiers arrayed in spotless white tunics. It was early morning (6 a.m.), and as the bright sun shone through the clear northern air, the line of large white birds stood out in bold relief amidstream. They were bobbing their heads up and down, and shifting uneasily as though they were going through the old method of regimental "sizing"—tallest at the end, shortest in the middle of the line. With characteristic timidity they rose in flight when our boat was two or three hundred yards away. I counted them as they rose and found that there were 76 birds, and there must in all have been at least a hundred pelicans along the rapids which extend some four miles. They looked like huge swans or gulls, the head being gracefully thrown back, bringing the point of the long beak very little in front of the breast. The shortness of the tail was obscured by the stout yellow webbed feet which were backwardly directed in flight and gave the bird a greater apparent length, as the feet extended beyond the blunt tail which, it may be added, consists of 20 or 25 short feathers. Each tail-feather terminates in a white pointed plate or horny tip. The expanse of the wings was the most remarkable feature. It imparts a majestic appearance to the bird. Seen from below, the outer half of each wing is observed to be of a dull black colour; the inner part, next to the body of the bird, is cream white; so that the wings have the appearance, when expanded, of a huge letter "U" of white, with the outer broad fringe of black. One famous U.S. naturalist speaks of the pelican as "clumsy on the wing;" but no one could so speak who saw these birds as I saw them in their native haunts.

They flew for some distance in a confused manner, without arranging themselves like ducks or geese in regular flying order. Some separated from the rest and moved round gracefully in circles with motionless outstretched wings, after the manner of

huge sea-gulls. Nothing could exceed the soaring sweep and grace of these great wheeling birds. Others settled upon the surface of the water and, with head upstream, gradually drifted down with the swift current.

When swimming the wings are not closed tight upon the body, as in the case of the duck: but are raised up and form a plumed arch above the body. The head is thrown back somewhat and the neck curved so that the beak is directed diagonally downward. The bright yellow gular pouch could be readily seen through a field glass. The Indians cut off this pouch when they secure a pelican, and sewing two together they make a quaint but useful pocket for needles, &c. The beak, I observed, was moved continually from one side to the other, more especially to the left side, that is, towards the bank of the river, alongside which the birds were drifting. Whether they were driving the fish shorewards or not I could not make out: but they were evidently not feeding. The tip of the beak was merely dipped into the surface of the water as they gracefully floated down below the rapids to the mouth of the river. On reaching the river mouth, several miles below, they are said to fly up to their starting point and once more drift down again, repeating this procedure time after time. They are said to be expert at catching fish, chiefly the fine whitefish which ascend from Lake Winnipeg to the Grand Rapids for spawning purposes in September and October. Each fish, as soon as it is caught in the capacious beak, slides into the pouch and then slips down the throat at a single gulp.

The Indians in the locality charge the pelicans with having driven the whitefish out of the river: but if the fish have diminished in number it is not necessary to seek further for the cause than the action of the Indians themselves who, for years, have scooped the rapids with dip-nets, and have captured the parent fish in numbers when just about to spawn There is no better

method of ensuring the depletion of fish than that, and the Grand Rapids certainly did not swarm with whitefish in September and October as they once did. The fish keep close to the bank of the river on account of the swiftness and force of the current, and slowly creep up, as it were, into the very midst of the boiling tossing rapids, which it is claimed are the finest rapids in the world. The salmon in the Fraser and other Pacific rivers hug the shore in the same way, when ascending the swift water of the canyons, the dark backs of the fish appearing above the surface of the turbid water, indicating the crowds of salmon at the very edge of the river. The capture of such fish is easy, and I had the opportunity of seeing some of the whitefish scooped up by the Indians just above the Grand Rapids Hudson's Bay Post.

The pelicans appear to be well aware of this habit of the migrating fish, for they float as a rule near the bank on either side, and capture the unsuspecting whitefish just when exerting all their strength and attention in battling with the descending stream.

The nesting grounds of these pelicans appear to be the dry gravelly beaches of Cedar Lake, over twenty miles above Grand Rapids. Their large streaked eggs, in shape like the eggs of the goose, may be gathered there in numbers. The pelican makes little or no nest, and has the reputation of being a very incompetent and neglectful parent. A common belief prevails that the black cormorants, of which a few are usually seen wherever the pelicans are found, sit and watch the eggs of the latter when the pelican is away fishing, and in return the cormorant receives a share of the captured fish. The pelican's eggs, it is said, are so exposed to the sun's rays that incubation continues when the parent bird is absent fishing. If the cormorants mutually consort with the pelicans, and share in the spoils of fish, as a return for guarding the temporarily forsaken eggs, they

afford a most remarkable case of commensalism or exalted parasitism, even more remarkable than that of the association of the Burrowing Owl (*Speotyto cunicularia, Mol.*) and the so-called Prairie Dogs.

The male pelican, during the breeding period, shows certain features prominently, such as the thick bunch or crest of white plumes passing down from the back of the head. A dry feathery bunch of plumes decorates the breast similar to the "powder-down" tract in the Heron (*Ardea*). These breast-feathers are often said to be phosphorescent, and when the pelican is fishing at night they are declared to lure the fish. The beak, at the period of nesting, exhibits an erect flat plate of yellow horny substance, some little distance from the tip of the upper mandible. Behind this large plate, about one and a half or two inches high, and two or two and a half inches long, there are several smaller erect plates, forming a saw-like ridge along the top of the beak. The adjacent surface, moreover, shows large flat scales, and at the tip of the upper mandible there is a sharp tooth-like hook almost as large as the nail of the little finger and actually pointed.

The male and female birds are alike in coloration, and this and some of the other features just mentioned support Stejneger's view that these birds, the Steganopodes generally indeed, are closely related to the Herodiones (the Herons and Storks).

ON THE COMPOSTION OF CANADIAN VIRGIN SOILS.*

By FRANK T. SHUTT, M.A., F.I.C., F.C.S.,
Chemist, Dominion Experimental Farms.

The soil investigations carried on in the Laboratories of the Dominion Experimental Farms, at Ottawa, have included the chemical and physical examination of certain typical virgin (uncropped and unmanured) soils. The samples, over 100, were carefully collected in the various provinces of the Dominion and may be regarded as types or representatives of areas of fair uniformity and considerable magnitude.

The majority of these samples are surface soils, but in a large number of instances the results upon their respective subsoils have also been obtained. The paper is accompanied by six tables of analytical data.

The exact value of an ordinary soil analysis in ascertaining the fertility or productiveness of a soil, is considered, and while it is admitted that hot hydrochloric acid sp. g. 1·115 dissolves larger amounts of mineral plant food than are of immediate availability to crops, it is pointed out that a knowledge of the "maximum" amounts shows decisively deficiencies, if any exist, and thus indicates lines for rational and economic treatment of the soil with fertilizers. Further, it is pointed out that soils possessing large "maximum" amounts will in all probability prove more fertile than those showing smaller percentages, the climatic influences in both cases being equally favourable.

The diagnosis of a soil as regards productiveness cannot be made from a chemical analysis alone—even if such includes a determination of the so-called "available" plant food. The physical condition of the soil, drainage, rainfall, mean tempera-

*Abstract of a paper read before the Chemical Section of the British Association for the Advancement of Science, Toronto, August, 1897.

ture, sunshine, &c., are factors that must receive careful consideration.

Pot or plot experiments with the various fertilizers are at present the only means of gaining reliable or accurate knowledge of a soil's needs, but the incentive given by Dr. Dyer in 1894 in publishing his results by the one per cent citric acid solution has resulted in many agricultural chemists on this continent directing their attention to this important subject, and the probabilities are that ere long we shall be agreed upon laboratory methods for determining available plant food in soils.

The standards of fertility as suggested by Dr Hilgard, of the California Experiment Station, are stated and deductions made from Canadian data are given. The latter show that good agricultural soils possess usually between ·25% and ·5% of potash—less than ·15% indicating the value of potassic fertilizers; phosphoric acid is usually between ·15% and ·22% but the adequacy of this element depends largely on the amount of lime associated with it. In lime, less than 1% in clay soils indicates that their productiveness will be increased by an application of a calcareous fertilizer. Peaty soils have always responded well to a dressing of lime. Richness in nitrogen invariably indicates, in Canada, loams of excellent productiveness. Omitting prairie soils, the large number of our good soils contain between ·125% and ·225 of nitrogen; many, however, reach ·5% and some exceed 1·0%.

BRITISH COLUMBIA.

As far as our investigations in this province have carried us, the soils fall into three well marked groups: (*a*) Deltaic, as at the mouth of the Fraser and Pitt Rivers, very rich in plant food; (*b*) Valley soils, of alluvial origin, of more than average fertility; and (*c*) Bench and plateau soils at varying altitudes—frequently light and sandy, ranging from very poor to soils of medium fertility.

Table I presents data from 29 samples, collected in Vancouver Island and the districts of New Westminster, Yale and Cariboo. The amounts of plant food, and the chief physical characters of these soils receive consideration and deductions are made therefrom as to their relative fertility. The soils formed by the accumulation of detritus at the mouths of the Fraser, Pitt and other rivers are shown to be particularly rich in plant food.

NORTH-WEST TERRITORIES AND MANITOBA.

The prairie soils of these regions present considerable uniformity in character. They are justly noted for their productiveness, for analysis has shown them to contain, as a rule, large percentages of the essential constituents of plant food. Especially are they rich in humus and nitrogen. The prevailing prairie soil is a black or greyish-black loam in which nitrification proceeds rapidly when the soil is tilled.

Attention is drawn to the fact that alkali soils are almost invariably found to contain an abundant supply of plant food. The application of gypsum, drainage and irrigation are the means suggested for converting them into fertile soils. Such methods, unfortunately, are not always feasible.

Table II gives analytical data of eight typical surface soils from these provinces ; those of a sample from the prairie soil of the Red River Valley being discussed in detail. The results demonstrate clearly that it may be classed among the richest of known soils.

ONTARIO.

Data are presented in Table III obtained from soils collected in the district of Muskoka only. These soils are characterized by a preponderance of sand, being such as would be classed as light loams. Clay loams, however, are occasionally met with. The chief deficiencies are in humus and nitrogen—frequently resulting from destructive forest fires—and in lime. Speaking of them as a class, the Muskoka soils are scarcely

heavy enough for wheat. Good yields of oats, potatoes and root and fodder crops, generally, are under good systems of culture readily obtained in favourable seasons.

QUEBEC.

The analytical results of clays and loams obtained from widely different areas in this province are contained in Table IV. Much variation in composition is to be observed, as might be expected, but, although some show inadequate quantities of certain elements for best results, all the surface samples come well within the limits of fertility we have discussed, and many of the soils are seen to compare most favourably with those of recognized productiveness.

THE MARITIME PROVINCES.

The analyses of several typical soils in the Maritime Provinces are given in Table V. Prominent among these is one from the Sackville Marsh, N.B., at the head of the Bay of Fundy. The tides of this bay are phenomenally high, carrying with them vast amounts of detritus. Large deposits of this so-called marsh mud consequently form, and this material is highly prized by many farmers as an amendment, frequently being applied at the rate of 100 to 200 loads per acre. Reclaimed marsh lands are found to be exceedingly fertile.

Particulars are presented of a typical soil from Prince Edward Island. It is seen to be inferior in several particulars to many of our Western soils and it would seem, therefore, that this province, justly known as a fertile one, owes its reputation rather to good soil texture and favourable climatic conditions than to large percentages of soil-food constituents.

Table VI shows the averages of the results from the soils examined, taken province by province. The data, however, are only to be interpreted as representing the composition of soils of large areas in the respective provinces.

General conclusions are drawn which indicate that in all the provinces large tracts of untilled land exist that would rank with the fertile soils of other countries and, further, it is shown that many Canadian soils are possessed of most abundant stores of plant food—stores so vast as to allow of their most favourable comparison with the richest soils of which we have any knowledge.

THE POISON OF POISON IVY (*Rhus radicans*).

In the Year Book of the United States Department of Agriculture for 1896, recently issued, there is a very interesting chapter entitled: "Some Common Poisonous Plants," written by Mr. V. K. Chesnut, of the Division of Botany, U. S. Department of Agriculture. Among the plants described and illustrated, the Poison Ivy, "as the principal poisonous plant of America," receives attention. After an account of its habitat and botanical characters, in which the writer points out how it may be distinguished from non-poisonous plants that bear certain resemblances to it in the form of their leaves, &c., there follows a discussion regarding the nature of the poisonous principle—a question over which there has been much dispute. As this is a matter of no little interest and practical importance, we shall quote at some length this part of the author's article:

"Poison ivy has long been regarded by the ignorant with a degree of awe akin to superstition. No one was able to tell how it produced its effects, and why it attacked some people and not others. Mysterious principles were relied upon to explain the phenomena, and up to the present time the common belief has been that the poisonous constituent was really an exhalation from the plant. In the latter part of the last century it was so regarded by the expert; then, as our knowledge of

plant chemistry advanced step by step, it was attributed more concretely to a specific gas, a volatile alkaloid, and a volatile acid like formic acid. More recently still, bacteria have been accused of causing the affection. Experiments have seemed to verify these ideas in turn, but the falsity of all has at last been proved by the discovery of a more tangible compound. In January, 1895, Dr. Franz Pfaff, of Harvard University, announced that the poison is in reality a non-volatile oil. Numerous experiments have been performed with the purified oil, and it has been shown to produce exactly the same effect as the plant itself. Dr. Pfaff has called this substance 'toxicodendrol.' It is found in all parts of the plant, even in the wood after long drying. Like all oils, it is insoluble in water, and therefore cannot be washed from the skin with water alone. Alcohol dissolves it readily. Alkalies saponify it, and thus render it inert, but this result is more easily obtained by an alcoholic solution of the sugar of lead (lead acetate)."

The two chief points of interest to our readers are: the establishment of the fact that the poison is non-volatile and, therefore, that actual contact of the leaves with the skin is necessary to cause the poisoning; and, secondly, that a remedy has been found that is at once simple and efficacious. The writer, as the result of many trials, in which he experimented on himself and others, says that "applications of an alcoholic solution of the sugar of lead always give immediate and permanent relief." This is certainly to be regarded as a valuable discovery. Respecting the application of the remedy, the writer concludes as follows:—

"In practice it is not desirable to use strong alcohol, which is apt to be too irritating to a sensitive surface, but a weaker grade of from 50 to 75 per cent, should be preferred, and to this the powdered sugar of lead is to be added until no more will dissolve. The milky fluid should then be well rubbed into the

affected skin, and the operation repeated several times during the course of a few days. The itching is at once relieved and the further progress of the malady is checked. The remedy has been tried in a large number of cases and has always proved successful, but it must be remembered that it is itself a poison when taken into the mouth." F.T.S.

FURTHER NATURALIST'S NOTES ON THE PACIFIC COAST.—II.

By ANDREW HALKETT, Esq.

While sailing through the Straits of Juan de Fuca the Olympian coast-range of mountains in the State of Washington is seen to special advantage. The coast-line is mountainous and timbered on both the British Columbian and United States sides; and the Olympians located well inland, being capped and covered with snow, form a most beautiful spectacle.

The day spent in this place closed with a calm and quiet sunset. The mountains assumed a deep black blue—a vessel was to be seen here and there in the distance—and the light at Cape Flattery (U.S.) shone with the softness of a planet. As the day declined the moon arose behind the mountains.

The student of marine life would find enough to engage his attention at Ucluelet Arm, Barclay Sound, situated on the west shore of Vancouver Island. The Sound is studded with islands, with rugged, wooded mountains in the background, and in some cases capped with snow. On one of these islands the surf was seen dashing up the rocks with great violence.

Three Shags were seen sitting on the extreme point of an adjacent island, and these with other sea-birds, such as Pigeon Guillemots, added variety to the scene.

The Shag or Cormorant (*Phalacrocorax pelagicus*, Pall.) belongs to the Steganopodes or Totipalmate* order of birds, which is distinguished by having the hallux or hind claw drawn to the front, so that the foot is three-webbed, a peculiarity which is not shared by any other order. Another peculiarity is the possession of a naked gular pouch, which in the case of the Pelicans (*Pelicanus*) is enormously enlarged, but is quite rudimentary and non-functional in the Cormorants. It is rather curious that the Steganopodes, in common with a few other orders comparatively low in the avian scale, are altricial, that is the young, like the young of the Insessorials or singers and perchers, are immaturely hatched, and therefore require to be fed and tended by the parent birds.

The Pigeon Guillemot (*Cepphus columba*, Pall.) has a pure white space on each wing, called the "mirror," which contrasts finely with the sooty black colour of the body, hence seamen call it the "white-winged diver."

When the tide recedes at Ucluelet Arm the pools are full of Star-fishes (*Asterias*), Sea-urchins (*Echinus*), Anemones (*Actinia*), Mussels (*Mytilus*), various Gastropods, Hermit-crabs (*Pagurus*), and Barnacles ; and how delightful it is to watch the harmonious mingling of colours, forms, and movements, in these limpid salt-water pools of a soft emerald green.

Several genera of Star-fishes are represented, but the most common is a species of the typical genus *Asterias*, the individuals of which are nearly as varied in their colour as the flowers on a vine of morning-glories, Some are yellow, others purple, and others again brown, and in seeking a solution to this problem of difference of colour in the same species, I advance the following as a simple explanation.

It is well known that under domestication animals are more varied in their coloration than they are in a wild state, as is

* "Having all four toes connected by webbing."—*Jordan.*

often witnessed in a litter of kittens or rabbits. The same litter of kittens may contain white, black, piebald, and tortoise-shell individuals. But in a wild condition cats and rabbits are of a sombre or uniform colour, and one individual of either species is virtually just like any other individual. The reason of this is that the dull inconspicuous colour corresponds more or less with the creature's surroundings, so that the wild-cat is disguised from the birds upon which it preys, and therefore is the better equipped to approach them stealthily ; and the rabbit on the other hand is the better concealed from the attacks of the wily fox or other foe. Now when cats or rabbits are domesticated, any individuals manifesting unwonten conspicuous colours instead of the usual uniform greys have no creatures on the alert or foes to observe them, hence there is no call for the survival of the fittest, and in course of time we have cats and rabbits, and in the same way cows and horses, black, white, brown, or spotted. If domestic cats and rabbits were suddenly to revert to a wild state, and yet could retain their conspicuous colours, the former would catch very few birds, and the latter would escape very few foxes, and soon they would cease to exist. Now Star-fishes do not require to be hidden from enemies, because they have few enemies, and they do not require to be disguised from their prey, because just as a cow gets plenty to eat in a field of clover, so the rapacious Star-fish gets all it can desire in the luscious bivalves which are permanently moored by a byssus in thousands to its habitat. Therefore a uniform or sombre colour is not requisite, and their conspicuous yellow, purple, or brown tints may be thus accounted for.

The Urchins, observed in this locality, have moveable spines of a beautiful purple. Unlike the Star-fishes they never come out of the water, but under its surface can make their way into crevices of the rocks. The shell of a Sea-urchin, which is remarkably symmetrical in shape, is not composed, as might appear, of one piece, but of hundreds of plates sutured

together, and at regular intervals there are rows of punctures, being the passages for as many ambulacral feet. The digestive system is very complete, the mouth being furnished with five teeth. They are also possessed of five rudimentary eyes.

It would be difficult without visiting the tropics to find a more pleasing object to the eye than the Sea-anemone, which abounds on this shore. The ground colour is a soft green, merging as it approaches the ends of the tentacles into the most delicate shade of pink. Biologically the Sea-anemones hold a place very distinct from the Star-fishes and Urchins, although both groups were included by Cuvier in his sub-kingdom Radiata.

The Mussels and Barnacles cover the rocks by thousands and the Hermit-crabs having robbed many a gastropod of its shell, move about actively over the stones in the pools, or in the the moist places caused by a dense growth of algæ.

One of the most charming sights which I can recall in my natural history studies is that afforded by a deep salt-water pool among the inshore rocks in this part of the Pacific. The long and narrow bladed grass partially covers the surface, and curtains the sides, which are strewed with great Star-fishes, Chitons, and Anemones with tints of delicate pink and green, which blend perfectly with the soft colour of the water.

The islands off Barclay Sound are worthy of mention. A few are jagged rocks, crowned with conifers, and covered with mussels and barnacles. Here again the anemones and starfishes find a suitable habitat, and are hidden and revealed each alternate moment as the white waves dash against the sides. Other islands are merely bare rocks without any vestige of a tree, and afford a home to the White-headed Gull (*Larus heermani*, Cass.) which in the breeding serson has a bill of a bright vermilion red, and a red ring around the eye.

A specimen of the Picked Dog-fish (*Squalus acanthias*, L.) was caught near here in 30 fathoms of water. This species is a

very small shark, seldom exceeding a length of three feet It occurs in both Atlantic and Pacific. The teeth have their points "so much turned aside that the inner margin of the tooth forms the cutting edge."—*Gunther.* Each dorsal fin is armed with a spine. The Dog-fish is valued for the oil which it yields.

A species of plant, of the natural order Ericaceæ, called *Gaultheria shallon* grows commonly throughout the woods at Ucluelet, and the berries are dried and used as food by the Siwash Indians, The Shallon grows several feet high in shaded woods. It is an ally of the Winter-green, the Heaths, the Arbutus, &c.

Leaving the shores of Vancouver Island the most conspicuous creatures to be seen whilst the vessel plies its way over the broad bosom of the Pacific Ocean are two species of birds. One of these is the Gony or Black-footed Albatross (*Diomedea nigripes*, Aud.) which "is noted for its protracted powers of flight, following vessels for hundreds of miles and subsisting on the refuse thrown overboard."* The other bird is the graceful Gray Fork-tailed Petrel (*Oceanodroma furcata*, Gmel), called by seamen the "Seal-bird."

Early one morning after a voyage of some twelve days land was fully in view, and the contrast between the vast expanse of ocean and the imposing volcanic mountain which now, as it were, suddenly loomed up before one, was so great as to render description difficult. Mount Shishaldin, situated on Unimak Island near the entrance to Unimak Pass, is over 8900 feet high. Adjoining it is another mountain, not a volcano nor as high, and both are covered with snow. As the volcano was approached, a thin film of smoke was observed to be issuing from it, but during the time it was in sight it did not appear to be continuously smoking.

On the west side of Unimak Pass are the picturesque islands of Tigalda, Akun, Akutan, &c.

Whilst the vessel was making its way through the pass I had the good fortune to see tens of thousands of Shear-waters (*Puffinus*) winging their way, near the surface of the water, in the opposite direction. These birds belong to the order Longipennes, which also comprises the Gulls, Terns and Petrels. Their onward, yet easy flight, their jet-black colour, and their countless numbers, produced a pleasing effect.

OTTAWA, March, 1897.

* "Nests and Eggs of North American Birds," by Oliver Davie.

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