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Volume II *No 3*

CHARADRIIFORMES

Suborder ALCAE

BY

E.V. KOZLOVA

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PREFACE

The present volume on the Fauna of the USSR deals with birds of the suborder Alcae and has appeared after a considerable interval. Like the four preceding parts (published between 1937 and 1947 and devoted to the study of birds) it is based mainly on investigations of collected material kept at the Zoological Institute of the Academy of Sciences of the USSR* (referred to in the text both as ZIN AN or the Zoological Institute).

The various chapters of the book are written in the same order as are the previous parts. With respect to individual features, considerably more attention is paid to functional-morphological analysis as well as to a more elaborate characterization of species; the plumage is also described in greater detail with regard to seasonal changes and age differences.

The attached bibliography, though not complete, nevertheless contains the most important works on the subject.

The photographs were provided by K. A. Yudin and the drawings prepared by N. N. Kondakov and V. S. Rozhdestvenskaya.

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* [Zoologicheskii Institut Akademii Nauk]

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Suborder **Alcae**

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SUBORDER ALCAE

To the suborder Alcae belong sea birds which are closely related to gulls but are adapted to aquatic conditions to a much greater extent and are less associated with terrestrial and aerial life.

Alcae, which feed exclusively on pelagic animals and predominantly on fish, have become highly specialized in swimming, diving and moving swiftly under water by means of their wings. This is extremely useful for catching prey.

Adaptation to underwater swimming brought about some essential structural modifications in the Alcae during the formative period of the group, particularly in the structure and distribution of the feather cover, the morphology of almost every skeletal part, and in certain muscular systems and internal organs.

Alcae have streamlined bodies — narrow and elongated; the wings are short and generally narrow. These features greatly facilitate underwater movement in a relatively dense medium. The tail is short (Figure 1). In flight and diving the legs are stretched backward and function as steering and brake apparatus, thus compensating to some extent for the shortness of the tail feathers. The three front toes (especially the middle one) are comparatively long and are united by swimming membranes, which reach the front edges of the distal phalanges or half of the toe length; the hind toe is either absent or rudimentary.

The plumage is thick and heavy. According to Kaftanovskii's count (1951), the number of feathers and their thickness is almost twice that of gulls. The feathers have aftershafts. The feather arrangement of the under parts resembles that of grebes. The apteria are located along the dorsal and ventral parts on each side of the body and consist of very narrow tracts running from the shoulders to the tail base and from the crop to the posterior end of the abdomen. The apteria and pterylae are covered with down. The thick heavy feather covering, in conjunction with a well-developed subcutaneous fat layer on the breast and abdomen, provides maximum heat retention, which is of great importance to birds living in aquatic conditions and in high latitudes. There are 11 primary wing quills (including the first, which is reduced) and 15 to 19 secondaries; the latter are generally a little shorter, while the secondary coverts and the greater primary coverts are very long (Figure 2). (Only in the species of the genus Cepphus is the relationship between the lengths of wing feathers and their coverts almost the same as that in gulls).

The tail is rounded and wedge-shaped and consists of 12 to 16 short steering feathers.

The plumage of all birds belonging to this suborder has a fairly uniform white, dark-brown and grayish coloring. Some species have elongated tufts of feathers on their heads, which usually appear during the period of spring-
8 summer plumage. Sexual dimorphism is not apparent in color phases, but seasonal dimorphism is very evident. The coloring of juvenile plumage resembles that of adult plumage in winter (only in young razorbills and little auks is the color of the plumage similar to that of adults in summer), but in species distinguished by a specific juvenile plumage the feather structure is different. Adult birds molt twice a year. In the complete fall molt of the majority of species the wing feathers are molted all at once so that the birds become flightless. Exceptions are the genera Cyclorrhynchus and Aethia, which molt gradually.

Figure 1. Common murre, Uria aalge

The tarsus is covered with angular lobes or transverse scales. The well-developed claws are adapted for grasping uneven vertical rock surfaces. In common and tufted puffins the claw of the second toe is particularly strong, because they use their feet for digging burrows (to throw out the
9 soil). In some Alcae the bill has a single horny covering. In others the bases of the upper and the lower mandibles are covered with several scales, some of which are shed in the fall and do not grow again until the spring, while the others are replaced during the same fall season. The coccygeal gland is feathered.

Generally, the skeletal bones of Alcae are not pneumatic; in some species only the coracoids and scapulae contain a certain amount of air. This

bone construction increases the body weight of the birds and is more effective for submersion when diving.

The palatine structure is schizognathous; the nasal bones are schizorhinal. The nostrils are porous, and are interconnected by very small openings. The vomer is well developed and bifurcated in the posterior part. The palatine bones are set more posteriad and are fused with the pterygoids, which form a wider angle at the joints than in gulls. The basilar sphenoid bone has no aliform projections. The median part of the supraoccipital, which covers the vermis of the cerebellum, forms a fairly sharp projection. The lateral processes of the basisphenoid which are present in gulls appear also in certain alcidine types (genera Fratercula, Lunda, Cerorhinca, Cyclorrhynchus and Aethia), but are absent in murres*, razorbills, little auks, guillemots**, and others.

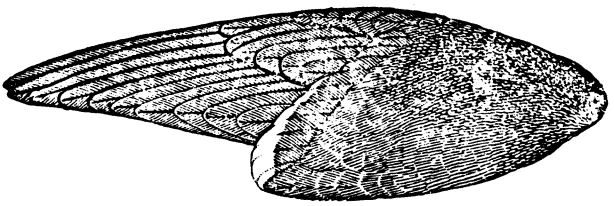

Figure 2. Wing of common murre, Uria aalge

In murres, little auks, and razorbills the interorbital portion of the cranium is wide and very deformed (Figures 3 and 4). Above the orbits are well-developed fossae with upturned outer edges bordering the entire portion of the orbit from the postorbital process of the squamosal bone to the lachrymal bone. The guillemot (Figure 5) and the ancient murrelet (Synthliboramphus) have small depressions instead of deep fossae above the orbits with slightly upturned edges appearing only at the posterior end of the orbit. In typical puffins (Fratercula), tufted puffins (Lunda), rhinoceros auklets (Cerorhinca), small auklets (Aethia), and paroquet auklets (Cyclorrhyncus), the supraorbital fossae are weakly developed and have shifted slightly posteriad toward the upper rear end of the orbit. The outer edges are not raised (Figure 6).

The extent of deformation in the frontal bone depends upon the development and location of the nasoorbital glands, which in most water birds lie above the orbits. The gland secretion serves to neutralize the irritating effect of sea water on the eyes and nasal cavity. In gulls these glands are well developed, as shown by the shallow but wide supraorbital fossae; their outer edges are slightly raised above the posterior edge of the orbit and are fused with the postorbital process of the squamosal bone. In the guillemot (Cepphus) and the ancient murrelet (Synthliboramphus) the size and position of nasoorbital glands apparently resemble those in gulls. In murres, little auks and razorbills, the glands are larger — this being related to the development of deep fossae with raised outer edges — although the glands are located in the same area as in gulls. In common puffins, tufted puffins and Cerorhinca, the glands are situated somewhat posteriad

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* [Murre refers throughout the text to birds of the genus Uria].

** [Guillemot refers throughout the text to birds of the genus Cepphus.]

and partly overhang (more than half of the width) the orbits, owing to the narrowness of the interorbital portion of the skull, which is not adequate. Their position is therefore different from that in gulls, and the size of the glands is not smaller than in murres.

According to the investigations of S. K. Krasovskii (1940), the protruding outer edges and the bony base of the supraorbital fossae are formed in murres and razorbills, and probably also in little auks, by the growth of the postorbital squamous process, which is turned upward in alcidine birds. The rapid growth of this process begins in these birds in the embryonic stage and is completed only with the final development of the skull skeleton. In other alcidine genera its size does not exceed that of razorbills and murres in their postembryonic stage.

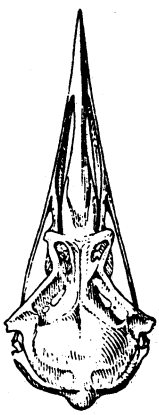

Figure 3. Skull of common murre, Uria lomvia

Figure 4. Skull of little auk, Plautus alle

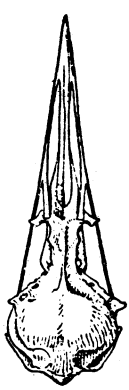

Figure 5. Skull of black guillemot, Cepphus grylle

Figure 6. Skull of horned puffin, Fratercula corniculata

Although the factors which cause the nasoorbital glands to develop in some species more than in others remain obscure, there is obviously some interconnection between the specific ecological characters of various forms which have not yet been sufficiently investigated.

Apart from the supraorbital fossae described above, the skull of murres and razorbills bears a prominent high crest and a deep groove running from the parietal bone toward the quadrate (Figure 7). To this are attached the masticatory muscles of the adductores mandibulae (m. pseudotemporalis superficialis and m. adductores externus profundus), which serve for holding prey in the bill. In guillemots these muscles are comparatively weak, judging by their less pronounced crests and cavities. The various degrees of the development of chewing muscles in murres and razorbills on the one
11 hand, and in guillemots on the other, can be explained by two factors – diet and relative bill length. Of the annual diet of razorbills and murres, fish comprises not less than 90 %, and in summer up to 100 %. The spring diet of the guillemot consists of 50 % crustaceans, mollusks and other invertebrates, and 50 % fish; during the other seasons their maximum fish consumption does not exceed 73 to 82 %. Fish being a slippery and wriggling prey, a great effort is required to hold it in the bill, and thus, well-developed adductor muscles are essential. A long bill (Alca and Uria) is also less suited to retain the prey than a short one (Cepphus). The ratio of the bill length, excluding the rhamphotheca (from the top of the upper mandible to the curve at its base) to the skull length (from the curve of the upper mandible to the most prominent point of the supraoccipital) ranges from 1.19 in Uria species, 1.10 to 1.17 (or an average of 1.14) in Alca, and 1.04 in Cepphus.

Birds belonging to the genera Fratercula, Lunda and Cerorhinca feed mainly on fish, and their relative bill length is not less than that in murres and razorbills. They lack, however, the deep fossae and the prominent high crests in the areas of the squamosal and parietal bones. Nevertheless, the chewing muscles of Fratercula and Lunda are effective enough.

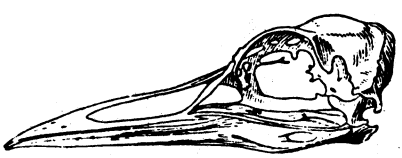

Figure 7. Skull of Brunnich's murre, Uria lomvia

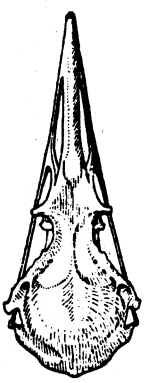

Figure 8. Skull of common European gull, Larus canus

In comparison with the skulls of razorbills, murres and guillemots, which are similar to those of gulls in shape and structure (Figure 8), the skull structure of Fratercula, Lunda and Cerorhinca is more highly specialized and only remotely resembles that of gulls. Such specialization, the origin of which may be related to the structure of the bill — which is high and compressed at the sides — contributed to a reduction in size and the modified shape of the brain case. In particular, the surface area of the squamosal bone occupied by the adductor muscles became narrower, while the lower end of the postorbital squamous process and the zygomatic process increased in size (compared with the proportional relationship between the same structures in gulls, razorbills and murres) (Figure 9).

The proportions of separate parts of the lower mandible in representatives of the two Alcae groups examined show a small but essential distinction which explains some differences in strength in the chewing muscles of murres and puffins. The angular and articular bones, which bear the adductor muscles, are longer in Fratercula corniculata (horned puffin) than in murres and razorbills. The ratio of the total length of the lower jaw to the lengths of the angular and articular bones is 2 : 1 in Fratercula corniculata, and 2.3 : 1 in Fratercula arctica (Atlantic puffin). In Uria lomvia (Brunnich's murre), where these bones are relatively shorter, it is 2.7,
12 and in Alca torda (razorbill) it averages 2.5. The nearer the adductors are to the top end of the lower jaw the more effective they are for seizing the prey. Consequently, even if in typical puffins and tufted puffins these muscles are not as strong as in razorbills and murres, they may function just as effectively. In Alcae the neck is relatively short. Of the 15 cervical vertebrae the second, third and fourth have marked upper and lower fibrous projections; in the tenth, eleventh, twelfth and thirteenth vertebrae the lower projections are particularly large. All the above-listed vertebrae serve as places of attachment for the strong muscles which bend and extend the neck. Their development is interrelated. The strong neck muscles of Alcae are a result of their having become adapted to providing leverage for the various rapid movements necessary for catching live prey in the water. The thoracic vertebrae are free. The pectoral bone is flattened, narrow, and very long (Figure 10). Its posterior portions forms a tongue-shaped projection which covers the internal organs. This protects the organs against strong pressure in deep waters and the bird from injury when it settles on the water. In certain representatives of this suborder the posterior end of the sternum has one pair of incisions and another pair of fontanels, in others only a pair of incisions or fontanels. The keel is high and combined with the large surface area of the elongated pectoral bone (in compensation for its narrow width), it serves for the attachment of the powerful flight muscles which operate the wings. Also characteristic in Alcae is the position of a small crest on the pectoral bone to which the m. supracoracoideus is attached. In most birds this crest diagonally crosses the anterior part of the sternum from the coracoid to the middle of the keel, thus separating only a restricted area occupied by the subclavicular muscle. In Alcae, however, this crest runs along the entire outer edge of the sternum almost as far as the incision in its posterior part. Consequently, the m. supracoracoideus occupies a much larger space in Alcae than in other diving and nondiving birds (except in penguins), underlying the m. pectoralis
13 along almost the entire surface of the pectoral bone. Owing to the increased

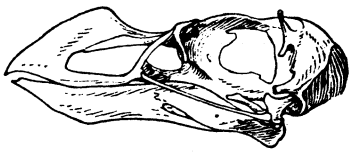

Figure 9. Skull of horned puffin, Fratercula corniculata

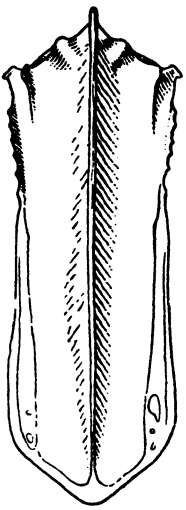

Figure 10. Pectoral bone of Brunnich's murre, Uria lomvia

strength of the subclavicular muscle, Alcae are able to raise their wings more vigorously, since this movement imposes a great strain upon these particular muscles in underwater paddling. Kaftanovskii clearly describes the position of the m. supracoracoideus in Alcae (1951). He also gives (Table VIII, p 37) the highly characteristic weight ratio between the m. pectoralis and m. supracoracoideus in various bird species, which confirms all the foregoing statements. The ratio in Uria aalge is 3.65, in Uria lomvia 3.04, in razorbills 3.49, in puffins 3.11, in guillemots 3.65, in herring gulls 11.71, and in striped black-throated divers (Gavia arctica), black-throated grebes (Colymbus caspicus), which use their feet for paddling in the water, it is 14.96 and 7.48 respectively.

In conformity with the elongated streamlined body form, the entire pectoral girdle has the same elongated shape as the sternum, and is very flexible owing to the length of the sternal and vertebral portions of the ribs, and the extremely sharp angle of their joints (from 45 to 30°). The sternal structures of each successive pair of ribs (from the first to the last) is comparatively longer than the vertebral portions. In razorbills the ratio of the costa sternalis to the costa vertebralis is 1 : 2.2 in the first, and 1 : 0.9 in the ninth pair of ribs. The joint of the last pair is on the same level as the free caudal vertebrae. The uncinate processes are well developed and lie close against the two adjacent ribs (Figure 11). Their large size is related to the stronger muscular system of Alcae, allowing for the movement of the ribs during respiration. The flexibility, i.e., the inflating capacity of the pectoral girdle, which permits considerable expansion of the air sacs for storing a greater amount of air, contributes to a slower respiration rate in Alcae than in nondiving birds.

The fore limbs of Alcae serve not only for flying but also for swimming, and they are used as paddles in the water. All the changes which occurred

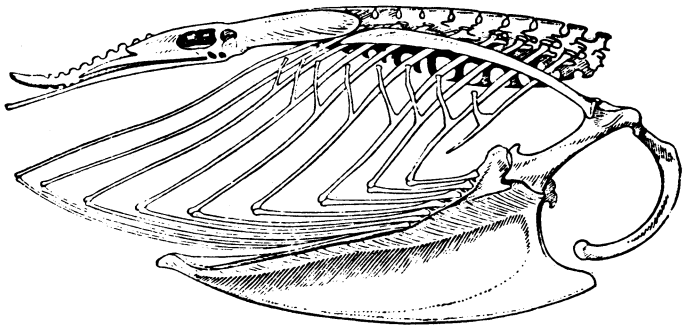

Figure 11. Diagram of the pectoral girdle of the Brunnich's murre, U. lomvia

in the shape and relative proportions of the individual skeletal wing parts of these birds evolved following the adaptability of the fore limbs to their
14 "new" (in the evolutionary process of the group) function as paddles in the water. This also brought about the flattening of the humerus, ulna and radius, which facilitates the cleavage of the water by the wings. A considerable shortening of the forearm (antebrachium) and to a lesser extent of the carpals is also noted as compared with the dimensions of the corresponding structures of the wing skeleton of gulls*. Kaftanovskii describes it very figuratively: "The forearm resembles the handle of an oar, the blade of which is the carpometacarpus" (it should be added – "together with the wing quills").

Obviously it is easier to steer with a short lever in a relatively dense medium (like water) than with a long lever. In Alcae the forearm is always shorter than the carpals, and is actually the shortest element in the wing skeleton. In gulls, whose wings are adapted to a great variety of aerial movements, the forearm is longer than the carpals and the humerus.

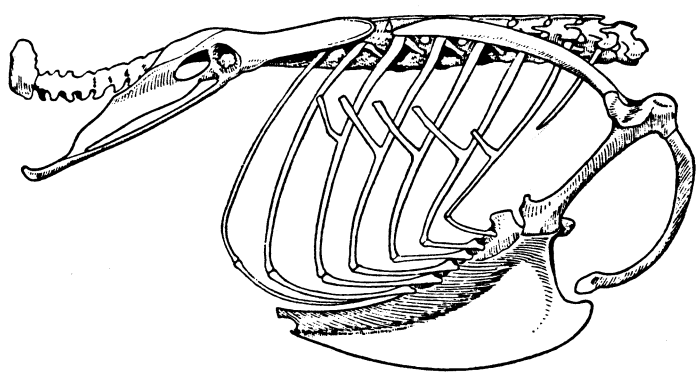

Figure 12. Diagram of the pectoral girdle of herring gull, Larus argentatus

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* The ratio between the different parts of the fore limb in certain species of Alcae is given in Kaftanovskii's study (1951).

The wings of Alcae, which are adapted to motion in an aquatic medium, become smaller, thus causing an increase in load on the reduced bearing surface. In consequence, the wings must move incessantly in flight to produce the maximum number of wing beats, according to the capacity of each species.

The furcula is U-shaped and almost reaches the keel, to which it is attached by connective tissue. The bases of the coracoids are set slightly apart. The scapulae are very long and narrow. In murres and razorbills they are particularly long in relation to the length of the coracoids owing to the powerful spinal muscles, especially the strong m. latissimus dorsi, which participates in the raising of the wings.

The pelvis girdle in Alcae is narrow and elongated. This serves to draw together the legs, which stretch backward in flight and diving (Figure 13). The ends of the pubic bones are level with the pygostyle. This shape of the pelvis and the position of the hind limbs accounts for the utmost streamlining of the bird's body, which is essential for a rapid forward movement, particularly in deep water.

The hind limbs are relatively short and shifted to the posterior edge of the trunk. The position of the feet is conditioned, not so much by the shifting of the pelvofemural articulation (which is only very slight) and the relationship between the various bones of the hind limbs (in Alcae, in contrast to Gaviiformes, this relationship is more like in nondivers because they also do not use their feet for underwater paddling), as by the relative position of the tibiotarsus and tarsometatarsus. Standing on land or swimming on the surface of the water, Alcae project the femur forward, and the elongated tibiotarsus bends backward, forming a sharp angle with the femur, almost parallel to the body axis. Thus the metatarsal joint, the tarsus and the foot are set more posteriad, where they are more effective in providing for a more or less erect position, which is very important for keeping the balance when walking on the ground. In surface swimming and in the air the legs are outstretched behind and extend beyond the length of the body. This increases the maneuverability of the body and its bracing power.

By comparing the relative lengths of legs in various alcidine species it was found that Cyclorrhynchus has the longest legs, and Synthliboramphus and probably Brachyramphus, the shortest (although with respect to the latter it could not be proved because of lack of skeletal material). In the order of their decreasing leg lengths Alcae can be grouped as follows*:

The relative leg length in Cyclorrhynchus psittacula (paroquet auklet) is 170.9 %, in Lunda cirrhata (tufted puffin) - 155.8 %, in Fratercula corniculata (horned puffin) - 152.3 %, in Aethia cristatella (crested auklet) - 148.1 %, in Plautus alle (little auk) - 147.8 %, in Cepphus grylle (black guillemot) - 143.5 %, in Uria lomvia (Brunnich's murre) - 133.2 %, in Uria aalge (common murre) - 125.9 %, and in Synthliboramphus antiquus (ancient murrelet) - 114.4 %. The legs of gulls are much longer than in the above species. The relative percentage in Larus argentatus is 208.6 %. (All

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* The relative length of the leg, which includes the femur, shin (tibiotarsus and fibula) and tarsometatarsus, is expressed as a percentage of the entire body length, the latter being measured from the cephalic end of the first cervical vertebra to the first free caudal vertebra. In the measurement of the shin, the cnemidium is not included.

measurements were taken by the author from the material of ZIN AN SSSR). The species with longer hind limbs also have a broader pelvis (Figure 14). The longer legs, and the accordingly broader pelvis, in Atlantic and tufted puffins have evolved from their habits, which link them to land for a longer nest-building period than other Alcae. The hind limbs of the Fratercula and Lunda are adapted not only to paddling and walking but also to the more complicated functions of digging burrows. In excavating, the bill is used to break and split the soil, and the accumulated earth is afterward thrown out by the legs, which must consequently be adaptable for a variety of movements. Nothing is known of the particular habits conducive to the preservation of the long legs of the paroquet auklet, which nests under large boul-
16 ders. Alcae have long front toes, especially the middle one, which in most species exceeds the length of the tarsus (except in ancient murrelets and little auks, which have a shorter one). This enlarged toe size and the correspondingly proportioned connective webbing probably developed because Alcae use their feet in flight and diving as steering and braking apparatus.

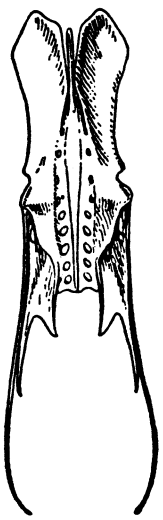

Figure 13. Pelvis of Brunnich's murre, Uria lomvia

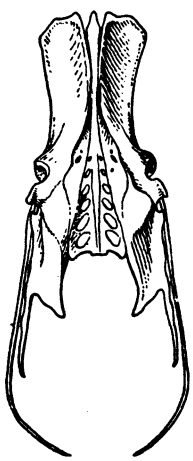

Figure 14. Pelvis of tufted puffin, Lunda cirrhata

The rudimentary hind toe is covered by skin. Storer (1945) detected it in little auk, murre, horned puffin, paroquet auklet, small auklets of the genus Aethia, murrelets of the genus Brachyramphus, and ancient murrelet.

The respiratory system of Alcae has some specific features peculiar to diving birds. The lungs are elongated and possess considerable capacity and weight. The relative weight of the lungs (per thousand) of a razorbill is 13.2, common murre - 14.0, Atlantic puffin - 15.7, while in geese it is only 9.5, and in birds of the genus Anas - 12. The air sacs, especially the interscapular* and abdominal ones, are also very spacious. Their free

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* ["Sic" in Russian text -- the anterior air sacs are the interclavicular, the axillary, and the cervical.]

inflatory action is related, as mentioned before, to the structure of the pectoral girdle and the elasticity of the rib cage. The great capacity of the air sacs permits a great quantity of air to enter the respiratory organs. The extensive surfaces of the respiratory system of Alcae permit the entry of air and the intensive oxygenation of the blood. This contributes to a very high oxygen content in their blood. The high oxygen content of the hemoglobin in the blood together with the high hemoglobin content (as compared with the blood of nondiving birds) explains not only the low breathing rate of Alcae, but also their capacity to hold their breath when diving or swimming
17 under water. Depending upon the amount of air expelled by the air sacs (through additional expiration), Alcae can deliberately increase their weight under the water, and are able to remain submerged up to two minutes.

Many birds of this suborder have a brightly colored yellow and orange-red palate. This coloring may be significant during the mating display, when many Alcae keep their mouths open. The tongue is fleshy and rather short; in fish-eating types both the palate and the base of the tongue are equipped with spines and barbs, which are turned backward and serve to hold the prey in the bill. In feeding their young, razorbills and typical and tufted puffins, which feed mainly on small fish, can carry as many as five to seven fish in their beaks, but guillemots and murres can carry only one. Most fish-eating species keep the fish in their mouths, seizing it across its body or very close to its head; only murres place the fish alongside the oral cavity with the fish's head inside it. During the feeding period, smaller alcidines, such as the little auk and crested and paroquet auklets, which feed on crustaceans and other plankton, develop a peculiar receptacle for the transportation of food, which appears like a lateral diverticulum extending from the bottom of the oral cavity. This feeding tube opens under the tongue and is attached along the front of the esophagus, occasionally extending also to the sides. It has a closed rounded bottom and in some forms attains a length of 5 to 6 cm.

Fish-eating Alcae, which bolt their food without grinding it, have a distended esophagus, which in Uria, Fratercula, Aethia and Cyclorrynchus, forms a croplike pouch. The glandular portion of the stomach is spacious, the posterior muscular portion small and rounded; the pylorus is very narrow. The intestine is almost twice as long as the entire body length (or even slightly longer). According to Kaftanovskii (1951), the length of the body of the Brunnich's murre is 47 cm and that of the intestine 100.2 cm. The caecum is usually rudimentary and particularly small in puffins, slightly more developed in murres. The liver is large, with smooth edges considerably overhanging the stomach. In species of Uria the left lobe of the liver is much larger than the right; in Fratercula the right lobe is larger (Groebbels, 1932).

The relative sizes and weights of the heart are more or less alike in Alcae and gulls (taking into account that with increased body weight the proportional weight of the heart is reduced). Kaftanovskii gives the following weights of heart per body: in Uria aalge - 9.69 per mill, Uria lomvia - 8.53 per mill, razorbill - 11.74 per mill, guillemot - 10.49 per mill, common European gull - 11.7 per mill, Atlantic kittiwake - 11.35 per mill, and herring gull - 10.8 per mill.

Owing to their diet, which consists of marine animals (fish, crustaceans, mollusks, polychaetes, and other invertebrates), Alcae are closely bound to the feeding grounds of the sea. The birds take their prey both from the surface and from the great depths of the water, hunting along the coasts of the mainland, near oceanic islands. During the nesting period they frequent the open sea, flying out to a distance of some hundred kilometers from the shore. They live in flocks at all seasons and are associated with the land only during the nesting period.

Alcae sit lightly on the surface of the water, generally floating high and lowering less than half of the body into the water. They dive with great swiftness, sometimes raising the front of the trunk and spreading their wings before the plunge, then swoop with outstretched neck into the depths. In
18 underwater swimming the carpal portion of the wing remains slightly bent, and the wings move upward and backward, downward and forward. At each beat the wing seems to flip over, forming a propelling surface. The upstroke is accomplished by a downward pull of the postaxial margin of the wing in relation to its preaxial part, and the upper surface functions as propeller. By the downstroke, the postaxial margin is raised and the under surface executes the propulsion. The motion is more rapid under water than when skimming the surface.

The take-off in Alcae is heavy, always against the wind. Wing flapping continues for a considerable length of time while the feet touch the water before gaining momentum and leaving the surface. Not being equipped for regulating flight speed, the birds swoop suddenly onto the surface of the water. The flight movement is rapid – a straight forward thrust.

The wings of murres and razorbills are ill-adapted for flight maneuvers. Owing to their nesting habits they have little need for it, since in approaching their nests from the sea they can descend upon the open ledges without making preliminary turns. Their flying equipment is mainly adapted to facilitate underwater paddling at the expense of maneuverability in the air, and through this practice their wings have acquired a slender, pointed shape (the secondaries are comparatively very short; the first primary feather is the longest). Cepphus, Aethia and Cyclorrhynchus, which build their nests in rock crevices and underneath boulders where the openings do not always face seaward, are often compelled to make sharp flight turns before entering. It may be assumed that the necessity for flight maneuverability has made their wings less specialized for paddling purposes. Birds of these genera have broad wings with comparatively long secondaries.

Murres and razorbills shuffle with difficulty on land, and walk with a waddling gait. The body is supported mainly by the tarsus and the tail, and is held in an upright position. Typical and horned puffins are more adept in walking on rocks using only their toes. In a resting position they stand erect, but walk with a slightly forward bend of the body, though the breast remains raised. Guillemots, too, walk on their toes with an awkward gait. Cepphus columba is better adapted to bipedal locomotion than C. grylle. Aethia and Cyclorrhynchus are not only good walkers but run with ease on land.

Different species of Alcae usually congregate in thousands in their colonies, together with other related bird forms, especially gulls.

The breeding colonies are located on sea cliffs, in rockeries and on flat stony beaches (so-called "flat bird bazaars"). Hole-dwellers settle

along elevated slopes and cliffs with soft sandy ground or peat layers. Open-nesting species do not build nests but lay their eggs on the bare rocky surface. Birds occupying holes and tunnels put some gravel or dry grass stalks between the rocks.

Alcae are monogamous, both sexes participating in the incubating and feeding activities. Normal clutches contain but a single egg; only the Cephus representatives and one particular species of murrelet (Brachyramphus craveri*) lay two eggs. Fratercula and Synthliboramphus lay one or two eggs. Nevertheless, all Alcae have developed two brood patches, with the
19 exception of murres and possibly the ancient murrelet, which have only one patch. Eggs of open-nesters are multicolored, whereas those of hole-nesters are uniform in color, frequently off-white of with a hardly visible pattern. Murres and razorbills have pyriform eggs, with one end sharply pointed and the other rounded, a shape adapted for balance on precarious cliff ledges, especially toward the end of the incubation period. With the growth of the embryo, when the enlarged air space moves toward the blunt end of the egg, the pull of gravity shifts to the pointed end, while the blunt end is slightly elevated. When even slightly disturbed, the egg begins to pivot on its axis and thus manages to remain on the spot (Uspenskii, 1950). Both poles of hole-nesters' eggs are equally blunt.

The incubated egg is held on the web of the spread toes. Incubation periods range from 21 to 36 days in the different species. Young birds are completely covered with natal down at birth (prepennae) and roam independently on their ledge (provided there is space) a few days after hatching, using their toes for walking. Hold-nestlings are less active and do not leave the nest until they go into the water, some descending with the aid of their wings when 37 to 46 days old. Young murres and razorbills depart earlier, when they are 19 to 24 days old (Kaftanovskii, 1951) and flutter down into the sea spreading their little wings, the supporting surface of which consists of only the elongated upper coverts of secondaries and greater primaries. At that time, the flight feathers – secondaries and primaries – have not yet emerged from the down (Johnson, 1938).

This early change from nest life to an independent aquatic life in the young of open- or semiopen-nesting Alcae is an important survival factor since, being able to dive, they are less exposed to predatory attacks and other disasters than on open ledges.

The hind limbs of young Alcae develop rapidly and have different proportions from those of the adults. According to the investigations of Kartashev (1955a), in common murres the ratio of the length of the leg to that of the body is 226 % in a one-day-old chick and 169.1 % in an adult. In puffins the proportion is 284.1 % in chicks and 207.9 % in adults.

Young birds change their down coat for juvenile plumage (Figure 15) or the first winter attire when still on land. The feathers of the juvenile plumage differ to a certain extent from adult plumage by their loose structure. Postjuvenile molt, i.e., replacement of juvenile plumage by the first winter attire, takes place in young Alcae during the first fall season of their existence after their return from the water.

Seasonal migrations are peculiar to all Alcae. They make most of the journey by swimming, only flying over icebound regions. Some species

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* [Apparently synonymous with Endomychura craveri (Craveri's murrelet).]

spend the winter in small flocks on their breeding grounds, even on the shores of Novaya Zemlya and Greenland. Others travel long distances south as far as the Canary Islands in the Atlantic and South Carolina on the American coast. In the Pacific the northern species sometimes appear near southern Japan and California. The continuous ice sheets, which make it impossible to catch food, are the chief cause of the departure of Alcae breeding in northern latitudes. . Great numbers of guillemots, some rare razorbill species and small flocks of murres winter on the Murman Coast where many large areas in the water remain unfrozen. The common murre, the Atlantic puffin and the guillemot are encountered wintering on the northern coast of Spitsbergen; little auks winter on the southern coast of Greenland and near the margins of pack ice in the Atlantic. Alcae with nesting grounds in the Boreal zone also migrate in search of food during the nonbreeding season, but their migration routes are not extensive.

The general nesting distribution of Alcae includes the Arctic and Boreal zones of the Northern Hemisphere; some individual species breed as far south as Brittany and Newfoundland in the Atlantic, and Japan and California in the Pacific. Certain genera, such as Uria and Cepphus, have a vast, almost circumpolar range, whereas others occupy only restricted areas in the Pacific Ocean where they are endemic. In general, most birds belonging to this group are associated with the Pacific Ocean, among them seven genera (Brachyramphus, Synthliboramphus, Ptychoramphus, Cyclorrhynchus, Aethia, Cerorhinca and Lunda) and 16 endemic species out of a total number of 12 genera and 23 species of the suborder Alcae. The North Atlantic has only two endemic genera (Alca and Pinguinus, the latter having become extinct in recorded time). The little auk of the genus Plautus is endemic to the Arctic Ocean, though it extends also into the Atlantic sector of the Arctic. Puffins, murres and guillemots are common in the Pacific and Atlantic Oceans, and also in the Polar basin.

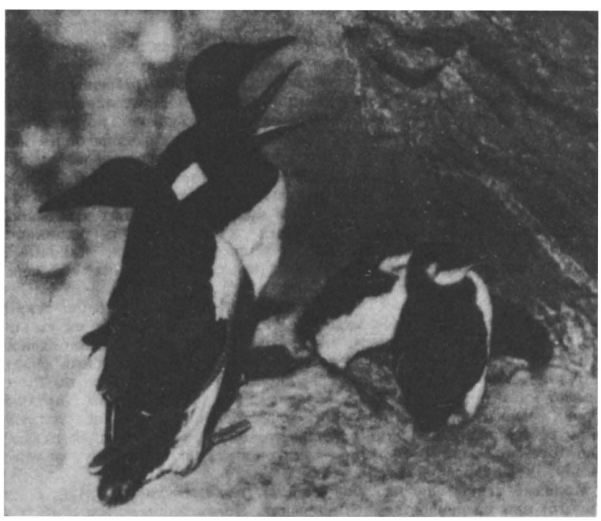

Figure 15. Brunnich's murres with their young

21 The prevalence of thermophobic forms in the Pacific (and not in the Atlantic) is a well-known fact with regard to the entire marine fauna (Ekman, 1935). It may be chiefly explained by climatic factors which, for a great length of time favored their development in the Pacific area. This does not apply to the Atlantic, whose history is mainly associated with warm, occasional subtropical and even tropical climatic conditions.

By fossil evidence Alcae can be traced to the Eocene epoch, and their establishment as a separate group probably dates back to the Lower Paleocene.

The evolution of their divergence within the general scheme can be represented in the following way.

Judging by their existing descendants, which differ considerably morphologically and ecologically, the ancestors of gulls and alcidines were distinguished by certain common structural features, and, though they were shore birds they possessed great ecological plasticity. Consequently, this ancestral form was able to exist on the shores of any water basin and to feed equally on land and water and in the air.

The divergence of Alcae into a separate group was related to more distinctive and highly specialized requirements of their living conditions. Alcae began to adapt themselves to living exclusively on oceanic coasts by changing their diet to marine fish, which they captured while diving. (It was only later that they apparently began to eat other marine organisms as well, particularly invertebrates). At the same time their association with the mainland naturally weakened, but it continued to serve merely as a breeding ground when the need for additional feeding places no longer existed.

The principal trend of organic specialization in Alcae was toward underwater swimming by means of the wings, by combining the functions of the fore limbs for flight and paddling, with definite priority given to the latter activity. In connection with this specialization, the entire structure of these birds underwent a fundamental modification, as shown in the foregoing description.

The adaptational process was identical in all representatives of this group. This process brought about changes in the skeletal and muscular structures of the limbs, the rib cage and the pelvis, increased the absorptive surface of the lungs, and intensified oxygenation and other adaptations associated with diving. The difference in the individual genera and species consists only in the degree to which these changes have developed. The alcidine types of birds evolved at the time when they began to swim and their fore limbs had to combine flying and paddling functions. During this formative period the skull structure of Alcae changed very little, apparently because the bill in primitive Alcae was already adapted for seizing and holding the captured fish and continued to function in essentially the same way as in primitive gulls and in the common ancestor of both Alcae and gulls. Later, however, further adaptations were acquired in individual members of the established group from the organic changes which developed after the Alcae became specialized in diving. These adaptations led to various characteristic changes, particularly in the skull structure.

22 Existing Alcae fall naturally into two groups on the basis of specific structures of the skull. The first group includes the guillemot, the ancient murrelet, the murrelet (Brachyramphus), the murre, the razorbill and the little auk, which show relatively few modifications in their skull structure;

the general structure, shape and comparative sizes of the endocranium are closely related to the skull of gulls and most probably, also to their common ancestor. In birds belonging to the second group, such as Aethia, Cyclorrhyncus, Lunda, Fratercula and Cerorhinca, the skull underwent considerable structural changes. The most prominent new character consists in the position of the postorbital bar, which in gulls and in murres of the first group of Alcae has a marked forward slant, but in Fratercula, Lunda and other species of the second group is almost vertical. This reduces considerably the size of the skull and the width of the interorbital skull portion. The assumption that the separate development of the second group of Alcae dates from a very remote past has been confirmed by the fossil remains of its typical representative, the extinct Cerorhinca dubia found in the Miocene deposits of California.

The factors which caused the separation of this group are unclear. Most likely this process was related to the new functional development of the bill in addition to its customary use – seizing and holding the prey.

Among the Alcae distinguished by a greatly modified skull structure are some curious bird forms of existing genera, such as Fratercula, Lunda and Cerorhinca. Fratercula has a very deep, comparatively short and extremely powerful bill, which may perhaps be explained by its new functional development. From the present level of our knowledge of the living conditions of Alcae, we may assume that this function is directly related to their having changed to hole-nesting habits.

Originally the nesting sites of this group were probably located on open rocks or coastal cliffs (the pigmentation of eggs even in typical hole-nesting Alcae, which still preserved a very weak pattern, confirms it indirectly).

At a later stage certain species transferred their nesting sites to naturally concealed places and burrows, while other open-nesting species began settling in colonies. Evidently, all these changes in their habits contributed to a better preservation of the progeny of Alcae.

Hole-nesters used their bills for breaking up the ground. The bill thus became adapted to this new work by enlarging its size and modifying its shape. This brought about further changes in the skull structure.

As yet unexplained is the cause of the curious bill shape of Aethia and Cyclorrhynchus, which breed in naturally concealed places and are distinguished by the same specialized skull structure as the puffins.

During the Eocene, the ancestor of the Alcae, represented by the subfamily Nautilornithinae, inhabited certain areas in the states of Oregon (Sunset Bay) and Utah (White River). The living conditions of Eocene Alcae in North America differed substantially from those of the entire contemporary group.

In the Middle Eocene, the states of Colorado, Utah and Wyoming possessed a flora known as "Green River" (Krishtofovich, 1933), which con-
23 tained not only arcto-Tertiary but also subtropical forms. Firs, birches, willows and other plants of the North American temperate zone grew together with palms, Ficus and Aralia. During the late Eocene, the Puget flora prevailed in the western parts of the states of Washington and Oregon and in British Columbia (palm trees of the genus Sabal predominating). This testifies to the presence here of a very warm, if not tropical, climate. These palms are now found in southern Europe, Japan and other warm temperate countries. We may conclude therefore that the ancestors of our

Alcidae were more used to warm temperatures than their contemporary representatives, although they cannot be regarded as typical tropical forms.

After having examined the fossilized bones of the limbs of Eocene Alcae, Wetmore and Miller (Lambrecht, 1933) came to the conclusion that all members of the subfamily Nautilornithinae were excellent swimmers and divers, but were less adapted to swimming under water by means of their wings (which were comparatively longer) than their modern descendants, and were probably shore birds.

The development of this group of swimmers and divers proceeded, as was mentioned before, in the sea, on the coasts of the mainland and islands, but not on smaller inland water reservoirs. The fossilized remains of an extinct alcidine, Hydrothericornis oregonus, of the Upper Eocene, found in Oregon (Sunset Bay) on the seacoast, fully confirmed the afore-mentioned assumption. The finding of the genus Nautilornis in the Eocene deposits of Utah did not help to clarify the picture. According to records of American geologists (Arldt, 1919-1922), the Upper Colorado basin approached the sea only during the Cretaceous period, when parts of it were under water (Colorado Sea). Neither the Pacific Ocean, nor the Gulf of Mexico transgressed these regions in subsequent periods. The evidence of fossil remains of Alcae in Utah seems nevertheless to prove that during the Paleocene at least a sea bay must have existed in this region.

On the basis of early Tertiary fossils from the North American Pacific coast and the present abundant endemic forms in the Pacific, we may assume with reasonable certainty that the Pacific regions north of the equator were the original home of all Alcae.

The Eocene Alcae which inhabited the subtropical borderlands of Oregon and Utah had to adjust to the effects of the more moderate climate which prevailed in their habitat during the subsequent epochs of the Tertiary period. The discovery of Miocene arctic mollusks on the Asiatic coast of the Bering Sea (Ekman, 1935) – and whatever else we know about the Middle Miocene fauna of Kamchatka – confirms, as indicated by Khomenko (according to Berg, 1934), the boreal character of this fauna. The conditions of the boreal climate and the corresponding food reserve, which consisted of specific marine animals, apparently promoted the development of Alcae.

The questions concerning the future of this bird group and the routes and timing of their migrations to the Arctic and Atlantic Oceans are rather difficult to answer in view of the scarcity of paleontological material. Apart from the above-mentioned Eocene fossils of ancestral Alcae, other evidence from the Miocene period was also found in western Europe and America: scapular bones of a representative of the genus Uria in the deposits of North Carolina and in Maryland of a medium-sized specimen belonging to the genus Miocepphus and related to Cepphus, but with a more massive skeleton; other Miocene remains of the extinct genus Cerorhinca dubia were found in
24 California, Uria ausonia and Uria sp. in the Pliocene deposits of Italy. The Pliocene deposits of California (Los Angeles, San Diego, etc) yielded remains of the flightless auk (Mancalla californiensis), similar to murres but much larger, the auk, Mancalla diegense (smaller than the former), and Brachyramphus pliocenus. In North Carolina, Pliocene fossils of an extinct murre species (Uria affinis) and in the Pliocene deposits of California, remains of the still existing Synthliboramphus antiquus and of Uria aalge were found.

Finally, the Pleistocene deposits of southern Iceland, southern Norway, the British Isles, France, Spain, Italy, and the Atlantic coast of North America (Newfoundland, the Carolinas, Northern Florida) yielded numerous remains of the flightless great auk Pinguinus impennis* (Figure 16).

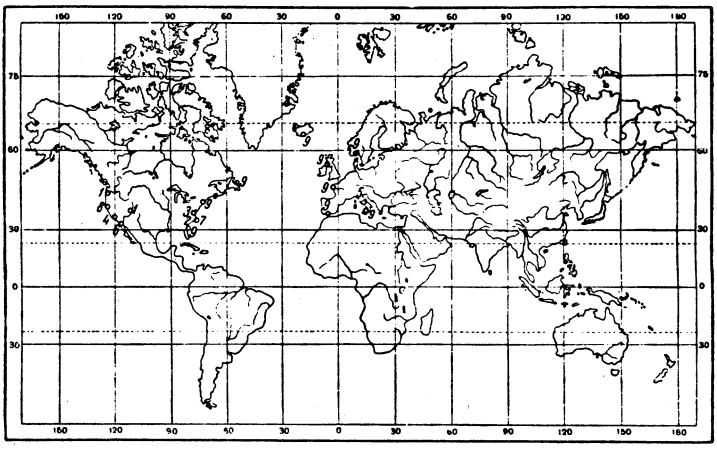

Figure 16. Regions and age of deposits where Alcae fossils were found

1-Hydrothericornis oregonus and Nautilornis, subfamily Nautilornithinae (Eocene); 2-Uria antiqua (Miocene); 3-Miocepphus sp. (Miocene); 4-Cerorhinca dubia (Miocene); 5-Uria ausonia (Pliocene); 6-Mancalla californiensis, Mancalla diegense and Brachyramphus pliocenus (Pliocene); 7-Uria affinis (Pleistocene); 8- Uria aalge and Synthliboramphus antiquus (Pleistocene); 9-Pinguinus impennis (Pleistocene and Holocene [Upper Quaternary])

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* The flightless great auk was considerably larger than all contemporary Alcae. Its powerful bill resembled in shape that of the Alca torda; the body - from the forehead to the tip of the tail - measured 625 to 700 mm; the wing length did not exceed 178 mm, i.e., it was comparatively very short, though normally developed.

P. impennis was highly specialized for swimming under water by means of wings and had apparently acquired great skill in this respect. Its flying equipment was exclusively adapted to this function in view of its protective importance. Because of its increased bulk P. impennis lost its ability to fly.

In recorded time it inhabited the smaller islands south of Iceland, the Faroe Islands, Kilda, the Orkney Islands, and the Funk Islands near the coast of Newfoundland.

25 The above paleontological data indicate that the existence of Alcae in their initial stage of development was closely associated not only with the Pacific but also with the Atlantic Ocean, which their representatives inhabited during the Miocene.

Judging by the present distribution of the individual genera and species of Alcae and the different degree of their kinship, the dispersal of these birds proceeded at different times and in several stages and directions.

The first and earliest migratory stage, which is believed to have occurred during the Oligocene or the early Miocene, brought the ancestral alcidine forms into the Arctic and Atlantic basins. There, under the influence of new living conditions, murres, great auks, common razorbills and little auks, which, until then, were all unknown in the Pacific area, became separate genera toward the end of the Miocene. A separation of the genus Plautus may also have taken place in the Polar basin. The habitat of the Pinguinus, Alca and Uria, which probably all had a common ancestor, was originally the Atlantic Ocean. Apart from the ancestral forms of these three Atlantic Alcae which remained in the Pacific, there seem to be no other surviving descendants. The only representative could have been the Pliocene Californian Mancalla which subsequently became extinct.

The origin of the genus Cepphus is also believed to be associated with the Atlantic, as indirectly proven by the Miocene remains of the Miocepphus of the Maryland coast. It is very likely that the Synthliboramphus and Brachyramphus derived from the original Cepphus population which remained in the Pacific.

The Miocene Alcae could have taken two routes from the Pacific to the Atlantic which are known to have been used by other marine animals. The first went through the "Tethys" Sea, which connected both oceans in the Central American region during the greater part of the Tertiary period (at least as late as the Lower Miocene). The second route crossed the straits in the Bering territory which opened up frequently during that period.

The route through the "Tethys", with its tropical climate and high water temperature, was naturally more suited to tropical creatures. To the boreal and arctic groups (which included the Alcae), however, the conditions in the Bering Strait and the Polar basin were certainly preferable. The migration could have proceeded further, either in a westerly direction along the Asiatic coasts, or eastward along the Arctic coast of America. The former trend is less likely since the Arctic Ocean was not linked to the Atlantic before the Pliocene, and the difficult route across the Ob basin, which stood open throughout the entire Pliocene but was suspended in the Miocene period, would have brought the migrants into the Mediterranean with its tropical climate and fauna. Most geologists believe that even had a connection still existed between the Mediterranean Sea and the Atlantic Ocean at that time, it would have been extremely difficult to use it by then.

An eastward migration toward America therefore appears the more probable and was accepted by many authors on the basis of paleontological data on boreal sea animals which migrated from the Pacific to the Atlantic mainly during the Upper Miocene and the Pliocene (Ekman, 1935).

26 On the other hand, it has been definitely established that the early Tertiary tropical fauna of the mid-Atlantic, and, in particular, of the southeastern coastal states of North America, underwent considerable changes during the Miocene. The tropical forms gradually became extinct or

migrated southward, to be replaced by new species accustomed to low temperatures and until then unknown in these latitudes (Ekman, 1935; Jhering, 1927). Jhering explains this change in the fauna by an opening – during the mid-Tertiary period – of broad straits between Greenland and America, through which the cold waters from the Polar basin flowed into the Atlantic.

From these facts we may conclude that the Miocene Pacific Alcae could have entered the Atlantic from the Arctic Ocean by the eastern American route.

The history of the later existence and segregation of the great auk and the genus Alca is related only to the Atlantic. Not before the end of the Quaternary Glacial period did the Alca torda inhabit the northern regions as far as Murmansk; it did not go beyond the realm of the warm Gulf Stream current. In ancient times the Alca apparently belonged to warm-climate forms.

The development of Uria and Cepphus proceeded along different lines. The Pliocene transgression period, when a direct connection was established between the Atlantic and Polar basins along the European littoral, was fovorable for the spread of these two species. Other representatives of this group which migrated along the Asiatic coast to the Bering Sea formed there new Pacific species (Cepphus carbo, C. columba, C. snowi, Uria lomvia). Some of the migrants (the nearest ancestor of Cepphus grylle) might have remained in the Arctic Ocean and, being accustomed to the cold, were able to survive the Quaternary Glacial period in these areas. At present it belongs to the inhabitants of the northern latitudes of the circumpolar range. Several species (which later became extinct) and our contemporary Uria aalge derived from the murres remaining in the Atlantic Ocean.

Fratercula and Lunda, whose ancestors were autochthonous in the northern Pacific, probably separated during the same Pliocene period.

The divergence of this ancestral form was apparently caused by the fact that one part of its population found itself in new surroundings while the other remained in less variable conditions within the boundaries of their former range. The new living conditions may have evolved naturally during the migration of the ancestral puffin forms (Fratercula and Lunda) to the Polar basin, where they occupied a vast range after having penetrated from the Eurasian coasts into the Atlantic sector of the Arctic, and during the Pliocene established a separate genus, Fratercula. The other ancestral line, which did not join this migration, also acquired certain new characters and gave rise to the genus Lunda in the Pacific.

The present division of the formerly unified range of Fratercula evolved as a result of the Quaternary climatic change. Some representatives retreated southward into the Bering Sea region and others went to the North Atlantic. The further existence and development of the Atlantic and Pacific puffins continued separately and caused their grouping into two species –
27 Fratercula arctica and F. corniculata.

The latest interchange of the Alcae fauna between the two oceans dates back to the relatively recent postglacial boreal transgression and to the establishment of a warmer climate. The dispersal of existing species, especially Uria aalge and U. lomvia , caused the widening of t..eir distributional range in the Polar basin and, as an effect of another cool wave, the disruption of these ranges and the formation of separate species in the severed portions.

The Alcae suborder includes only one family, the Alcidae.

The characters and the ranges of distribution of this family coincide with those of the suborder Alcae. The family comprises 13 genera, including the flightless great auk (Pinguinus), which disappeared during the last century. The USSR fauna embraces 11 genera, but one genus , the Ptychoramphus, which is related to Brachyramphus, inhabits the islands and coasts of North America, from the Aleutian Islands to southern California.

Key to the Genera

1 (4) Claw of inner front toe more sharply crooked than on other toes (Figure 55).

2 (3) Transverse grooves on each side of bill are developed on upper mandible only (Figure 66). When these grooves are absent (in young birds), the bill is 20-25 mm deep at its base, and its total length is 45-50 mm. .....8. Lunda Briss. - Tufted puffin.

3 (2) Transverse grooves on each side of bill on upper and lower mandibles (Figure 53). In young birds, when these grooves are absent, the depth of bill at base is 15-20 mm, total length 30-35 mm. .....7. Fratercula Briss. - Puffin.

4 (1) Claw of inner front toe not more crooked than those on other toes.

5 (12) All secondary flight feathers tipped with white.

6 (9) Wing length over 180 mm.

7 (8) A narrow white line runs from middle of base of upper mandible over forehead to eye; in the adult, winter plumage may occasionally be hidden by brown feather tips. Adults have deep transverse grooves (one of them white) across bill (Figure 22)..... .....2. Alca L. - Razorbill.

8 (7) White line from base of bill to eye is absent; also no groove on bill, which has a smooth horny sheath, the rhamphotheca (Figure 1).....3. Uria Briss. - Murre.

9 (6) Wing length does not exceed 145 mm.

10 (11) Rectrices partly white, or with white patches. Bill small, flat and slender. In summer, under parts white, with many blackish-brown spots.....6. Brachyramphus Brandt* - Murrelet.

11 (10) Rectrices uniformly black-brown. Bill short, but deep and broad. In summer, breast and abdomen pure white; throat, neck and frontal part of crop black (Figure 19)..... .....1. Plautus Gunn. - Little auk.

12 (5) White tips absent on secondaries.

28 13 (16) Length of bill from top to posterior edge of external nares over 22 mm.

14 (15) Feathers of upper mandible do not extend to posterior edge of external nares. Wing always uniformly dark brownish above. In summer, adults acquire high horny projection at base of upper mandible (Figure 71)...9. Cerorhinca Bp. - Rhinoceros auklet.

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* Species B. brevirostris Vig.

15 (14) Feathers on upper mandible extend to middle part of upper edge of external nares. Wing always white above, or white patch or white ring around eye. Bill elongated, narrow, lacks horny projection (Figures 37, 44)..... 4. Cepphus Pallas–Guillemots.

16 (13) Length of bill from crown to posterior edge of external nares not exceeding 20.5 mm.

17 (18) Front of tarsus covered with transverse scales. Minimum bill length from crown to anterior edge of external nares 12 mm. Almost all lower coverts pure white.....
.....5. Synthliboramphus Brandt–Ancient murrelet.

18 (17) Front of tarsus covered with angular plates. All lower coverts gray or brownish, occasionally partially white; in the latter case, bill length from rictus to external nares does not exceed 8 mm.

19 (20) Very short tarsus, approximately equal to the length of the two basilar phalanges of middle toe (Figure 48).....
.....6. Brachyramphus Brandt–Murrelet.

20 (19) Tarsus relatively longer, approximately the same length as middle toe excluding claw.

21 (22) Length of bill from rictal feathers 14 to 16 mm. Mandibles curve upward (Figure 75).....
.....10. Cyclorrhynchus Kaup–Paroquet auklet.

22 (21) Length of bill from rictal feathers 9 to 12 mm. Mandibles form either straight or curving line (Figure 77).....
11. Aethia Merrem–Small auklet.

1. Genus PLAUTUS Gunn. – DOVEKIE

Gunnerus, 1761, Trondheimske Selskabs Skrifter, I: 263 (type Alca alle L.) – Alle Link, 1806, Beschr. Nat. Semml. Univ. Rostock, I: 17 (type Alca alle L.).

This is one of the smaller representatives of the Alcae. It feeds exclusively on marine invertebrates and breeds in natural shelters either on the shore or some distance away from the sea. It frequently walks to the entrance of the nest.

The bill is stout and short, fitted with a rhamphotheca. The ratio of the length of the bill to that of the skull is 0.9. The width of the upper mandible at the base is equal to its depth (or sometimes less in different subspecies of Plautus alle). The nares are rounded and partly covered by a fold of horny skin. In front of the nares is a short shallow transverse groove which begins at the nares, but does not extend to the rictus. The base of the bill is feathered, the feathers extending to the posterior edge of the nare After the fall molt, when the horny scale cover is shed, the bill becomes flatter, and the crest of the upper mandible less curved.

The tarsus is slightly shorter than the middle toe excluding the claw.
29 It is 31.5 % of the body length. The entire foot is relatively long, exceeding that of the black guillemot (C. grylle) – 147.8 % of the body length – so that the bird can move quite freely on dry land.

The wings are short, pointed and narrow. The length of the wing skeleton is 199.3 % of the body length. The ratio of the wing length to its tip averages 2.02. The tail has 12 feathers and an almost stubby end.

During the nuptial period adults develop a neck pouch which opens under the tongue and serves to carry food to their nestlings.

The skull structure of the dovekie (Plautus) relates it to the murre type of Alcae. The upper margin of the postorbital bar shows a distinct forward incline. The interorbital part of the skull is broad. The deep cavities, which contain the rhinal glands, have upturned outer margins that form a complete arch between the postorbital process of the squamosal bone and the lachrymal bone (Figure 4). The zygomatic process is undeveloped; the lateral processes of the basisphenoid are lacking. The temporal fossae containing a part of the mandibular adductor muscles are flat and short (Figure 17) owing to the undeveloped corresponding muscles which have become almost useless, since the bird's food consists of small marine invertebrates and does not require any effort on the part of the jaw muscles.

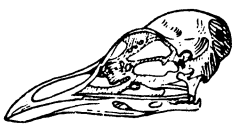

Figure 17. Skull of dovekie, Plautus alle

Figure 18. Pelvis of dovekie, Plautus alle

The pectoral bone is long and narrow, with a well-developed keel and a small tongue-shaped metasternum. The posterior part of the sternum has two incisions, one on each side. The ends of the ribs are embedded in six facets [on each side of the sternum]. The pelvis is comparatively broad; there are eight free caudal vertebrae (Figure 18). Seasonal dimorphism is well developed; the various age groups have similar attires. Young birds change their juvenile plumage for the first winter attire in their first fall season. Partial spring molt in adults apparently involves only the small feathers of the front part of the body.

The distribution of Plautus is associated with the Atlantic island coasts in the Arctic zone and extends eastward to Severnaya Zemlya (North Land).

There is only one known species of this group.

1. Plautus alle – DOVEKIE

Alca alle Linnaeus, 1758, Syst. Nat., ed. X, 1: 131 ["Arctic Ocean"]. - Alle alle (L.), Menzbir, 1895, 1: 74. -Plautus alle (L.) Dement'ev, 1951. -Ptitsy Sovetskogo Soyuza, 2: 179.

Adult males and females in summer. The entire upper body surface, the upper coverts and the tail are glossy black with light-brownish hues. The lateral parts of the head, the throat, the frontal and lateral parts of the neck, and the anterior region of the crop are chocolate brown. The pure white patch over the eye is produced by feathers which are shorter and narrower than the other feathers of the head. Both vanes (inner and outer) of the humerals are white-tipped. The secondaries likewise have white tips (except for two inner feathers), and form a white band across the wing. Breast and abdomen are white; a dark-brown line stretches along the flanks. The iris is hazel brown, the bill black (Figure 19); the feet are brownish or slate gray. In winter, male and female have a white streak running from the throat beneath the auricular feathers to the nape. The throat and under parts are white. The crop feathers are frequently light brown, with white tips; this has the effect of a dark necklace. Otherwise the coloring is the same as in summer. The downy nestlings are smoke gray or brownish gray, the under parts somewhat lighter. Juvenile plumage is similar to that of adults in summer but their back feathers are a duller black. The bill is brown and smaller than that of adults. Juvenile winter plumage, which is assumed during the first fall season of young birds, resembles adult winter plumage, except that it is more brownish. Measurements: wing length in males and females - 111.8 to 134.0 mm; tarsus - 18.7 to 24.0 mm; bill from naris to tip - 10.2 to 15.0 mm long and 6.8 to 12.1 mm deep at the rictus.

Figure 19. Dovekie, Plautus alle

Distribution. It nests on Franz Josef Land, on the west coast of the North Island of Novaya Zemlya, on the northeastern coast of the Oktyabr'skaya Revolyutsiya Island (Severnaya Zemlya), and possibly in northern Taimyr, where it was found by Amundsen in 1919. According to Antipin (1938), dovekies do not breed on the northeastern coast of the North Island of Novaya Zemlya, but they winter there in considerable numbers from late November to April, and feed in the sea on their southward flight. Some observers mentioned seeing dovekies on Bennet Island in July. Outside the USSR, they breed in Spitsbergen, Bear Island, Jan Mayen Island, and Iceland, north of the west and east coasts of Greenland, and on the Canadian archipelago from Baffin Island to Grinell Land. They spend part of the winter on the northeastern shores of the North Island of Novaya Zemlya, on its South Island near the Murman coast, and also in Kola Bay, from where the ZIN AN received a good supply of specimens collected in December and January. Dovekies were occasionally found on the south and west coasts of Finland, and a few isolated birds were encountered inland. In winter they were seen in southern Greenland and around the pack ice in the Atlantic; there were rare encounters in the North Sea in the late fall. Their southward migration extends to the Canary Islands and the southeast coast of the United States (Carolinas) (Figure 20).

The two subspecies differ mainly in size.

Habits. Seasonal migratory routes are not usually very extensive because dovekies may winter wherever open water spaces can be found, even

in northern latitudes. Young immature birds often spend the summer in the water amidst floating ice in small groups of eight to ten.

The arrival of sexually mature dovekies at their nesting sites is governed by ice conditions. Dovekies generally tend to assemble in large flocks all the year round. In densely occupied territories their colonies number hundreds of thousands of birds which settle either in groups on rocky promontories or in long rows along narrow cliff ledges. On land they move
31 fairly well, walking on their toes; they lean on the tarsus when resting. They roost on boulders, looking animatedly around, often raising their voices in a twittering sound. This curious singing can also be heard on the water and in the air during their flight. When it is windy they sit in gloomy silence, and in stormy weather they prefer to remain on land. But on calm days the surface of the water is packed with thousands of feeding dovekies (Demme, 1934). They dive easily, submerging at an angle of 45 to 60°, but remain under water not more than 30 seconds. Their diet consists mainly of planktonic crustaceans: copepods (Calanus), amphipods (Gammarus, Themisto, Gammarellus, etc) and schizopods (Thysanoessa, Mysis, etc), and less frequently of annelids and mollusks. Every observer of dovekies at their nesting sites has noted the way they rise in clouds in the air and encircle the cliffs like a swarm of bees.

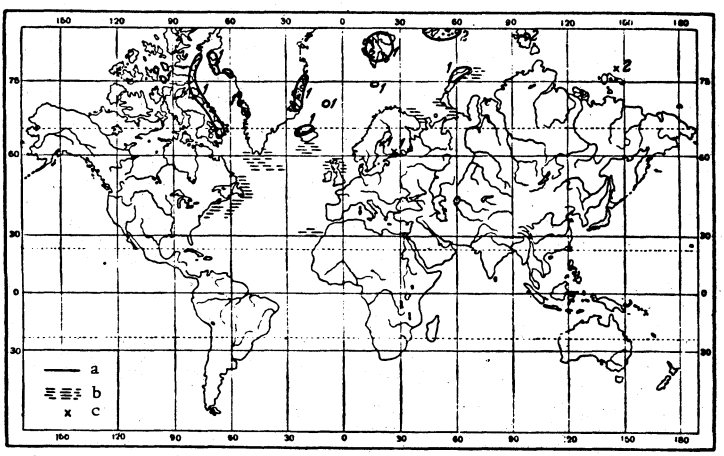

Figure 20. Distribution of dovekie, Plautus alle

1- P.a. alle; 2-P.a. polaris; a-boundaries of nesting sites; b-migration routes; c-places visited by migrant birds

Spring animation, the pursuit of females by males, and sometimes fighting among males begin long before the actual nesting period. The birds pursue each other in the air and, when one is caught, its sparring partner plucks the feathers from its head and back; they then roll down onto the snow, where they continue their scramble.

Dovekies settle on the seacoast, or up to 6 km from the sea, among screes or large boulders, and sometimes in deserted puffin nests. They often establish independent colonies, but they may also nest intermingled

with guillemots, and less often with murres. In the latter case, they occupy the lower terrace of the bazaar [seashore colony]. Their nests can be easily identified by the red droppings on nearby stones.

32 Single-egg clutches are common (two eggs are rare); the egg is laid on the bottom of a tunnel underneath stones, without any lining material. Usually the egg is of a uniform bluish-green color, sometimes with barely perceptible pale-brown spots. The egg length ranges from 45.0 to 53.0 mm, the width from 30.0 to 36.8 mm. Both parents participate in the incubation, and each develops two brood patches. The incubation period lasts 24 days. The young are fed on small crustaceans which the parents bring in a neck pouch that opens under the tongue. The front part of the neck is swollen in dovekies returning from the sea to their nests, and this is visible even to the naked eye.

Juvenile plumage begins to emerge in 8 to 10-day-old nestlings. The flight feathers and rectrices appear simultaneously with the coverts and the short general body feathers. The down remains for a long time on the tips of the growing feathers. The young stay in their nest hole until their wings are grown, after which they depart for the sea, even if some of the lateral upper primaries are not fully developed at nest-leaving time.

The change from the juvenile to the first winter plumage occurs during the early migratory period, usually near the nesting site. Adults undergo complete molt in the fall and partial molt in the spring, when only the short feathers on the front of the body are replaced.

The flesh of dovekies is very palatable, without any disagreeable aftertaste, and is widely used by the native population.

1a. Plautus alle alle (L.) – Common dovekie

Alca alle Linnaeus, 1758, Syst. Nat., ed. X, 1: 131 (Europe). – Alle alle (L.) Menzbir, 1895, 1: 74; Birulya, 1910. – Ezhegodnik Zoologicheskogo muzeya Akademii Nauk, XV: 178; – Gorbunov, 1929. – Trudy Instituta po izucheniyu severa (NTU VSNKh USSR), 40: 214. Plautus alle (L.), Dement'ev, 1951. – Ptitsy Sovetskogo Soyuza, 2: 180.

Length of wings of males and females 111.8 to 127.5 mm, average length 118.3 mm (23 specimens measured); tarsus 18.7 to 21.2 mm, average length 20.1 mm (23 specimens measured); length of bill from naris (in summer) 11.7 to 12.3 mm, average length 12.1 mm (5 specimens measured); length of bill from naris (in winter) 10.2 to 12.3 mm, average 11.3 mm (16 specimens measured); depth of bill at base (in summer) 7.2 to 10.0 mm, average 8.9 mm (6 specimens measured), depth of bill (in winter) 6.8 to 9.2 mm, average 7.9 mm (16 specimens measured).

Distribution. Inhabits the entire range of the genus, with the exception of the coastal region of Franz Josef Land and, possibly, Severnaya Zemlya (North Land).

Systematic Remarks. Measurements of two dovekies, captured on 25 August in North Land (at Bazarnaya Mountain on the northeastern coast of Oktyabr'skaya Revolyutsiya Island, Cape Voroshilov region), showed the following: wing length 122.7 to 128.3 mm; tarsus 20.0 to 22.0 mm; bill length from naris 11.7 to 12.0 mm; depth of bill at base 10.2 to 12.0 mm.

This shows that the dovekies from North Land (Severnaya Zemlya) have a somewhat longer wing and tarsus and a deeper bill than P. alle alle, but the collected data are still not sufficient to allow definite statements about these Plautus subspecies.

Habits. Dovekies depart in April from their wintering places in Kola Bay. Antipin's observations (1938) confirm that the number of migrant
33 dovekies on the northeastern coast of Novaya Zemlya increases in April. This leads us to assume that it is in that month that spring migration begins.

In Archangel Bay (Novaya Zemlya) large numbers of dovekies nest among screes at the bottom of cliffs occupied by murres. Gorbunov's observations (1929) indicate that although the young in these dovekie colonies have acquired juvenile plumage by mid-August, their wings are not yet full-grown and they do not leave their sheltered nests. The same author noted their departure for the sea in late August and recorded having found only fifteen dovekies at the Archangel Bay bazaar on the 26 August 1927.

Complete molt of adult dovekies from Novaya Zemlya takes place from July to early August. From 7 August birds on the Matochkin Shar Strait undergo intensive molt: their wings and tail feathers are shed and new feathers still in dermal papillae appear on the throat and foreneck. Toward the end of August the change of plumage is almost completed. By 30 August males from the Barents Sea have not lost all of their brown summer feathers in the crop region, but white feathers are rapidly pushing their way out and many new dermal papillae appear on the back. In general, the coloring is almost the same as in winter.

In the Murman region partial spring molt is completed by the middle of March. A dovekie was found on 22 March in the Kildin Strait in almost full summer plumage, with some white feathers remaining at the sides of its head and throat, but new dark feathers were projecting from papillae. By 1 April all birds from the Murman waters had acquired summer plumage. One dovekie captured in that region on 25 February had not yet started molting. (All the above data used for the study on the molt of dovekies were taken from the basic collections of ZIN AN).

1b. Plautus alle polaris (Stenh.) – Great dovekie

Alle alle polaris Stenhouse, 1930. Scott. Natur., 182: 47 (Franz Josef Land). – Alle alle (L.) Gorbunov, 1932, Trudy Arkticheskogo instituta, IV: 141.

A comparatively large dovekie. The bill is deeper than that of the common dovekie.

Measurements: wing length of males and females 123.5 to 134.0 mm, average 128.0 mm. (Measurements of 40 specimens were taken from the basic collections of ZIN AN which were obtained on Franz Josef Land during the spring-summer seasons); tarsus 19 to 24 mm, average 21.4 mm; bill (from naris to tip) 11.2 to 15.0 mm long, average 12.8 mm (40 specimens measured), and 9.0 to 12.1 mm deep at base, average depth 11.1 mm (27 specimens measured).

Distribution. Nests on Franz Josef Land and possibly on Severnaya Zemlya where many dovekie bazaars were established on the northeastern

coast of the Oktyabr'skaya Revolyutsiya Island. (See Systematic Remarks on Russian page 32).

Habits. Dovekies arrive at dawn at an early date (in the last 10 days of February or early March) on the shores of Franz Josef Land. They do not settle on the rocks immediately, but at first make daily visits to the site of their future breeding colony. They then return to the sea, where they feed for many hours in the open water. With the onset of intensive spring flooding along the coasts of the islands they spend more time on the cliffs. The males begin their courtship at the end of March, and nesting does not begin before early June.

34 Dovekies are abundant on Franz Josef Land. They settle there in screes on the seashore or some hundreds of meters inland. Toward 10 June, eggs which are in the first stages of incubation are found in these regions, and in early August downy nestlings are encountered with some feather growth beneath the concealing down. The latest young birds in the colonies are found at the beginning of September. Observations conducted over many years have confirmed that their fall migration begins between 14 September and 1 October.

The complete molt of adults occurs in the first half of September. On Franz Josef Land the spring change from winter to nuptial plumage takes place early in March, and by mid-March, or, in more instances, toward the end of the month, the molt is completed.

2. Genus ALCA Linn. – RAZORBILL

Linnaeus, 1758, Syst. Nat., ed. X, 1: 130 (type – Alca torda L.).

The razorbill is one of the largest forms of Alcae. It is an exclusively piscivorous bird, nesting on coastal cliffs and in small naturally sheltered places, which it enters by direct flight from the sea, thus limiting the use of the hind limbs on land. It became highly specialized in using its wings in deep underwater swimming when pursuing its prey, but has lost much of its capacity for aerial maneuverability. The bill is adapted for seizing and holding slippery food and for carrying several fishes in long flights to their nestlings; it is laterally compressed and comparatively deep in relation to its length. The tip of the upper mandible curves downward, while the tip of the lower mandible is sharply upturned. The rhamphotheca is crossed by several broad grooves, one of which is covered by a thin whitish horny plate. The inferolateral edge of the upper mandible, and to a lesser extent the superolateral edges of the lower mandible, are bent inward and thus ensure the firm grasping of the prey. This is a feature common to many piscivores, but is particularly well developed in razorbills. The curvature of the upper and lower mandibles is more developed on the horny portions of the beak and less so in its bony structure. The rictal feathers extend to the slit of the external nares, which are set at the lower end of the upper mandible and are hidden beneath short overhanging feathers.

The tail, which is made up of 12 pointed feathers, is graduated. The tarsus is shorter than the middle toe and constitutes 28.3 % of the body length, while the total foot length in relation to the body is 125.7 %. The

wings are short, pointed and slender. The length of the wing skeleton constitutes 191 % of the body length (according to the osteological data at ZIN AN). The ratio of the wing length to its upper part averages 1.7 : 1.

The cranial structure is distinguished by the following characteristics. The upper part of the postorbital arch is bent markedly forward, and accordingly, the upper portion of the endocranium bends in the same direction. The broad supraorbital portion of the skull has deep cavities containing the nasoorbital glands. The postorbital projection of the squamosal bone is distinctly arched and forms the outer raised edge of the supraorbital sockets. The parietal and squamosal bones are deformed by fossae and crests. The posterior end of the deepest fossa adjoins a high crest and runs from the parietal toward the quadrate bone. The upper edges of the left and right fossae almost meet in the parietal region and are separated by a flat narrow crest (the width of this crest varies in individual cases). The zygomatic process is weakly developed; the lateral projections of the basisphenoid are lacking (Figure 21). The quadrate bone has a very noticeable bulge like an upturned projection. The nares are oval and very elongated. The pectoral bone is extremely slender and long. The metasternum juts backward like a short spadelike projection. On both sides of the sternum are eight facets to which the ribs are attached.

The pelvis is very elongated and narrow as in all specialized divers which make little use of their hind limbs for movement on land. The front part of the ilium does not reach the crista spinosa but forms two narrow fossae at both sides of it. There are eight free caudal vertebrae.

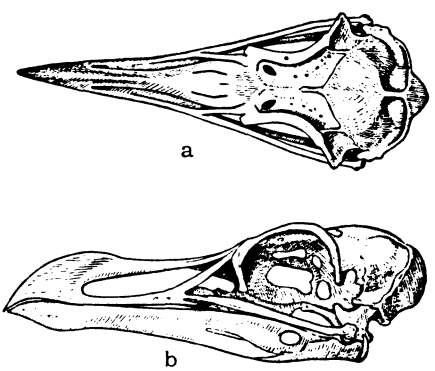

Figure 21. Skull of razorbill, Alca torda

a-dorsal view; b-lateral view

Coloring varies in seasonal plumage but is similar in all age groups. Young birds are distinguished from adults by the shape and size of their bills and by their juvenile plumage, which they exchange during their first fall season for the first winter plumage. Partial spring molt affects the short feathers on the head, neck, crop region and back. Breast and abdominal feathers are apparently not renewed in spring. Some age and seasonal modifications are expressed in the length of the small contour feathers. In the winter plumage of young birds, the short feathers on the upper part of the body and on the under parts are shorter than those of adults in winter. Juvenile and adult birds alike have longer winter feathers on the body and head than in their summer plumage, but the feathers on the breast and abdomen are the same length in both seasons and are apparently not changed during the spring molt. Apart from the feather length, age and seasonal distinctions are also apparent in the color and the diversity of feather arrangement. (See the description of molting in razorbills below).

In the USSR the razorbill nests on the coast of the Kola Peninsula and on the northern coasts and islands in the Atlantic and adjoining seas.

There is only one known species of this genus.

1. Alca torda L. - RAZORBILL

Alca torda Linnaeus, 1758, Syst. Nat., ed. X, 1: 130 (Stora Karlso Island, near the west coast of Gotland in the Baltic Sea); Menzbir, 1895, 1: 68, Spangenberg, 1941. -Trudy Gosudarstvennogo zapovednika "Sem' ostrovov", 1: 78; Uspenskii, 1941, Idem: 32. -Alca torda torda L., Dement'ev, 1951. -Ptitsy Sovetskogo Soyuza, 2: 175; Kaftanovskii, 1951, Materialy k poznaniyu fauny i flory SSSR, new series, 28 (XIII): 75.

36 Adult males and females in summer. The upper part of the body, the wings and the tail are black with a light-slate tint. Narrow white margins edging the secondaries form a white band across the wing. The sides of the head behind the ear, the auriculars, chin, throat, and front and sides of the neck are a dark-chocolate color. A narrow distinct white line (produced by pure white feathers) runs from the horny crest on the upper mandible to the eye. The under parts, under coverts and humerals are white. In front of the rictus, at the horny base of the upper mandible, is a transverse, horny, sausagelike ridge which is crossed in front by a deep groove. The iris is dark brownish, the oral cavity lemon colored, and the bill black with a white band across the upper and lower mandibles.

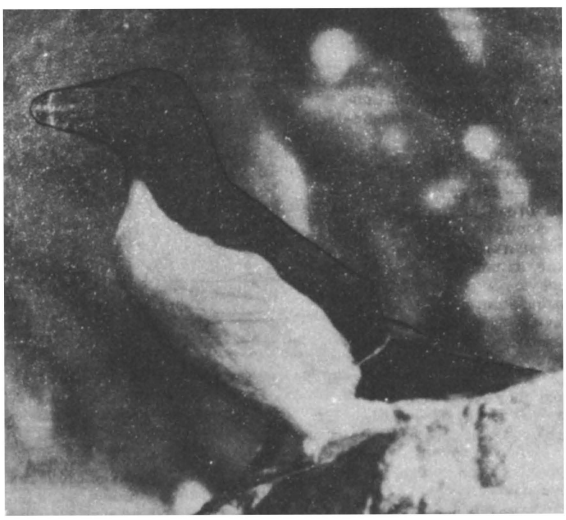

Figure 22. Adult razorbill, Alca torda, in summer

The feet are black (Figure 22). Adult males and females in winter. Distinguished from adults in summer only by the light-brownish hue on generally black upper parts. Chin, throat, front and sides of neck are white. There is also a broad white band from the throat to the eye, and from behind the eye to the occiput. The front of both sides of the lower
37 part of the neck is sometimes dark brown. The transverse horny sausage-like ridge and the deep groove on the upper mandible are absent. The

base of the upper mandible up to the white ridge is almost smooth. The white band, which in summer extends from the bill to the eye, is considerably darker, At times it is barely perceptible, and can only be seen by separating the intermediate feathers which are white at the quills and black at the tips. The nestling is covered with soft short down; neck, head and throat are faded, or off-white; the upper part of the body is gray with a pale-ocher shade, and the base of the down feathers is black and fluffy. The abdomen is gray, lighter in color than the back; it darkens gradually as the down wears off. The juvenile plumage, acquired immediately after the down stage, is similar to adult plumage in summer, except that the upper parts are more brownish, with barely perceptible margins on the feathers. The white band from bill to eye is clearly visible. The horny tip of the bill is much smaller than that of adults, and completely smooth. The first juvenile winter plumage is similar to adult winter plumage, except that the upper parts are more brown. A pale narrow whitish line runs from the crest of the upper mandible to the eye. The young birds are distinguished from the adults by their smaller bill, which is less deep at the tip and has an upper mandible with a more slanted curve. The horny bill cover has neither grooves nor ridges. On the base of the rhamphotheca are one or two depressions which are not clearly marked. The coloring of the first spring plumage of young birds is similar to adult summer plumage. The upper part of the bill is higher in summer than in winter. At the base of the rhamphotheca, in front of the rictus, there is a transverse, deep, narrow groove (Figure 23). In the second spring, another whitish transverse groove appears on the beak, but there are no other grooves in the area between the white line and the end of the bill.

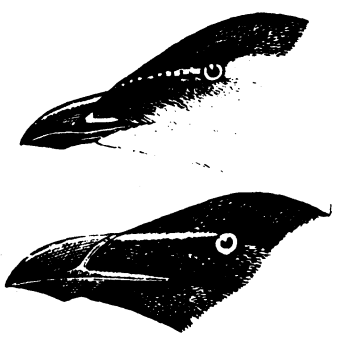

Figure 23. Young razorbill, Alca torda
above-in their first winter season; below-in their first spring season

Measurements: wing length in males and females 185 to 220 mm; tarsus 30.0 to 34.8 mm; bill length (from rictus to tip) 32.2 to 37.4 mm; maximum depth of naked bill 21.0 to 26.0 mm. Average weight of males 733.7 g, of females 700 g.

Distribution. They nest along the Murman coast and on adjoining islands, especially on the Kharlov, Kuvshin, Bol'shoi and Malyi Zelenets islands. They have also been found nesting on the western coasts of the White Sea, from the Kandalaksha Gulf to the mouth of the Onega River, and on the Solovetskii Islands. According to Finnish ornithologists, they breed in small numbers on Yalai Island, northwest of Lake Ladoga. They were captured in the fall in the Leningrad region and in summer in Estonia. They were once found on Bazarnyi Island at Malye Karmakuly on Novaya Zemlya.
38 Outside the USSR they inhabit the Arctic, Atlantic and Baltic shores of Scandinavia, the west and south coasts of Finland as far eastward as Kotka, the islands of Aland, Gotland and Bornholm, the coast of Denmark, Brittany, the British Isles, Iceland, West Greenland (north of Upernavik): in North America they range from New Brunswick and the Gulf of St. Lawrence to

the Labrador coast inclusively. Individual razorbills were encountered on Bear Island, and one encounter was recorded on Spitsbergen. In winter, the razorbill appears occasionally on the West Murman coast, but the main migratory range covers the coastal waters of the Atlantic, southward to the Moroccan and west Mediterranean coasts, and on the American side, it extends to New Jersey (Figure 24).

The two known subspecies, which differ only in size, are: 1) Alca torda torda L., (the larger bird), which breeds in the USSR, Scandinavia, the Baltic Sea, West Greenland, and North America; 2) Alca torda islandica Brehm, 1831 (also A. t. britannica Ticehurst, 1936) (the smaller subspecies), which has a wing length of 187 to 195 mm and a 20 to 23-mm-deep bill, inhabits the coasts of Brittany, Helgoland, the British Isles, and Iceland.

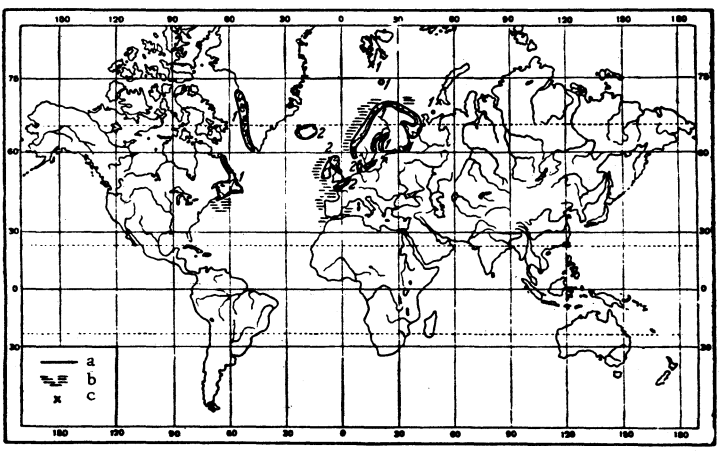

Figure 24. Distribution of the razorbill, Alca torda

1-A. t. torda; 2-A. t. islandica; a-boundaries of nesting sites; b-migration routes; c-places visited by passage migrants

Habits: In nonbreeding time it travels widely over the Atlantic Ocean, keeping close to the mainland, or stays near its nesting sites (Danish birds were found wintering in the southern parts of the Baltic Sea), but are seldom found far from the coast in the open sea.

39 On the water the razorbill floats high on the surface, with its neck drawn in and its tail often raised. It swims easily and swiftly. On land it moves awkwardly, walking on the tarsus and the toes, and clinging with its toes to the uneven parts of the rock to keep its balance. In walking, the body is bent slightly forward, the tail not touching the ground. Usually it rests on the abdomen with its feet tucked in. As in most Alcae, the flight is straight and direct, with continuous rapid flapping of the wings. The razorbill usually skims the surface of the water, but occasionally rises high into the air. In flight, its silhouette appears solid and short, head, trunk and tail being level. Before alighting on cliffs, the bird soars straight up onto the ledge and uses strong quick wing beats for braking ("reverse motion"), while the body is kept in a vertical position. The tail is spread forward like a flap, the wings expanded fanlike. By grasping the ledge with its

claws, the razorbill first leans with its breast on the cliff edge before moving forward. It cannot develop takeoff speed from level ground and for this reason it takes off only from cliffs. From the surface of the water or from the crest of a wave it rises with difficulty against the wind. In under-water swimming it uses the wings for paddling and, like other Alcae, it uses the outstretched legs as a rudder.

According to Kaftanovskii (1951), razorbills nesting at the "Seven Islands" Sanctuary seldom feed near the shore, but usually fly out into the sea at a distance of several (up to 9) kms, where they keep out of sight. West Eorpean ornithologists have noticed that in British waters razorbills feed during the breeding period chiefly on fish, which they usually catch by diving to a depth of approximately two meters from the shore. They remain under water up to 22 seconds. Their dive does not exceed a maximum depth of 5 to 7 meters and their underwater stay lasts from 40 to 52 seconds.

The food of razorbills consists of 97 % fish on an average. In East Murman they eat mainly capelins and sand eels in spring, with crustaceans and polychaetes comprising about 9 %. In the fall the latter-mentioned organisms are absent, and herring and sand eel prevail in the fish diet.

Razorbills are essentially social birds. They often settle together with murres in the center of bazaars, occasionally in the peripheral areas. In rare cases they stay in small separate groups when they can find a sufficient number of concealed nesting sites.

During the courtship display the male and female stand erect on the ground facing each other, touch or rub their bills, preen the partner's feathers on neck or head, and alternately lower and raise the neck and head. Occasionally one bird stretches its neck almost vertically and makes clicking noises with half-open bill, while the other preens the neck feathers.

Most of the time razorbills are silent, but during the nuptial period they utter rough croaking sounds. They lay one-egg clutches in crevices, cavities or holes in cliffs, in tunnels between rocks, and sometimes in abandoned puffin burrows, but generally on a site which is more or less protected although visible from outside. The egg is very seldom laid on an open ledge. The lining material of the nest consists of peat particles or dry plant stubble. If the first egg is lost the razorbill lays a second one, and if this too is destroyed it may lay a third. Both sexes participate in incubation, and each develops two brood patches, probably a throwback to former two-egg clutches.

The ground color of the egg is white, greenish, yellowish, and pale brown, with superficial black and brownish dots, and more ingrained bluish-
40 gray spots. British ornithologists report findings of black, dark-brown, greenish and white eggs, devoid of spots (Witherby, 1952). The eggs are 60 to 84 mm long and 44 to 59 mm wide. The egg surface is slightly rough with large pores. The incubation period of razorbills from the East Murman coast lasts from 34 to 36 days (Kaftanovskii, 1951).

The young are fed on small fish. The parents carry a beakload of several (up to eight) fishes, holding each fish across the body, near the head. In the first days after hatching the downy nestling is completely helpless and remains in the nest. Short feathers appear over the entire body on the sixth day. The two-week-old bird clad in juvenile plumage can move about near the nesting crevice if the location and surface of the adjoining cliffs permit this. The feather structure of the juvenile plumage is loose, the number of barbs and interlocking hooklets being smaller than in adults.

The departure from the cliff for the sea occurs when the bird is 18, 20, or 22 days old (Kaftanovskii, 1951; Kartashev, 1955a). At that time the razorbill is in full juvenile plumage, except that the flight feathers and rectrices have not yet developed, but the upper primary and secondary coverts already provide the necessary supporting wing surface for parachuting when the bird plunges from the air into the water. This way the young depart from the land to the sea quite independently. From the start the young bird is able to dive and it paddles freely under the water with the aid of its wings, which have not yet attained their full length. It attains sexual maturity in the second or third year.

The change from juvenile to winter plumage occurs in the sea and coincides with the intensive growth of the wing and tail feathers. The postjuvenile molt progresses more slowly than the prenuptial molt of adults. Birds under one year old don their complete summer plumage in May. The replacement of summer plumage by the second winter plumage takes place earlier than in adults; it begins during the summer season.

Adults molt twice a year. Complete fall molt begins with the shedding of the short body feathers, and the wing feathers are shed more or less simultaneously soon afterward, followed by the rectrices. As mentioned before, the feathers are longer in winter than in summer, particularly the head feathers. The short feathers covering the base of the bill, where a narrow white line appears in summer, are dark brown at the tips. This explains why the shite line from bill to eye is concealed in the new winter plumage of adults. The white near the feather quills can be seen only after the dark feather tips begin to wear off.

The horny bill covers are also replaced in the fall through gradual peeling. The bill is more laterally compressed in winter, and the arched crest on the downward curve of the upper mandible becomes more curved. The lower mandible is less deep due to the loss of the outer horny layer of the rhamphotheca. The deep transverse groove at the base of the upper mandible is absent in winter and the surface of the rhamphotheca from the feathered border to the white groove is almost smooth, since the transverse horny sausagelike ridge at the base of the bill is shed in the fall.

Spring molt of adults takes place over a short concentrated period lasting two to three weeks, and is completed around the middle of April. The spring molt usually begins with the feathers of the head and neck, but may also involve the short feathers on the upper part of the body. These feathers
41 are shorter than the winter ones. Salomonsen (1944) reported that in the spring some birds also renew the feathers on the under parts. He describes the fall and spring molt of down feathers that are arranged between the capital, cervical and postventral feather tracts. This precedes a general change of plumage.

1a. Alca torda torda L. – Northern razorbill

Alca torda Linnaeus, 1758, Syst. Nat., ed, X, 1: 130 (Stora Karlso Island, near the west coast of Gotland in the Baltic Sea). -Alca torda pica L., Salomonsen, 1944, Goeteborgs Kungl. Vetenskaps Handlingar, Ser. B., III, 5: 20.

A comparatively large form of razorbill. Length of wing in males and females 195 to 220 mm; maximum depth of naked bill 22.0 to 26.0 mm. Birds nesting in the USSR have only one or two transverse grooves on their bill between the shite groove and the bill tip.

Distribution. Inhabits the entire range occupied by the genus in the USSR, and also the Baltic Sea, the Scandinavian coast, West Greenland, and the afore-mentioned regions in America. Banding has shown that adults and young birds which originated on the East Murman islands spend the winter on the Atlantic coast of Norway, occasionally extending south toward the Kattegat Straits and the coast of Poland (Kartashev, 1955b).

Systematic Remarks. Salomonsen (1944) restricts the distribution of the subspecies A. torda torda to the Baltic Sea and Lake Ladoga. He regards the razorbills which inhabit the Murman coast, the White Sea, the west and north coasts of Scandinavia, Greenland and America as a separate subspecies under the name of A. torda pica L. on the grounds that 62 % of these birds have three distal transverse grooves on the upper mandible instead of only one groove as in the majority of the Baltic razorbills. To accept the existence of the subspecies A. torda pica does not seem justified on the basis of this one vague indication. The materials of ZIN AN do not contain a single razorbill from the Murman or White Sea regions with three distal grooves on the bill, and in the collections of the Moscow University Museum only one specimen out of 25 is distinguished by this feature.

Habits. The spring arrival of razorbills at the cliffs of the East Murman islands occurs in late April. During the investigations conducted over several years (from 1937 to 1940) Kaftanovskii (1951) found the first eggs between 26 May and 4 June. According to the author, the average time of mass hatching is in mid-July. Spangenberg (1941) reports that the majority of eggs found between 28 June and 3 July, 1932, on Kharlov Island were either freshly laid or very little incubated. A two to three-day-old nestling preserved in the ZIN AN collection was found on 18 July on Gavrilov Island (Murman). Young birds leave their nests for the sea in late July or at the beginning of August. Young birds in juvenile plumage with some down left on the feather tips were found on Kuzov Island in the White Sea in late July. On 21 July a young razorbill in juvenile plumage and with fully developed upper coverts was taken on Bol'shoi Zelenets Island. On the same Murman coast the first winter plumage is donned at the end of September. Complete molt of adults begins in Murman with the replacement of short body feathers early in August, when the birds are still dwelling on the cliffs. The razorbill sheds the large feathers during its migration away from the coast, not before September.

1. Genus URIA Briss. – MURRES

Brisson, 1760, Orn. 1: 52 (type Colymbus troille L.)

42 A large alcidine type, feeding primarily on fish and nesting in the open on ledges of coastal cliffs or on rocky coastal plateaus, which they approach in direct flight from the sea. Murres are little adapted to walking; their

fore limbs are highly specialized for underwater paddling at the expense of flight maneuverability. The bill is well suited for seizing and holding wriggling prey, and carries but a single fish for long distances when the nestling is being fed.

The bill is slender, long, low, and tapered toward the tip. Its proportion to the length of the skull case (from the bend at the base of the upper mandible to the tip) is 1.2 (in U. lomvia). The crest of the quadratojugal bone is completely flat (without a projection at the base), the rhamphotheca is smooth (without grooves) and the outer edges on the upper and lower mandibles are bent sharply inward. The rictal feathering extends to the front edge of the slitted external naris, and occasionally even further. On the preterminal part of the lower edge of the rhamphotheca there is a noticeable indentation.

The tail, which is made up of 12 to 14 rectrices, is slightly rounded. The rectrices are comparatively broad and not pointed at the tips. The wings are slender and pointed, averaging a ratio of 1.9 of the entire wing length to the tip, while the length of the wing skeleton averages 170.9 % of the body length.

The skull case of murres resembles in shape and structure that of razorbills (see description of the genus Alca), except for the fact that the deep fossae in the temporal region are slightly smaller in the skull of murres, and the upper edges of the right and left fossae are separated by a relatively wide bony bridge. The interorbital partition is poorly ossified (Figure 7).

The pectoral bone is long and narrow. The metasternum projects in a keel directed backward. The sternum has one pair of incisions and seven facets for the attachment of the ribs (Figure 10). Murres have a narrow pelvis; the frontal edges of the ilium are fused with the crista spinosa (Figure 13). The tarsus is short and forms 25.1 % (U. aalge) and 27.5 % (U. lomvia) of the body length. The entire leg skeleton (excluding toes) is 125.9 % (U. aalge) and 133.2 % (U. lomvia) of the bird's body.

The juvenile plumage of young birds is distinguished by its loose feather structure and is changed into winter plumage in their first fall. In adult birds only the short feathers on head and neck are renewed during the spring molt. Summer and winter feathers are of equal length in U. lomvia, and differ insignificantly in U. aalge.

The representatives of this genus inhabit the polar continental and island coasts in the Arctic, Atlantic and Pacific oceans within the boundaries of the Northern Hemisphere.

The two known subspecies breed in the USSR.

Key to the Species

1 (2). White ring around eye. Narrow white line on both sides of head runs backward from behind eye (Figure 1).....
.....2. U. aalge (Pont.)–Common murre.

43 2 (1). White ring around eye absent. Narrow dark line on dark background, resembling parting, runs backward on both sides of head from behind eye.

3 (6). Throat and sides of head white.

4 (5). White patch on sides of head extends from behind eye to occipital; intersected at eye level by dark stripe.....
.....2. U. aalge (Pont.)–Common murre (winter plumage).

5 (4). White patch on sides of head does not extend to eye level.....
.....1. U. lomvia (L.)–Brunnich's murre (winter plumage).

6 (3). Throat and head entirely dark, without any white coloring.

7 (8). Throat, sides of head, and front of neck dark brownish. Top of head and nape dark slate. Base of bill distinguished by protuberant outer edge; lacks feathering between external naris and mouth corner. This dilated edge is whitish-blue or yellowish in contrast to the rest of the upper mandible, which is dark (Figure 25).....1. U. lomvia (L.)–Brunnich's murre (in summer).

8 (7). Head, throat and neck uniformly grayish-sooty brown. Outer edge of base of upper mandible less prominent, with feathers at mouth corners, and also dark like other parts of horny bill cover.
.....2. U. aalge (Pont.)–Common murre (in summer).

1. Uria lomvia (L.)– BRUNNICH'S MURRE

Alca lomvia Linnaeus, 1758, Syst. Nat., ed. X, 1: 130 (Greenland)–Uria brunnichi, E. Sabine, Menzbir, 1895, 1: 63–Uria lomvia Gorbunov, 1925.–Trudy instituta izucheniyu severa, 26, 1a: 22; Gorbunov, 1929, Trudy instituta po izucheniyu severa (NTU VSNKh SSSR) 40: 215; Gorbunov, 1932.–Trudy Arkticheskogo instituta, Vol IV: 154; Krasovskii, 1936. Izvestiya Nauchnogo instituta imeni Lesgafta, Vol XIX, 2: 51; Krasovskii, 1937.–Trudy Arkticheskogo instituta, Vol LXXVII: 42; Kaftanovskii, 1951; Materialy k posnaniyu fauny i flory SSSR, new series, 28 (XIII): 85; Dement'ev, 1951.–Ptitsy Sovetskogo Soyuza, 2: 190.

Bill relatively short and fairly deep compared with that of other murres. Outer lower edge at base of horny upper mandible slightly dilated, lighter in color than other horny parts; lacks feathering. Wing length in proportion to tip – 2 : 1.

Adult male and female in summer. Top of head and hind neck dark slate. Remaining upper parts, wings and tail blackish or grayish brown. Sides of head, throat, front and sides of neck –coffee-brown. Dark seam, like a narrow line, behind eye extending backward. Under parts white, flanks mottled and dark brownish. Wing feathers brownish, lighter at quills; secondaries – white-tipped. Under coverts mostly white; only the longest feathers grayish. Iris brownish, bill brownish black, upper mandible at base edged with whitish or yellowish tint. Feet black (Figure 25).

Adult male and female in winter. White sides of head to mouth level; throat and front of neck – white. A dark-brownish band, either broken in the middle or completely closed, frequently encircles the neck. Top of head, frenum, wide space beneath eye, and sides of head behind eye-brownish black. Otherwise, as in summer (Figure 26). The downy nest-
44 ling is dark brownish above (sometimes with a reddish tint), but lighter at tips of down feathers; flanks brownish, head blackish with long hairlike downy whitish tips as in the hindneck region. Chin, throat, and usually

front of neck – brownish; main part of breast and abdomen white*. Young birds in juvenile plumage donned after down stage. Upper parts brownish black, sometimes with a grayish shade; margins of feathers darker than main plumage. Throat and chin off-white with brownish tips. Under parts, including front of neck–white. Young birds in first winter plumage acquired in their first fall differ from adults by a smaller bill and the mottled design on white sides of head.

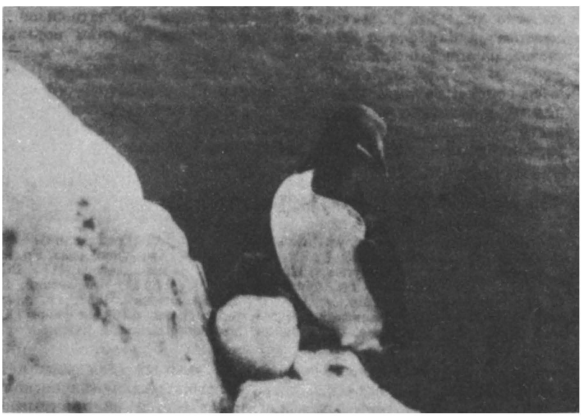

Figure 25. Brunnich's murre, Uria lomvia, with its nestling

Measurements. Length of wing in male and female: 197.5 to 238.0 mm; tarsus 31 to 41 mm; bill from external naris to tip 26.6 to 39.0 mm; depth of bill at rictus 10 to 16 mm. Average summer weight of male in East Murman 988.6 g, in the bazaars of Novaya Zemlya – 1,026.6 g; weight of female 998.7 g and 995.8 g respectively.

Distribution. The Brunnich's murre nests on the Murman coasts and adjacent islands, Franz Josef Land, Novaya Zemlya; on islands off the East Taimyr coast, the New Siberian Islands, Wrangel Island, Kolyuchin Island, the eastern part of the northern coast of Chukot Peninsula (east of Kolyuchin Bay), and along its east and south coasts, on Kamchatka, the Commander Islands, the northwest coast of the Okhotsk Sea, the Shantarskie Islands, Sakhalin, and the Kuril Islands. Outside the USSR, it inhabits Spitsbergen, Jan Mayen, Medwezhii Island, Iceland, the east, west and northwest coasts of Greenland, the northeast coasts of America, and the

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* The down of nestlings of both murre species has the following structural characteristics. Each down feather consists of a long naked shaft, from the base of which minute branches of barbs arise on either side. The shaft is fairly resilient and comparatively rigid, and resembles coarse hair. A bundle of down feathers is connected at the bases by a transparent horny cylindrical cover cupped over the joined barbs of each growing feather of the juvenile plumage.

eastern islands of the Canadian archipelago, from the Gulf of St. Lawrence in the south to Grinnell Land in the north, and also the west and south coasts of Alaska and the Aleutian chain.

In winter, small groups of murres are occasionally found migrating in West Murman and in the White Sea. Brunnich's murres remain for the winter in considerable numbers near Novaya Zemlya, but in certain years they perished in masses during November and December. When ice conditions are favorable, they also winter near the coasts of Franz Josef Land and in the open waters of the Barents and Kara seas. Banding has proved that young Brunnich's murres are capable of covering such large distances as from the coastal islands of East Murman to the West Greenland coast. (So far only one young murre has been found in November or December, 1949, near Julianehaab in West Greenland; it was banded as a nestling on 13 July of the same year on Kuvshin Island —Kartashev, 1955b). Migrations are common among them along the Scandinavian coasts, in the North Sea and in British waters. On the American Atlantic coasts they winter in the Gulf of St. Lawrence and penetrate into Hudson Bay, occasionally advancing southward into Maine and the Carolinas. It seems likely that their migrations extend to the coasts of Severnaya Zemlya (North Land) where in some years near Cape Molotov (Komsomolets Island) vast expanses of water opened up in the spring. In the Pacific Ocean the majority of Brunnich's murres winter mostly in the Bering Sea, on the Aleutian and the Commander Islands, and they advance southward to Japan (Figure 27). Passenger migrants were found in November and December in the regions of Kostroma, Vladimir, Kalinin, Mozhaisk, and Vitebsk [central part of the European USSR], and occasionally Brunnich's murres appear in winter at the Estonian and Latvian coasts. In difficult ice conditions, large flocks of Brunnich's murres penetrate deeper inland. This was noted in the winter of 1902 to 1903, when a flock of nearly 1,000 birds descended on several lakes in Finland north of Lake Ladoga (Vakhvajari, Ruskeala, and other lakes), and spread from there over the whole country.

The species U. lomvia comprises four subspecies, which inhabit the USSR.

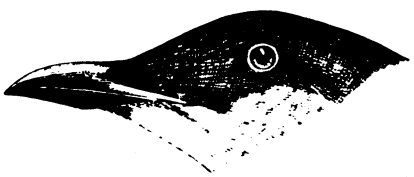

Figure 26. Brunnich's murre, Uria lomvia, in winter plumage

Habits. The dates and extents of the seasonal migration of Brunnich's murres largely depend upon the ice conditions existing in each particular year. Lack of sufficient open water is the main reason for the migration of these birds. The flocks which migrated beyond the fringe of the pack ice moved further in pursuit of fish schools, occasionally advancing into the open sea for a distance of many hundreds of kilometers off the continental coast. In common with all Alcae, Brunnich's murres do not move by long flights over open expanses of water, but use their wings only for crossing ice barriers.

In flying ability, the Brunnich's murre does not surpass the razorbill. The following characteristics demonstrate the similarities in the flying

apparatus of the two genera: the straight rapid movement, the low sailing over the water surface assisted by incessant wing flapping, the ascent to cliff ledges from below, and further flying peculiarities which it shares with other Alcae in its upward and downward flight. The murre is distinguished in flight from the razorbill by its longer neck and shorter tail, and its compact, heavy body. On land it walks with a waddling gait, stepping on the tarsus, which supports the body weight by itself, since the toes are not used and barely touch the ground. The roosting bird turns its head back under the wing feathers; in a resting position the body is held upright.

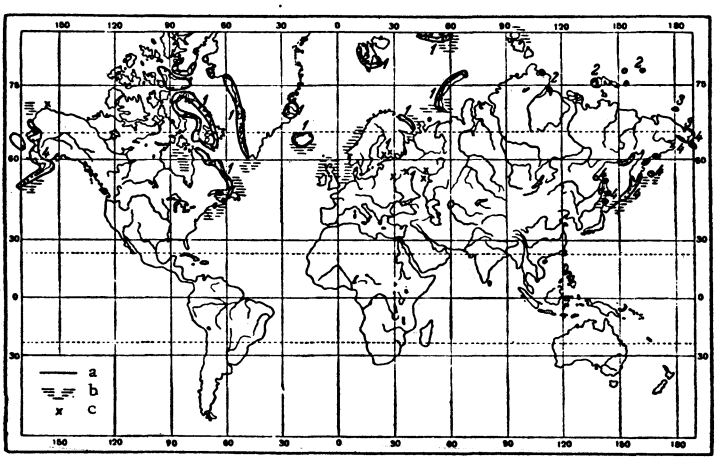

Figure 27. Distribution of the Brunnich's murre, Uria lomvia

1-U.l. lomvia; 2-U.l. eleonorae; 3-U.l. heckeri; 4-U.l. arra; a-boundaries of nesting sites; b-migration routes; c-places visited by passage migrants.

During the nesting period murres are very noisy both on water and on land. They emit a hoarse croaking sound with a great variety of intonations. At nuptial displays both sexes pursue one another on the water with excited calls. Each new arrival on the ledge is greeted with croaking by its neighbors. Alarm, too, is expressed by cries.

Fish is the principal food of Brunnich's murres. In East Murman it comprises 89.6 % — supplemented by small amounts of crustaceans and polychaetes — and in Novaya Zemlya 100 %. The chief fish forms in East Murman are herring and sand eels, in Novaya Zemlya – cod and cod fingerlings (as reported by L. O. Belopol'skii). The prey is captured either near
47 the water surface, or by diving to great depths. As in all Alcae their digestion is very intensive and rapid. Krasovskii (1937) discovered in a young murre a fully digested fish head 18 minutes after the whole fish was swallowed.

On their return from winter migration the murres at first stay far from the shore on the open water, but in fine weather they begin gradually to sit on cliffs, returning to the sea when it gets stormy. They only begin to settle definitely in the bazaars 5 to 6 days after their first appearance at

the breeding colony. In the climatic conditions prevailing in Franz Josef Land, the bazaars are occupied when the islands are still icebound, and during the first month food must be obtained by flying long distances from the mainland into the open sea. In spring they appear well nourished at the colony, and their sex glands are already in the development stage. Banding has established that the pairs remain mated for several years, and that each pair continues to nest on the same ledge. The most convenient nesting sites are horizontal ledges, completely bare, up to 1-2 m wide, and free of rubble and vegetation. During the occupation a sharp competitive struggle takes place, as a result of which the weaker Brunnich's murres are usually pushed out to the periphery by the common murres, or evicted to soil-covered or very narrow ledges, or to steeply-sloping cliffs – in brief, to sites less favorable for the rearing of the nestlings. As a rule, both murre species breed in colonies, and as noticed by Kaftanovskii (1951), they never settle in small groups or in two or three pairs. Courtship displays are performed in various ways: bowing to one another, bobbing the head, plucking of head and neck feathers, touching and rubbing of bills and necks, and loud croaking calls. Copulation occurs in the water, on land or on ice, when the pursued female leaps out of the water onto the ice.

On the islands of the East Murman region, the murres lay their eggs 4 weeks after occupying the nest (Kaftanovskii, 1951). In Novaya Zemlya it takes only 7 to 10 days (Krasovskii, 1937). A single egg is laid directly on the bare rock ledge without any lining, sometimes on the remaining snow cover, but in every case it is laid in the open. The incubated egg is kept on the foot webbing. Both parents sit on the egg and each has one brood patch. The incubation period lasts from 33 to 35 days. The eggs differ considerably in their coloring. The prevailing ground color is bluish green, but it varies from very pale to very deep shades. The overlying dotted and linear markings are dark brownish; beneath them are purplish-blue spots. The length of the egg ranges from 67.5 to 91.0 mm, the width from 41 to 59 mm; average weight 110 g. On a horizontal surface the elongated pyriform egg can roll in a circle when disturbed, but remains on one spot. During bird fights, however, or on their sudden rise into the air, the eggs frequently roll off the ledge. If the first-laid clutch is lost, murres, like razorbills, lay a second egg after an interval of two and a half weeks; should the second clutch also be destroyed, a third egg may be laid.

The murre sits firmly on the "nest" to supply constant heat to the egg. The parents take turns in covering the egg and do not leave it even in the event of danger, as for instance, at the approach of man. On open ledges
49 the egg is an easy prey for glaucous gulls. The pairs which are not bound to the nest by incubating duties either stay in the water to feed, or gather for roosting on the cliffs (Figure 28). The nestling takes about 24 hours to break through the egg shell and, according to Kaftanovskii (1951), up to 3 days.

For the first few days after hatching, the parents remain constantly near the chick until its body temperature becomes stable, taking turns at brooding to protect it from cold. Feeding with small fish (sand eel and capelin) begins after 3 days (Krasovskii, 1937); until then the chick receives its nourishment from the yolk of the egg sac. Both murre species, unlike other fish-eating Alcae, carry the fish in the bill not across but along its body, with the fish head dangling down the oral palate. In this way, the adult

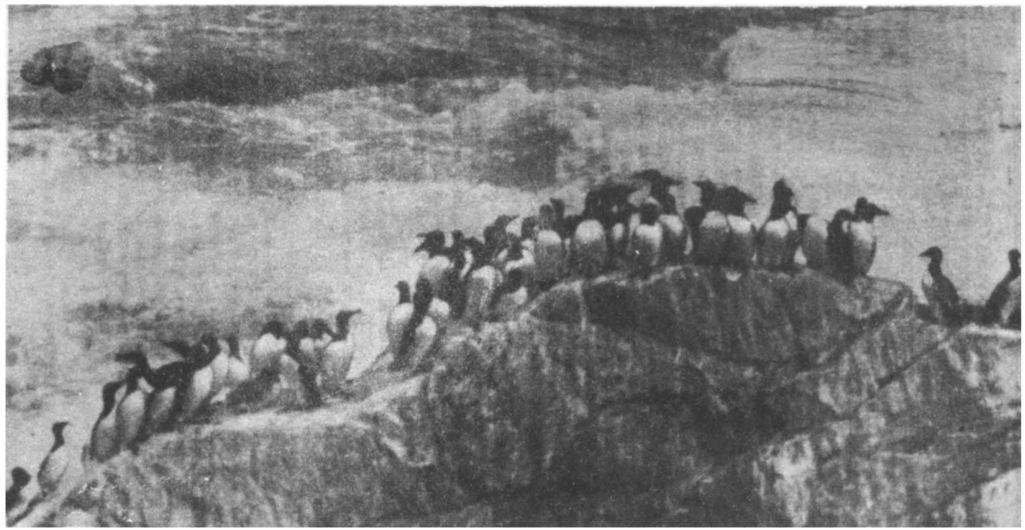

Figure 28. Nonincubating or hunting murres congregating on flat coastal cliffs

returning from the sea can carry one fish in its beak (Figure 29).

Although the downy nestling is able to roam about the ledge on the second day, it keeps near the place in which it was hatched unless startled into departure by the intrusion of man or predator. As parental care becomes less attentive, and both parents fly out in search of food, the young bird seeks protection against the cold under he wing of an adult neighbor. Murres are inclined to brood strange young, but do not feed them. Returning murres will chase away strange begging nestlings until they have fed their own.

Figure 29. Common murre, Uria aalge, bringing a fish to its young

The first feathers of the juvenile plumage are the upper coverts, which usually appear on the fourth or fifth day after hatching (Kaftanovskii, 1951). A two or three-week-old murre already wears a loose-feathered juvenile coat before the flight and tail feathers have emerged. The down remains longest on head and neck.

50

At the age of 25 to 30 days (in Novaya Zemlya), or 20 to 40 days (in the East Murman region), the young Brunnich's murre descends quite independently into the sea from a cliff ledge 20 to 70 m high, encouraged by the excited calls of adults swimming at the foot of the cliff. Stretching its immature wings and spreading its webbed toes, the fledgling jumps from the ledge and parachutes into the water. It dives swiftly under the crest of the wave, using its wings and paddling with its feet, and soon reappears on a calmer surface to join the waiting parents. In parachuting, the supporting surface is provided, as in razorbills, by the upper coverts of the primaries and secondaries. At nest-leaving time the bazaar is noisily animated. The shrieks of adult murres calling their young mingles with the squeaking and whistling of the fledglings swimming in the sea.

The families of murres gathered in the sea take off from the shore and start on their journey. Soon afterward young and adult birds begin molting. The shedding of juvenile plumage for the first winter plumage usually begins with the short feathers on both sides of the head and throat, followed by the dorsal feathers, while the remiges and rectrices start intensive growth simultaneously. In adults, the short body and wing feathers are replaced at the same time, and the wing feathers are shed all at once. The tail feathers change later, which accounts for the fact that in birds with new full-grown wing feathers, the tail frequently remains undeveloped. In partial

spring molt only the short feathers on head and neck are replaced.

Murres attain sexual maturity in their second year. First-year murres make their spring appearance at the bazaars together with other murres, but they spend most of their time on the sea or sit in groups on cliffs which are not occupied by breeding birds. Nonbreeding young are the first to leave the bazaar in the fall to start their migration.

The eggs of both murre species are tasty and nutritious and widely used by the native population for food. The yolks are also used in the manufacture of soap. The average murre egg measures 85 cm^3. Regular egg collection for industrial purposes began only in 1932 on the west coast of Novaya Zemlya, where the largest bazaars of Brunnich's murres are located, yielding annually 200,000 to 300,000 murre eggs (Kaftanovskii, 1951). According to Gizenko (1955), the bazaars of the common murre (U. aalge) on Tyulenii Island (Sakhalin region) can yield by systematic exploitation up to 80,000 eggs per year (which is only a quarter of the estimated capacity). Since 1948, egging on Tyulenii Island has been engaged in regularly (though it is not sufficiently well planned) by harvesting organizations. In the north of the USSR the meat of murres serves principally as food for sled dogs.

1a. Uria lomvia lomvia (L.)–Atlantic Brunnich's murre

Alca lomvia Linnaeus, 1758, Syst. Nat., ed. X, 1: 130 (Greenland). Uria lomvia arroides Portenko, 1937, Mitteilungen aus dem Zool. Mus. in Berlin, 22, 2: 227 (Franz Josef Land); Portenko, 1931.–Trudy Biogeokhimicheskoi laboratorii AN SSSR, II, Appendix: 37; Antipin, 1938.–Problemy Arktiki, 2: 153.

Upper parts blackish brown, without gray tint.

Measurements: wing length 198.0 to 220.0 mm; tarsus 31.2 to 37.8 mm; bill from external naris to tip, 29 to 33 mm long, at base 10.1 to 15.5 mm deep.

51 Distribution. It inhabits the Arctic sector of the Atlantic. On Murman and the adjacent islands it nests in smaller numbers than the common murre, but it predominates in the bazaars of Novaya Zemlya, where it is found all along the west coast, and according to Portenko's estimate (1931), numbers about 4 million. The same number also inhabits the west coast – the islands around Cape Zhelanie southward to the Kara Strait, Hemskoerk Island (Antipin, 1938). On Franz Josef Land the Brunnich's murre concentrates its nesting range on the southern coast of the south islands. Outside the USSR it occupies the entire Atlantic range of the species, including the American coast.

Systematic Remarks. In 1937 Portenko described the Brunnich's murre of Franz Josef Land under the name of Uria lomvia arroides, as distinguished from U. lomvia lomvia by its darker upper parts, which relate it to U. lomvia arra; however, its smaller size is more similar to U. l. lomvia. In Portenko's opinion, the Brunnich's murre of Franz Josef Land differs from other [types of] U. l. lomvia merely by its darker upper parts. By comparing the limited data on murres from Novaya Zemlya and the Murman coast, the subtle color distinctions are hardly visible, and it

would, therefore, be too difficult as well as purposeless to accept the evidence of a separate subspecies on Franz Josef Land.

Habits. At the end of winter migration, Brunnich's murres approach their breeding grounds. Their spring appearance at the islands near the Murman coast occurs on the water in the middle or the latter half of March, and on the cliffs in the last 10 days of that month. In the central part of the west coast of Novaya Zemlya (approximately between Gusinaya Zemlya and the Admiralty Peninsula), they were observed in late April, while southward, at the Kara Strait, only in early or mid-June, depending upon the different dates when the coast became free of ice. On Hemskoerk Island they first sit on cliffs at the beginning of April, though the island is still icebound. At Franz Josef Land murres appear mostly in mid- or late March, but do not go on land before the first half of April; mass nesting was observed in the first half of May. General egg laying on the islands of East Murman and the west coast of Novaya Zemlya – between Gusinaya Zemlya and the Admiralty Peninsula – begins in the last 10 days of May or the first 10 days of June. According to Antipin (1938), egg laying occurs on Hemskoerk Island in mid-June, at the southeast coast of Novaya Zemlya (from Kara Strait to Belush'ya Inlet) in late June or early July (Gorbunov, 1929), which is evidently caused by the peculiarities of spring melting and drifting of the ice. Mass laying on Franz Josef Land was recorded in mid-June. The length of the egg ranges from 67.5 to 87.5 mm, the width from 41.0 to 59.0 mm.

Most young birds in East Murman hatch during the first 10 days of June on Novaya Zemlya. Nestlings were found on 12 to 15 July, and on Hemskoerk Island as late as 25 July (Antipin, 1938). The materials of ZIN AN contain downy nestlings which were collected on Novaya Zemlya be-
52 tween 2 and 10 August (apparently from the second clutch, following the loss of the first one). On Franz Josef Land newly hatched birds appear early in the second half of July. Two downy nestlings of this collection were found on Franz Josef Land on 25 and 28 July respectively.

The numerous departures of fledglings for the sea usually occur in East Murman during the first 10 days of August; on Novaya Zemlya they leave the cliffs between 5 and 13 August, and young birds from later clutches leave in mid-September. On Franz Josef Land the departure of murres for the sea was noted in mid-August.

When the nesting period is over, murres begin their journey as soon as the fledglings have moved from the cliffs to the sea. After summering at the coast, nonbreeding juveniles leave earlier. Krasovskii (1937) registered the departure of the young from Novaya Zemlya in mid-August, while the last murre families lingered at their breeding colonies until late September.

Young birds hatched from early clutches change from juvenile to first winter plumage in late August or in September. On 8 September 1929, an adult murre was found on Barents Island (Novaya Zemlya) together with a young bird clad in winter plumage not yet fully grown. Adults from Novaya Zemlya usually complete their molt in September, but occasionally molt extends until November. According to ZIN AN materials, all Brunnich's murres taken on Novaya Zemlya in August (up to 31 August inclusive) were in summer plumage with no apparent molt. Some complete their molt by the end of September. A murre captured in Russkaya Gavan' on 24 September was clad in winter attire, but some feathers were projecting from

papillae on throat and crop. A murre found on 24 November on Novaya Zemlya also had short feathers not fully developed on throat and breast. Adults apparently undergo partial spring molt in March, as a murre was found on 23 February on the Murman coast in full winter plumage with no signs of molting. In the same region (from 1 to 13 April) and on Franz Josef Land (also in April; exact date not recorded), the murres had already changed to summer plumage with the entire feather covering fully grown (ZIN AN materials).

1b. Uria lomvia eleonorae Port. – Siberian Brunnich's murre

U. lomvia eleonorae Portenko, 1937, Mitteilungen aus dem Zool. Mus. in Berlin, 22, 2: 227 (Begichev Island = Preobrazhenie Island). – Uria lomvia Pall., Birulya, 1907. – Nauchnye rezul'taty Russkikh polyarnykh ekspeditsii, 1, 2: 41. – Uria lomvia arra (Pallas), partly; Pleske, 1928, Birds of the Eurasian Tundra Mem. Boston Soc. Nat. Hist. 6, 3: 176.

Upper parts brownish black, but with a distinct grayish tint.

Measurements: wing length 205 to 216 mm; bill length from external naris 26.6 to 29.0 mm.

Distribution. Nests on Begichev Island (Preobrazhenie Island) in Khatanga Bay, on some of the New Siberian Islands (west coast of Bel'kovskii and Kotel'nyi islands). The Brunnich's murres breeding in Faddey Gulf (eastern Taimyr), Cape Emma on the southern end of Bennet Island, on Henrietta and Vil'kitskii islands probably also belong to the same subspecies. (Records from all the above-listed places are lacking).

Habits remain so far unexplored. On 12 September 1900, the Rus-
53 sian Polar Expedition recorded having observed on the sea near Bennet Island a downy nestling with an adult murre among a large flock of these birds. Evidently, the downy nestling was from a late clutch, possibly a second one. ZIN AN materials contain a young murre in juvenile plumage with almost imperceptible flight feathers, which was captured on 22 August near the New Siberian Islands. Adults from Khatanga Bay (Begichev Island) do not undergo complete molt until mid-September, as indicated by ZIN AN materials, which contain bird specimens from this region in fully unchanged summer plumage obtained in late August and early September.

1c. Uria lomvia heckeri Port. – Chukot Brunnich's murre

Uria lomvia heckeri Portenko, 1944. – Doklady Akademii Nauk SSSR, 5: 238 (Cape Waring, northeastern coast of Wrangel Island); Portenko, 1937. – Problemy Arktiki, 3: 117.

U. l. heckeri resembles U. l. eleonorae by the grayish shade of the upper body feathers, but is distinguished by its larger bill.

Measurements: wing length 213.2 to 234.0 mm; bill length from naris 29.5 to 31.7 mm.

Distribution. It nests on Wrangel Island (possibly also on Herald Island), Kolyuchin Island, and the polar coast of the Chukot Peninsula.

Information on its habits has not yet been published. According to Mineev (Portenko, 1937), Brunnich's murres arrive later than guillemots on Wrangel Island, approximately in the first half of May, and settle in large numbers (tens of thousands) on the bazaars of Cape Waring. Fall migration begins in mid-September.

Judging by the two Brunnich's murres captured on 25 August and 19 September in Providence Bay on the Chukot Peninsula, the plumage changes later in this Arctic region. They were in full summer plumage with no traces of the beginning of molt. L. A. Portenko reported (orally) that on the northern coast of Wrangel Island the Brunnich's murre starts molting in the last 10 days of August. On 26 August he found several females which had lost their flight feathers. It is regrettable that these important findings were not processed for preservation and were therefore not included in the collections of the Academy of Sciences. We may only assume that the murres of Wrangel Island complete their partial spring molt in the middle of May when they don their full summer plumage, and no partially developed feathers on head and neck are in evidence. One-year-olds molt later. A female Brunnich's murre was found at Wellen on 18 June still clad in winter plumage without any signs of forthcoming change. The age of the bird could be established by its relatively small bill (27.2 mm long from the external naris, compared with 31.2 mm in adults of this subspecies from the Chukot Peninsula). Portenko, who captured this bird, mentions the firm consistency of its ovaries and the absence of a marked granulated structure.

1d. Uria lomvia arra (Pall.)—Pacific Brunnich's murre

Cepphus arra Pallas, 1811, Zoographia Rosso-Asiat., II: 347 (Kamchatka); Johansen, 1934.-Trudy Tomskogo Gosudarstvennogo universiteta, 86: 252; Bergman, 1935, Zur Kenntnis Nordostasiatischer Voegel: 146; Dul'keit and Shul'pin, 1937.-Trudy Biologicheskogo nauchno-issledovatel'skogo instituta, Tomsk University, IV: 126; Portenko, 1939. Fauna Anadyrskogo kraya, Ptitsy (The fauna of the Anadyr region, Birds), II: 28; Averin, 1948.-Trudy Kronotskogo zapovednika, 1: 81, Bailey, 1948, Birds of Alaska, Colorado Museum of Natural History, 8: 256.

54 Upper parts are a dark brownish-black color, without any gray. It is the largest of all the subspecies.

Measurements: wing length of male and female 207 to 238 mm; bill length from external naris 31 to 39 mm.

Distribution. It nests on the Diomede Islands (Bering Strait) and on the southern coast of the Chukot Peninsula, where it was found in June, July and August in the Providence Bay, and in late June in the Krest Bay (Materials of ZIN AN). It may also nest on the bazaars in the Olyutorsk Cape. It is very common on the Commander Islands, and the eastern coast of Kamchatka, and is widespread on Karaginskii Island and the Kronotskii Peninsula south of Cape Kozlov. It is more seldom found on the western coast of Kamchatka probably because there are fewer cliff sites suitable for breeding, but is frequently encountered at the bazaars of the Okhotsk coast from the Taigonos Peninsula to Ol'skii Islands. The late S. I. Snigirevskii reported that they do not occur in the Ayan region. The Shantarskie Islands (Ptichii and Utichii) are densely occupied by the breeding U. l. arra, which

also nests on the Kurils, on Sakhalin (Cape Elizabeth), and on Tyulenii and Moneron Islands (though it is less abundant here than the common murre) and at the Tumnin River in the northern Maritime Territory. Portenko's investigations showed that it does not breed on the Anadyr coast but visits it on its migratory or passage flights. In different years it was seen on 25 May and 26 September on the Kazachka River, on 25 July on the seacoast near Tumanskaya, and on 13 June in Novomariinsk. During the summer it was captured near Vladivostok. Outside the USSR it breeds on the Pribilof and Aleutian Islands, on Kodiak, along the western coast of Alaska up to Cape Lisburne.

Occasionally it winters near its breeding ranges, particularly on the coasts of Commander Islands, Kamchatka and the Kurils, and also in the open waters of the Bering Sea, advancing southward to Hokkaido (Japan) and northward to Cape Barrow (Alaska).

Habits. Under favorable ice conditions, solitary specimens may be found until December near Ust'-Kamchatsk and the Bering Island. Their earliest appearance on the Commander Islands was noted by Johansen (1934) in late February, but generally they arrive here in late March or early April. In the north of Bering Island they appear at a later date – not before the beginning of May. Bergman (1935) recorded the first Brunnich's murre also in May in Avachinskaya Bay. Before the end of May they have crossed the open expanses of water to their breeding grounds in the region of the Bering Strait. Some years have witnessed them in late April on their northward flight near Cape Prince of Wales moving from one open body of water to another. Their early arrival in northern regions has proved disastrous when the weather was unfavorable. Portenko (1939) tells the story reported by Sed'ko how in late May of 1936 a flock of murres caught in a snowstorm alighted on the ice of the Anadyr estuary, and the birds, being unable to take off from level ground, had their feet frozen and perished from starvation.

Murres on the Commander Islands begin breeding in mid-June and continue through the month of July. Egg laying is not limited to open ledges but, as noted by Johansen, may take place also in rock crevices. On the Diomede Islands mass egg-laying was recorded early in June. The eggs of the U. l. arra are similar in color to those of the U. l. lomvia, but are larger in size – 73 to 91 mm long and 47 to 59 mm wide.

The first downy nestling was obtained on Bering Island early in August; general hatching occurs only in the second half of the month. On the cliffs of Kotzebue Sound (West Alaska) birds in juvenile plumage were seen on 8 August; other young birds which had not acquired their winter plumage were on the sea in the first days of September. The collections of ZIN AN contain a young female murre from Avachinskaya Bay taken on 21 October, in winter plumage. Although it was almost adult size, its flight feathers were not fully developed and it had white papillae on its neck. Other young murres had almost completed their winter molt and had normal, full-grown wings. In the waters near Kamchatka complete fall molt starts in late September. On 29 September a female had new papillae emerging on throat, nape and back, but its flight feathers had not yet been renewed although it was in summer plumage. Between 20 and 30 October the molt is in full swing. On 22 October, a male from Petropavlovsk had shed its wing and tail feathers, but most of the upper coverts were undeveloped (they were in

papillae), and many white feathers had appeared on the throat. Also on 22 October, a bird obtained in the Avachinskaya Bay had new flight and tail feathers – the former were half of their normal length, the rectrices were just projecting from papillae. The short body feathers on the throat and on both sides of the head were partly renewed (ZIN AN). In the region of the Commander Islands partial spring molt of adult murres is completed in late April.

2. Uria aalge (Pontop.)–COMMON MURRE

Colymbus aalge Pontoppidan, 1763, Danske Atlas, 1: 621 (Iceland). – Uria ringvia Brunnich, 1764, Orn. Bor.: 28 (Iceland). –Uria troille L., Menzbir, 1895, 1: 61; Krasovskii, 1936. –Izvestiya Nauchnogo instituta imeni Lesgafta, XIX, 2: 51; Krasovskii, 1937. –Trudy Arkticheskogo instituta, 27: 41; Kaftanovskii, 1951. –Materialy k poznaniyu fauny i flory SSSR, new series, 28 (XIII): 113; Dement'ev, 1951. – Ptitsy Sovetskogo Soyuza, 2: 184.

The bill is comparatively slender, dorsoventrally compressed and long. The outer margin of the base of the upper mandible is the same color from naris to mouth corners as the other parts of the rhamphotheca. The corners of the mouth are feathered. The wings are narrower than those of the Brunnich's murre. The ratio of wing length to tip is 1.9.

Adult males and females in summer. The head, chin, throat and neck are coffee brown. The head and nape are slightly darker above. A narrow dark ridge resembling a hair parting runs posteriorly from above the eye. Some individuals have a white ring around the eye and a white patch behind it. The other parts of the upper body, the upper coverts and the tail are brownish black, sometimes with a grayish tint. The flight feathers are brownish black, whitish at the base of the inner vane. The secondaries are white-tipped, and the lower coverts are white, sometimes having dark-brown spots at the tips. The longest lower coverts are gray. The axillaries are brownish with white tips. The crop region, breast and abdomen are white, with brownish stripes along the flanks. The iris is dark brown. The bill is black or dark brown. The posterior portion of the foot is blackish brown and the anterior brown (Figure 30). Adult males and females in winter. The top of the head and the white band under
56 the eye which extends backward are dark brown. The top of the head and the broad band extending backward from under the eye are dark brown. The throat, the sides of the head and the foreneck are white, but occasionally a brownish transverse piece appears on the white foreneck and a narrow white stripe with a brownish tinge occurs on the nape. Otherwise, it is the same as in summer (Figure 31). Downy nestlings are similar in color to young Brunnich's murres, except that the down feathers on the upper parts have no reddish tinge (Kaftanovskii, 1951). Juvenile plumage donned after the down stage is similar to that of adults in winter, except that the dark
57 stripes on the flanks are absent and the dark-brownish feathers on the upper body are edged with sooty brown (Figure 32). Young birds in their first winter plumage, which they assume in the fall, are similar to adults in winter, but there are fewer dark stripes along the flanks and more white transverse stripes on the nape. The young birds also have a smaller bill.

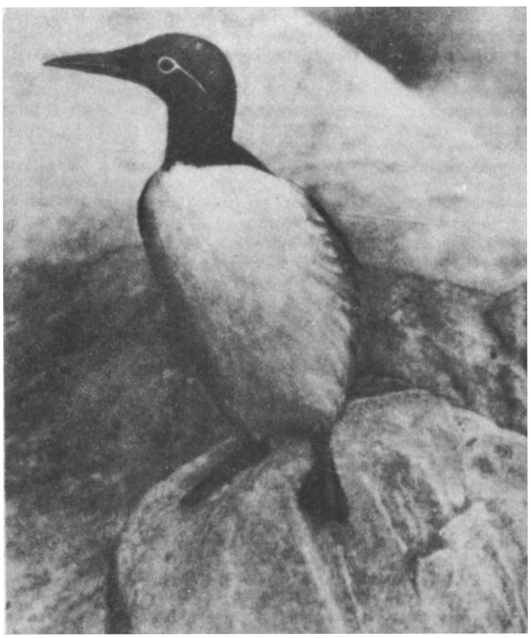

Figure 30. Common murre, Uria aalge, with a white ring around the eye (individual variations in coloring)

Measurements: wing length of males and females 190 to 228 mm. Tarsus 33 to 39 mm. Bill length from external naris 36 to 47 mm, depth of bill at rictus 13.0 to 14.5 mm. Average weight of males in East Murman 1,066 g, of females 1,040.5 g (Belopol'skii).

Distribution. It nests on continental and island coasts in the northern parts of the Atlantic and Pacific Oceans. In the Atlantic sector of the Arctic it inhabits the Murman coast and the adjoining islands, and is more abundant than the Brunnich's murre. It is rarer in the northern part of the west coast of Novaya Zemlya toward Archangel Bay. In the Pacific it was found in summer (10 to 13 July) at Olyutorskii Bay, where it may also breed. It occupies the bazaars of eastern and southwestern Kamchatka and the Commander Islands, but is less abundant there than U. lomvia. It has not been established that it nests on Taigonos Island (though it was captured there in the middle of August), but there is no doubt that Ayan and Shantarskie Islands are included in its breeding range. At its breeding grounds north of the Tatar Strait, on Sakhalin and the Kurils it is more abundant than the Brunnich's murre. Nesting has been reported on Russian Island near Vladivostok (Shul'pin, 1936). The common murre visits the estuary of the Anadyr River. An individual bird was found on 10 July near the mouth of the Tumanskaya River.

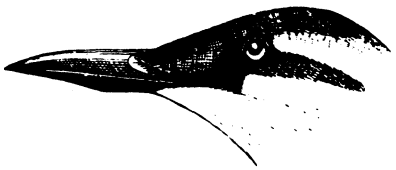

Figure 31. Adult common murre, Uria aalge, in winter plumage

Outside the USSR the common murre nests on Bear Island and Jan Mayen, on the western Scandinavian coasts. In recent years it extended its range to the Baltic Sea, to Bornholm Island and the Gulf of Bothnia, where it penetrated to 63° N. Lat. It nests in the British Isles, the coast of Brittany (France), and the Pyrenean Peninsula. The southern limit of its distribution in Europe is situated to the north of Lisbon. It also inhabits Iceland, western Greenland, and the east coast of North America, from the Gulf of St. Lawrence to Labrador. In the Pacific Ocean it nests on the east Korean coast, Hokkaido Island, the Aleutian and Pribilof Islands, and the west and east coasts of Alaska, extending northward to Norton Sound and south to the state of Washington. An isolated breeding colony occupies the Farallon Islands near the Californian coast. It was found at Cape Hope, south of Cape Lisburne, in early August.

In winter it is encountered in small numbers in West Murman, but the principal wintering places of the Murman murre range along the Scandinavian coast. A large number of murres inhabiting the northern regions winter in southern Norway, and advance further southward to the western part of the Mediterranean. Along the Atlantic coast of America they extend south-
58 ward to the state of Maine. On the Pacific coast they winter chiefly in the southern parts of their breeding range, but also near the Commander Islands, Kamchatka, and the Pribilof Islands (Figure 33).

Two of the seven subspecies described nest in the USSR.

Systematic Remarks. In describing the plumage of common murres it was mentioned that some individuals have a white ring around the eye and a white stripe at the side of the eye which extends laterally backward. This coloring is retained throughout all seasons and in all age groups. For a long time these bords were regarded as a separate species and were known as Uria ringvia Brünnich– the spectacled murre. In the Atlantic sector of the Arctic the so-called spectacled murre shares the bazaar with other murres, frequently mating with them. It is rare in southern ranges, but more numerous in the north, constituting 1 % of all common murres breeding on the coasts of Brittany and southern England, about 10 % in Scotland, 42 % in the islands of East Murman, and about 50 % on Novaya Zemlya. It is, however, absent in the Pacific.

59 According to Krasovskii (1936), the spectacled murre differs from the common murre by some specific features of its skull structure. Judging by ZIN AN materials, the common and also the Brunnich's murre show individual variations in certain details of their skull structures. On the basis of his records, Kaftanovskii found that the cranial distinctions indicated by Krasovskii in the spectacled murre are not always present, and hence cannot serve as characteristics of a separate species. Kaftanovskii's investigations conducted over several years at bird bazaars of Seven Islands on the Murman coast showed no ecological differences between murres which

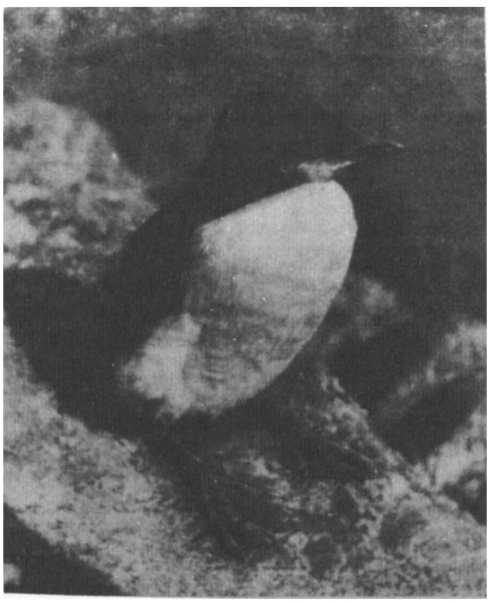

Figure 32. Young common murre, Uria aalge, in juvenile plumage

vary in the color of their plumage.

Apart from geographical and other previously described distinctions in the common murre, the differences in these intraspecies consist virtually in their size, the length and depth of the bill, color variations of the upper parts, and in more or less pronounced dark stripes along the flanks or of dark spots on the margins of the white lower coverts. Five of the recorded subspecies belong to the Atlantic and two to the Pacific areas. The inadequate evidence in Russian collections on the Soviet and other Atlantic regions of the Arctic makes it impossible to ascertain the existence of so large a number of this subspecies with such vaguely defined characteristics.

From his abundant materials on the Atlantic common murre Salomonsen (1944) has formulated the following description of the subspecies.

Uria aalge albionis Witherby – upper parts a pale mouse-gray color. Under coverts usually white, without markings. Wing length of males and
60 females 191 to 204 mm; length of bill 37 to 49 mm, depth of bill 13 to 16 mm. Inhabits the British Isles (excluding northern Scotland), Helgoland, Brittany (France) and the Pyrenean coast.

Uria aalge intermedia Nilsson – upper parts darker than in albionis, of a slate-gray shade. Lower coverts white with several dark spots. Wing length of males and females 192 to 211 mm; length of bill 43 to 52 mm, depth of bill 15 to 16 mm. Nests in the Baltic Sea area.

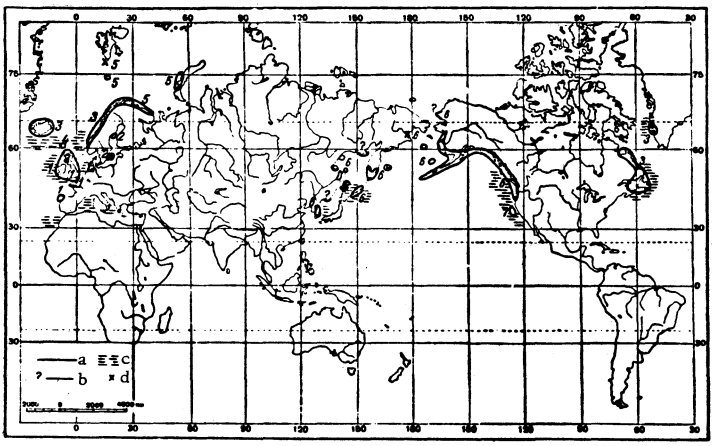

Figure 33. Distribution of the common murre, Uria aalge

1-U.a. albionis; 2-U.a. intermedia; 3-U.a. aalge; 4-U.a. spiloptera; 5-U.a. hyperborea; 6-U.a. inornata; 7-U.a. californica; a-boundaries of nesting sites; b-probable, but not definite nesting sites; c-migration routes; d-places visited by passage migrants

Uria aalge aalge (Potoppidan) - black-slate-gray upper parts. Streaks and spots make flanks appear darker. Color of lower coverts varies considerably in individual birds. Wing length of males and females 195 to 208 mm. Length of bill 44 to 53 mm; depth of bill 13.5 to 16.0 mm. Inhabits Iceland, Greenland, North America, northern Scotland, and western and southern Norway.

Uria aalge spiloptera Salomonsen - has the darkest upper parts of all subspecies. Distinguished by strikingly dark stripes along flanks. Lower coverts always spotted. Similar in size to U.a. aalge. Nests on the Faroe Islands.

Uria aalge hyperborea Salomonsen - upper parts almost black as in U.a. spiloptera. Largest of the Atlantic Uria subspecies. Also distinguished by a somewhat stouter and shorter bill. Wing length 204 to 227 mm; length of bill 43 to 53 mm; depth of bill 15 to 18 mm. Nests on the European coasts of the Arctic, though not farther east than Murman, and on Novaya Zemlya and Bear Island.

Uria aalge inornata Salomonsen - upper parts relatively pale. Lower coverts usually pure white. Wing length 210 to 224 mm; length of bill 43 to 47 mm. Nests in the northern parts of the Pacific.

Uria aalge californica (Bryant) - very similar to U.a. inornata, but the wing is slightly shorter - 195 to 210 mm. Bill length 42 to 47 mm. Nests on the Farallon Islands.

Witherby's investigations (1952) showed that the differences between the Atlantic subspecies U. aalge intermedia and U.a. spiloptera are not always evident and therefore do not substantiate the existence of a separate subspecies.

Habits. The life pattern and habits of the common murre are similar to those of the Brunnich's murre; in flight it appears more compact and its body seems longer than that of the latter (Figure 34). The spring diet of the common murres of East Murman consists mainly of capelin and cod fingerlings, with about 10.5% crustaceans and polychaetes, but in summer and fall they feed exclusively on fish, with herring predominating.

So far, little is known about the selection of their nesting sites. Judging by the nesting distribution of both murre species on the islands of East Murman where the common murre predominates, it occupies the centrally located bazaars and chooses the most convenient wide ledges with completely bare rocky surfaces. On Novaya Zemlya, where it is less abundant, it occupies only the upper platforms of cliffs or the rocky plateaus on the Bazarnyi and Pukhovyi islands (Gorbunov, 1925). On Tyulenii Island, near Sakhalin, it nests on flat coastal cliff sites as well as on cliff ledges. The
61 common murre apparently nests exclusively on bare rocks, whereas the Brunnich's murre may settle also on ledges which are covered with a certain amount of soil.

The single egg of the clutch is elongated, more pyriform, and larger than that of the Brunnich's murre; it is 66 to 97 mm long and 42.5 to 59.0 mm wide. Its coloring is not peculiar to the species, except that eggs of the U. aalge frequently have a white ground, which has never been found in eggs of U. lomvia (Kaftanovskii, 1951).

Incubation lasts from 33 to 35 days. Both species change from down to juvenile plumage and depart from the jointly occupied bazaars for the sea at the same date.

The molt of juvenile and adult birds also progresses more or less similarly in both murre species. In adults, fall molt begins with a gradual change of the short body feathers, followed soon afterward by the shedding of primaries and secondaries, and of the upper ooverts. Rectrices change later. The short body feathers may still not have molted completely when the new large feathers are already full grown (Salomonsen, 1944).

Figure 34. Common murre, Uria aalge, in flight over the sea

2a. Uria aalge hyperborea Salom. – North Atlantic common murre

Uria aalge hyperborea Salomonsen, 1932, Ibis: 130 (Bear Island); Spangenberg, 1941. – Trudy zapovednika "Semi ostrovov", 1: 78; Dement'ev, 1951. – Ptitsy Sovetskogo Soyuza, 2: 186.

Back, wings, and tail generally sooty brown. Lower coverts are white, tipped with dark-brown spots.

Measurements: wing length of male and female 200 to 220 mm. Length of bill 45 to 56 mm, depth of bill 12.5 to 14.5 mm (ZIN AN materials).

Distribution. Most abundant on the bazaars of Murman and adjoining islands. Occurs in small numbers on Novaya Zemlya, between

Malye Karmakuly and the Archangel island groups. Also inhabits Bear Island and northern Norway.

Habits. In March, flocks of common murres arrive on the sea, in the vicinity of their breeding grounds in East Murman and nearby islands; mass settling on cliffs begins in May. According to Spangenberg's obser-
62 vations on Kharlov Island (1941), the eggs of common murres were in an advanced stage of incubation at the end of June and the beginning of July 1932, and only a few freshly laid eggs could be found. The eggs were 66.0 to 93 mm long and 42.5 to 56.6 wide. The first nestling was found there on 3 July; soon afterward the number of nestlings increased rapidly. The departure of fledglings to the sea was noted in Murman around 23 to 25 July, and lasted until 10 August. The last nestlings were seen on the cliffs in the first third of September.

On Novaya Zemlya the complete molt of adults does not begin before September. An adult female found on 27 August showed no traces of the onset of molt (ZIN AN).

Salomonsen reports (1944) on a female found on 9 September in northern Norway whose short body feathers were in the molting stage. Its wing feathers had already been replaced, though were not yet full grown. In East Murman, murres complete their partial spring molt in April. An adult male taken on 25 April was attired in full summer plumage with fully developed feathers. In northern Norway, young birds molt their juvenile plumage intensively and acquire winter (adult) plumage during the first 10 days of September. By that time the new primaries have attained approximately half of their normal size.

2b. Uria aalge inornata Salom. – Pacific common murre

Uria aalge inornata Salomonsen, 1932, Ibis: 128 (St. Matthews Island in the Bering Sea); Dement'ev, 1951. –Ptitsy Sovetskogo Soyuza, 2: 189.

A large subspecies of the common murre. Upper parts are grayish brown; lower coverts are pure white without dark markings.

Measurements: wing length of males and females 201 to 228 mm. Bill length 37 to 47 mm; depth of bill 13.0 to 14.5 mm (ZIN ZN).

Distribution. Occupies the entire Pacific breeding range of the species, excluding the Farallon Islands.

Habits. The common murre is very abundant in the southern ranges of the Asiatic Pacific coasts and the adjacent islands (especially on Sakhalin and the Kurils, but less numerous than the Brunnich's murre on the bazaars of the Commander Islands and Kamchatka. In winter, single specimens appear near Ust'-Kamchatsk until January when, the bays being frozen over, they are forced to migrate to the open sea. A considerable number winter at the southern Sakhalin coast in Aniwa Bay.

According to Gizenko (1955), the largest colonies of Pacific common murres are concentrated on some Kuril islands such as Shirinki, Kamen' Avos', Ekarma, Raikoke, Matua, and Broiton, and on the Moneron and Tyulenii islands belonging to the Sakhalin group. Smaller murre colonies are established on the Sakhalin mainland –Cape Terpenie and near Cape Elizabeth.

On Tyulenii Island murres nest chiefly on a vast rocky plateau. A peculiar feature of flat bazaars is the established pattern of nesting murres that, even in densely populated territories, each bird has its own fixed site. In the absence of the parent, the egg may roll off the ledge on an uneven surface and fall into a recess below, where several eggs will eventually assem-
63 ble. Upon its return from the sea, the murre, not finding its egg in the old nest hole, will roll an egg off the nearest depression containing several eggs, and continue incubating what might be a strange egg. Apart from these habits peculiar to inhabitants of flat bazaars, the murres may also acquire other biological characteristics which have unfortunately not been studied.

The murres arrive at the nesting sites on Tyulenii Island around the middle of May. On 23 May 1948, the first clutches were found there; mass laying began on 3 June. The eggs of the Pacific common murre are larger and have thicker shells than those of the Atlantic subspecies U. a. hyperborea. The eggs are 70 to 97 mm long (or an average of 82 mm) and 42 to 59 mm wide (average 50 mm) (Gizenko, 1955). The first nestling was found there on 2 to 3 July, general hatching was recorded on 5 to 7 July, and the departure of the young for the sea took place around 20 August.

The ZIN AN materials contain a young bird in juvenile plumage with some wisps of down still clinging to head and nape. It was captured by Voznesenskii on 3 August on the American shore of the Bering Sea. The small body feathers change from juvenile to the first winter plumage in August and September.

Adults apparently undergo complete molt in September and October, judging by the male Pacific common murres obtained on 23 August near the Mal'minskie Islands (Sea of Okhotsk) and on 18 August at Ayan. They were in full summer plumage unaffected by molt. A male from Kodiak Island captured on 17 November had completely changed into winter plumage (ZIN AN).

Partial spring molt sometimes takes place very early. A male captured at Hakodate on 20 December and a female taken on 2 March on Hokkaido were in almost full summer plumage except for a few white feathers remaining on throat and neck (ZIN AN). Dement'ev, on the other hand, reports (1951) on a murre at Olga Bay (Kamchatka) still wearing winter plumage on 15 April. Presumably, it was a young bird not more than one year of age, since one-year-old murres molt later in the season than adults.

4. Genus CEPPHUS Pall. – GUILLEMOTS

Pallas, 1769, Spicil. zool., I, V: 33 (type – Alca grylle L.)

A medium-sized genus of Alcae which feeds on marine invertebrates as well as on fish. It usually hunts not far below the surface of the water in the littoral zone. As a result, its fore limbs have not become as highly specialized for underwater paddling as those of murres and razorbills. The slightly broader wings contribute to flight maneuverability. Guillemots move freely on land and settle either in various natural shelters on the shore or at some distance from the sea.

The bill is narrow, long, depressed, and straight, adapted to seizing and holding a single fish. The ratio of the bill length (without horny cover) to the skull length averages 1.08. The rhamphotheca is smooth, with slit-
64 like nostrils at the external edge of the upper margin. The feathers extend from the rictus to the rear or the middle of the external naris.

The tarsus, which is covered with angular plates, is shorter than the middle toe, including the claw, and in C. grylle it is 38.5 % of the body length. The entire foot length is less than in murres and razorbills and is 143.5 % of the body length.

The wings are broader than those of murres and razorbills. The ratio of the wing length to its tips averages 2.4. The ratio between the individual parts of the skeleton of the fore limbs is lower than in murres and razorbills. In C. grylle the ratio of the wing skeleton to the body length is 165.5 %. The tail, which is made up of 12 to 14 feathers, is either slightly rounded or square-tipped.

Its cranial structure closely relates the guillemot to gulls. Within the Alcidae family the guillemot most closely resembles Synthliboramphus, Brachyramphus, and Uria, which supports the generic relationship to the Alcae group (Figure 35). The interorbital part of the skull is considerably narrower than in murres; the supraorbital cavities containing the rhinal glands are shallower and lack upturned edges (Figure 5). The postorbital process of the squamosal bone extends into a thin short plate which forms the base of these cavities at the posterior edge of the eye sockets. The fissure causing the deformation on the surface of the parietal and squamosal bones is less developed than in Uria, but more prominent than in Fratercula.

Figure 35. Skull of black guillemot, Cepphus grylle

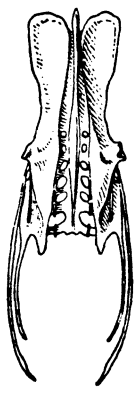

Figure 36. Pelvis of black guillemot, Cepphus grylle

The pectoral bone has six facets to which the ends of the ribs are attached. The metasternum is fairly long and tongue-shaped; the pelvis is broader than in murres (Figure 36) due to the more active use of the hind limbs on land. The inner edges of the ilium do not extend to the crista spinosa. The lower posterior projection of the ischium, which is long and chisel-like in all Alcidae, is particularly large in guillemots and fails to

reach the distal end of the pubic bone by one quarter of its length. There are nine free caudal vertebrae.

Seasonal and age plumages vary greatly. Juvenile plumage, which is exchanged in the fall for the first winter plumage, is distinguished by its loose structure. During the partial spring molt all small feathers of the mantle are replaced. In juvenile plumage the small body feathers are the same length as in the first winter plumage and at least 8 mm shorter than the same feathers in adult winter plumage. In the adult C. grylle the winter
65 feathers are 5 to 6 mm longer than the summer ones. In C. columba and C. carbo there is no seasonal or age difference in feather length.

Representatives of the genus nest on island and continental coasts of the Atlantic, the Pacific, and the northern Arctic oceans. In the Atlantic they extend south to the coast of Germany and to Maine, and in the Pacific to the Kurils and southern California.

The four known species all nest in the USSR.

Key to the Species

1 (2). Axillaries white.....1. C. grylle (L.)-Black guillemot.
2 (1). Axillaries smoke gray.
3 (4). Primary wing coverts usually white (in adults) or white with brownish-black edges (in young birds) (Figure 42).....
.....2. C. columba Pall.-Pacific pigeon guillemot.
4 (3). White entirely absent on wing, except for narrow white margins on tips of dark upper coverts.
5 (6). White patch (in adults), or at least white ring around the eye (in young) (Figure 44)..... 4. C. carbo Pall.-Spectacled guillemot.
6 (5). White completely absent around the eye.....
.....3. C. snowi Stejn.-Kuril guillemot.

1. Cepphus grylle (L.)-BLACK GUILLEMOT

Alca grylle Linnaeus, 1758, Syst. Nat., ed. X, 1: 130 (Sweden); Menzbir, 1895, 1: 56; Salomonsen, 1944, Goeteborgs Kungl. Vetenskaps Handlingar, Ser. B, III, 5: 59; Kaftanovskii, 1951.--Materialy k poznaniyu fauny i flory SSSR, new series, 28 (XIII): 59; Dement'ev, 1951.-Ptitsy Sovetskogo Soyuza, 2: 198.

Number of rectrices 12, occasionally 14.

Adult males and females in summer. Upper parts and under parts brownish black, with a slight olive-green tinge on back. The greater and middle upper coverts are white and form a distinct white "mirror" on the wing surface. Occasionally the greater wing coverts are dark brown at the base, forming a dark band across the white "mirror". The flight feathers are brownish black, the lower part of the inner vanes white. The lower coverts and axillaries are also white. The rectrices are black. The iris is dark brownish, the bill black; the inside of the mouth and the feet are red. Adult males and females in winter. The brownis-black upper parts are tipped with white edges that occasionally widen on the nape and lower back, thus making them appear almost all white. The

under parts and sides of the head are white. The wings and tail are the same as in summer. The nestling is brownish black above and a little lighter with some grayish below. Its down feathers are very long and soft, more dense on the under parts, which come into contact with the humid nest lining. Young birds in juvenile plumage have brownish-black upper parts, with or without white tips. The coronal and dorsal regions and upper tail coverts are usually very dark; the nape and interhumeral region are traversed by narrow stripes. The lateral part of the head and the rump are white with brownish transverse stripes; the middle regions of breast and abdomen are sometimes all white. The white upper coverts are edged
66 with wide brownish margins which make the white "mirror" appear darker; the lower coverts, also white, have narrow dark edges. Young birds in their first winter plumage are similar to adults in winter, but the wings above and below and the under parts of the body have brown transverse stripes.

Measurements: wing of males and females 150.5 to 175.5 mm. Tarsus 25.5 to 34.0 mm. Bill from external naris 21.0 to 27.2 mm. Average summer weight of males in East Murman (C. grylle atlantis) 431.2 g, of females 434.8 g. On Novaya Zemlya the males (C. g. mandti) had an average summer weight of 390.9 g, the females 411.7 g (Belopol'skii).

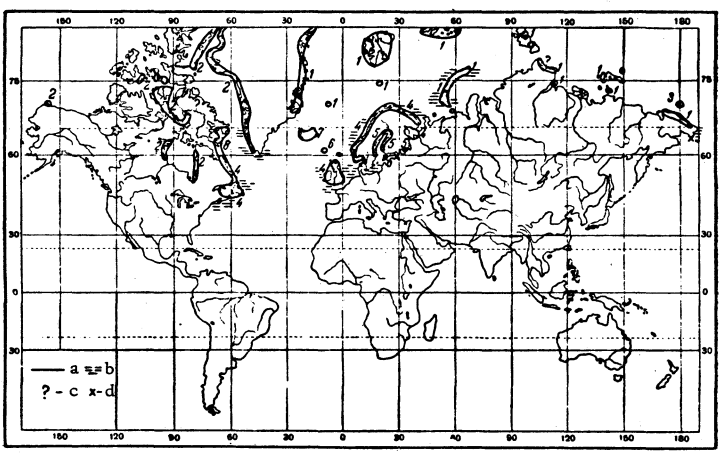

Figure 37. Distribution of the black guillemot, Cepphus grylle

1-C. g. mandti; 2-C. g. ultimus; 3-C. g. tajani; 4-C. g. atlantis; 5-C. g. grylle; 6-C. g. faeroeensis; 7-C. g. islandicus; 8-C. g. arcticus; a-boundaries of nesting sites; b-probable, but not definite nesting sites; c-migration routes; d-places visited by passage migrants

Distribution. It nests on the Murman coast, the coasts and islands of the White Sea, the islands in Lake Ladoga, the Estonian coast, Vaigach Island, Novaya Zemlya, Franz Josef Land, Severnaya Zemlya (North Land) (Oktyabr'skaya Revolyutsiya Island), Begichev Island in Khatanga Bay, New Siberian Island, Wrangel and Herald islands, and along the East Siberian

coast from Chaun Bay to Cape Serdtse-Kamen'. It was encountered in April and July near Providence Bay. Birds of passage are known to have visited the Leningrad region and Latvia.

Outside the USSR it is believed to nest along the northern coast of Alaska, especially at Cape Barrow where a great number of young guillemots (C. g. mandti) were captured in June. It nests on many islands of the Canadian archipelago, in Hudson Bay, and south along the Atlantic American coast ot Maine. It inhabits Greenland, Iceland, Jan Mayen Island, Spitsbergen, the British Isles, the north, west and east coasts of Scandinavia and the west coast of Finland (Figure 37).

In winter it is frequently encountered on the Murman coast, in the White Sea, on the southern and northeastern coasts of Novaya Zemlya, in the Baltic Sea, in the British Isles, and in the northern parts of the Atlan-
67 tic Ocean. In some winters it goes south but not farther than the coast of France and New Jersey on the American side. It visits the Bering Strait in its eastern range.

Systematic Remarks. Intraspecific distinctions are reflected in guillemots in their measurements (length of wing and length of bill) and the amount of white in their plumage, especially the inner vane of the primaries, on the upper coverts and on the upper parts in their winter plumage.

The eight known subspecies can be divided into two groups. The first group comprises northern subspecies of the polar type of guillemot (C. g. mandti Mandt) whose winter plumage is distinguished by a pure white patch on the wing, striking white coloring of the inner greater primary vanes and the very light color of the upper body (apart from C. g. mandti) : C. g. ultimus Salom. and C. g. tajani Port. The second more southern group is related to C. g. atlantis Salom. In winter the upper parts are darker, the white patch on the wing is crossed by a dark stripe, and there is less white on the inner vanes of the greater primaries. This group is composed of the following subspecies (apart from C. g. atlantis); C. g. grylle L., C. g. faeroeensis Brehm, and C. g. islandicus Horring. The subspecies C. g. arcticus Brehm represents an intermediate form between the two groups.

The four subspecies nesting in the USSR are: C. g. atlantis, C. g. grylle, C. g. mandti, and C. g. tajani. Their main characteristics are given below.

The four subspecies nesting outside the USSR are as follows:

C. g. faeroeensis which inhabits the Faroes. It is closely related to C. g. atlantis but has more brownish coloration on the upper coverts and no white on the greater primaries;

C. g. islandicus, which nests exclusively in Iceland, is distinguished from C. g. atlantis by the blackish-brown stripe which runs from the feather base along the edge of each inner vane of the greater primaries;

C. g. arcticus inhabits western Greenland from Cape Farewell to Disko Bay, and the coast of Labrador south as far as Hamilton Inlet. Its winter plumage is lighter than that of C. g. atlantis, but darker than that of C. g. mandti. The white wing patch has fewer brownish spots;

C. g. ultimus nests on the western coast of Greenland, northward from Disko Bay to Robson Strait, on Grant Land, Grinnell Land, Ellsmere Island, Baffin Island, Melville Peninsula. along Hudson Bay, and possibly, at Cape Barrow (Alaska). It differs from C. g. mandti, to which it is closely related, by its shorter bill (24 to 28 mm long) and larger wing patch.

Habits. Seasonal migrations of sexually mature guillemots do not extend very far. The birds may stay within their breeding range the whole year round if there are places which remain open through the winter. Non-breeding young specimens (according to Kaftanovskii, 1951, guillemots attain sexual maturity in their third year) roam over wider expanses and are occasionally found far away from the mainland in the open sea. The Fram Expedition spotted guillemots 330 kms north of Franz Josef Land, and Papanin observed them between latitudes of 88° and 89°.

In summer, guillemots gather in flocks on the sea; in winter, they are often encountered singly. They swim freely and are able to immerse the body to various depths. They dive with flashlike speed, remaining under water not longer than 50 to 60 seconds, but they cover as much as 30 to 50
68 m during that time. Pinegin (Portenko, 1937) watched a guillemot dive beneath an ice block (75 m long and 1.5 m thick) and reappear after a while at the opposite end holding a fish in its beak. When swimming, the bird often dips its bill into the water for a second, preens itself, flaps its wings while raising the front of the body above the water surface, and generally behaves in a very lively manner. In fine weather it frequently leaves the water for the land or the ice, where it sits leisurely in the sun (Figure 38). Its voice is a loud, but not shrill, melodious whistle which is mostly heard during the nuptial season.

On land the guillemot moves fairly well, usually walking on its toes; when resting it squats down and leans upon the entire tarsus. Its flight is swift as in all Alcae, but is more skillfully maneuvered. Its comparatively short broad wings permit fairly nimble turns in the air.

On the coasts of East Murman and Novaya Zemlya the guillemots feed on crustaceans (over 50 % of their diet), and mollusks and polychaetes (5 to 8 %); they supplement their diet with fish. In summer, fish food predominates. It consists of cod fingerlings, sand eel, and more rarely of herring and capelin.

During his courtship the male ardently pursues the female on the water and she seeks to escape by diving. Sometimes he flies above his partner, trying to catch her in the air. Before mating, guillemots stand facing one another on land, alternately drawing in or stretching out their necks; the male accompanies this performance with whistles, keeping his bill wide open.

In selecting the nesting site guillemots are not very discriminating. They settle in screes, among boulder piles, in deep cliff crevices, beneath large rocks, in small caves and peat holes, and other sheltered places. Guillemots breed either in pairs or in small groups, depending upon the territory and the number of suitable breeding sites. Occasionally, their nests are interspersed among other birds' nests in large bazaars, in which case they usually occupy the lower terraces. Generally, the distance from the sea is not more than 300 m, though there are some known cases of nesting sites 3 kms away from the shore (Birulya, 1910).

The eggs are laid 50 to 70 cm, less often 1 to 2 m away from the nest entrance. The walls of the nest cavity are usually covered with mold, and the inside is damp and cold. The eggs are laid on pebbles, or shells or stalks of dry grass blown in by the wind. A normal clutch in Murman was usually observed to number two eggs, rarely a single one. On Kent Island (in Baffin Bay), Winn (1950) found two-egg clutches in 39 C. grylle nests,

and a single egg in nine nests. The male and the female each develop two brood patches.

The incubation period on the East Murman islands lasts 27 to 28 days (counting from the deposition of the second egg, which is laid after a three-day interval). The shape of the egg is ovoid or elliptical ovoid. It is whitish, with pale-bluish or greenish tints and brown or pale-bluish dots. The eggs are 51.2 to66.3 mm long and 32.2 to 44.0 mm wide. At first the guillemot does not sit continuously, but may be startled into rising into the air when alarmed by noise and birdcalls at the bazaar; at a later stage the incubating bird seldom leaves the nest hole unless it is relieved at the nest by its partner, so that incubation is never interrupted.

For the first 3 days after hatching the nestling remains motionless. On the fourth day it is able to roam about the nest hole. On the sixth or seventh day feathers appear on the back, together with the small ventral feathers and remiges. The rectrices emerge from the papillae on the tenth
70 or twelfth day. Head and neck feathers begin to grow on the fifteenth day. Down feathers remain longest on the head, the foreneck and the flanks.

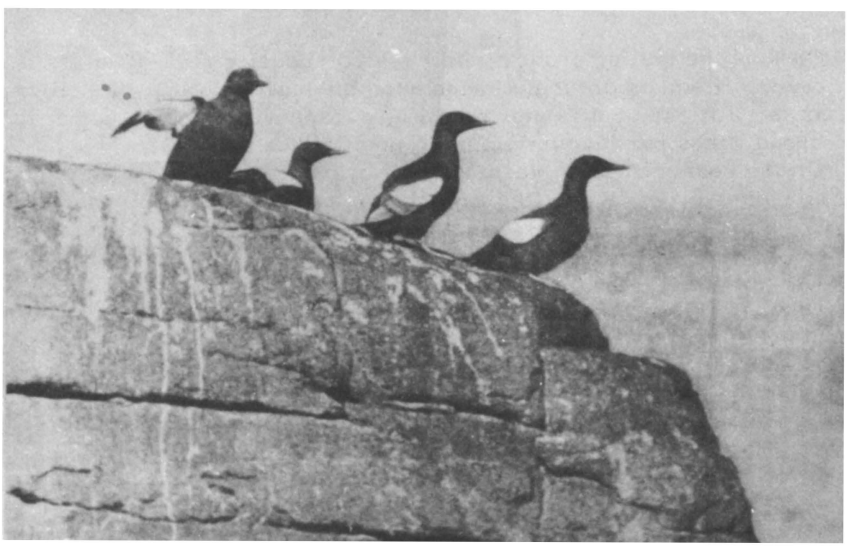

Figure 38. Resting black guillemots, Cepphus grylle

The nestlings are fed chiefly on fish – sand eels, gunnels and herring, rarely on cod brood and haddock; crustaceans constitute only a minor part (18%) of the diet. The fish brought to the nest does not measure more than 10 to 16 cm. During the nesting season guillemots search for fish along the coast, occasionally flying several kms away from the shore into the sea. The beak can hold only one fish (Figure 39), which is carried across the body next to the head. Upon catching the fish, the bird kills it immediately by strangling it with the jaws. It swims for a while holding the prey in its beak, immerses it in the water, drops it and seizes it again from the

surface. When attacked by a gull that tries to snatch away the fish, the guillemot resorts to diving. In early and mid-August, the guillemots feed most intensively during the second half of the polar night, between 0100 and 0700 hours, i.e., at dawn or daylight. In later months they feed during the morning hours. Observations conducted in 1939 on Bol'shoi Litskii Island (East Murman) showed that guillemots occasionally join forces to catch the approaching fish. They swim in chain formation one after another, then they dive and gradually bring the chain ends together until they form a ring which encircles the fishes.

Toward the end of the nesting period the young birds begin to move nearer to the nest entrance and occasionally venture a few feet from the hole. On the 35th to the 38th day they depart for the sea, already clad in
71 juvenile plumage. At that time the greater primaries are not yet full grown but they suffice to carry the bird from the land to the sea. It could not otherwise be explained how the fledglings of guillemots can cover a distance of sometimes 3 or 4 kms between their nesting sites and the shore. Kaftanovskii (1951) conducted experiments with young guillemots. He threw them into the air and watched them alight on the ground about 100 feet away. Apparently he made these tests with young birds that were not yet ready for the water.

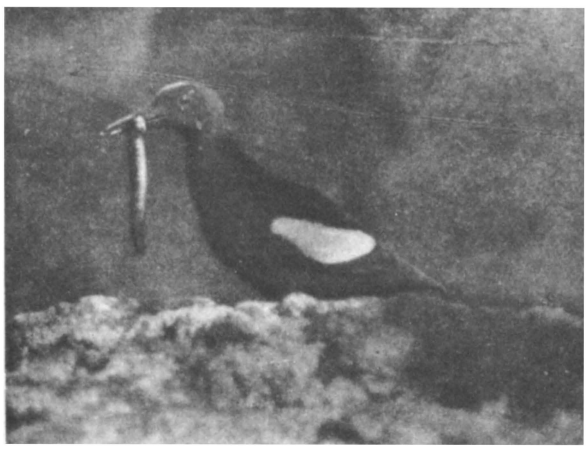

Figure 39. Black guillemot, Cepphus grylle, bringing a fish to the nestlings

The nestlings, deserted by the adults, feed quite independently in the sea. Mineev (Portenko, 1937) tells of having seen adult guillemots accompanied by young "which were half-covered with down feathers and unable to fly". These observations are, however, contrary to those of other witnesses and leave the accuracy of Mineev's information open to doubt.

Once the young guillemots are settled on the water, their wings soon attain normal length. The birds then begin their postjuvenile molt and acquire their first winter dress which, in the spring, is exchanged for the first nuptial plumage. Since the flight feathers and their coverts are not

affected by these two molts, it is always possible in summer to distinguish one-year-old birds from adults by the color of their wings. In adult guillemots the wing patch is either pure white or white with a dark crossbar, whereas in young birds the white patch is profusely mottled with a dark shade.

Adults molt twice a year. Complete fall molt begins with the short general body feathers on the upper parts, those of the under parts molting at about the same time. Shedding of the remiges begins when the body feathers are most intensively in molt; rectrices are the last to change. Occasionally, large and small feathers molt at one time. Partial spring molt involves the small feather cover of the entire body.

1a. Cepphus grylle atlantis Sal. – North Atlantic guillemot

Cepphus grylle atlantis Salomonsen, 1944, Goeteborgs Kungl. Ventenskaps Handlingar. Series B, III, 5: 77 (Bogusland, Sweden). –C. g. grylle L., Kaftanovskii, 1951. –Materialy k poznaniyu fauny i flory SSSR, new series, Department of Zoology, 28 (XIII): 59; Dement'ev, 1951. –Ptitsy Sovetskogo Soyuza, 2: 200.

Only the lower part of the inner primary vanes is white. The upper coverts are dark brownish from the base to half or three quarters of the feather length. In adults there is a dark band on the white wing patch ("mirror").

Adults in winter have the head above and the nape grayish brown with white feather tips, the remaining upper body parts, including humerals and lower back, are brownish black with white margins (which are particularly broad on the lower back and humeral feathers). The sides of the head and throat are off-white; there is a small dark-brown patch in front of the eye. The foreneck is white with brownish dots. The under parts are all white. Flank brownish with white feather tips. Young birds in adult (winter) plumage are distinguished from adults in winter by the broad brownish-black margins on the white upper coverts, which form two (occasionally three) broad dark-brown stripes across the white wing patch. The throat and sides of the head are entirely white, lower body also white, but edged with dark-brown margins, which are designed in a transverse linear
72 pattern. Nape grayish brown. Feathers on humeral tract and lower back are brownish black with narrow white margins (Figure 41b). Juvenile plumage of young birds is blackish brown on the upper parts, including the humerals, but lacks white edges; on the nape are light-shaded streaks due to the whitish coloring at the quills. Throat and sides of head beneath the eye are white with small dark spots. The front and lateral parts of the neck, and the entire lower part of the body are white streaked with dark-brownish bands (formed by the dark feather tips), which make the under parts appear darker than in the first winter plumage. The coloring of the wing is the same as in the previously described plumages.

Measurements: wing length of males and females (ZIN AN materials) 152.8 to 169.2 mm (Kaftanovskii); tarsus 28 to 34 mm; length of bill from external naris 22.6 to 27.2 mm, from the rictus 29 to 35 mm (Salomonsen). Average summer weight of 120 examined specimens from East Murman 433 g (Belopol'skii).

Distribution. It nests on the Murman coast and adjacent islands (Ainovy, Seven Islands, Bol'shoi and Malyi Zelenets, etc), the White Sea along the western Karelian coast, Kandalaksha and Onega bays and on the islands of Solovets, Sosnovets, etc. Outside the USSR it inhabits the northern and western coasts of Scandinavia, south to the Kattegat, the British Isles and also North America from South Labrador to Maine. During the nonbreeding period they remain either at their nesting sites or migrate southward to the coasts of France, and on the American side of the ocean to Massachusetts.

Habits. In the entire Murman region, especially Kola Bay and the White Sea (Kandalaksha and Onega bays), guillemots are very common during the winter and it is therefore difficult to establish the beginning and the end of seasonal migrations. It is likely that they are to some extent residents of that area. During the winter, adults and juveniles in first winter plumage were found in the water.

At the end of April and in May, in the region of Kharlov Island (of the "Seven Islands" group), guillemots stay on the water near the nesting sites, but do not alight on cliffs, because at that time of the season the passages between the rocks and cliff crevices are still blocked with snow. In the first 10 days of June they begin to visit the r sheltered nesting sites. They also sit on cliffs and become engaged in mutual pursuits. On Kharlov Island and Bol'shoi Litskii Island egg laying usually begins on 7 to 10 June, in exceptional years even late in May. The latest eggs were found on Bol'shoi Litskii Island on 24 June, and the earliest fresh ones in Pala Inlet in Kola Bay on 27 May and 11 June, though at the same time on 7 June incubated eggs were also found. In Onega Bay egg laying begins 10 to 13 days later than in East Murman and the neighboring islands.

Normal hatching starts on Seven Islands in late June or early July, and hatching from delayed clutches was registered in the last 10 days of July. On Kharlov Island, fledglings were observed to leave their nests for the water in the first 10 days of August. In certain years this took place from the middle of August to 25 August. ZIN AN materials contain a young bird from Solovets Island captured on 6 August, which had largely changed into juvenile plumage but still retained some down feathers on the head, the foreneck and the flanks. Another nestling taken on 14 August in Ermolich'ya Inlet (Kandalaksha Bay) wore juvenile plumage and was almost the size of an adult bird, but its wings were not fully developed. The molt of the first winter plumage lasts through the entire month of September and sometimes
73 continues into October. In Murman the young birds wear winter plumage in November. Spring molt of young birds usually begins in April and May, rarely in March. On 5 March, a young guillemot from Porchnikha was still in winter plumage with no signs of molt.

Complete molt of adults in northern Soviet waters begins in late August and lasts through September, but occasionally guillemots are found wearing summer plumage in October. The collections of ZIN AN contain a bird found on 5 September in Olen'ya Inlet which had undergone intensive molt. The remiges and some rectrices were projecting from the papillae, but five rectrices of the summer plumage still remained. The feathers on the upper parts were beginning to change, while on breast and abdomen they had been entirely replaced. Partial spring molt begins in January or late December and lasts until the end of February (Salomonsen). In East Murman, however,

Kaftanovskii observed guillemots wearing winter plumage in late April, though this observation may apply to one-year-old birds which undergo spring molt later in the season than adults.

1b. Cepphus grylle grylle L. – Baltic black guillemot

Alca grylle Linnaeus, 1758, Syst. Nat., ed. X, 1: 130 (Gotland Island); Salomonsen, 1944, Goeteborgs Kungl. Vetenskaps Handlingar, Ser. B, III, 5: 60, Dement'ev, 1951. –Ptitsy Sovetskogo Soyuza, 2: 202.

This is larger than the previous bird group, which it resembles in coloring (Salomonsen, 1944).

Measurements: wing length in males and females 169 to 172 mm; bill length from rictus 30 to 35 mm.

Distribution. It nests in limited numbers on Yalayansaari, in the northwestern part of Lake Ladoga, in Estonia, and along the Baltic coasts of Scandinavia and Finland, but does not migrate beyond the Baltic Sea.

Systematic Remarks. The absence of data on guillemots from the Baltic and the Lake Ladoga in USSR collections does not permit us to verify the existence of the C. g. grylle as a separate subspecies. The measurements of guillemots from Murman and the Gulf of Bothnia taken by different authors are not in agreement with those indicated by Salomonsen as distinguishing the two subspecies.

Habits have hardly been studied. In Estonia egg laying was recorded in late May or in the first half of June. Adults undergo fall molt in August and September. Molt sometimes continues until the end of November. Salomonsen recorded spring molt which extended from early March to late April.

1c. Cepphus grylle mandti (Mandt) – (Polar) Mandt's guillemot

Uria mandti Mandt, 1822, Observ. Hist. Nat., Itin. Groenl.: 30 (Spitsbergen). Cepphus mandti (Licht.) Menzbir, 1895, 1: 55; Thayer and Bangs, 1914, Proceedings of the New England Zoological Club, 5: 8; Salomonsen, 1944, Goeteborgs Kungl. Vetenskaps Handlingar, Ser. B, III, 5: 101; Dement' ev, 1951. –Ptitsy Sovetskogo Soyuza, 2: 203.

The inner primary vanes are largely white. (Only the tips are brownish). The greater upper coverts are also white, with some white or whitish at quills (Figure 40). In adult winter plumage the head is whitish above, the
74 nape appears all-white because of the broad white margin on the feather. The humerals are either plain white, or dark brown edged with very broad white margins. The rump is plain white, the upper tail coverts partially white. The entire under surface is white. Young birds in first winter plumage are very similar to adults in winter; their greater and middle upper coverts are white with narrow dark-brownish margins; the nape is plain white, or white with light grayish-brown hues. The white under tail coverts have sparse dark-brownish margins; the humerals are also partially white. The under parts are white, but breast, abdomen and flanks are mottled with barely discernible elongated dark-brown dots. In juvenile plumage the upper body is dark brown with white feather tips, while the

rump and humerals are white, tipped with dark brown. The brown margins on the white upper and middle upper coverts and the white under parts are considerably narrower than in Cepphus g. atlantis. In general, young and adult C. g. mandti have a much lighter coloring than C. g. atlantis and are easily identifiable (Figure 41).

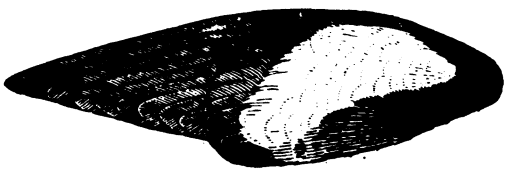

Figure 40. Wing of adult guillemot, Cepphus grylle mandti

Measurements: wing length of males and females 150.5 to 167.5 mm, average (of 33 specimens) 161.1 mm. Tarsus 25.5 to 34.0 mm. Length of bill from external naris 21 to 26 mm, average (27 specimens) 22.7 mm; from rictus 29 to 34 mm.

Distribution. It nests on Franz Josef Land, along the entire western and part of the northeastern coast of Novaya Zemlya from Cape Zhelanie to Hemskoerk Island on Waigach Island. Farther eastward on Severnaya Zemlya (North Land) guillemots are abundant in the northeastern part of Oktyabr'skaya Revolutsiya Island (at Cape Voroshilov and the coasts of Matusevich Fiord), on Begichev Island (at the entrance to Khatanga Bay), and are believed to occur on the east coast of Taimyr. Among the New Siberian Island Group the polar guillemot was found on the islands of Bel'kovskii, Kotel'nyi, Stolbovoi, and Bol'shoi Lyakhovskii, and also on the De Longa Islands – Henrietta, Bennett and Vil'kitskii. On the northern coast of the Chukot Peninsula the polar guillemot ranges from Chaun Bay to Cape Serdtse-Kamen'. Outside the USSR it is known on the east coast of Greenland, south to Scoresby Sound, on Jan Mayen Island, Spitsbergen, and Bear island. It was found migrating on Novaya Zemlya, including the northeastern coast of the northern island, wherever open waters can be found, on the Murman coasts, in the Kara and Barents Seas. From the extreme northeast they migrate southward and enter Bering Strait. Sexually immature birds
75 travel very extensively and were found at high latitudes (up to 88° N. Lat.). In summer they were obtained in Providence Bay, on the south coast of the Chukot Peninsula (ZIN AN materials).

Habits. Under favorable ice conditions, adult breeding guillemots winter in the vicinity of their nesting grounds and arrive there very early in the spring. On the coastal waters of Franz Josef Land the first guillemots were noted in the last 10 days of February. Mass occupation of nesting grounds occurs there during the first half of March. In Matochkin Shar Strait, flocks containing thousands of guillemots arrive between 20 and 30 May. On the northeastern coast of Novaya Zemlya they are much more abundant during the month of April. Early in April they begin sitting on cliffs. In 1933, the first guillemots begin to arrive on Severnaya Zemlya (North Land) – on the west coast of Oktyabr'skaya Revolutsiya Island, which

76 belongs to the Sedov Archipelago – were noted in mid-May. In Bering Strait they usually appear in late April and in May, and from there migrate northward toward the end of May. On Hooker Island (Franz Josef Land) guillemots were seen on 28 March performing their mutual "bowing" antics, the male in pursuit of his partner. The beginning of egg laying was observed by Antipin on 17 June 1938 in the northeastern part of Novaya Zemlya and neighboring islands. In 1903, the first eggs were found in the region of Matochkin Shar on 10 July. On Franz Josef Land, at the Flora and Stolbovoi capes, eggs were found from 23 June to 15 July. Nest leaving begins on the Gorbovy Islands, in the northwestern part of Novaya Zemlya, in late August or early September, and in the northeast – Hemskoerk Island – during the second half of August, approximately at the same time as on Franz Josef Land, where it extends from 11 August to the beginning of September. In certain years the young birds were still in their nest holes on 30 August on the western polar coast of the Chukot Peninsula, at Cape Kiber, east of Chaun Bay; at Cape Schmidt, which is in the same latitude as Wrangel Island, the feeding of nestlings continued until 16 September. In other years, however, guillemots abandoned the cliffs of Cape Kiber by 10 September.

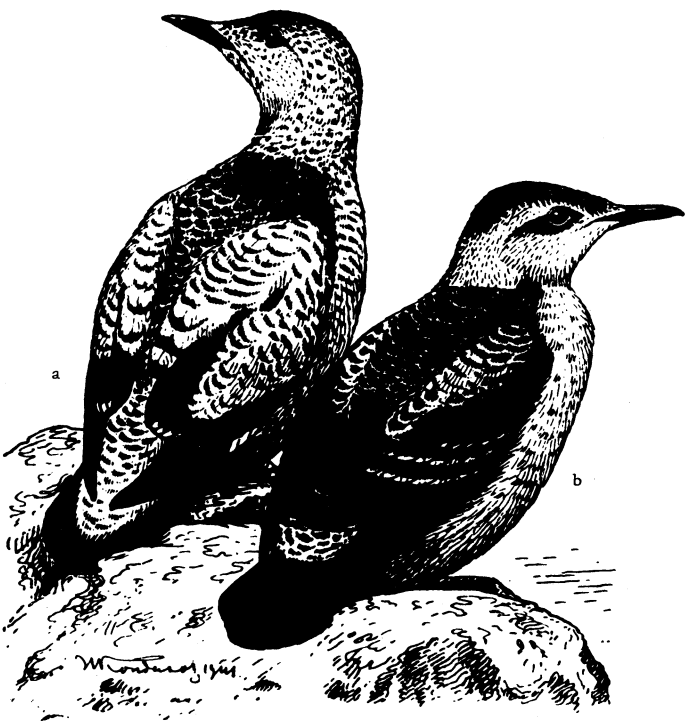

Figure 41. Young guillemots in their first winter plumage

ZIN AN materials contain some polar guillemot nestlings in juvenile plumage with partially grown wings; they were captured on Novaya Zemlya on 26, 28, and 31 August, and on Bennett Island on 2 and 18 September.

A nestling taken on 2 September still had down clinging to the feather tips of the foreneck. On Franz Josef Land, the change from juvenile plumage into the first adult (winter) plumage occurs in the second half of September. A young bird taken there on 21 September had already acquired new plumage on its upper parts.

Guillemots residing on the latitude of Franz Josef Land perform their fall migration in late October, and those from Severnaya Zemlya (North Land) in the middle of November.

Adult guillemots begin their complete molt soon after their departure for the water. This occurs during the month of August in Novaya Zemlya. In mid-October the summer feathers have been shed, but the new feathers on the under parts are still in papilae. The flight feathers of an adult guillemot taken on 17 August in Russkaya Gavan' were emerging from papillae; the rectrices were unchanged, the small body feathers on the upper parts were newer, and those on the under parts were undergoing intensive molt. An almost identical sequence of molt was observed in a female captured on 15 September in Russkaya Gavan'. In another female taken on 13 October on Novaya Zemlya, some feathers from her summer plumage remained on the under parts, the new white feathers were in papillae, but on the upper parts the covering had been completely replaced and all the new feathers were of normal size. According to Gorbunov (1932), adult guillemots from Franz Josef Land undergo partial spring molt between the end of February and the end of March. An adult male from Cape Chaplin (Chukot Peninsula) was still undergoing molt on 11 April, with a number of winter feathers clinging to the upper and under parts of the body and his new black feathers in papillae.

1d. Cepphus grylle tajani Port.—Tayan black guillemot

Cepphus grylle tajani Portenko, 1944.—Doklady Akademii Nauk SSSR, XLIII, 5: 239 (Cape Pillar, Wrangel Island)—Cepphus mandti (Licht.), Portenko, 1937.—Problemy Arktiki, 3: 118.

Very closely resembles C. g. mandti in color but exceeds it in average wing length.

77 Measurements: wing length of males and females 161.8 to 175.5 mm, average length 166.9 mm (36 specimens measured). Measurements of C. g. mandti: 150.5 to 167.5 mm, average 161.1 mm (33 specimens measured).

In describing C. g. tajani, Portenko indicates that it is distinguished from C. g. mandti by a "more vivid black with intense green hues" in the summer feather covering of the upper parts. When one compares large numbers of polar guillemots from Wrangel Island, Franz Josef Land, Novaya Zemlya, and other parts of their range, the color distinctions in the Wrangel Island birds appear very insignificant. This difference becomes perceptible only when one compares their skins stuffed by the same method; otherwise it can barely be seen. We can only accept C. g. tajani as a separate subspecies on account of the greater wing length of Wrangel guillemots.

Distribution. Breeds on Wrangel Island, possibly also on Herald Island.

The guillemots of eastern and western Wrangel Island are very abundant. Mineev (Portenko, 1937) saw many thousands of specimens nesting on the cliffs of Cape Hawai. The first individuals arrive on these island cliffs in late April or early May, when the island is still icebound and they have to fly far out into the open sea in search of food. It appears that upon arrival they first spend entire days on the open water and gather for the night only at their future nesting grounds. Fall migration was registered in late September.

2. Cepphus columba Pall. – (POLAR) PIGEON GUILLEMOT

Cepphus columba Pallas, 1811, Zoographia Rosso-Asiat., II: 348 (Kamchatka). –Uria grylle columba (Pall.), Johansen, 1934. –Trudy Tomskogo Gosudarstvennogo universiteta, 86: 253; Storer, 1945, Ibis, 87, 3: 447, --Cepphus grylle L., Averin, 1948. –Trudy Kronotskogo Gosudarstvennogo zapovednika, 1: 81; Bailey, 1948, Colorado Museum of Natural History, 8: 258--Cepphus grylle columba Pall., Dement'ev, 1951. –Ptitsy Sovetskogo Soyuza, 2: 205.

The tail is usually made up of 14 rectrices, slightly rounded.

Adult male and female in summer. Upper parts slaty black; sides of head, neck, and entire under parts, wings and tail brownish black. The white wing patch has distinct wedge-shaped marking. The middle upper coverts are white in half to one third of the higher parts, blackish brown at the base. The greater upper coverts are blackish brown at the outer edge of the wing, and are tipped with broad white margins (Figure 42). The inner primary vanes are usually white, the outer vanes and tips of the flight feathers brownish black, and the axillaries smoky brownish. The iris is brown, the bill black, and the inside of the mouth and feet red. Adult male and female in winter. Grayish-black upper parts with white margins at tips. Under parts white; flanks also white with grayish brown stripes alongside. Downy nestlings blackish brown above and lighter brown below. Young birds in juvenile plumage. Top of head, back and humerals brownish black; humerals edged with white margins. Nape and rump white with brownish-black margins. Greater and middle upper coverts are brownish at base and tips, with broad white stripes
78 just before the tip, thus darkening and mottling the white wing patch. Under parts white, streaked with brownish crossbars. Young birds in first winter plumage are similar to adults in winter. Upper parts, including humerals, are brownish black with white margins at tips; under parts white with brownish crossbars, but fewer than in the juvenile plumage. The brownish markings on the white wing patch distinguish young birds from adults in their first summer, since partial spring molt involves the short body feathers, but not the wing coverts. Otherwise, the first nuptial plumage is similar to that of adults. The second winter plumage also resembles adult winter plumage, except for several dark crossbars generally marking the abdomen and the sides of the breast. The white wing patch is usually mottled with a brownish coloring near the outer wing edge.

Measurements: wing length of males and females 164.5 to 186.5 mm. Tarsus 29.0 to 36.5 mm. Bill length from external naris 21.2 to 27.0 mm. Weight 490 to 505 g.

Distribution. Inhabits the coasts of the Chukot Peninsula from Cape Wellen to Krest Bay, and the Diomede Islands. May nest around the Anadyr Estuary. Nests abundantly on the Commander Islands. On the eastern coast of Kamchatka it extends south from the Kronotskii Peninsula to Cape Lopatka, and on its southeastern coast north to the Kambol'naya River. S. I. Snigirevskii asserts in his oral communication that it nests near Ayan on the islands in the Sea of Okhotsk. Outside the USSR it inhabits the islands of the Bering Sea (St. Lawrence, St. Matthew, Pribilof Islands, the Aleutians), the south and west coasts of Alaska north to Kotzebue Sound, and the American coast south to California, including the Farallon Islands. In winter the pigeon guillemot migrates along the coasts of Kamchatka, the Kuril Islands, south to Japan and along the American coast to the southernmost boundaries of its nesting range.

The four known subspecies differ in general size, and in the length of wings and bill. The two subspecies C. c. columba Pall. and C. c. kaiurka Port. nest partially on Russian territory; C. c. eureka Storer inhabits the Pacific coasts and North American islands, from the mouth of the Columbia River to the Santa Barbara Islands off California. C. c. adianta Storer nests along the coasts of the state of Washington, British Columbia, Alaska, and some of the Aleutian Islands.

Figure 42. Wing of the pigeon guillemot, Cepphus columba

Systematic Remarks. Cepphus columba should be regarded as a separate species (not as a subspecies of C. grylle) in view of the unchanging color of its plumage, which has no intermediate shades linking it to C. grylle. C. columba has smoky-gray axillaries and under coverts, though among the latter a few feathers have partly white outer vanes. In C. grylle the axillaries and under coverts are always white. Moreover, C. columba has, as a rule, 14 rectrices, the C. grylle almost always only 12.

79 It is very likely that the genetic relationship between these two guillemot groups – C. grylle and its subspecies, on the one hand, and C. carbo, C. columba, and C. snowi, on the other – arises from a common ancestral form which in ancient times was widely distributed throughout the Arctic and the Atlantic. This ancestral population entered the Pacific Ocean from the north, possibly under the influence of the increasingly colder climate during the late Pliocene. Its further evolution and modification proceeded in completely isolated conditions, as a result of which the origin of the present-day species that arose from this form, such as C. carbo, C. columba, and C. snowi, are associated with the history of the Pacific, whereas C. grylle has become isolated from the group within the Atlantic sector of the Arctic.

Habits. The migratory routes of the pigeon guillemot are not very extensive, especially in their southern range, where they remain all the year round. On the sea they behave in a very lively manner, constantly dipping their beaks into the water. Occasionally they swim with their heads entirely immersed.

They subsist on fish, small crustaceans (amphipods, isopods, etc), mollusks and polychaetes. The data presented in 1923 by Preble and McAtee

(Storer, 1952) show that the diet of C. columba on the Pribilof Islands comprises 56.8% amphipods, 20.8% crabs, 17.2% isopods and 4.0% fish. Near the Californian coast, the pigeon guillemot hunts at great depths, far from the mainland (Storer).

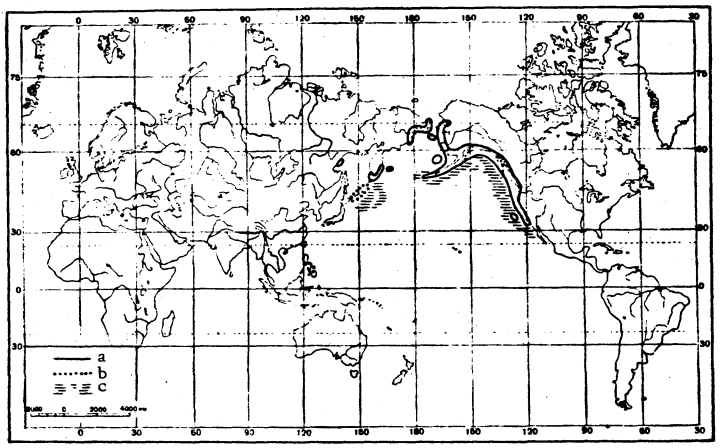

Figure 43. Distribution of the Pacific pigeon guillemot Cepphus columba, and the Kuril guillemot, Cepphus snowi

a-boundaries of nesting sites of C. columba; b-boundaries of nesting sites of C. snowi; c-migration routes

On land the pigeon guillemot moves easily and swiftly, Courtship
80 begins on the water and ends on the cliffs. Males and females emit loud whistling calls with their bills wide open. They pursue one another and perform mutual "bowing" antics with jerky movements, lowering and erecting the head. On the water several pairs usually join in these performances. When approaching the shore, they either fly or step on land, where they continue their pursuit, running around in small circles, their bodies almost horizontally inclined. At times, the bird in front stops suddenly and crouches on the ground, while the other covers it. Toward the end of the game the birds turn around and run in the opposite direction, the male and female changing places, but whenever they come to a halt, the pursuer always tries to cover its mate. Watching this game, Storer (1945) could not determine whether copulation actually took place during these "tours". During the nuptial period the males are very aggressive, frequently fighting among themselves on and below the water surface.

Pacific guillemots nest in single pairs among screes and cliff crevices. The eggs are laid beneath overhanging rocks practically in the open, but never without shade. According to Dawson (Bent, 1919) C. columba is known to dig its nest hole in clayey or sandy cliff sites with the aid of its bill and claws. Usually, such tunnels are very high above the sea, though sometimes they are not more than one meter from the water surface. The nest sites are not restricted to the coast and are also found in the interior of the island.

A full clutch contains two eggs, the second being laid after an interval of several days. Incubation begins with the first egg, which means

that hatching does not occur at the same time. In shape and color the eggs resemble those of C. grylle, but are larger and have a more distinct crude pattern. The ground color is either pale greenish gray or greenish or bluish white, splashed with large dark-brownish or sooty dots, underneath which appear grayish or lilac ones. Occasionally, the design is more delicate and the spots rarer and small. The egg sizes vary from 57.0 to 68.5 mm in length and from 37.5 to 43.5 mm in width. Incubation, in which both parents participate, lasts 21 days. (This is probably an underestimation). The newly hatched bird soon becomes very active, running out from its concealment, but departs into the water only when its wings are grown.

Complete fall molt of adults begins with the change of the feathers on the upper parts, followed by the shedding of the flight feathers. This is accompanied by the emergence of winter feathers on the back, and later on the rump.

2a. Cepphus columba columba Pall. – Great Pacific pigeon guillemot

Cepphus columba Pallas, 1811, Zoographia Rosso-Asiat., II: 348.--Cepphus columba columba Pall., Bergman, 1935, Zur Kenntnis der Nordostasistischer Voegel: 147.--Cepphus grylle columba Pall., Dement'ev, 1951. -Ptitsy Sovetskogo Soyuza, 2: 205.

A comparatively large subspecies.

Measurements: wing length of males and females 169.0 to 186.5 mm. Tarsus 32.0 to 36.5 mm. Bill length from naris 22.6 to 26.5 mm.

Distribution. It nests on the south and east coasts of the Chukot
81 Peninsula north to Cape Wellen, and also on the Diomede Islands. Was observed on 23 July around the Anadyr Estuary, where it may possibly nest. Was encountered once migrating on 26 July near Kolyuchin Island. Adult males were taken on 23 July [June?] and 12 July at Cape Serdtse-Kamen' (Storer, 1952). Its nesting sites are very common in East Kamchatka south of the Kronotskii Peninsula, but are rare on the southwest coast. Apparently this subspecies also nests at Ayan. Outside the USSR, it breeds along the south and west coasts of Alaska, but not farther north than Bering Strait. It is possible that it nests also in Kotzebue Sound. It inhabits the islands in the Bering Sea, the eastern Aleutian Islands west of Unalaska. Along the American coast it extends south into California.

Habits. A large number of pigeon guillemots winter near the coast of Kamchatka; only a few flocks, which probably originate in the extreme north, move toward the Kurils. Bergman (1935) reported that in winter (December) they swim into the Avachinskaya Bay. They appear at their breeding places on the Diomede Islands in spring (late May or early June). In Kronotskii Bay (Kamchatka) they become more abundant toward the end of March, and begin decreasing in October.

Bergman has observed on Toporkov Island that some guillemots build their nests so close to the sea that they are sprayed by the waves. On 2 to 3 August he recorded nestlings half the size of adult birds, and their characteristic whistle was heard from every crevice. On 3 July, 1948, Bailey found an egg on the Diomede Islands, and on 27 August he observed fledglings swimming in the water.

Adults molt in late July and during the first 10 days of August, but the dates may vary in different species. The majority of guillemots assume their winter plumage in November, though some do not complete molt until mid-January. A bird found on 14 January on Kodiak Island had an equal amount of black summer and winter feathers, and a few white feathers projecting from papillae on the abdomen. Some individuals completed partial spring molt in the first 10 days of March. In Avachinskaya Bay (Kamchatka) the juvenile plumage changes into the first winter plumage in the first half of November. (All the above data on molt are taken from ZIN AN materials).

2b. Cepphus columba kaiurka Port. –Little Pacific pigeon guillemot

Cepphus columba kaiurka Portenko, 1937, Mitteilungen aus dem Zool. Mus. in Berlin, 22, 2: 228 (Mednyi Island). --Cepphus grylle kaiurka Port., Dement'ev, 1951. –Ptitsy Sovetskogo Soyuza, 2: 207.

A smaller subspecies of the Pacific pigeon guillemot.

Measurements: wing length of males and females 164.5 to 172.0 mm. Tarsus 29.0 to 34.5 mm. Bill from naris 21.2 to 23.5 mm.

Distribution. These birds nest on the Commander and the Aleutian Islands, but do not range farther east than Unalaska.

Habits. They do not winter in the region of the Commander Islands, where they appear in the spring, about the middle or end of March, and whence they again depart in October. On Bering Island and Mednyi Island they settle in pairs, but on the small Toporkov Island (opposite Bering
82 Island) there is a large colony of these birds. Egg laying begins in mid-June; fresh eggs were found in Arii Kamen' on 30 June. Downy nestlings were registered in mid- or late July. Stejneger (1885) collected newly hatched nestlings on Mednyi Island in 20 July.

Adults usually complete their fall molt in November. A bird from Bering Island was at the peak of molt on 8 October; its flight feathers had been changed, though they were not yet of normal size, and new white feathers were emerging on the under parts, back and rump. An immature guillemot from Bering Island had not completely changed from first winter to first nuptial plumage on 24 June – a number of white feathers still remained on the under parts (ZIN AN). A young female taken on 11 May on Bering Island (Storer, 1952) had only 20% of dark summer feathers on her under parts, an adult female from Mednyi Island had only 15% of her feather cover replaced on the under parts by 8 April, while another adult female from Bering Island was clad in full nuptial attire when captured on 15 April 1912.

3. Cepphus snowi Stejn. – KURIL PIGEON GUILLEMOT

Cepphus snowi Stejneger, 1897, Auk: 201 (Kuril Islands). --Cepphus columba snowi Stejn., Yamashina, 1931, Journ. f. Orn., LXXIX, 4: 533; Bergman, 1935, Zur Kenntnis der Nordostasiatischer Vogel: 254. --Cepphus grylle snowi Stejn., Dement'ev, 1951. –Ptitsy Sovetskogo Soyuza, 2: 207.

Adult males and females in summer. Top of head, upper and under parts brownish black. Middle and greater upper coverts brownish black with narrow white margins at tips. White patch on wing absent. Under coverts uniformly grayish brown, without any white. Axillaries brownish. Inner vanes of primaries grayish brown, without white. Iris brownish, bill black, inside of mouth and feet red. Winter plumage of adult males and females resembles that of C. columba, except for the color and design on the upper and under coverts and primaries, which retain the same coloring as in summer.

Young birds are not described.

Measurements: wing length of males and females 171 to 185 mm. Tarsus 31.6 to 35.0 mm. Length of bill from naris 25.1 to 27.6 mm.

Distribution. It nests on the Kuril Islands. Was captured at Cape Crillon in Sakhalin in June and at an unknown date at Cape Terpenie. Was also encountered on 10 September at Aniwa Bay (Gizenko, 1955). Nesting sites were reported on the southern coast of Kamchatka. ZIN AN materials contain one specimen captured on 13 June on Mednyi Island, and another (undated) at Petropavlovsk. Its winter migration is confined to the breeding range and extends south to Hokkaido.

Systematic Remarks. Contemporary taxonomy regards C. snowi as a subspecies of C. columba; some ornithologists even consider it to be a subspecies of C. grylle. We believe such a classification to be incorrect for the same reasons as described earlier, which refuted the grouping of C. columba as a subspecies of C. grylle.

Russian collections do not possess sufficient materials to determine the taxonomic relationship of C. snowi. The examination of five specimens
83 from ZIN AN collections obtained on the Kuril Islands and of one bird from Mednyi Island on 13 June (apparently an immature migrant) shows that the difference between C. snowi and C. columba consists in a few but constant characters. As described before, C. snowi has brownish upper coverts with narrow edges, and uniformly brownish under coverts. In C. columba one half or one third of the upper coverts, and one vane of the under coverts are white. Our literature contains no information regarding specimens with intermediate characters. Yamashina (1931) mentions guillemots in the central part of the Kuril Islands with entirely dark upper coverts; most likely their shabby summer plumage had lost the former narrow white edging. ZIN AN materials contain guillemots from Uruppu Island, some of which have clearly defined white margins on the upper coverts; in others, barely visible white spots indicate that at an early stage the feathers were marked with these margins. Since guillemots do not change their coverts during the partial spring molt, these feathers are very shabby by May or June.

Unless new materials will disprove that the above characters are of a constant nature, and will bring some intermediate forms which show the kinship between C. snowi and C. columba, we must consider C. snowi as a separate species.

Habits of C. snowi have not been studied. While observing large numbers of C. snowi on the Kuril Islands, Bergman (1935) found them nesting on every cliff along the coasts. According to Jourdain (Hartert, 1922), an egg kept at the British Museum measures 62.5 by 39.6 mm.

A bird of this species taken in 13 June on Mednyi Island (ZIN AN) seems to be a young one which had not yet completely changed into summer plumage – the under parts still retained some white feathers, and a few summer feathers were in papillae.

4. Cepphus carbo Pall. – SPECTACLED GUILLEMOT

Cepphus carbo Pallas, 1811, Zoographia Rosso-Asiat., II: 350 (Kuril Islands). Shul'pin, 1936, Promyslovye, okhotnich'i i khishchnye ptitsy Primor'ya (Industrial, game, and predatory birds of the Maritime Territory): 405; Dul' keit and Shul'pin, 1937. –Trudy Biologicheskogo nauchno-issledovatel'skogo instituta, Tomskii Universitet, IV: 127; Dement'ev, 1951. –Ptitsy Sovetskogo Soyuza, 2: 208.

The tail, which is composed of 14 rectrices, is straight at the tip.

Adult male and female in summer. Plumage entirely grayish black; small white spot on either side of beak; large white patch around eye (Figure 44). Under coverts and axillaries grayish brown. Iris dark brown, bill black, feet red. Adult male and female in winter. Under parts white, upper parts, throat and foreneck grayish black; otherwise as in summer, including white spot on beak and white patch around eye. Young birds in juvenile plumage have brownish-black upper parts, wings and tail, and a white ring around the eye. Under parts have brownish-black crossbars. Under coverts grayish-brown with dark-brown margins.
84 Downy nestlings are not described. Young birds in first winter plumage are similar to adults in winter, except that the generally white uner parts are marked transversely with dark-brownish spots. The wing is as in juvenile plumage.

Measurements: wing length in males and females 183.5 to 196.7 mm. Tarsus 34.2 to 37.8 mm. Bill from naris 28.2 to 32.0 mm. Weight 540 to 655 g.

Distribution. Nests in many places along the coast of the Sea of Okhotsk, from Penzhina Bay to the Shantarskie Islands, especially on the Taigonos Peninsula and the rocky island near Ayan. Nests abundantly in the Tatar Strait, is fairly common on Sakhalin and the adjacent islands where, according to Gizenko (1955), its nests are spread over various coastal sites. A nestling with feather cover, but not yet able to fly, was taken on Moneron Island. It is reported that adult males and females are encountered in summer at Aniwa Bay, Cape Terpente, in the regions of Aleksandrovsk and Pil'vo Bay. On the Kuril Islands the spectacled guillemot seems to be rare, except on the southerly islands of Shikotan (where Kobayashi (1933) discovered eggs) and Kunashiri, but is common in the southern part of the Maritime Territory advancing south to Posʹet Bay (Figure 45). Stejneger (1885) observed four spectacled guillemots on 28 April on rocks near Bering Island. It may be assumed that these birds were immature migrants. Outside the USSR, they breed in northern Japan and on the east coast of Korea (Austin, 1948).

The spectacled guillemot winters frequently along the coasts of Sakhalin (at Moneron Island), near the Kuril Islands, and on the Japanese coasts.
85

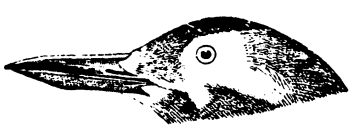

Figure 44. Spectacled guillemot, Cepphus carbo

Habits. In view of the practice of the spectacled guillemot to remain within its nesting range throughout the winter, it is difficult to determine the seasonal migration dates.

Like other representatives of the genus, the spectacled guillemot floats high on the water and resembles the gull by the ease with which it settles on the surface. When swimming, it often

immerses the bill up to the eyes as if searching for underwater prey. Its call is a pleasant sweet whistle but, when alarmed, it emits an agitated trill. It is fairly cautious; if a man approaches at feeding time, it does not enter the nest but stays on the water holding the prey in its bill. Because of this shyness it is difficult to seize the C. carbo in its nest, as it is alerted at the slightest alarm. Adults and young feed principally on small fish.

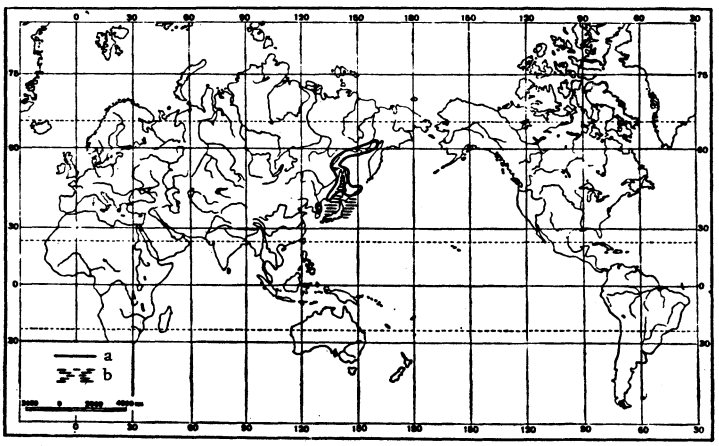

Figure 45. Distribution of the spectacled guillemot, Cepphus carbo

a-boundaries of nesting sites; b-migration routes

From Shul'pin's observations (1936) in the Maritime Territory it is known that these guillemots neither assemble in large groups nor settle in colonies during nuptial and migration periods. Arsen'ev, who observed them in the Tatar Strait, noted on the label of a captured specimen that they "inhabit the northern cliffs of the Strait in dense masses."

When migrating, or in search of food, the spectacled guillemot does not enter river estuaries; in deep bays it occurs casually at a distance of 10 km from the shore or more. It builds its nest beneath rocks or in cliff crevices, frequently not far above the water, more rarely at a height of 10 m, and occasionally far away from the sea.

The clutch contains a single egg, but male and female each develop two brood patches during the breeding season. The egg has a white or yellowish-white ground color dotted superficially with dark brown, and below with bluish gray. The eggs are 62.2 to 69.0 mm long and 40.8 to 45.3 mm wide. Both parents participate in incubation. Along the Tatar Strait slightly incubated eggs were found on 23 June. In the Ternei Bay, Vorob'ev (1954) observed a guillemot carrying a fish to its nestlings on 12 July. In the southern part of the Maritime Territory fledglings are not seen on the water during the first 10 days of August, and adults continue to carry food to the nests. On Moneron Island (South Sakhalin) nestlings were in juvenile plumage on 14 July. Their wings were undeveloped and some down still clung to the feather tips on neck, nape, and crop (ZIN AN).

Adults complete their fall molt by the end of November. Partial spring molt of the short body feathers takes place in April and May. By 20 May many white feathers usually appear on the under parts among the predominant brownish-black ones. The change into nuptial plumage is completed on Sakhalin by 23 April. Young birds undergo spring molt later in the season and reach the peak at the end of May. (A specimen from Nakhodka Bay has been preserved in ZIN AN collections).

5. Genus SYNTHLIBORAMPHUS Brandt – ANCIENT MURRELET

Brandt, 1837, Bull. Ac. Sc. Petersb., II: 347 (type – Synthliboramphus antiquus)

The ancient murrelet is a medium-sized representative of Alcae. It feeds on marine invertebrates which it usually catches from the upper water layers. The fore limbs are highly specialized for paddling under water at the expense of their flying ability. This may probably be attributed to the retention of an ancestral morphological trait of the genus which has now
86 lost its adaptive significance. The ancient murrelet nests in individual shelters. Adults move more clumsily on land than young birds.

The bill is small and depressed. The upper mandible bends downward at the end. The oval-shaped nares are covered with membranous tissue. The rictal feathers extend to the posterior end of the naris. A horny plate covers the entire beak. The legs are very short, shorter than in other Alcae except the Brachyramphus, whose legs are even shorter. The tarsus is either a little shorter, or very slightly longer than the middle toe including the claw, and is covered in front with transverse plates. The claws are short and fairly broad. The wings are pointed and very narrow. The ratio of the length of the wing to its tip averages 1.9. The length of the wing skeleton comprises 174.6 % of the body length. The tail, which is made up of 14 rectrices, is straight at the tip.

The genus is closely related to Cepphus by its skull structure. The upper portion of the postorbital bar is also bent forward. The orbitosquamous process, where it widens, forms the bony basis of the posterior supraorbital cavities, which are small and shallow and lack upturned outer edges. But the fissure across the temporal region, which contains a part of the depressor muscles, is considerably shorter than in Alcae, and consequently the m. adductor externus profundus is likewise relatively less developed. This is connected with the exclusive consumption of marine invertebrates by the ancient murrelet and the complete absence of fish in its diet.

The sternum and pelvis are longer and narrower than in birds of the genus Cepphus and approach in shape those of the genus Uria. The very short metasternum is poorly developed. There are nine free caudal vertebrae. The entire foot length constitutes only 114.4 % of the body length. The femur and shin are the shortest elements of the hind limbs. The tarsometatarsus [tarsus] is slightly narrower in its distal part.

The juvenile plumage is distinguished by a comparatively looser feather structure than the adult one, and it changes into the first winter plumage in the first fall. In adults, spring molt involves the short body feathers of the mantle. Winter and summer feathers are the same length.

Representatives of the genus breed along the coasts of the Bering Sea, the Sea of Okhotsk, and the Sea of Japan, north – to the Mal'minskie and the Commander Islands and southern Alaska, and south – to Korea and the southern islands of Japan, on the American side to British Columbia. Of the two known species, one nests in the USSR; the other is encountered there only during the nonbreeding season,and inhabits the small islands of Japan.

Key to the Species

1 (2). White crown. Front of throat gray. Crest of long narrow feathers on forehead .....
..... 2. S. wumizusume Temm.–Crested murrelet (in summer).
2 (1). Crown and throat black. Feathers on crest absent.....
.....1. S. antiquus (Gm.)–Ancient murrelet (in summer).

1. Synthliboramphus antiquus (Gm.)– ANCIENT MURRELET

Alca antiqua Gmelin, 1789, Syst. Nat., I, 2: 554 (Bering Sea); Johansen, 1934.–Trudy Tomskogo Gosudarstvennogo universiteta, 86: 254; Shul'pin, 1936. Promyslovye,okhotnich'i i khishchnye ptitsy Primor'ya. (Industrial, game, and predatory birds of the Maritime Territory): 410; Dement'ev, 1951.–Ptitsy Sovetskogo Soyuza, 2: 215.

87 Adult male and female in summer. Top of head and back of neck glossy black. On each side of the crown and nape is a garland of long narrow white feathers running above and behind the eye. Sides of head coffee-black, upper parts slate gray. On the back of the neck, rows of short narrow white feathers frequently appear. Chin, throat, foreneck and flanks coffee-black. Sides of neck, crop and entire under part – white, but sides of crop are black,striped with narrow white elongated feathers. These frequently appear also in the anterior interscapular region. Remiges and rectrices dark brown. Inner vanes of primaries white at the base. Marginal upper coverts sooty-black; the others – slate gray. Under coverts white, axillaries dark brownish. Iris dark brownish, bill grayish white with light-bluish tint. Crest of bill black (Figure 46). Inside of mouth pale bluish white. Feet light gray with dark-gray webbing and black claws. Adult male and female in winter. Throat and foreneck white; chin gray. The short white feathers on the head and the sides of the neck are generally absent, and only a few of them appear casually in birds which underwent molt in the fall, to be finally shed before the spring molt. Flanks grayish with white edging. Otherwise as in summer. Downy nestlings are black above, bluish gray at down tip, this color being reflected on back and crown. Sides of head and patch under eye black; small white spot behind ear. Under parts white. Young birds in juvenile plumage donned after the down stage are similar to adults in winter. On the sides of the crown and on the nape is a distinctly visible garland of off-white feathers that are shorter than in adults, and a few short narrow whitish feathers on either side of the crop. Flanks grayish brown. Upper parts blackish gray, darker than in adult winter and summer plumage. Young birds in first winter

plumage can barely be distinguished from adults in winter, except for many dark brownish-gray feathers on flanks – perceptible beneath the folded wing – and a darker chin. White feathers with brownish-gray tips extend from chin to throat. Bill is less deep than in adults.

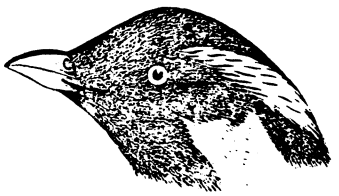

Figure 46. Ancient murrelet, Synthliboramphus antiquus

Measurements: wing length of males and females 127 to 140 mm. Tarsus 24.5 to 27.2 mm. Bill from naris to tip 12.0 to 14.2 mm. Weight approximately 200 g.

Distribution. Nests in limited numbers along the entire coast of the Maritime Territory from Poset Bay and Russian Island to Tatar Strait, where it is very common, except in the northern part. Along the Sea of Okhotsk breeding sites were found only on the Mal'minskie Islands (at Ayan). Although it has been seen on the Shantarskie Islands, nests have not been found there. It does not nest along the Asiatic coast north of Ayan, but was captured on the Penzhina River at its confluence
88 with the Belaya River, probably when passing the area on its migration. It inhabits the Kuril Islands (eggs were found on Iturup and Ptichii Islands, south of Shikotan, and downy nestlings were seen on Paramushiri Island), southeastern Kamchatka; north to Avachinskaya Bay, and the Commander Islands*. Is rare on Sakhalin, and nesting sites have not been established there. According to Gizenko (1955), an ancient murrelet was seen in late June at Cape Terpenie, another in late May at Cape Kuznetsov, one was taken in mid-August near Lake Chipezani, and another on 7 July, 1910, in Pilevo Bay (east coast of Sakhalin). Outside the USSR, it nests in southern Alaska, on the Aleutian and Pribilof Islands, and along the American coast south to British Columbia. It also breeds on the east and west coasts of Korea and on the north coast of China (at Shantung).

Winters partially within the boundaries of its nesting range. Was encountered in January at the Commander Islands and at Cape Crillon on Sakhalin, and in October and November in Aniwa Bay. Dybovskii and Godlevskii encountered adult and young birds in the Abrek Bay between the months of November and March (Tachanovskii, 1893). Migrates via Japanese waters, occasionally south to Taiwan Island and along the American coast to California (Figure 47).

Habits. It is very common in early April in the Tatar Strait. At the Commander Islands it becomes considerably more abundant early in May.
89 Fall migrations were noted in November. In winter it migrates to the sea, staying near to the shore, but does not enter bays and inlets. In summer it stays in more shallow sheltered places, and frequents bays and coves protected from storms. When swimming, it dips the bill briefly into the water as if in search of prey. It dives relatively seldom and can cover only short

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* The summaries mention an ancient murrelet from Krest Bay which was actually a [specimen of] Brachyramphus brevirostris taken there on 28 May 1931, and was mistaken for Synthliboramphus antiquus. The specimen belongs to the collections of ZIN AN.

distances under the water. It feeds on small invertebrates obtained from the surface of the water.

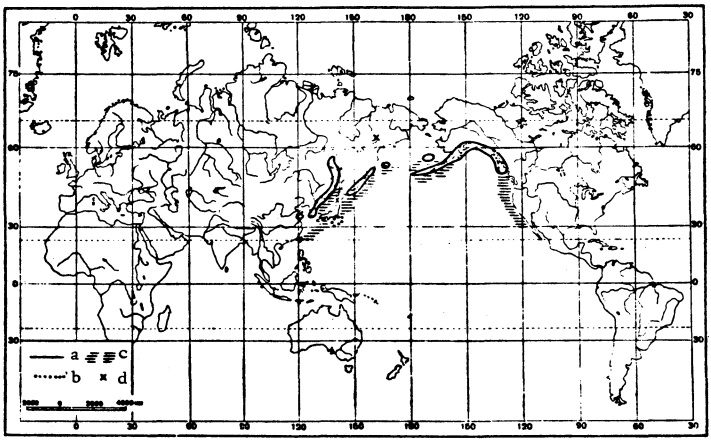

Figure 47. Distribution of the ancient murrelet Synthliboramphus antiquus, and the crested murrelet S. wumizusume

a-nesting range of S. antiquus; b-nesting range of S. wumizume; c-migration routes; d-places visited by migrants

Its flight is swift and direct, just above the water, from where it takes off with ease. From land it takes off against the wind, in calm weather only from cliff ledges and rocks. Ancient murrelets stay very quiet in little flocks without raising their voices. Sometimes they whistle in their nests, or trilling sounds can be heard. They breed in colonies, often in the company of other Alcae, preferably with Aethiae. They make their nests in crevices and passages, amid rocks, in abandoned puffin burrows or in grassy turf layers, where they dig a narrow passage half a meter long amid the tangled dry and fresh blades leading to a wider chamber where they lay their eggs. The nesting sites are either near the water or at a distance of 100 to 200 m from the sea. Nests made on cliffs and rocks are without any lining, but the burrows amidst grass have the bottom covered with dry stalks (Bent, 1919).

The clutch contains one or two eggs. In the spring both male and female develop a single brood patch. There is an interval of several days between the first and second egg. Incubation seems to begin after the laying of the second egg, since the nestlings hatch at the same time, or with a one-day interval. Ancient murrelets brood steadily, and in most cases can be seized from the nest. Both parents participate in incubation, relieving one another during the night hours. The egg shape varies from oval-elliptical to an elongated cylindrical oval. The shell is smooth, slightly glossy, and of a fine granular texture, with fairly deep pores. The ground color ranges from bluish white, creamy white or olive-white, to ocher, rusty or grayish, and is marked profusely with brownish, ocher, and lilac-gray irregularly-shaped spots which are spread evenly over the entire surface. The eggs are 57.5

to 64.3 mm long and 35.7 to 42.0 mm wide. In the De-Castri Bay (Tatar Strait) eggs in an advanced stage of incubation were found on 23 June. The average length of the incubation period was established as 32 days on the basis of Ishizawa's observations (Austin, 1948) of 17 pairs of breeding ancient murrelets on Shishihatsu Island off the southwest coast of Korea.

Downy nestlings were found on 23 August near Ayan and on 4 August on Paramushiri Island. On 8 August in Taba Bay (northern part of the Maritime Territory) a nestling was found in juvenile plumage with still undeveloped wings (the primaries just emerging from papillae) and some down remaining on the dorsal feathers, but with normal-sized rectrices (ZIN AN).

Heath (1915) observed the breeding habits of ancient murrelets on Forrester Island (southeastern Alaska) and noted how within a couple of days after hatching the nestlings went into the water, usually during the night hours, so that this procedure could be watched only with torchlights. While the adults swimming along the shore entice the young with uninterrupted whistles, the latter hasten to the sea, climbing over the uneven rocky ground or grass and tangled brushwood. In stormy weather the waves sweep them off the low ledges, but they dive with ease through the surf and soon emerge beyond the tide line. A similar description of the early departure of nestlings from land to sea is given by the Japanese observer Ishizawa (quoted before), who watched the birds in 1933 in southwestern Korea. S.I. Snigirevskii said, however, that during his observations on the Mal'minskie Islands downy nestlings never appeared on the water, whereas young birds in juvenile plumage were frequently seen swimming near their nesting sites. Littlejohn (Bent, 1919: 136) saw adult ancient murrelets in the company of young birds of "half-normal size" on the open sea, 400 to 500 miles from the Kuril Islands, though their undeveloped wings could evidently not have supported them in flight. The author pointed out that young ancient murrelets dive and swim like adult birds through the deeper layers of the water, whence they reappear as rapidly as the latter and at the same place where the parents have emerged.

In Russian territorial waters, complete molt of adults occurs in September and October, judging by the still unchanged summer plumage of the specimens in ZIN AN collections obtained on 22 August near the Mal'minskie Islands. Ancient murrelets found in late October in Nakhodka Bay (Maritime Territory), near Ayan, and on 21 October in Petropavlovsk on Kamchatka were all clad in winter dress, although on the throat and crown the feathers were still in papillae.

Partial spring molt of adults occurs in April. A male taken on 28 April on Honshu Island was undergoing intensive molt of the small winter feathers on head, neck, back, throat, crop and breast. Some specimens may change before the month of April. A bird taken on 30 May in the Gulf of America (Vladivostok) had shabby summer feathers, especially on the back.

In September and October young birds change from juvenile plumage into the first winter plumage. An ancient murrelet captured on 18 October on Bering Island wore its first winter plumage; a few coronal and interscapular feathers were still in papillae. One-year-old birds do not undergo spring molt. Among the first winter feathers, a few short white narrow feathers appear above and behind the eye. This accounts for the fact that one-year-old birds are distinguished in summer by their shabby winter plumage,

as confirmed by the two specimens caught on 25 July in Pkhusun (Maritime Territory)*.

2. Synthliboramphus wumizusume (Temm.)– CRESTED MURRELET

Uria wumizusume Temminck, 1835, Pl. col.: 579 (coasts of Korea and Japan); Buturlin, 1934, 1: 193; Dement'ev, 1951.–Ptitsy Sovetskogo Soyuza, 2: 217.

Adult male and female in summer. Forehead black; crown and nape white. Crest of long narrow black feathers on forehead. Sides of head and stripe curving backward grayish black. Front of throat gray. Sides and back of neck black interspersed with narrow white feathers. Rectrices blackish gray. Half of the inner vanes of primaries, from the base upward, white. Under parts white; flanks black, with some gray. Otherwise similar to ancient murrelets. Iris dark brownish; bill and feet grayish. Adult male and female in winter. Crown and nape grayish black; crest on forehead absent. The remaining parts are similar to those of ancient murrelets in winter. Downy nestlings brownish gray above; back and rump marked with barely visible grayish-white stripes. Under parts white. Young birds in juvenile plumage are not described.

91 Measurements: wing length of males and females 126 to 136 mm. Tarsus 24 to 26 mm. Bill from rictus 16.5 to 18.0 mm.

Distribution. It nests on the small islands east of Honshu Island. Casually seen passing through South Sakhalin and the Kuril Islands. Was once found on 20 April off the southeast coast of Korea.

In view of its rarity, little is known of the habits of the crested murrelet. The clutch contains two eggs. The ground color is yellowish or pinkish, sometimes grayish white, spotted with bluish gray and brown. According to Jourdain (Hartert, 1922), the eggs are 52 to 56 mm long and 33.6 to 36.0 mm wide.

6. Genus BRACHYRAMPHUS Brandt – MURRELET

Brandt, 1837, Bull. Ac. Sc. Petersb., II: 346 (type – Colymbus marmoratus Gm.)

Medium-sized genus of Alcae, feeding on marine invertebrates and optionally on fish, which it catches not far below the water surface. As in Synthliboramphus (as indicated before), the fore limbs of the present-day Brachyramphus are highly specialized for paddling in the depths of the water, and are not adapted to the hunting of small prey. Nests in the open on cliffs, sometimes distant from the seashore. Travels with difficulty on land. The bill is slender and graceful, very short in certain species. The edges near the tip of the upper mandible bear distinct incisions. The nares are rounded. The rictal feathers extend to the posterior edge of the nares. The tarsus is stout and very short – about the length of the two main phalanges of the

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* All these data are based on materials from ZIN AN collections.

middle toe (Figure 48). The tail is made up of 14 rectrices of equal length. The wings are very narrow and pointed. The ratio of the length of the wing to its tip is 1.9 : 1.

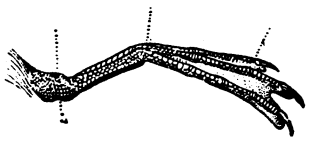

Figure 48. Ratio of length of tarsus to toes in a species of the Brachyramphus genus

The tarsus is almost the same length as the two main phalanges of the middle toe.

The skeleton, especially the cranial structure, is closely related to that of the genus Synthliboramphus, but the pelvis is comparatively shorter and broader than in the latter. There are seven free caudal vertebrae.

Young birds are clad in juvenile plumage, which they exchange for the first winter plumage in the first fall. Spring molt involves the small feathers of the mantle. The feathers are the same size in every age group and at every season. Representatives of the genus range along the Asiatic and American coasts of the Northern Pacific, and partly also along the polar coasts of both continents that are nearest to the Bering Sea; they advance southward to Vladivostok and the Gulf of California.

Of the four known species, two nest in the USSR; the other two species – B. hypoleucos Xant. (which modern American ornithologists classify as a separate genus Endomychura) and B. craveri Salvad. – nest only in North America.

Key to the Species

1 (2). Rectrices either uniformly black-brown, or outer rectrice edged with very narrow white margin (Figure 49a). Minimum bill length
92 from external naris to tip 12 mm.....
.....1. B. marmoratus (Gm.) – Marbled murrelet.

2 (1). Outer rectrices white, or mostly white with black-brown spots (Figure 49b). The middle [feather] pairs black-brown. Maximum bill length from external naris to tip 11 mm.....
..... 2. B. brevirostris (Vig.) – Kittlitz's (or gray) murrelet.

1. Brachyramphus marmoratus (Gm.) – MARBLED MURRELET

Colymbus marmoratus Gmelin, 1789, Syst. Nat. 1, 2: 583 (Prince William Sound, southeast coast of Alaska); Shul'pin, 1936. Promyslovye, okhotnich'i i khishchnye ptitsy Primor'ya (Industrial, game, and predatory birds of the Maritime Territory): 409; Averin, 1948. –Trudy Kronotskogo Gosudarstvennogo zapovednika, 1: 80; Dement'ev, 1951. – Ptitsy Sovetskogo Soyuza, 2: 210.

Adult male and female in summer. Entire upper part brownish black with rusty or yellowish-buff margins. Sides of head, front and sides of neck, and under parts white, edged with broad dark-brown margins. Flanks almost entirely dark brown. Upper coverts dark brown, occasionally with narrow white edges. Under coverts and axillaries brownish

gray. Rectrices brownish black, occasionally with narrow white margins and brownish dots on outer rectrices. Iris dark brownish, bill has dark-colored horny cover (Figure 50), feet flesh pink. Webbing between toes and rear of tarsus black.

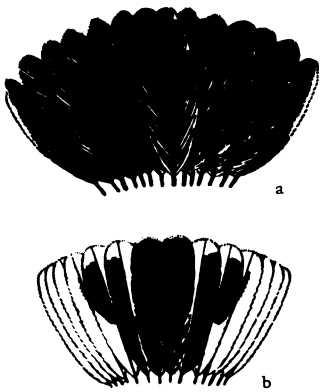

Figure 49. Rectrices of murrelets

a-Brachyramphus marmoratus; b-Brachyramphus brevirostris

Adult male and female in winter. Dark brownish above, with bluish-gray margins, scapulars largely white. White ring around eye. Sides of head and band around neck, extending almost to nape, are white. Under parts white, flanks sprinkled with brownish feathers. Downy nestling not described. Young birds in juvenile

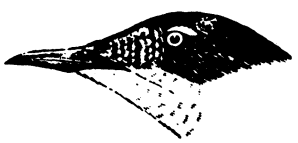

Figure 50. Marbled murrelet, Brachyramphus marmoratus, in summer plumage

plumage uniformly dark brownish above, scapulars white with dark margins at tips. Under parts and sides of head white, mottled with blackish brown, which does not conceal white ground color. Under coverts brownish gray with some white. White bars on outer rectrices. Inner vanes pale brownish. Young birds in first winter plumage similar to adults in winter, but they have more brownish above and the bluish-gray margins are less visible. Under parts mottled with brown.

93 Measurements: wing length of males and females 119 to 148 mm. Tarsus 14.0 to 18.1 mm. Bill from external naris to tip 12.5 to 20.2 mm.

Distribution is little known, as up to now the nests and nesting grounds of the marbled murrelet have never been found. In summer it was seen on the water near the east coast of Kamchatka, on the Kuril Islands, on Sakhalin (Chaivo Bay, Chipezani Lake, Terpenie Bay, all in the Makarov region), in the Sea of Okhotsk, Tatar Strait, the southern part of the Maritime Territory, and Hokkaido. On the American side it is known to occur near the Aleutian Islands, in southern Alaska, and on the North American coast south to California (Figure 51).

Of the two known subspecies, one breeds in the USSR, the other belongs to the American fauna and only occasionally visits Russian territory.

Habits. Our knowledge regarding the life habits of marbled murrelets in Russian and American waters is very limited. On the basis of our scanty information, we may conclude that during the summer feeding season they stay in pairs or form little groups in the company of Synthliboramphus in small sheltered bays and inlets. Their calls are loud and chipper; on the water and in flight they frequently utter brief recurrent sounds –

"mi-ir, mi-ir". Their food consists chiefly of small fish, mollusks and crustaceans.

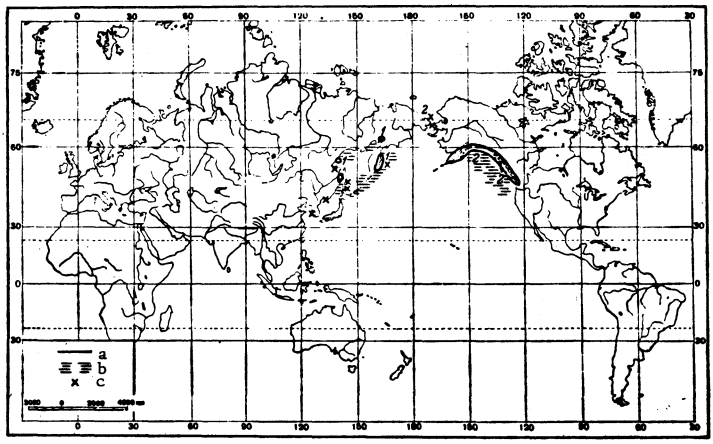

Figure 51. Distribution of the marbled murrelet, Brachyramphus marmoratus

1-B. m. perdix; 2-B. m. marmoratus; a-boundaries of nesting sites; b-migration routes; c-places visited by migrants

When rising from the water, the little birds fly swiftly and very low, often skimming the surface with their bellies, but they sometimes play high up in the air. Usually they become more animated at dusk when, flying over small islands, they head inland. Dawson (1940) watched small flocks of murrelets on the Californian coast in May, June, and July, traveling inland from the sea during the evening hours (around 1900 hours) and again descend-
94 ing the valley to the sea at dawn (0415 hours). Once he saw a flock of marbled murrelets in the air. He recognized them by their characteristic calls, 30 km from the sea, where they were heading. He believes that they breed in the Trinity Mountains in Northern California at a considerable distance from the coast. Other American observers (Bent, 1919) encountered marbled murrelets during the breeding season mostly near high forested shores. According to Bent, the local population believes that they make their nests amid forested mountains.

The only unlaid egg to have been taken from the ovary of a captured B. marmoratus from Prince of Wales Island (thus leaving no doubt as to its origin) has an oval-cylindrical shape, pale-yellowish ground color evenly dotted with fine grayish-brown spots. Another egg was found on rocks 108 km north of Nome (at Norton Sound, Alaska) which resembles the previous one in general coloring and shape. It may therefore be a marbled murrelet egg. It measures 60.5 by 37.5 mm.

1a. Brachyramphus marmoratus perdix (Pall.) – Asiatic marbled murrelet

Cepphus perdix Pallas, 1811. Zoographia Rosso-Asiat., II: 351; Bergman, 1935, Zur Kenntnis der Nordostasiatischer Voegel: 148; Dement'ev, 1951. – Ptitsy Sovetskogo Soyuza, 2: 211.

A large, comparatively pale-colored subspecies. In the summer adults have yellowish-buff margins on the upper parts, which in winter turn bluish gray and are lighter than in the American subspecies.

Measurements: wing length of males and females 131.5 to 148.0 mm. Bill length from external naris 17.2 to 20.2 mm.

Distribution. It can be assumed with considerable certainty that this subspecies nests along the east coast of Kamchatka, where it is very frequently encountered during the nesting season, extending south to Avachinskaya Bay. In the region of Petropavlovsk a young bird in juvenile plumage was taken. Its wings were not fully developed (ZIN AN). There is also reason to believe that it breeds on the coasts near the Sea of Okhotsk – a murrelet was taken in July in the Penzhina Estuary, and another at Ayan on 24 August. ZIN AN materials contain a marbled murrelet specimen from the collection of I.G. Voznesenskii, with the undated label "Sea of Okhotsk". Its flight and tail feathers had been shed and the new feathers were just emerging from papillae.

Other specimens collected during the nonbreeding season originated in Litke Strait (northeastern Kamchatka) from 18 August; on Mednyi Island from 11 May (on the Commander Islands murrelets are rare and certainly do not breed); in Sakhalin; in Chaivo Bay from 4 June, in Terpenie Bay from July, and in Aniwa Bay from 23 September. Shul'pin found a dead murrelet on 7 August 1936, in Taba Bay (north of De-Castri Bay in the Tatar Strait), and captured two birds in De-Castri Bay on 3 and 10 July respectively. A young female fledgling with traces of down on some feathers was taken on 30 July at Cape Tumannyi (Belopol'skii, 1955) and on 1 June a murrelet was captured in Wrangel Inlet in the Gulf of America (Vladivostok). Murrelets have also been found at the Kuril and the Shantarskie Islands
95 (dates unknown). During the nonbreeding season they travel within their range, and appear at the coasts of Japan, where they have been repeatedly captured at Hakodate and Yokohama. On 13 June, 1933, an apparently immature migrant bird was captured near southwestern Korea.

Habits have not been studied. A young murrelet, its wings not full grown, was captured in mid-August at the coast of Kamchatka.

Some adults undergo complete fall molt during the first 10 days of August. A female taken on 7 August in the northern part of Tatar Strait (Taba Bay) shows an intensive growth of new feathers on her under parts, but flight and tail feathers were unchanged. Another female from the Sea of Okhotsk had already shed her flight and tail feathers by 31 August, and the small body feathers on her under parts were mostly in papillae. In some adults molt is delayed, and they wear full summer plumage in late August with no traces of molt (on Litke Strait on 18 August and at Ayan on 24 August) (ZIN AN materials).

1b. Brachyramphus marmoratus marmoratus – American marbled murrelet

Colymbus marmoratus Gmelin, 1789, Syst. Nat., 1, 2: 583 (Prince William Sound, southeastern coast of Alaska); Dement'ev, 1951. –Ptitsy Sovetskogo Soyuza, 2: 212.

One of the smaller subspecies, distinguished from the previous one by darker coloring on the upper parts. In summer, the feathers of adults are edged above with rust-colored margins, in winter with gray-blue ones.

Measurements: wing length of males and females 119.0 to 131.5 mm. Bill length from external naris 12.5 to 14.6 mm.

Distribution. In the USSR it was captured only during migrations – on 19 May at the Diomede Islands in Bering Strait (ZIN AN) and on Idlidlya Island in Kolyuchin Bay (northern Chukot Peninsula on an unknown date (Bent, 1919). It nests on the eastern Aleutian Islands, in southern Alaska, and along the American coast south to Puget Sound in the state of Washington, and, according to Dawson (1940) as far as California.

Habits. The American murrelet appears in the northern parts of its range in the first 10 days of April. Some birds winter on the islands of Sitka and Kodiak, where they were frequently captured in January (ZIN AN). Mass departure from northern nesting grounds begins in September.

Breeding in the region of the Prince of Wales archipelago during the last 10 days of May was confirmed by the finding of an egg taken from the ovary of a female murrelet on 23 May. ZIN AN collections contain young birds (whose wings are not full grown) that were taken in California on 12 August, and at Sitka on 5 November.

Complete molt of adults generally takes place in September and October, and may extend into November. Partial spring molt begins in April and is completed by the end of May. On 29 April a male from Sitka was in the stage of intensive molt. The molt may be delayed until June, especially in young immature birds, as shown by a male murrelet obtained on 31 May from the Diomede Islands. There were many new partially developed summer feathers in papillae on the upper parts, but most of the short body feathers above and below still remained from the winter plumage (ZIN AN).

2. Brachyramphus brevirostris (Vig.) – KITTLITZ'S MURRELET

Uria brevirostris Vigors, 1828, Zoological Journal, IV: 357 (Mexico); Thayer and Bangs, 1914, Proceedings of the New England Zoolog. Club, 5: 8, Bailey, 1948, Birds of Alaska, Colorado Museum of Natural History, 8: 258; Dement'ev, 1951. –Ptitsy Sovetskogo Soyuza, 2: 213.

Adult male and female in summer. Upper parts of the body slaty black with rusty spots at tips. Sides of head and under parts white with
96 black-mottled tips and subterminal buff patches. Center of chest and abdomen lighter in color. Sides of head, chin, throat, crop region, and flanks very densely mottled with black. Remiges and upper coverts dark brownish; secondaries tipped with white. Under coverts and axillaries smoky brown. A few outer rectrices white (number varies), other rectrices, including middle pair, grayish brown tipped with white. Iris brownish, bill

black, feet yellowish gray. Adult male and female in winter. Upper parts dark bluish. Inner humerals white. Sides of head, including eye region, collar curving backward to nape, and entire under surface white. Grayish-brown collar at crop region interrupted in center. Description of downy nestling missing. Young birds in juvenile plumage are similar in color to young murrelets, but are distinguished by a small short bill and white outer rectrices. Young birds in first winter plumage are lacking in collections of the ZIN AN and are not mentioned in ornithological literature.

Measurements: wing length of males and females 126.0 to 142.6 mm. Tarsus 15.5 to 18.0 mm. Bill length from external naris to tip 7.9 to 10.5 mm.

Distribution. It nests along the southern and arctic coasts of Chukot Peninsula northwest to Wrangel Island inclusively; also on the Diomede Islands in the Bering Strait. A specimen was captured in Krest Bay on 28 May and in Providence Bay on 6 August. Not found on the Anadyr coast. A migrant bird less than one year old was taken in Karaginskii Bay (northeast Kamchatka), and another murrelet on 12 July on its migration near Paramushiru Island. Very rarely encountered on the Kuril Islands.

Outside the USSR it nests along the coasts of Alaska, from the Glacier Sound in the southeast, where it is very common and nests regularly, to Cape Burrow. Eggs were found 8 km offshore in the mountains of Cape Prince of Wales. At the Little Diomede Island murrelets were obtained on 3 June. Nesting has not been established at Cape Burrow, though they were encountered there from August to October, as well as early in May and on 10 and 15 June (Figure 52). In winter they were observed migrating only along the coasts of Kamchatka and the Kuril Islands; southward migration on the American coasts was never registered.

Habits have hardly been studied. Apparently they return from their winter migration in April, since they are encountered at the end of the month in the Bering Strait. The Kittlitz's murrelet flies very swiftly, and rises with ease from the water. During the nonbreeding season, flocks of several hundreds of murrelets have been observed in the Glacier Sound region. Their diet consists of small crustaceans.

Their breeding grounds are high up on mountain cliffs, above the forest line. The egg is laid on the open bare rock. In Alaska eggs were found
97 in late May and on 10, 16, and 29 June. The eggs are 57.6 to 62.1 mm long, 35.6 to 36.8 mm wide. The ground color is yellowish gray or olive gray, spotted with light and dark brown.

The dates of complete fall molt are not definitely known. A bird found at the beginning of August in the north of Chukot Peninsula (ZIN AN) was in full summer plumage. Partial spring molt of adults is completed by the end of May in the south of Chukot Peninsula. A murrelet from Krest Bay had summer feathers on 28 May projecting from follicles on head, neck, back and crop. Immature birds molt later; a murrelet in winter plumage which was captured on 20 May while crossing the Karaginskii Bay (northeast Kamchatka) had only its crop feathers renewed (ZIN AN).

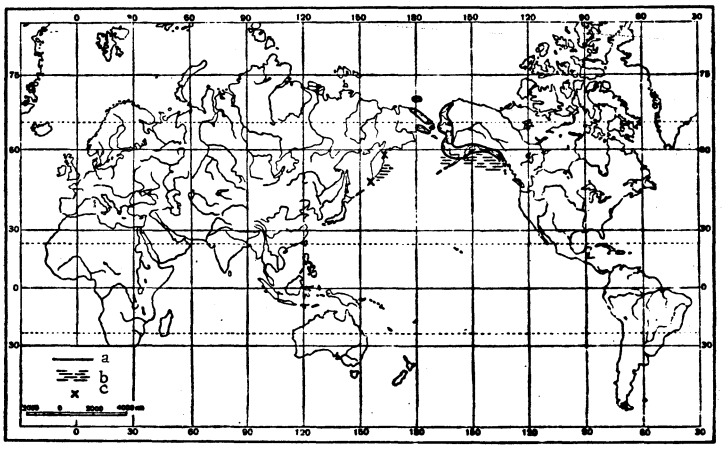

Figure 52. Distribution of the Kittlitz's murrelet, Brachyramphus brevirostris

a-boundaries of nesting sites; b-migration routes; c-places visited by migrants

7. Genus FRATERCULA Briss. – PUFFINS

Brisson, 1760, Orn. I, VI: 58, 81 (type – Alca arctica L.)

These are large Alcae representatives, feeding on fish and marine invertebrates. They breed in burrows which they dig themselves by splitting the soft ground with the bill and throwing out the soil by means of the feet. To serve these functions (and possibly also others hitherto unknown), the puffins developed a powerful large bill and a modified skull structure. The larger size and greater strength of the hind limbs was an adaptive feature for digging nest holes, and also for the comparatively longer stay or motion of the puffins on land. The shape of the pelvis also changed accordingly and became broader. The wings are as highly specialized for underwater swimming as those of murres and razorbills.

Puffins have large stout bills, exceptionally deep and very compressed laterally. The crest of the upper mandible curves downward. The nares are slit nearest to the lower edge of the upper mandible. The feathered lore extends almost to the posterior end of the naris, but is covered in summer by a porous horny plate. Several transverse grooves cross the terminal part of the bill (usually three on the upper and two on the lower mandible). During the spring-summer season a transverse protruding roll bordering the feathered rictus and the lores develops at the base. The space between this roll and the grooves over the end of the upper mandible is covered with a thick horny plate that extends down to the naris. Beneath the naris and along the lower margin of the upper mandible is a narrow horny plate. There is a narrow transverse plate on the upper part of the lower mandible. At the corners of the mouth lies a rosette-like ornament formed by soft skin wrinkles. Above and below the eye are also small epidermal ornaments

(Figure 53). During general fall molt, the separate horny plates and the roll at the base of the bill are shed, thus reducing the size of the bill and shortening the rhamphotheca. The thick triangular plate above the nostril between the basal roll and the terminal part is also shed; by retaining only the horny sublayer of the rhamphotheca, the base of the upper mandible actually becomes thinner. The narrow longitudinal band beneath the naris and the thin transverse band at the base of the lower mandible, which borders the rictus and the upper horny layer of the basal part of the lower mandible, are cast off separately. The rosette at the mouth corners is shed and the epidermal eye adornments wither away. The terminal part of the bill with the transverse grooves, however, retains its size in winter and summer alike, since, like the majority of birds, the wearing off and replacement of this "permanent" portion of the rhamphotheca proceeds gradually.

The wings of puffins are pointed and narrow. The proportion of the length of the wing to the tip is 1.95. In F. corniculata the length of the wing
99 skeleton comprises 204.1 % of the body length. The tail, which is composed of 16 rectrices, is slightly rounded. The tarsus, which is slightly longer than the two main phalanges of the middle toe, is webbed and covered with a row of transverse scales.

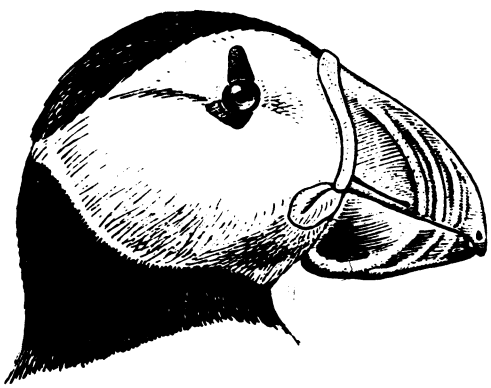

Figure 53. Puffin, Fratercula arctica, in summer

In skull structure puffins differ considerably from all the Alcae previously described (razorbills, murres, guillemots, etc). The principal differences consist in the following features: the postorbital bar is almost vertical (not bending forward in the upper part), thus reducing the size of the skull case. The postorbital process of the squamosal bone is wing-shaped; both edges – the anterior and posterior ones – are free (Figure 9). The supraorbital portion of the skull is very narrow. The supraorbital cavities, which lack upturned edges, are also narrow and have not enough room for the rhinal glands. In puffins these glands are greatly enlarged and protrude outside the cavities for more than half of their width. The supraorbital processes of the lachrymal bones are short and are fused with the frontal bones (Figure 6). The cavities and crests on the squamosal and parietal bones are not very well developed and serve as attachments for the mandibular muscles which articulate with the lower jaw muscles (m. adductores externus profundus and m. pseudotemporalis superficialis) (the reasons for the underdevelopment of these mandibular muscles in puffins were stated before in the general characterization of the suborder). The zygomatic process attains considerable dimensions. The clearly defined lateral processes of the basisphenoids, on which rests the inner process of the quadrate bone (Figure 54a), provides additional support to the lower jaw and is necessary for strengthening the lower mandible in connection with its function of digging burrows. (Similar supplementary strengthening of the lower jaw is noted in Lunda). The premaxilla forms an elevated projection or hump (involving also the frontal processes of the

bone), which varies in shape and size in the different species of the genus (see description of species).

The pectoral bone is wider in its posterior half. The metasternum projects into a broad tongue-shaped keel. On either posterior edge of the sternum is an incision and a fontanel varying from very large to diminutive sizes in different species, and even in different individuals belonging to the same species. The pelvis is relatively shorter and broader than in other Alcae, such as murres and razorbills, owing to the adaptive modification of the puffin's hind limbs in connection with their function as digging apparatus. The use of the feet for shoveling and removing the soil when digging burrows affects the position of the inner toe and causes the powerful development of the claw in puffins and other alcidine nest holers (Figure 55a). When the bird stands on land resting on the toes, the inner toe and claw lie flat on the ground, with the sharp claw end pointed inward. This reversed position of the inner toe which, together with the connective webbing, forms a kind of spade, is very efficient in grabbing loose soil. The hind limbs (excluding the toes) are accordingly very long; in Fratercula arctica they comprise 149 % and in F. corniculata 152.3 % of the body length.

Young birds do not have a specific juvenile plumage. The first feather covering following the down is worn throughout the winter (Salomonsen, 1944); its small body feathers are 5 mm shorter than in adults and have a less fluffy aftershaft (ZIN AN). The short mantle feathers of adults do not vary in length at different seasons. Spring molt of adults involves the feathers on head and neck (Dement'ev, 1951), based on materials of the Zoo-
100 logical Museum of Moscow University). According to Salomonsen (1944), molt of Fratercula varies in different individuals. Some puffins undergo normal postnuptial molt and partial spring molt which replaces the head and neck feathers; others change these feathers in the fall and undergo full molt, including the remiges, in the spring. These data cannot be properly checked on the basis of ZIN AN materials.

Representatives of the genus range in the northern part of the Atlantic, the Atlantic sector of the Arctic, and along the continental and island coasts in the northern Pacific Ocean.

There are two known species of this genus, both of which belong to the fauna of the USSR.

Key to the Species

1 (2). Front of chin, throat, and collar uniformly brownish black, regardless of age and season. . 2. F. corniculata (Naum.)–Horned puffin.

2 (1). Chin and throat light gray, whitish gray, or gray, and lighter than the dark brownish or brownish black, regardless of age and season. . . . . 1. F. arctica (L.) – Atlantic puffin.

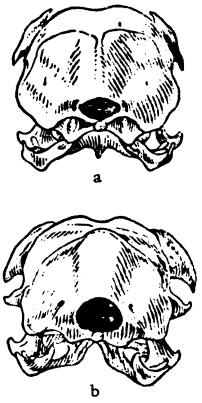

Figure 54. Skulls of a puffin and a murre (posterior view)

a-Fratercula arctica; b-Uria lomvia

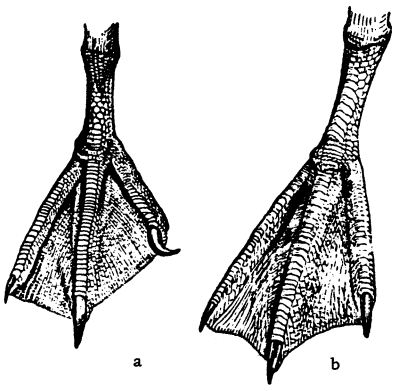

Figure 55. View of right feet

a-of puffin; b-of murre

1. Fratercula arctica (L.) – ATLANTIC PUFFIN

Alca arctica Linnaeus, 1758, Syst. Nat., ed. X, 1: 130 (Norway); Menzbir, 1895, 1: 48; Salomonsen, 1944, Goeteborgs Kungl. Vetenskaps Handlingar, Ser. B, III, 5: 109; Kaftanovskii, 1951, Trudy Gosudarstvennogo zapovednika "Sem' Ostrovov", 1: 54, 69-70; Gerasimova, 1951. –Uchenye zapiski Moskovskogo gorodskogo pedagogicheskogo instituta imeni V.P. Potemkina, XVIII: 115; Dement'ev, 1951. –Ptitsy Sovetskogo Soyuza, 2: 229.
1951,

The terminal part of the rhamphotheca, which remains unaffected by seasonal molt, is very large and constitutes the major part of the upper man-
101 dible, extending along its keel almost to the rictus; for this reason the outline of the crest of the upper mandible is the same in summer and in winter.

The skull of Fratercula arctica is distinguished by the following specific features. The premaxilla forms a high elongated projection which extends almost over the entire length of the upper mandible and breaks off abruptly above the posterior naris, near the anterior edge of the frontal bone (Figure 56). The nostril openings are almost triangular, with narrow external edges. The lower mandible is elevated in its preterminal part, and in its deepest part the crest forms a sharp projection at an obtuse, almost right angle.

Adult male and female in summer (Figures 53 and 57). Head above grayish brown or dark slate gray. Sides of head, including parts of crown above eye, chin and throat, whitish gray. A narrow band of gray feathers runs backward to the nape. Along either side of the throat from the sides of the lower mandible runs a short, dark-gray, vaguely indicated, longitudinal stripe; the degree of its clearness varies in different specimens.

The remaining upper parts, wings, tail, and upper tail coverts are black or brownish black. There is a fairly wide brownish-black "necklace" on the front and sides of the neck. The rest of the under parts are white, flanks dark brown, shins marked with a brown spot. Under coverts and axillaries brownish gray. Short hornlike growth of cornified skin above the eye; narrow horizontal epidermal roll below the eye. A bulging horny plate scattered with minute pores extends across the base of the upper mandible. The rosettes at the mouth corners are formed by tiny skin wrinkles. Iris hazel-brown, naked ring around the eye vermilion, excrescent growths at eye steel-gray. Basal roll on upper mandible yellow; the adjoining triangular plate slate-gray. Permanent end of rhamphotheca red. Rosettes at mouth corners orange; inside of mouth and tongue light yellow; feet orange-red.

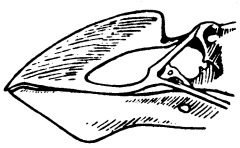

Figure 56. Bill of Atlantic puffin, Fratercula arctica, without rhamphotheca

Adult male and female in winter. Sides of head and throat dark gray, patch around the eye dark brownish. On upper parts some black feathers with grayish terminal margins. Otherwise the same as in summer. Growth around eye, roll at base of upper mandible, horny basal plate on lower mandible, and rosette at mouth corners are absent. The upper and lower mandibles are smaller at the base; the lower mandible is shaped differently in winter than in summer. The downy nestling is covered with long, soft, tender, black-brown or black down, with white or whitish-gray on middle abdominal region. Bill and feet black. Young birds in first winter plumage acquired after down stage (Figure 58) are similar to adults in winter, but darker around the eyes and on the lores. Young birds up to two years of age are distinguished from adults mainly by the size and shape of the bill, which is relatively flat. In the first fall its depth measures half of its length. The terminal part of the bill is completely smooth without any ridges in the first winter, and possibly in the first summer too, or with a single ridge in the second summer, i.e., in two-year-old birds. The crest of the upper mandible is more slanted and
102 bends less sharply at the tip than in adults. The bill is uniformly dark brownish.

Measurements: wing length of adult males and females 142 to 186 mm. Tarsus 22 to 30 mm. Length of bill from rictus to tip 40.5 to 56.0 mm; depth of bill at base (in summer) 29.2 to 42.0 mm. Average summer weight of males in East Murman 500 g, of females 485.3 g, in West Murman 510.8 g and 476.7 g respectively (L.O. Belopol'skii).

Distribution. The Atlantic puffin nests on many islands near East and West Murman, on the western coasts of Novaya Zemlya. Outside the USSR it ranges in Spitsbergen, on Jan Mayen Islands, Bear Island, Iceland, the British Isles, the coast of Brittany, the north and west coasts of Scandinavia, the south, west, and east coasts of Greenland, and in North America from central Labrador to Maine. It is found migrating near its breeding ranges, occasionally at the coasts of Kola Peninsula, frequently in southern Greenland, Iceland, and the British Isles; it advances south to the Canary Islands, the Azores and the western parts of the Mediterranean as far

as Sicily. It is encountered more frequently than other Alcae in the open sea south of Greenland and Iceland. In the American Atlantic waters it mig-
103 rates to Massachusetts and New York State. Salomonsen (1944, pp 111 and 126) mentions that an immature bird was found in the summer of 1873 in the White Sea. Kaftanovskii (1951) reports that it was encountered near Kandalaksha in the White Sea (Figure 59).

Figure 57. Atlantic puffin, Fratercula arctica, in summer

By means of banding it has been established that, on its migration, the European puffin, especially F. arctica grabae, reaches the American shores. Two puffin nestlings banded in August on St. Kilda Island in Scotland were recovered in December of the same year in Newfoundland (Lockley, 1953).

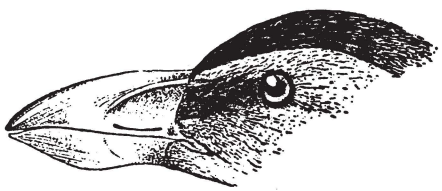

Figure 58. Young Atlantic puffin, Fratercula arctica, in its first winter

The intraspecific modifications of the Atlantic puffin are featured in the different sizes of wings and bill. The southern population is smaller, the northern bigger in size. Of the three subspecies, two nest in the USSR;

the third and smallest subspecies - F.a. grabae (Brehm) - inhabits the British Isles, the French coast, and southern Norway; its wing length is 148 to 166 mm (Witherby, 1952); the bill is 42 to 50 mm long and 34 to 38 mm deep.

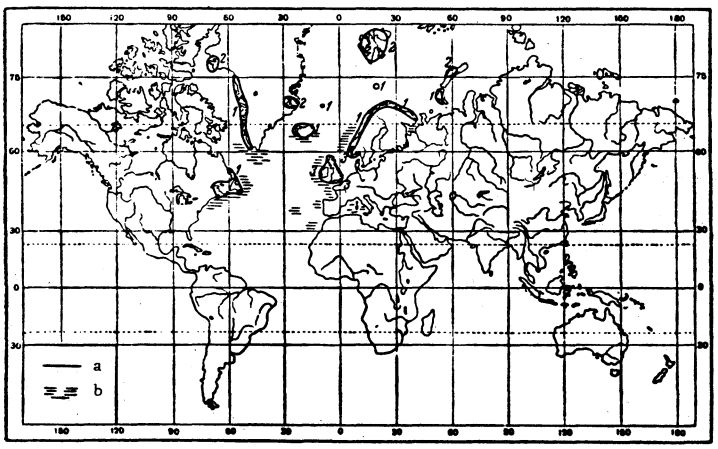

Figure 59. Distribution of the Atlantic puffin, Fratercula arctica

1-F.a. arctica; 2-F.a. naumanni; 3-F.a. grabae; a-boundaries of nesting sites; b-migration routes

Habits. Puffins return later than murres from their winter migra-
104 tion (when the breeding grounds were abandoned during the winter). The nest holes are not always free of winter snow on their arrival and the birds must wait a while before being able to settle on land. Fall migration proceeds gradually, with the departure of the birds for the water.

Puffins are more alert on land than murres and guillemots. Besides having a good walking ability, they are able to run leaning on their toes, keeping the tarsus vertical and the body in an almost horizontal position. Standing on one spot, especially in a watchful position, they always stand upright, keeping the tarsus vertical (Figure 60). The development of comparatively longer hind limbs and a broader pelvis, which facilitates movement on land is related chiefly, if not exclusively, to the puffins' nest-digging habits when preparing their burrows to serve as concealed breeding places. They have the same ability as other Alcae in swimming and diving; in flight maneuverability they surpass murres, but are inferior to guillemots. When there is no wind, launching from the water is difficult. In calm weather they rise after prolonged flapping of wings, and skim rapidly over the water, touching it with their feet as if running on the surface. On land they take off only against the wind, but from cliffs and rocks they rise directly in full flight.

Puffins are usually very silent. Their croaking growl is mostly heard during mating or feeding at sea. They are frequently found in colonies together with gulls where they occasionally become aggressive, pursuing their neighbors on and below the surface of the water and in the air. When seized

with the bare hand they defend themselves with the bill and may inflict serious injuries.

On the coasts of Murman and on the adjoining islands puffins feed largely on fish – sand eel, herring, capelins; crustaceans and polychaetes form about 30 % of their spring diet, but in the fall, invertebrates are not found in their stomachs. In the spring, sand eel and capelin predominate in the food (70 %), in the fall – herring and sand eel (100 %). On Kharlov Island puffins frequently obtain their food in summer 8 to 10 km from the shore, on the Ainovy Islands generally only 300 to 400 m away (Gerasimova, 1951), depending upon the approach of fish schools. When feeding, they gather in large buoyant flocks and in the summer they spend whole days at sea.

In springtime male puffins often fight on the surface of the water. During courting male and female stand facing each other, breasts touching. They pluck at each other's bills, and at the feathers on the head and neck, while briskly moving and bowing their heads. From time to time the male throws his head back and, without uttering a sound, opens his bill wide to display the bright yellow mouth lining. Occasionally, by pressing his upper mandible upon the base of the female's bill, he turns her head aside, while the female resists by pushing his bill away. In the end both birds are wagging their heads, and their tails are cocked up. This performance with the bill is apparently a very important moment in the courtship of puffins. It not only excites the pair involved but also attracts other puffins, which rush to the place with outstretched heads as if desiring to participate in the game, whereupon the couple separates immediately and the male attacks the nearest curious intruder, seizes his bill and pushes it around with angry growls.

Puffins nest either in colonies or in single pairs. In bird bazaars situated on sea cliffs they occupy the upper sites, preferably among peat
105 layers which frequently cover the ledges. In their southern ranges, including Murman, they nest almost exclusively in burrows, but in more northerly latitudes, such as southwestern Greenland, where the ground remains frozen throughout the summer, they make their nests in passages amid boulders, or in the crevices of cliffs. The location of the nesting grounds varies from steep cliffs to slopes and level ground, usually in thick or thin peat layers overgrown with osier, cloudberries, crowberries and annual grass crops, and may be found at varying distances from the sea – on Kharlov Island, not more than 150 meters. The burrows are laid out in straight patterns with one or several tunnels leading to a dead end which is slightly wider and serves as a nest chamber (Figure 61). Burrows with many passa-
106 ges are occupied by several pairs, but one passage may also lead to several nests, though usually these colonies have different entrances and each pair uses its own tunnel. The tunnel is usually about one meter long, but in some cases reaches 3 and even 15 meters. (The last figure was given by Gerasimova from her observations on the Ainovy Islands, 1951). The depth of the nest chamber depends upon the thickness of the peat layer, and may vary from 30 to 100 cm. The puffin prefers to settle in old burrows, which he merely repairs and makes deeper. Excavation is carried out by chipping and splitting off soil layers with the bill, which is used as a pickax (with straight downward, or sometimes slanted strokes). The broken-up soil particles are shoveled and thrown out with the feet by keeping the toes and the stretched webbing wide spread (Lockley, 1953).

The bill is stout but deep and laterally compressed and well adapted for this task. The transverse grooves at the terminal part, and the

thick horny plates which appear in the spring at the base make it a better equipped instrument. The transverse, horny roll (in Fratercula) or the fairly broad horny plate (in Lunda), which develop at the borderline of the rictus and the lores and hide the feathers, enlarge the horny surface of the bill without making it longer (which would be undesirable in view of its given function), and at the same time protect the feathers from being soiled by earth particles.

Figure 60. Puffin, Fratercula arctica

When nest-building is finished, puffins can often be seen in their colonies carrying bunches of grass stalks or leaves in their bills. They may pull out a piece of turf or a single grass blade, pick up a leaf or feather, or a pebble, and run into the nesting hole whence they reappear in a few seconds with the same material, turn around the nest entrance to disappear there again, and emerge once more, until finally they drop their load somewhere, as if having lost all interest in its use. Puffins evidently have a very strong instinct for collecting nesting material, though the effort expended does not correspond to its actual usefulness. The nest chamber is very sparsely lined. In Murman a few dry stalks, some leaves and feathers may be found in the burrows, but in the British Isles burrows usually have no lining.

Puffin burrows are dry, and the temperature inside is higher and more constant than outside. The clutch consists of one egg, rarely of two. The egg is round, whitish, faintly marked with deeply incised lilac streaks. It

is 55.6 to 68.0 mm long and 39.0 to 48.0 mm wide. Both mates participate in incubation, though the female spends more time in the nest. Direct observations have revealed that the time of uninterrupted and unrelieved brooding does not exceed six and a half hours for each partner (Kaftanovskii, 1951). Male and female each develop two brood patches. The incubation period lasts 35 days in Murman, but does not begin immediately after the egg has been laid. Lockley puts the incubation time of F. a. grabae in the British Isles at 40 to 43 days.

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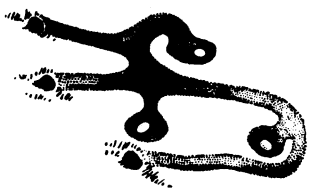

Figure 61. Burrow arrangement of Fratercula arctica (Lockley, 1953)

Nestlings are fed exclusively on fish, mostly sand eel. The parents carry 10 to 12 fish in the bill, holding them across the body and near the head. The outermost fish is placed in the rosette which lies at the mouth corners outside the beak, where the fish is securely held inside the folds of skin. The prey brought to the nest is always dead.

Natal down cover is replaced in the nest by the first winter plumage. The large feathers develop first, beginning with the remiges on the tenth or eleventh day after hatching (Kaftanovskii, 1951), or on the sixth to seventh day (Gerasimova, 1951). The tips of the rectrices start protruding on the seventeenth to eighteenth day. Down feathers, which are retained longest on the back and neck, are shed when the young leave for the water, sometimes even later. Newly hatched nestlings do not move around, but stay in the nest chambers and become more active only at a later date. Kaftanovskii found a grown nestling occupying a nesting hole which was excavated beyond the limits of the chamber. The nestling's bill was smudged with soil, which was probably proof of its casual work on deepening its habitat.

Young puffins leave the nesting hole when they are 39 to 46 days old (as observed in Murman). Then they are no longer dependent on their parents for food. (According to Lockley, nestlings are fed only up to the age of 39 to 43 days). During the last days in concealment the young bird begins to approach the entrance, but does not venture outside. After leaving the burrow, however, it never returns. Lockley observed that the departure of young puffins for the sea takes place during nocturnal hours only and that they always walk to the shore. In view of this statement it should be checked with the information provided by Kaftanovskii (who did not actually himself watch their departure) that at nest-leaving time the remiges of young birds are already fully developed.

Young birds molt only partially in the spring, and this molt seems to involve a very limited number of short feathers.

Complete molt of adult puffins begins ashore and sometimes continues throughout the winter, in which case the remiges are replaced in the spring when prenuptial partial molt also sets in*. Puffins reach maturity in the

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* Salomonsen's information (1944) – that in some birds postnuptial molt is confined to head and neck and that complete molt occurs in spring – should be rechecked.

third or fourth year. One-year-old nestlings spend the second year at sea; after the second year they appear in colonies but apparently do not yet breed (Lockley, 1953).

In the USSR, puffins are not abundant, and cannot therefore serve industrial purposes, although they should be given protection. According to the assessment made by Gerasimova (1951), there are only about 2,500 puffins in the region of East Murman, about 30,000 on the Ainovy Islands, not more than 150 on the South Island of Novaya Zemlya; no count was taken on the North Island, but their number is also limited.

Outside the USSR puffins are commercially exploited; particularly their smoked meat is used for food by the native population.

1a. Fratercula arctica arctica (L.) – Common Atlantic puffin

Alca arctica Linnaeus, 1753, Syst. Nat., ed. X, 1: 130 (Norway); Dement'ev, 1951. –Ptitsy Sovetskogo Soyuza, 2: 231.

108 Measurements: wing length of males and females 151 to 175 mm, average 162 mm. Length of bill from rictus 41.7 to 50.2 mm; depth of bill at base 34.5 to 39.8 mm.

Distribution. It nests on the following islands of East Murman: Kharlov, Bol'shoi Zelenets, Malyi Zelenets, Kuvshin, M. Litskii, and also on the Ainovy Islands, and on the western shores of the South Island of Novaya Zemlya.

Outside the USSR, it extends over the coasts of Scandinavia (excluding southern Norway), Bear Island, Iceland, southwestern Greenland northward to the 73° 38' latitude, and the American coasts in the Atlantic. In winter it occurs casually at the coasts of the Kola Peninsula, particularly at Kil'din Island and at Porchnikha.

Habits. In the region of Seven Islands (East Murman) puffins appear on the water in mid-April, but since at that time the openings of their nesting holes are still blocked with snow, they only begin to settle on land early in May.

Kaftanovskii (1951) observed that in years with normal spring conditions egg-laying starts on Kharlov Island toward 10 June, rarely in the last 10 days of May. Fresh eggs were found even in mid-July (Gerasimova), derived from delayed clutches on slopes with a northern exposure where the melting of snowdrifts at the hole entrances was delayed.

Mass hatching was reported in 1939 and 1940 on Kharlov Island from 4 to 12 July. The departure of nestlings for the water has been registered over various years in the first 10 days or in the middle of August; general nest-leaving takes place around 20 August. At the end of August, puffins start on their migration.

A specimen captured on 11 August in the bay near Malyi Zelenets Island (ZIN AN) showed that adults undergo complete molt at the beginning of this month, when the short feathers on the under parts are being replaced. As mentioned in published sources (Salomonsen, 1944), adult birds from the waters of Norway and Iceland molt in November, when the separate horny strips of the bill covering are shed, and continue molting until December or

January. Frequently the remiges are not replaced before the spring and this process coincides with the partial prenuptial molt, which begins in April. Dement'ev's data show that spring molt of puffins from Seven Islands takes place from early April to the end of May.

1b. Fratercula arctica naumanni Nort. – Large-billed Atlantic puffin

Fratercula arctica naumanni Norton, 1901, Proceedings of the Portland Society of Natural History, II: 144 (described on the basis of Naumann's sketch and therefore lacking terra typica). Fratercula glacialis Leach, Menzbir, 1895, 1: 53; Salomonsen, 1951, Grønlands Fugle, III: 410. – Mormon arcticus glacialis Naum., Koenig, 1911, Avifauna Spitsbergensis: 261.

Measurements: wing length of males and females 172 to 186 mm, average 180 mm (measurements taken of ten specimens from Spitsbergen preserved in ZIN AN collections). Length of bill from rictus to tip 49.7 to 55.8 mm; depth 40.2 to 44.8 mm.

Distribution. The single specimen preserved in ZIN AN collections which was captured on 6 August in Russkaya Gavan' (North Island of Novaya Zemlya) evidently belongs by its measurements to this subspecies (wing length 180 mm; length of bill 55.6 mm, depth of bill 45.8 mm). It can be assumed that the large-billed Atlantic puffin nests on the western shore of the North Island of Novaya Zemlya. Outside the USSR it inhabits Spitsber-
109 gen and also Greenland, where it is found on the northwest coast in the region of Thule, and on the east coast near Scoresby Sound.

We have no information on the habits of the large-billed Atlantic puffin which inhabits Novaya Zemlya. The data obtained by foreign ornithologists are also very scarce. These puffins arrive in the spring at the coasts of Spitsbergen in Horn Sound in the second half of April (ZIN AN). In Greenland and Spitsbergen they nest only in hollows amid boulders and rocks, and do not dig burrows, since the ground only unfreezes to a very small extent during the short north-arctic summer. In Zassen Sound, West Spitsbergen (72° 28' N), adult birds were seen early in July carrying fish to the crevices. This indicates that they were feeding the nestlings at that time. The first nestlings to repair to the sea were registered on 28 August near Amsterdam Island. The departure of puffins from Spitsbergen begins in the middle of September. The birds caught on 2 September in King's Bay and preserved at ZIN AN show no trace of molt.

2. Fratercula corniculata (Naum.) – HORNED PUFFIN

Mormon corniculata Naumann, 1821, Isis: 782 (Kamchatka); Stejneger, 1885, Bull. U.S. Nat. Mus., 29: 59, pl. III; McGregor, 1902, Condor, IV: 137-138; Johansen, 1934. –Trudy Tomskogo Gosudarstvennogo universiteta, 86: 256; Bergman, 1935. Zur Kenntnis der Nordostasiatischer Voegel: 152 and 256; Portenko, 1939. Fauna Anadyrskogo kraya, Ptitsy (The fauna of the Anadyr Region, Birds), II: 30; Averin, 1948. – Trudy Kronotskogo Gosudarstvennogo zapovednika, 1: 80; Dement'ev, 1951. –Ptitsy Sovetskogo Soyuza, 2: 234.

In contrast to the Atlantic puffin, the horned puffin has a relatively short vertical projection or hump of the premaxilla, about half the length of the upper mandible, and the crest ends in a more slanted bow at a

greater distance from the anterior edge of the frontal region (Figure 9). In its most elevated part the projection is level with the mid-naris. The nares are almost square, with a wide external margin. The subterminal part of the lower mandible juts out at an angle, but the curve is smoother than in F. arctica; at its highest point the crest forms an obtuse angle of about 135° (Figure 62b). In conformity with the basal bony structure of the upper mandible, the end of the rhamphotheca, i.e., the part which is not replaced during seasonal molt, is relatively short, not more than half of the length of the mandible, and it extends along the crest to the anterior edge of the broad basal plate. Consequently, after the molt of the basal plate and the shedding of the transverse horny roll at the rictus, the outline of the upper mandible changes. In adults, the base of the upper crest is parallel in winter to the mouth opening, and only the permanent part of the rhamphotheca retains the sharp downward curve. In summer, the crest of the upper mandible descends gradually, beginning at the rictus in a slanted bow, but the terminal part is as sharply hooked as in winter.

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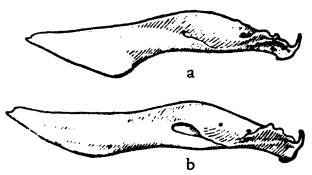

Figure 62. Lower jaw (lateral view)

a-Fratercula arctica;
b-Fratercula corniculata

Adult male and female in summer (Figure 63). Top of head dark gray, sides of head pure white, with only a narrow blackish stripe extending backward from the eye. Chin and throat brownish black merging into one dark design with the neck collar. Remaining feathering colored as in Atlantic puffins. Skin excrescence above eye long and narrow, larger than in common puffins, attaining 12 mm in some individuals. Iris brownish gray, excrescence near eye brownish black with silky luster. Naked ring around eye-red. Red terminal part of bill remains unchanged, base yellow. Rosette at mouth corners orange, feet pale red, sometimes with an orange tint. Adult male and female in winter. Lateral parts of forehead, lores and front of cheeks blackish brown; remaining head parts whitish gray; narrow black stripe behind eye. Growths around eye, rosettes, and basal roll are absent. The modifications in the upper mandible following the molt of the broad basal plate have been described above. Lower mandible smaller and shaped differently than in summer. Ring around eye and base of bill brownish, feet pale flesh-colored. Downy nestling wholly brown, center of abdomen whitish. Young birds in winter plumage acquired after down. Lores and region around eye black; both sides of head beneath and behind eye dark smoky gray. Center of throat and foreneck brownish black. Otherwise like adults in winter. The given description was taken from two horned puffins found on 19 September in Providence Bay and on 24 October in an unknwon place (ZIN AN data). Young birds in second fall (Figure 64) are similar to adults in winter, except for the terminal part of the bill, where there are no grooves. Crest of upper mandible curves gradually downward to tip.

Measurements: wing length of males and females 173.7 to 194.0 mm; tarsus 27.2 to 31.5 mm. Length of bill from rictus to tip in adults (in summer) 46 to 57 mm, depth of bill at base (in summer) 38.2 to 48.0 mm.

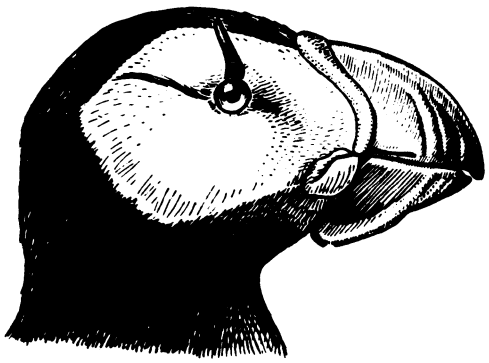

Figure 63. Adult Fratercula corniculata in summer

Distribution. Nests on Wrangel Island, on Kolyuchin Island, and
111 along the northern coast of Chukot Peninsula, east of Kolyuchin Bay, on Cape Dezhnev, on the Diomede Islands in the Bering Strait, and over the eastern and southern coasts of Chukot Peninsula; in Providence Bay and on Kolyuchin Island the horned puffin established particularly large colonies. Southward, a number of nesting haunts are known in the Anadyr Estuary, on Alyumka Island. It is common on the Commander Islands, especially on Mednyi Island; along the eastern coast of Kamchatka it is found in every place suitable for nesting. Was observed in July and October near Litke Strait. Nesting has been established on Kronotskii Peninsula. Is likely to nest southward as far as Cape Lopatka, and definitely up to Listvenichnaya Bay. Has never been found on the western coast of Kamchatka. Extends over the entire Kuril chain, but ranges predominantly on the northern and central islands; was observed nesting in Sakhalin - on Cape Terpenie, Moneron Island and Tyulenii Island. Nests along the Okhotsk coast, on the Taigonos Peninsula near Ayan (as reported orally by Snigirevskii and confirmed by data from collections of the Zoological Institute), and on the Shantarskie Islands. Was taken in July on Reineke Island in the Tatar Strait, but nests were not found in that region.

Outside the USSR it nests on the Aleutian and Pribilof islands, the islands of St. Lawrence and St. Matthew, along the south and west coasts of Alaska, north to Cape Lisburne. On winter migrations it crosses into the southern Kuril Islands and southern Sakhalin, then appears on the Commander Islands and the east coast of Kamchatka (Olga Bay), and near the Aleutians. On the American coast it travels south to the Queen Charlotte Islands.

Habits. In spring the horned puffin returns rather late from its winter migration to its breeding grounds. On Moneron Island, near South Sakhalin, and on the Commander Islands it was seen early in May, and in the Anadyr Estuary around the middle of June. In the fall it was captured in the northern part of its breeding range in the last 10 days of September (on 22 September on Kolyuchin Island and on Cape Dezhnev), which proves that migration starts only in October.

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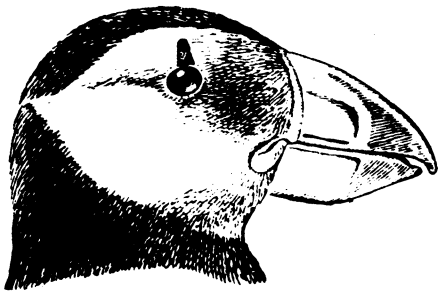

Figure 64. A young Fratercula corniculata in its second fall

In its habits, the horned puffin resembles the common puffin. Its diet consists also of fish (McGregor, 1902). In Norton Sound it feeds chiefly on Ammodytes personatus, Pygosteus pungitius and Mesopus olidus, on mollusks and crustaceans. It walks with ease on cliffs, even on sloping surfaces, apparently leaning mainly on its tarsus (in which it differs from the common puffin) and grabbing the uneven rock surfaces with its claws. Portenko (1939) has noted that it "walks awkwardly" when walking on its toes.

On Kamchatka and on the Commander Islands, where it is mostly encountered together with the tufted puffin, the latter predominates. In both of these regions it settles only in the crevices of cliffs and in passages between rocks, but it does not dig burrows, whilst on small islands in Norton Sound it was found nesting beneath rocks as well as in burrows excavated in soft ground (McGregor). Portenko reports that on Alyumka Island and in the Anadyr Estuary, nests of horned puffins were found both amid rocks and in burrows made in peat bogs. According to American observers (Bent, 1919), the burrow usually has two entrances which are used by the same pair for several consecutive years. McGregor gives a description of these nests made of grass blades, with a hollow in the middle. Grinell (Bent) reports having found eggs laid on bare ground, occasionally on a small bunch of stalks.

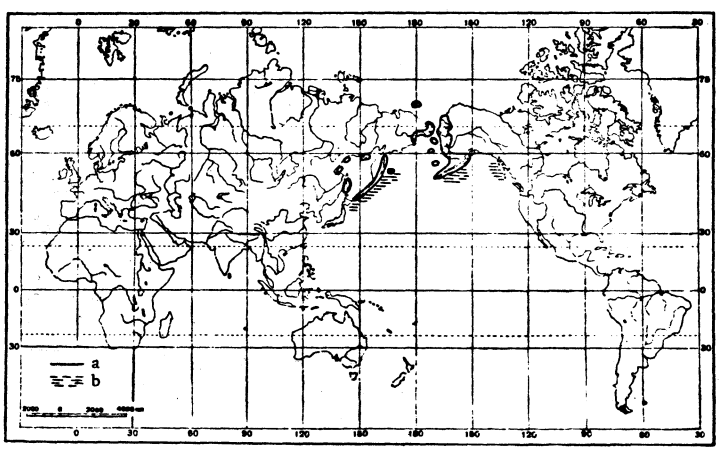

Figure 65. Distribution of the horned puffin, Fratercula corniculata

a-boundaries of nesting sites; b-migration routes

The clutch contains one or two eggs. On the Commander Islands breeding starts in July and extends through August. On Alyumka Island the eggs were in an advanced stage of incubation with fully developed embryos on 1 August. On Shamisso Island (Kotzebue Sound, West Alaska) fresh eggs were found in the first 10 days of July, and nestlings were observed in the majority of nests at the beginning of August (Bailey, 1948). The eggs are between 57 and 76 mm long and 41 to 50 mm wide. The color is off-white,
113 occasionally marked with light-brown bars and spots. Both parents incubate. On Mednyi Island, a downy nestling was taken on 19 August. Departure of the young for the sea takes place in September on the Commander Islands, and in the first 10 days of September on Moneron Island. Nestlings were found on 19 September in Providence Bay with partially developed primaries and with rectrices still in papillae. Apart from the afore-mentioned young birds, the materials of the Zoological Institute contain a nestling of similar age taken on 24 October (place not indicated).

Adults apparently undergo complete molt at a later date. The birds captured on Cape Dezhnev on 14 and 22 September show no indication of a change in their plumage. In the second half of September the rhamphotheca begins to molt. Young birds (over one-year-old) complete their full molt early in the fall. A one-year-old horned puffin taken on 5 August in Providence Bay wore a full new attire.

8. Genus LUNDA Pall. – TUFTED PUFFIN

Pallas, 1811, Zoographia Rosso-Asiat., II: 363 (type – Alca cirrhata Pall.).

It resembles the genus Fratercula, to which it is closely related, by its life habits and various structural features, in particular, the shape and structure of the bill, which is also heavy, deep, and very compressed laterally, but is distinguished by its coloring. The bill is longer than that of common and horned puffins. The crest of the upper mandible curves sharply downward and is hooked at the tip which converges firmly with the tip of the lower mandible. In summer, two or three grooves cross the "permanent" terminal part of the rhamphotheca, and when in winter the broad basal plate on the upper mandible is shed, an additional transverse groove – the third or fourth – is revealed. The lower mandible has no grooves. The feathering on the lores, which extends almost to the posterior edge of the naris, is hidden in summer under a broad flat porous transverse plate that lies at the base of the upper mandible and is shed during the molt. In some specimens, the feather tips, which penetrate the pores, are visible through the openings. During the spring-summer season a thick roll, which drops off in the fall, extends along the crest of the basal part of the upper mandible, between the rictus and the "permanent" terminal part of the rhamphotheca. (This roll is absent in Fratercula). The rosette which develops at the corners of the mouth is also shed before the winter. The epidermal adornments around
114 the eye are absent (Figure 66). Thus, in winter, after the molt of the horny bill covering, the rhamphotheca becomes shorter (owing to the shedding of the transverse porous plate which borders the bill and covers the feathers of the lores), less deep (owing to the shedding of the longitudinal roll at the

base of the crest of the upper mandible), and thinner (after the broad basal plate between the naris and upper crest is shed). The shape and location of the nares are the same as in common puffins).

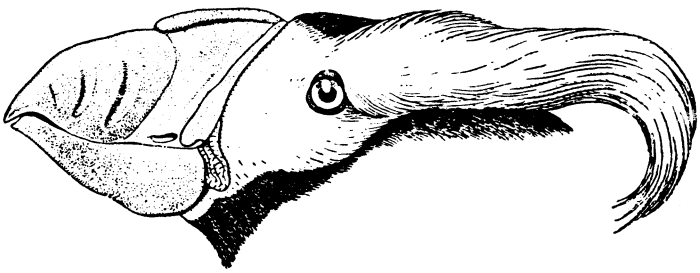

Figure 66. Tufted puffin, Lunda cirrhata, in summer

The wings are pointed and narrow, but somewhat broader than in Fratercula. The ratio of the length of the wing to its tip averages 2 : 1. The length of the wing skeleton comprises 208.6 % of the body length. The tail is composed of 16 rectrices, and is slightly rounded. The length of the tarsus equals that of the two main phalanges of the middle toe.

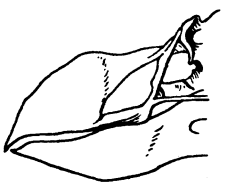

Figure 67. Bill of Lunda cirrhata without rhamphotheca

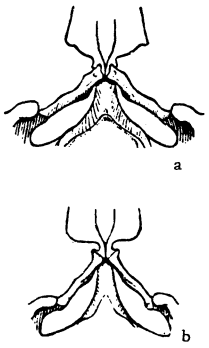

Figure 68. Aliform bones

a-Lunda cirrhata; b-Fratercula corniculata

The skull structure greatly resembles Lunda and Fratercula. Certain differences in the genus Lunda consist in the following features: the premaxillary protuberance, or hump, is more elevated than in Fratercula, and at its highest point is almost level with the upper external naris (Figure 67). The proximal part of the hump is very depressed, its posterior edge not quite reaching the anterior edge of the frontal region. The shape of the lower mandible more closely resembles that of F. corniculata than of F. arctica. The nares are almost triangular, their lower external edge forming a sharp angle. The crest of the squamosal bone, to which the m. adductor externus profundus is attached, is more elevated than in Fratercula. The pterygoids are markedly bent and have in general a different shape than those in the common and horned puffins (Figure 68).

The sternum (Figure 69) and pelvis of the tufted puffin are very similar to those of the representatives of the genus Fratercula. The hind limbs are longer than in common and horned puffins. The skeletal foot length of the tufted puffin comprises 155.8% of the body length.

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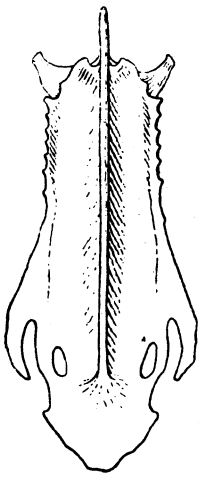

Figure 69. Pectoral bone of the tufted puffin, Lunda cirrhata

Young birds have a specific juvenile plumage, which is distinguished from adults' by the looser structure and smaller size of the feathers (5 mm shorter). It is exchanged in the fall for the first winter plumage in which the contour feathers are of the same length as those of adults in winter. The contour feathers (on back and abdomen) of adults are the same length in winter as in summer, probably because they are not renewed in the spring. Description of spring molt is lacking in the literature.

The tufted puffin is commercially exploited by the native population wherever this bird nests in large colonies. It is captured with nets attached to poles. Waiting for the flocks to return from the sea, the poacher is stationed amid the colony, and at their approach, thrusts up the net in which the birds, not being able to turn aside and swerve on their swift flight, get entangled. Their meat and fat are used as food; the skins are made into light, warm parkas. Eggs are rarely collected, since it is not easy to dig out the burrows.

Representatives of the genus are spread widely over the island and continental coasts in the Bering Strait, the Bering Sea, the Sea of Okhotsk and the Sea of Japan, advancing south on the North American shore into California.

One species is known.

1. Lunda cirrhata (Pall.)– TUFTED PUFFIN

Alca cirrhata Pallas, 1769, Spicil. Zool., V: 7 (Pacific Ocean, between Kamchatka and North America); Stejneger, 1885, Bull. U.S. Nat. Mus., 29: 43; Johansen, 1934.-Trudy Tomskogo Gosudarstvennogo universiteta, 86: 255; Bergman, 1935, Zur Kenntnis der Nordostasiatischer Voegel: 149; Shul'pin, 1936. Promyslovye, okhotnichi i khishchnye ptitsy Primor'ya (Industrial, game and predatory birds of the Maritime Territory): 414; Averin, 1948.-Trudy Kronotskogo Gosudarstvennogo zapovednika, 1: 80; Dement'ev, 1951. -Ptitsy Sovetskogo Soyuza, 2: 237; Gizenko, 1955. Ptitsy Sakhalinskoi oblasti (Birds of the Sakhalin region): 92.

Adult male and female in summer. Entire upper surface, wings, tail, and upper tail coverts brownish black. Lores, cheeks, region around eyes and narrow band around bill - white. Tufts of long yellow-white feathers behind the eye. Throat, sides and front of neck, and under parts

deep brownish, feathers on chest and abdomen lighter, sometimes whitish at base. Under coverts brownish gray. Humerals edged with white. Iris ivory colored, occasionally with some gray; vermilion ring around the eye. Tip of bill and rosettes at mouth corners red or orange-red; basal part of bill pale olive green or olive yellow. Narrow band around base of bill near rictus, red. Feet pinkish red. Adult male and female in winter. Head and under parts dark brownish. Region around eye of lighter grayish-brown color. Yellowish-white tuft absent. Upper parts (except head) brownish black. Flat basal plate above nares, horny roll at base of crest of upper mandible, transverse plate at rictus and rosette all absent. Basal part of rhamphotheca brownish; terminal part red, as in summer. Remainder as in afore-mentioned birds. Downy nestlings entirely silky black or deep smoky brown above, grayish below; down very dense and long. Young birds in juvenile plumage. Upper parts similar to those of adults in winter. Vaguely indicated gray stripe behind eye. Throat, foreneck, and
116 part of crop region brownish gray; chest and abdomen white, with more or less visible brownish-gray terminal margins. Iris brownish gray; naked ring around eye blackish. Bill brownish, feet light gray. Bill short and not deep. Terminal part of upper mandible completely smooth. Young birds in first winter plumage donned in their first fall similar to their juvenile plumage, but the brownish-gray edges of the white feathers on chest and abdomen are distinctively developed. In the first spring young birds do not molt, but when the dark edges wear off, the feathers on chest and abdomen are completely white. Throat, foreneck, and crop region brownish gray. Sides of head brownish. Gray stripe behind eye faintly marked. Bill relatively flat; upper mandible smooth at tip and lacks horny plates and rolls at the base. Two-year-old birds are similar in winter coloring to adults, except for lighter under parts, which have more gray due to the white base of the brownish-gray feathers on chest and abdomen. A grayish stripe made up of slightly elongated hairlike feathers runs backward from the eye. The bill is brown at the base, orange at the tip. After the second partial spring molt the birds have white feathers on either side of the head, a white ring around the bill, and short white tufts behind the eye. The basal part of the upper mandible acquires additional horny plates and rolls, and two or three shallow impressions (instead of grooves) appear at the tip. The bill is usually smaller than in adults, and curves more gently toward the tip.

Measurements: wing length of males and females 189 to 206 mm; tarsus 30.2 to 36.0 mm. Length of bill from rictus (in summer) 54 to 64 mm; depth at base (in summer) 38.0 to 49.5 mm; weight 450 to 500 g.

Distribution. It nests on the northeast, east and south (Providence Bay) coasts of the Chukot Peninsula, southwest to Kolyuchin Island, and on the Diomede Islands. Portenko (1939) found a small colony on Alyumka Island in the Anadyr Estuary. It is abundant on the Commander Islands, especially in Bering Strait, and is more abundant than other Alcae on the east coast of Kamchatka, where it was found nesting from Cape Kronotskii to Cape Lopatka. On Toporkov Island (Petropavlovsk region) and Utashut Island (51° 20') are colonies numbering thousands of tufted puffins. Was taken on Karaginskii Island, northeast of Kamchatka, at the beginning of August, and in summer at Cape Goven (within the boundaries of the Koryak National District on the coast of the Bering Sea), where nesting, though not confirmed,

is very likely. Bergman has observed settlements of tufted puffins on cliffs of a small island off the southwest coast of Kamchatka, between the mouths of two rivers – the Kambol'naya and the Ozernaya – and was told that they spread farther north wherever favorable living conditions are found. It is likely that it nests at Gizhiga and on the Taigonos Peninsula in the northwestern part of the Sea of Okhotsk. Snigirevskii reports that they are known to breed on the Mal'minskie Islands and at Ayan, where they were captured in June, July, and August (ZIN AN collections), and on the Shantarskie Islands. According to Vorob'ev (1947b), it ranges over the Kuril Island chain and is particularly abundant on Kunashiri Island, Bliznetsy Island (near Uruppu Island) and Toporkov Island (near Matsuwa Island). Each of these colonies numbers about ten thousand birds (Gizenko, 1955). Along the west
117 and east coasts of Sakhalin, it does not nest in large numbers and is only encountered in single pairs. A large colony is known on Moneron Island, a small one on Tyulenii Island. In the region of the Maritime Territory, tufted puffins and their eggs were found on an island in Peter the Great Bay, and a female with an egg in her ovary was found near Askol'd Island. Most likely the tufted puffin nests in De-Castri Bay.

Outside of the USSR this species ranges over the south and west coasts of Alaska, north to Cape Lisburne, St. Lawrence Island, the Pribilof Islands and the Aleutian Islands. Along the American coasts it advances south to California.

On its winter migrations it is encountered near the Commander Islands (in January and February), occasionally at the coasts of Kamchatka (Olga Bay), at Sakhalin (Aniwa Bay), and on the Kuril Island chain, extending south not farther than northern Japan. In American waters it does not migrate beyond the southern borders of its range (Figure 70).

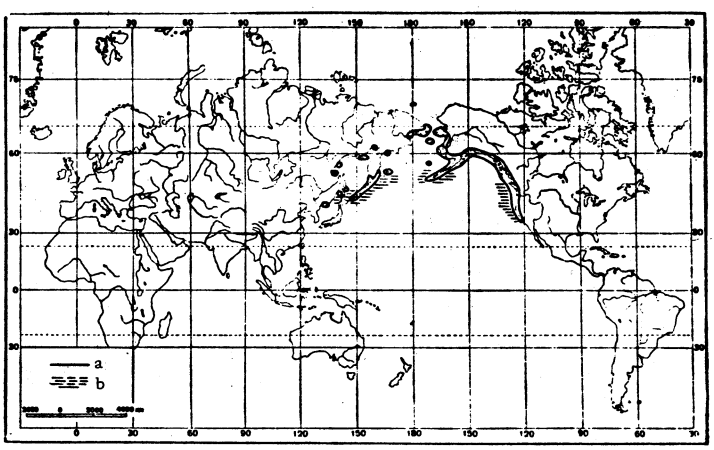

Figure 70. Distribution of the tufted puffin, Lunda cirrhata

a-boundaries of nesting sites; b-migration routes

Habits. The first arrival of tufted puffins in Bering Strait was noted early in June, but at the Commander Islands they arrive in flocks in late April, when they are also seen around Uruppu Island and in the region of

Vladivostok usually even early in April. On arrival they stay on the water, visit land only briefly, and settle at their nesting grounds only a month later. Fall migration at the coasts of Kamchatka and on the Kuril Islands was noted at the end of September or in October.

Though its flight is rapid, the tufted puffin has difficulty in taking off from the water and is unable to rise from level ground. During its seasonal migration flight and when hunting for food, it flaps its wings more frequently than other Alcae. It travels long distances in search of favorable feeding
118 grounds. Fish is its principal food (herring, capelin, etc), supplemented by crustaceans, mollusks, and other marine invertebrates.

On land it travels with great ease, leaning upon the toes and keeping the body in a slightly bent position. Generally the tufted puffin is calm and quiet, and does not attack strange nestlings and eggs. Its call – a deep growl – can be heard from the crevices, particularly when it is agitated or alarmed. If seized by hand it defends itself vigorously with the bill and may inflict serious injuries. Exploration inside the nest hole is also fraught with danger, for from a shallow recess the bird observes the intruder at the entrance, dashes out and strikes at his face with its bill.

The nesting grounds of the tufted puffin may be situated in deep crevices between cliffs or on the ground beneath branches of low bushes with a path providing access through the tangled herbage; but usually the nest is located in a hole which the bird has dug in the soft ground, generally on a steep slope. Tufted puffins prefer to breed on small islands inaccessible to foxes and other predatory quadrupeds. They may scatter in pairs or gather in large colonies, occasionally together with other puffin species. In very crowded colonies, like those on Toporkov Island near Bering Island, and on the other Toporkov Island in the Avachinskaya Bay in Kamchatka, the nests are so close together that there may be up to three nest openings on an area of one square meter. On Alyumka Island they occur in limited numbers (from 50 to 100 specimens), distributed in pairs among the enormous colony of horned puffins.

On Sakhalin the tufted puffin often makes its nest on sandy ground reinforced by roots of lyme grass (Elymus), which forms a dense thicket. The burrow is usually not longer than one meter, sometimes shorter. The bottom of the nest chamber is lined with dry grass stalks and feathers.

The single egg is bluish white or off-white, occasionally marked with grayish or brownish spots. It is 65.5 to 78.0 mm long and 45.0 to 5.15 mm wide. On Bering Island the first eggs were registered in late June, but mass laying takes place only in July. Stejneger found fresh eggs on Mednyi Island on 12 and 18 July, and a slightly incubated egg on 18 July. L.A. Portenko found eggs on 1 August on Alyumka Island. In the Ayan region two males engaged in incubation were found in different burrows on 23 August. On Uruppu Island in 1947 eggs were found late in May. Both parents participate in incubation and change shifts about every 12 hours. The relieved bird flies out to feed in the sea and on its return sometimes has to wait a long time near the nest entrance for its mate to come out. Incubation lasts about 30 days. Bent (1919) cites Emerson when reporting a 21-day incubation period, but this does not agree with our evidence.

On the Commander Islands, nestlings hatched out in the first 10 days of August. Bergman encountered two-week-old birds in the Avachinskaya Bay on 10 August. An almost full-fledged young bird was taken on Mednyi

Island on 31 August, and another on 24 September on Bering Island. A downy nestling half-clad in juvenile plumage was also recorded there on 6 September, and a bird that had hatched later (possibly from a delayed clutch, after the first one was lost owing to the egg collecting), in full juvenile plumage but with undeveloped remiges and rectrices and some down left on the abdomen, was taken on 15 October (ZIN AN). The first nestlings were found
119 on Uruppu Island early in July; downy nestlings were collected on Paramushiru Island on 31 July, 1928.

The nestlings are fed chiefly on fish. The young leave the nest when fully fledged, although some greater primaries may not be completely grown at the end of August or in mid-September (Sakhalin region), and change from juvenile into the first winter plumage at sea in the first fall, but apparently do not undergo partial spring molt. Year-old birds change from the first into the second winter plumage at the beginning of October. Adults undergo full molt late in September and October, possibly even later. A tufted puffin taken on 23 February on Bering Island had only very newly acquired feathers.

Partial spring molt does not occur before March and not later than mid-May, when the remiges of adult birds already have a worn-out appearance (ZIN AN).

9. Genus CERORHINCA Bonap. – RHINOCEROS AUKLET

Bonaparte, 1828, Ann. Lyc. New York, II: 427 (type – Alca monocerata Pall.)

By its size Cerorhinca is related to the Atlantic puffin. It feeds mainly on marine invertebrates and less on fish. Digs its burrow itself.

In its habits it is little distinguished from Fratercula and Lunda. Its skull structure is similar, but the bill is different and less specialized, though it performs the same functions. The hind limbs are adapted to swimming, to movement on land, and to throwing out the soil when digging burrows. This relates it also to Fratercula and Lunda.

The bill is short and not as raised as in puffins; it is laterally compressed. The upper mandible arches abruptly toward the tip. During the nuptial period (as in Fratercula and Lunda), there develops at the base of the upper mandible a narrow, flat, very thin transverse plate which covers the rictal feathers, and a high vertical horny projection which is fused with the broad basal plate of the rhamphotheca that lies above the nares and reaches the permanent terminal part of the latter. At the base of the lower mandible a narrow protruding roll develops. The lower edge of the upper mandible between the nares and the corners of the mouth bulges markedly (Figure 71).

During the postnuptial molt the narrow transverse plate which covers the rictal feathers and the broad basal plate with the projecting horn are shed, and only a small knob remains. The narrow horny roll on the lower mandible also drops off. Thus the outline of the upper mandible changes considerably according to season, while the difference in the lower mandible is insignificant. The nares are slit (as in Fratercula and Lunda) and are situated above the lower edge of the upper mandible. The base of the bill

is feathered as far as the posterior end of the nares and is covered by a transverse plate during the nesting season.

The wings are narrow and pointed; the ratio of length to tip is 1.97 : 1. The tail is slightly rounded and is usually made up of 16 rectrices. The tarsus is a little longer than the two main phalanges of the middle toe and is completely covered with multiangular scales.

The skull of Cerorhinca is very similar in shape and structure to that
120 of Fratercula and Lunda, and differs chiefly in the shape of the upper mandible (Figure 72). The premaxilla has no projection or hump. Without the rhamphotheca the crest of the upper mandible forms a completely smooth line which runs parallel to that of the mouth. Level with the external naris is a slight impression from which the vertical horn of the rhamphotheca projects in the nuptial period. The terminal part of the upper mandible is only slightly curved. The nares have triangular openings. The angular projections are absent in the preterminal part of the flat lower mandible. The inner process of the lower quadrate bone does not articulate with the lateral processes of the basisphenoids. In shape and structure the upper surface of the skull case is similar to that of the genus Fratercula. The young Cerorhinca has a specific juvenile plumage, which it changes for winter attire in the first fall. The length of the contour feathers differs in both plumages. Apparently, partial spring molt involves only the short body feathers of the front.

The only representative of the genus ranges on the Shantarskie Islands, northern part of the Maritime Territory, Sakhalin, and the southern Kuril Islands, also over Korea, Japan, the Aleutians and the west coast of North America.

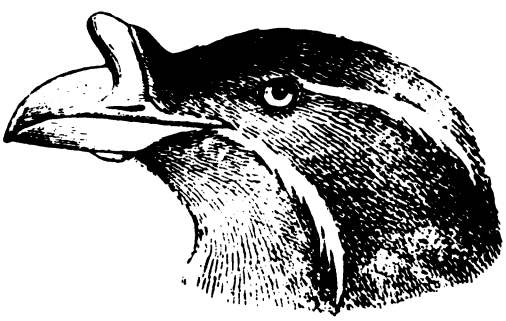

Figure 71. Rhinoceros auklet, Cerorhinca monocerata, in summer

1. Cerorhinca monocerata (Pall.) – RHINOCEROS AUKLET

Alca monocerata Pallas, 1811, Zoographia Rosso-Asiat., II: 362 (Alaska); Shul'pin, 1936. Promyslovye, okhotnich'i i khishchnye ptitsy Primor'ya (Industrial, game and predatory birds of the Maritime Territory): 413; Gizenko, 1951. –Okhrana Prirody, 13: 133; Dement'ev, 1951. –Ptitsy Sovetskogo Soyuza, 2: 227.

Adult male and female in summer. Crown and entire upper surface, wings, tail and upper coverts – black. Small upper marginal

coverts whitish. Sides of head to eye level and sides of neck dark gray. Elongated white hairlike plumes extend backward from mouth corners to below auricular region, and another narrow line of white feathers extends from above the eye to the sides of the nape. Chin, throat, front and sides of neck, and crop region of lighter brownish-gray. Chest and abdomen white, in some individuals tipped with narrow grayish-white margins. Flanks dark gray. Under coverts brownish gray. A prominent vertical projection separated from the rictus by a thin horny transverse plate rises at the base of the upper mandible. There is a small horny roll over the keel of the lower mandible. Iris pale brownish, slightly yellowish. Bill orange, horny projection on upper mandible bluish yellow; bulging edges of the upper mandible from nares to corners of mouth–yellow. Feet yellowish white with black webbing. Adult male and female in winter have similar plumage to that of summer except that the coloring on throat, neck, and crop is gray with almost no brown. The elongated white feathers behind the eye and alongside the bill are absent and occur only in winter*. Also absent are the horny projection (instead of which only a little lump remains), the narrow flat transverse plate at the base of the upper mandible, and the horny roll on the lower mandible. Otherwise as in summer. The downy nestling is entirely dark brownish, lighter below; chest and abdomen grayish brown. Young birds in new juvenile plumage resemble adults in winter – crown and upper parts, wings, tail and upper coverts black. Sides of head dark gray. Throat, neck, crop and flanks brownish-gray, but lighter than sides of head. Chest and abdomen white with pale-brownish margins at tips. Bill short, flat, lacking protuberance at base of upper mandible. (Description taken from three nestlings, whose remiges were not fully developed, captured in Taba Bay in the first 10 days of August (ZIN AN data). Young birds in first winter plumage are similar to the above-described birds, but have no brown on throat, foreneck, and crop region**. In the corners of the mouth and behind the eye are a few short light-brown hairlike plumes. The bill is longer and deeper than in young birds in the fall, though only half as deep as in adults in winter. There is a small knob at the base of the upper

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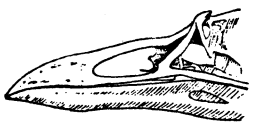

Figure 72. Bill of Cerorhinca monocerata, without rhamphotheca

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* [Error in Russian text; should read "summer".]

** The published records (Bent, 1919; Dement'ev, 1951) claim that the young C. monocerata has only one winter plumage, which is acquired immediately after the down stage and worn until the next fall. This statement, however, does not agree with our evidence. Apart from the difference in coloring of foreneck and crop, the fact that juvenile and first winter plumages are not identical, but are acquired subsequently, is proven by the difference in the length of their feathers – in the juvenile plumage they are about 2 mm shorter on the chest and 4 mm on the back than in the first winter plumage. Moreover, the short body feathers of the first winter coat are completely new in December, and some feathers on the back are still in papillae.

mandible. (Description based on a specimen taken in California on 12 December (ZIN AN data).

According to Bent (1919), young birds do not molt in the first spring, but acquire additional horny formations on the bill; when the dark margins on chest and abdomen wear off, these areas appear all white. The white plumes behind the eye and at the sides of the bill are shorter than in adults. The bill is shorter and mainly less deep than in adults, and in addition, the terminal part of the upper mandible arches more gently.

Measurements: wing length of males and females 165.5 to 189.5 mm; tarsus 25.7 to 29.5 mm. Length of bill from posterior edge of naris 28.0 to 33.2 mm; depth of bill in front of horny projection 17.9 to 20.0 mm. Weight 502 to 640 g.

122 Distribution. It nests on the Shantarskie Islands, at Cape Crillon on Sakhalin, and on small islands near Moneron Island. Is common on the small Kuril Islands (Ptichii, Polyanskii, Anuchin Islands). Was observed in June and July on the islands of Kunashiri and Iturup. It is possible that it nests in the vicinity of De-Castri Bay (Taba Bay) in the northern part of the Maritime Territory, where several young birds with not fully developed flight feathers were taken. It is necessary to recheck Shul'pin's report (1936), made on the basis of information obtained from Firsov, that there is a nesting colony on Russian Island near Vladivostok, although the rhinoceros auklet was frequently obtained in that region in May. It is very rare in Kamchatka and on the Commander Islands.

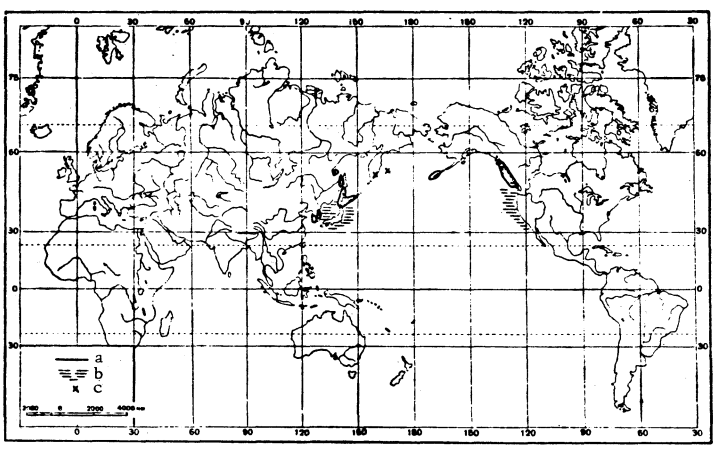

Figure 73. Distribution of the rhinoceros auklet, Cerorhinca monocerata

a-boundaries of nesting sites; b-migration routes; c-places visited by migrants

Outside the USSR it nests on the Aleutian Islands (Atka, Agattu, and Umnak, and along the North American coasts from Baranof Island south to the state of Washington (Destruction Island); also in northern Japan (Hokkaido and Honshu) and along the northeast and west coasts of Korea.

In winter it travels along the coasts of the Maritime Territory, Japan and America, southward into California (Figure 73).

Habits. The first arrival of the rhinoceros auklet on Moneron Island has been noted in the last 10 days of March or early in April, but it does not begin to go on land immediately after its return from winter migration, since in early spring the nesting holes are still blocked with snow.

On the water its body appears very solid with the neck frequently drawn in. As seen from Dawson's picture (1940), it floats high, but swims submerged up to the wings in the water. It usually feeds at sea during the
123 morning and evening, and also during the night; it is seldom seen by day, probably because it stays in its burrow. Its diet consists chiefly of crustaceans, partly of fish which it obtains several tens of kilometers in the open sea, but occasionally it feeds ashore, though it never enters inlets or bays. It dives for prey at intervals of 2 or 3 seconds and remains up to 30 seconds under water. On migration and during summer feeding time it stays mostly alone, or in scattered flocks. Its voice has a wailing sound and the call consists of four notes in rapid succession. When alarmed, it utters a growl.

The nesting grounds are usually on sloping mountain sites covered with brushwood, grass or forest vegetation, on sandy, sandy clay or podzolic soils, but seldom on cliffs. The colony on Moneron Island, which was observed by Gizenko (1951), was not far from the shore amid thickets of lyme grass. Like Fratercula and Lunda, Cerorhinca excavates its burrow in soft ground or cleans the old one by removing the cones, feathers and other rubble, which are brought in by rodents during the winter and which frequently accumulate at the hole entrance. There is always a main tunnel in the burrow measuring 2 to $2\frac{1}{2}$ m in length and about 12 cm in width, with a short lateral passage near the entrance. On Moneron and the adjacent islands, the burrows were dug only in the upper soil layers at a depth of 10 to 15 cm; the maximum length of the tunnels is 2 m, sometimes as short as 20 to 30 cm, when they look like caves. The tunnel ends in a chamber lined with whatever vegetative materials may be at hand – dry cereal stalks, small branches, shrubbery, even moss. It may be assumed that the lateral passage is occupied by a nonbreeding bird. The entrance is often near a tree trunk, or sheltered by windfallen branches or a bunch of grass, but seldom in an open place.

The first clutches were noted on Moneron Island early in May. The single egg is white, often spotted with a faint grayish or brownish tint. The eggs are 63.7 to 73.5 mm long and 42.6 to 50.0 mm wide. Both male and female participate in incubation; the length of the incubation period is not definitely known. (According to American observers it lasts about 3 weeks, but the accuracy of this statement should be checked) (Bent, 1919 : 106). Nestlings 5 or 6 days old were found on Moneron Island on 12 July (Gizenko, 1951). On the same day, partially fledged birds were observed with partly grown short body feathers with long soft down left on the tips (ZIN AN).

According to Gizenko's observations, the nestlings are fed on fish – herring, smelt, salmon, capelin, etc – which the parents bring in during the night. The departure of the young for the water proceeds with the use of the wings, though at that time the greater primaries have not attained their full size.

Such young birds were captured in Taba Bay in the first 10 days of August (ZIN AN). The complete change from juvenile into the first winter

(or nuptial) plumage is terminated during the migration season in December, as can be concluded on account of the light-brown hairlike feathers which appear in winter at the corners of the mouth and behind the eye of young birds. (See earlier reference to the specimen captured in California on 12 December). They do not molt in the first spring. One-year-old birds begin their
124 postnuptial molt very early – in mid-June – as is known from a female captured on Forrester Island on 16 June which shows an intensive growth of new feathers on the upper and under parts but no change of remiges and rectrices. The white lateral head plumes were retained, and also the projection on the rhamphotheca, the transverse basal plate at the rictus, and the elongated horny roll on the lower mandible. The age of the bird can be determined from the shape and size of the bill, as in young ones the tip of the upper mandible is not as sharply bent as in adults, but descends in a sloping curve. The bill is also at least 1.5 mm shallower than in adults.

Prenuptial molt of birds in their second year involves most of the short body feathers, and begins early in March. At that time the white hairlike feathers are still in papillae (the dates of appearance of these ornamental feathers vary in different specimens), and the horny projection on the beak is not yet grown.

Complete molt of adults begins about mid-July in the southern Sakhalin region. (In specimens from Moneron Island in the collections of ZIN AN, which were obtained on 7 to 12 July, the new short feathers on chest, crop, hindneck and back are still in papillae). Prenuptial molt of adults and the growth of the white hairlike feathers presumably occurs not earlier than May. Dawson (1940) watched rhinoceros auklets on Santa Cruz and captured some specimens, between 14 and 17 April, which already had horny formations on the beak, and white feathers on the sides of the head. The USSR data do not contain information of the dates of the spring molt.

10. Genus CYCLORRHYNCHUS Kaup. – PAROQUET AUKLET

Kaup, 1829, Skizz. Entw. Gesch. u. Natürl. Syst.: 155, 195 (type – Alca psittacula Pall.)

A medium-sized bird of the Alcae group, smaller than Cepphus. It feeds exclusively on small crustaceans. It nests in various natural concealments. The bill is well adapted by its curious spoonlike shape to its main function of catching small prey. The similarity in skull structure to Fratercula and Lunda testifies to its kinship and common morphological basis with these genera.

As in all Alcae, the fore limbs of Cyclorrhynchus serve the combined functions of paddling and flying. They are not as highly specialized in paddling as the large alcidine birds, because the present method of pursuing their prey does not require the same rapidity and alertness as in the past. They have, however, preserved their former flight maneuverability. The structure of the fairly long hind limbs and the broad pelvis are general characteristic traits of the genus. We have no explanation as to what caused the Cyclorrhynchus to retain its ability to move freely on land (and for skillfully maneuvered flight).

The bill is short, deep and laterally compressed. The edges of both mandibles, like the outline of the mouth, curve upward at the tip (Figure 75). The length of the bill, from rictus to tip, is equal to or only slightly greater than its maximum depth. The crest of the upper mandible is sharply hooked toward the tip, and the keel of the lower mandible also turns sharply upward in its terminal part. The subterminal lower edge of the rhamphotheca has small saw teeth. The rhamphotheca is made up of five separate parts; the longest of these, which covers the terminal part from the tip to the external naris, does not change during the seasonal molts. The other four smaller plates at the base of the upper mandible are shed in the fall, soon to be replaced by new ones. The nares are slit and are situated higher above the edge of the upper mandible than in puffins. The rictal feathers do not extend to the posterior edge of the naris.

The wings are sufficiently broad to assist in flight-steering maneuvers. The ratio of wing length to tip is 2.5 : 1, and its skeletal length comprises 214.4 % of the entire body length. The tail, which is made up of 14 rectrices, is almost square. The tarsus is equal to or slightly shorter than the middle toe excluding the claw. It is covered in front by polygonal scales.

During the nesting season males and females develop a pouch on the neck in which they carry food to their nestlings. This pouch is smaller than in other auklets.

The skull resembles that of Fratercula and Lunda in shape and structure (Figure 74). The postorbital bar stands almost vertical, the supraorbital space is narrow; the cavities containing the rhinal glands are more flat than in the above genera and have upturned edges. The postorbital process of the squamosal bone is not aliform as in the other genera, but forms a small, almost square projection. The processes of the lachrymal bones are more developed than in Fratercula and Lunda, and are not fused with the frontal bones, but their terminal part projects in an angle and has a sharp end.

Figure 74. Skull of the paroquet auklet, Cyclorrhynchus psittacula

The large lateral processes of the basisphenoids bear the quadrate bones of the lower jaw (as in puffins). The terminal part of the upper mandible has considerable depth and its premaxilla forms a projection, or hump, which extends to above the center of the naris. The nares are elongated and fairly broad, almost square slits. The inferior edges of the lower mandible are smoothly outlined and curve gradually upward, in contrast to Fratercula and Lunda, in which they jut out at a sharp preterminal angle. The pectoral bone is much longer than in the other genera. It lacks incisions, and the large fontanels are located far posteriad and include a considerable part of the metasternum.

The pelvis is even broader than in the other genera, and the hind limbs are longer, comprising 170.9 % of the body length. Thus, the framework supporting the posterior part of the body is better adapted to locomotion on land than in other Alcae.

According to the published data (Bent, 1919), the young do not have an intermediate juvenile plumage, but change immediately from the down cover

to the first winter plumage. Spring molt of adults involves all of the contour feathers.

The paroquet auklet nests on the coast of the Chukot Peninsula, on the Commander Islands, in the Sea of Okhotsk at Ayan, in Alaska, on the islands in the Bering Sea, and on the Aleutian Islands.

Only one species of Cyclorrhynchus is known.

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1. Cyclorrhynchus psittacula – PAROQUET AUKLET

Alca psittacula Pallas, 1769, Spicil. Zool., V: 13 (sea between Kamchatka and Japan); Stejneger, 1885, Bull. U.S. Nat. Mus., 29: 38; Johansen, 1934. Trudy Tomskogo Gosudarstvennogo universiteta, 86: 255; Portenko, 1934. -Trudy Arkticheskogo instituta, XI: 8, 11 ; Dement'ev, 1951. -Ptitsy Sovetskogo Soyuza, 2: 255.

Adult male and female in summer. Entire upper part of the body, crown, sides of head and neck, wings and tail – brownish black or grayish black. Stripe of elongated white feathers behind the eye (Figure 75). Throat and foreneck dark gray with narrow off-white margins at tip, white at base. White crop and flanks tipped with dark-gray margins. Chest and abdomen entirely white. Under coverts grayish brown. In spring, the new feathers on upper parts are gray instead of brown. Some feathers on the back of the neck and the back have clearly visible off-white or grayish-white edges. Iris white. Bill salmon-red, seasonal plates at base brownish. Soft bulging lower edge of upper mandible between naris and mouth – whitish or pinkish white. Inside of mouth whitish. Feet bluish white with yellowish tint. Adult male and female in winter are similar to birds in summer plumage, but the entire lower part of the body is white, except chin and throat, which are grayish black and white at base. Although the horny plates at the base of the upper mandible have been shed, the shape of the bill remains unchanged. The whitish swelling along the lower edge of the upper mandible disappears about the mouth. Downy nestling smoky gray above, center of chest and abdomen pale gray. A description of young birds in their first plumage is missing.

Measurements: wing length of males and females 142 to 156 mm; tarsus 26.2 to 30.0 mm; bill from rictus to tip 13.8 to 16.1 mm. Maximum depth of bill 12.8 to 14.5 mm.

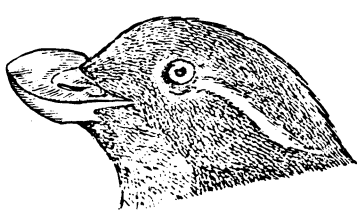

Figure 75. Paroquet auklet, Cyclorrhynchus psittacula, in summer

Distribution. Ranges along north, east and south coasts of the Chukot Peninsula northwestward to Cape Serdtse-Kamen'; in the south was found only in Providence Bay. Nests on the Diomede Islands and commonly on the Commander Islands. S.I. Snigirevskii reports that nesting has been verified only near Ayan on the Asiatic coast of the Sea of Okhotsk. Has been observed on some of the Kuril Islands (Shimushiru and Raikoke), but nesting has not been established. Used to be captured at the end of the last century in Sakhalin

(ZIN AN). Gizenko (1955) affirms having seen small flocks of paroquet auklets in Aniwa Bay in December and January 1950-1951.

Outside the USSR, it ranges on the American islands in Bering Strait (Pribilof, St. Lawrence, St. Matthew), the Aleutians, and Kodiak Island. Was captured at Cape Barrow on 12 September, 3 October, and 27 July (apparently nonbreeding migrants) (Figure 76).

Habits. Paroquet auklets arrive at the Commander Islands in late
127 April, at Cape Prince of Wales in Bering Strait in the last 10 days of May, at Cape Dezhnev at the beginning of June. They leave their nesting grounds early in September after the young enter the water. Generally, they are very quiet and calm. They do not gather in large groups at sea, although they nest in colonies. Their call, a low vibrant whistle, resembles that of guillemots. They hunt for food in the sea, far from land; in summer they fly out to feed once during the day, traveling high above the water. Their diet consists of amphipods and other crustaceans. In the spring, preceding incubation, they can be seen at dawn or in the afternoon resting in pairs on rocks and ledges. At sunset they rise in swarms together with other auklets and circle above their colonies. They walk with ease on rocks, the body bent slightly forward. They nest in a variety of locations – in passages amid rocks, beneath overhanging ledges, in crevices of cliffs, and occasionally under piles of driftwood. On the Commander Islands their nesting colonies are mostly on precipitous cliffs which drop steeply into the sea. The eggs are deposited without protection on small pebbles or on rocks with smooth surfaces. The clutch contains a single white or bluish-white egg, which measures 51.5 to 58.0 mm in length and 33 to 40 mm in width. Both parents participate in incubation. On the Commander Islands fresh eggs were registered on 10 June, and also in the middle and at the end of that month. A fully-developed unborn chick was taken from an egg on Mednyi Island on 3 July. On the Diomede Islands eggs were collected also on 3 July, presumably fresh ones, as breeding was not noted there on 25 June (Bailey, 1948).

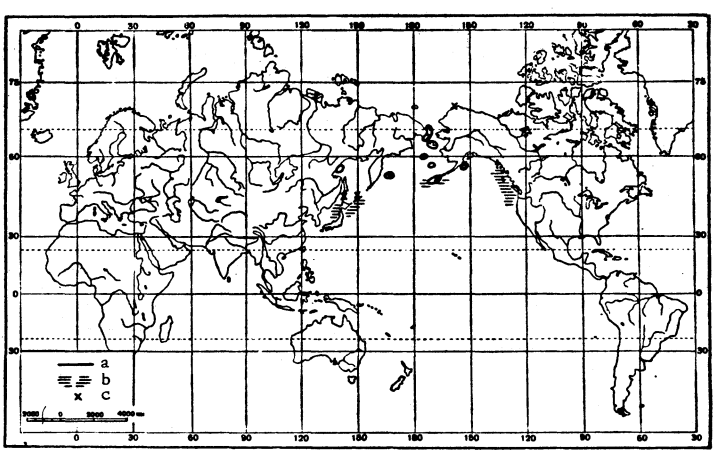

Figure 76. Distribution of the paroquet auklet, Cyclorrhynchus psittacula

a-boundaries of nesting sites; b-migration routes; c-places visited by passage migrants

Downy nestlings were obtained on the Commander Islands in mid-July.
128 Stejneger (1885) observed that the remiges of nestlings begin to grow rather early. A young bird of almost adult size has half-grown wings when the down is still left on all the short body feathers. The down is retained last of all on the feathers on the head, neck, and the center of the chest. On the Commander Islands fully-fledged birds venture into the water in August and leave the coast soon afterward, accompanied by the adults.

According to Stejneger (1885), adults begin to change their large feathers soon after the nestlings are hatched. This occurs in late July, beginning with the inner primaries and the upper coverts, and gradually all the flight feathers are shed. From Mednyi Island it is reported that molt of the horny basal plates on the upper mandible takes place in the first half of July. From 3 to 11 July Stejneger obtained birds with deep grooves between the separate plates of the rhamphotheca, which usually precedes their shedding. ZIN AN specimens captured on 24 August on the north coast of Chukot Peninsula and on 11 September on the Mal'minskie Islands had a worn-out summer plumage with no signs of molt. In Providence Bay partial spring molt of adults occurs in May, as known from a male specimen found there on 18 May which had many new feathers in papillae on the chin, throat, chest, and also on the crown, nape, back of neck, and back, and in general was already clad in a new feather coat.

Information regarding molt of young birds is lacking.

11. Genus AETHIA Merr. – CRESTED AUKLET

Merrem, 1788, Tent. Nat. Syst. Av.: 7, 13, 20 (type – Alca cristatella Pall.)

Representatives of the Alcae group, ranging from medium to very small sizes. They feed on marine invertebrates obtained not far below the water surface. They dwell in naturally sheltered places. They have good flight maneuverability and superior walking ability on land. In the structure of fore limbs and hind limbs they closely resemble paroquet auklets, to which they are related.

The bill is very short, deep, and fairly broad, especially in the spring and summer, when horny plates appear at the base. Its depth at the unfeathered part of the base is more or less equal to its length measured from the rictus (it varies according to species). The outline of the upper mandible may vary from a sharp to a very gradual curve toward the tip. The basal part of the rhamphotheca consists either of several separate plates, which are shed during the seasonal molt, or of a single sheath. The nares are either slit or oval-shaped. In one species the rictal feathers extend to the posterior end of the naris in winter only (A. cristatella), while in the other two species they remain unchanged throughout the year.

The wings are short and comparatively broad. The ratio of the length of the wing to the tip is 2.26 : 1 in A. cristatella, 2.48 : 1 in A. pygmaea, and 2.47 : 1 in A. pusilla. The wing skeleton of A. cristatella comprises 187.3 % of the body length. The tail, which is made up of 14 rectrices, is straight. The tarsus is either shorter than the middle toe excluding the claw, or the same length. It is entirely covered with multiangular scales.

The skull of Aethia cristatella is similar in shape and structure to
129 that of Cyclorrhynchus psittacula (information on other Aethia species is lacking), but the tip of the upper mandible and the projection of the premaxillae is less deep and its posterior edge is level with the front edge of the external naris. The supraorbital processes of the lachrymal bones are smaller than those of the Cyclorrhynchus described previously; they are formed like small angles. The subterminal part of the lower mandible projects abruptly.

The pectoral bone is broader and the pelvis narrower compared with the paroquet auklet; the hind limbs are shorter, comprising only 148.1% of the body length.

During the breeding period males and females develop a neck pouch beneath the tongue which serves to carry food to the nestlings. Young birds change directly from down to feather cover, which they apparently wear until the summer. In adults, partial spring molt involves the contour feathers of the entire body (actually verified only in A. pygmaea). Adults change their greater flight feathers gradually, beginning with the inner, and followed by the outer primaries.

The three species of the genus range over the northern Pacific and partially on the north coast of Chukot Peninsula. All of them belong to the fauna of the USSR.

Key to the Species

1 (2). Abdomen, under tail coverts, and entire lower part of the body uniformly gray, independent of season. Wing length over 130 mm.... .....1. A. cristatella (Pall.)–Crested auklet.

2 (1). Abdomen and under tail coverts white or whitish. Maximum wing length 120 mm.

3 (4). Maximum wing length 100 mm. Under parts, including throat, crop, and chest, entirely white, or white-tipped with dark-brownish margins..... 3. A. pusilla (Pall.)–Least auklet.

4 (3). Wing length over 100 mm, generally 106 to 117 mm. Throat, chest, and crop always uniformly brownish gray with no white..... .....2. A. pygmaea (Gm.)–Whiskered auklet.

1. Aethia cristatella (Pall.)–CRESTED AUKLET

Alca cristatella Pallas, 1769, Spicil. Zool., I, V: 18 (Kuril Islands); Stejneger, 1885, Bulletin of the U.S. Nat. Mus., 29: 24; Johansen, 1934.–Trudy Tomskogo Gosudarstvennogo universiteta, 86; 254; Portenko, 1934.–Trudy Arkticheskogo instituta, XI: 5-10; Shul'pin, 1936. Promyslovye, okhotnich'i i khishchnye ptitsy Primor'ya (Industrial, game and predatory birds of the Maritime Territory): 411; Portenko, 1948.–Priroda, 10: 50-51; Bailey, 1948, Birds of Alaska, Colorado Museum of Natural History, 8: 259; Dement'ev, 1951.–Ptitsy Sovetskogo Soyuza, 2: 218.

In adults, the upper mandible curves sharply downward, and in summer its lower edges form an undulating line caused by the bulging horny plates, which extend to the corners of the mouth (Figure 77). After the

fall molt it is straight, and bends only at the very tip. Another horny plate, which is seasonally renewed, covers the nares and extends to the crest of the upper mandible; a third narrow transverse plate, which appears in summer behind the nares, hides part of the rictal feathering. In spring the lower mandible develops two horny plates on either side, one along the upper edge from the external naris to the corners of the mouth, and the second
130 at its base partially covering the rictal feathers. A hard rosette-like ornament appears at the corners of the mouth in contrast to the soft one of Fratercula. The upper edge of the lower mandible is more or less straight. When the described parts are shed in the fall, the rhamphotheca is smaller (especially on the lower mandible), and the upper rictal feathers extend to the posterior end of the naris. The nares are slit, wider, and ovoid posteriorly.

Figure 77. Adult crested auklet, Aethia cristatella, in summer

Figure 78. Adult crested auklet, Aethia cristatella, in winter

Adult male and female in summer. Crown, nape, and upper parts, also wings, tail and upper coverts – brownish black. A brownish-black tuft of narrow elongated feathers rises from the light-brown forehead and curves forward. The sides of the head and entire under part of body brownish gray. A stripe of elongated white plumes extends backward from the eye. During the breeding season some sparse whitish plumes appear on the crown. These plumes are shed soon after mating. Iris white. Bill yellowish at tip, orange-red at base, like the rosette. Feet grayish. Adult male and female in winter have the same coloring as in summer. In the fall (late August and September) the tuft on the forehead is absent, but it appears again and attains its former size in the middle of winter. The white stripe behind the eye is absent in the fall, but it begins growing again in November. The bill is entirely dark brownish (in dried mounted skins). Both mandibles are feathered up to the nares. The additional plates at the base and along the mouth, and the rosette are absent (Figure 78). Downy nestlings are brownish above, light brownish or grayish below. Young birds in winter plumage donned directly after down are similar to adults in winter. The tuft on the forehead starts growing in November and attains adult size in the middle of winter. At the same time a white stripe of elongated narrow feathers appears behind the eye. The only difference between young and adult crested auklets in winter is noted in the shape of

the bill (Figure 79). In young birds, the depth of the bill at the rictus measures 2.3 to 2.6 mm less than its length from rictus to tip, and the keel of
131 the upper mandible arches gradually toward the tip, while in adults the depth of the bill is either equal to its length, or only 1.0-1.2 mm less, and the upper mandible curves abruptly downward.

The young birds do not molt in the first spring. The bill, however, acquires some additional plates, which are smaller than those of adults, and accordingly it is only slightly enlarged and retains its juvenile shape. The plates bordering both mandibles and extending posteriorly from the nares are half as wide as in adults. As far as we can judge from dry skins, the bill is of a paler, duller orange at the base.

According to various authors (Hartert, 1921-1922; Bent, 1919; Dement'ev, 1951), young birds have neither the tuft on the forehead nor the white stripe behind the eye in the first winter. These develop only later, after the partial spring molt. However, among ZIN AN materials are crested auklets captured on 19 November in Providence Bay and in January on Bering Island which, estimated by the size and shape of their bills, are obviously one-year-old birds. The male taken in November bore tufts of feathers growing out of papillae on the forehead, and the white stripe behind the eye, though not yet formed, was indicated by six or seven very short separate feathers on either side. The female captured in January had a large tuft on the forehead, a distinct white stripe behind the eye, and even a few white small plumes among the rictal feathers. A young female from Wellen (Chukot Peninsula), captured on 16 June, had a flat bill, the seasonal basal plates being weakly developed. Her plumage was very shabby, especially on the under parts; it could not have been so badly worn in June if she had molted in the spring. A number of new feathers in papillae were growing on the head. From this specimen it can be concluded that young crested auklets change their short body feathers not in spring, but early in summer, when the large feathers too are undergoing molt.

Measurements: wing length of males and females 130.6 to 145.0 mm; tarsus 24.5 to 30.0 mm; bill from rictus to tip 10.0 to 13.4 mm; depth of bill at beginning of the unfeathered part 10 to 13 mm. Weight 250 to 270 g.

Distribution. It nests along the north coast of Chukot Peninsula, westward to the Cape Schmidt region, where Portenko found it in large numbers on the Spit of Dva Pilota (Two Pilots), and on the east coast and the Diomede Islands in Bering Strait. On the southern Chukot coast, colonies are known near the Preobrazhenie Inlet and in Providence Bay. In Krest Bay they were seen in May and June, but have not been captured. Casually visits the coast of Anadyr. Nelson observed it in August on Wrangel Island, and there he caught a specimen which is now in the collections of ZIN AN (undated). Mineev also frequently recorded their appearance about 10 to
132 15 km offshore. Nesting sites were found on the Commander and Kuril Islands*. It is common throughout the entire Kuril Island group, from Onnekotan to Iturup, but the most abundant colonies are located on the central islands of Matsuwa and Ushishir (Gizenko, 1955). Were noted on 18 May near Krasnogorsk (Sakhalin), and on 11 September at Cape Crillon; winters

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* Johansen (1934) did not find crested auklets nesting on the Commander Islands. Stejneger (1885) observed their nesting habits mainly on Bering Island. Sokol'nikov obtained a downy nestling on Mednyi Island on 30 June.

Figure 79. Young crested auklet, Aethia cristatella, in the first winter

in many places on the west and southeast coasts; occasionally passes into the interior during severe blizzards. A young male, now in the Khabarovsk Museum, was captured on 17 September near Ayan (Shul'pin, 1936). Dul'keit has observed them on the Shantarskie Islands, but could not establish their breeding at the Sea of Okhotsk. In the spring they were encountered in the Peter the Great Bay.

Outside the USSR the crested auklet nests along the west coast of Alaska and adjacent islands; it was observed late in June and early July north of Bering Strait; several specimens were captured in May, June, July, and September in the sea around Cape Barrow. It inhabits the Aleutian Islands, the islands of Kodiak, Pribilof, and St. Lawrence. It was encountered in winter near the Commander and Kuril Islands in Tatar Strait, and in great numbers at southern Sakhalin (Figure 80). A migrant bird was once taken on 15 August north of Iceland in the Atlantic.

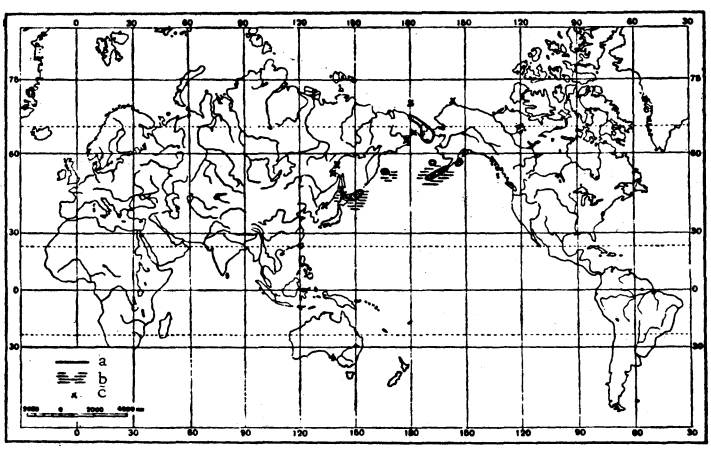

Figure 80. Distribution of the crested auklet, Aethia cristatella

a-boundaries of nesting sites; b-migration routes; c-places visited by passage migrants

Habits. Crested auklets are apparently little adapted to a quick change of their wintering grounds in accordance with the freezing over of the water. From Gizenko we learn that in the hard winters of 1947 and 1948 many of them perished from lack of food at the coasts of Sakhalin, and some were found frozen on ice floes in Aniwa Bay.

It is difficult to establish their seasonal movements, as they winter
133 partially within the boundaries of their breeding range; in its northern part they were found in May in Krest Bay and on 23 May in Bering Strait. American observers (Bailey, 1948) declare that at the beginning of September their number declines considerably near the Diomede Islands (Kruzenshtern Island), though in Providence Bay they were obtained even from 17 to 19 November.

Crested auklets are very active birds. They spend much time in flight above the sea changing their feeding grounds, and often circle in multitudes above their colonies like swarms of bees. Running swiftly over cliffs and rocks, they leap from one steep ledge to another, and dart into their nesting crannies. At twilight they become particularly lively. Their voice sounds like a groan or growl. Although noisy at the breeding ground, they are silent at sea. They gather in large dense flocks to collect their food, which consists of small crustaceans and polychaetes.

They nest among cliffs and stone heaps on the seacoast, frequently in the company of paroquet auklets. The single white egg is laid between stones, without lining, or inside a deep crevice of the cliff. They do not sit steadily on the nest, and usually fly out before the hunter can seize them. The egg is 50 to 60 mm long and 32.5 to 42.5 mm wide. On the Diomede Islands eggs were found in late July. Both parents take part in incubation. A downy nestling was obtained on Mednyi Island on 30 June. The young are fed on small crustaceans which the parents carry in their neck pouch, recognizable by the swollen neck and throat when returning from the sea. At the end of August or the beginning of September, when they are fully fledged, the young birds leave the land. A young bird found on Atka Island (Aleutian Islands) on 26 August had partially developed flight feathers (ZIN AN).

Complete molt of adults begins in the second half of August with the shedding of the horny basal covers on the bill and the small feathers on the back of the neck and the back, followed later by the molt of the remiges. A bird captured on 17 August (place unknown) had new feathers in papillae on the back of the neck; the horny plates of the bill had been partially shed. A crested auklet from Bering Island was fully clad, in October, in new feathers, except for a few remiges which were not fully developed. In a female from Providence Bay on 28 August the plates at the base of the bill had begun to loosen; the ornamental head feathers and most of the white feathers behind the eye had been shed, but new feathers had not yet appeared. The plumage of another female taken at Cape Schmidt (north coast of the Chukot Peninsula) on 2 September was in a similar condition, except for the new papillae protruding on crown, back and crop. The short feathers begin to change in late April, as known from a female which was captured by Stejneger (1885) on 1 March [should be May] and had new feathers in papillae on crown and neck. Complete molt of almost one-year-old birds begins earlier than that of adults (in mid-June), but apparently they do not molt in the spring.

2. Aethia pygmaea (Gm.) – WHISKERED AUKLET

Alca pygmaea Gmelin, 1789, Syst. Nat., I, 2: 555 (Bird's islands between northern Asia and America). - Simorhynchus pygmaeus (Gm.) Stejneger, 1885, Bulletin of the U.S. Nat. Mus., 29: 25; Johansen, 1934. - Trudy Tomskogo Gosudarstvennogo universiteta, 86: 254; Bergman, 1935, Zur Kenntnis der Nordostasiatischer Voegel: 255; Dement'ev, 1951. -Ptitsy Sovetskogo Soyuza, 2: 221.

134 The entire beak up to the rictus is sheathed by a horny cover, except for the nares, which are surrounded by a soft skin membrane (Figure 81).

No additional horny formations appear at the base in the breeding period which would change its shape or enlarge the surface of the rhamphotheca. Stejneger observed that during molt the rhamphotheca sheds its upper horny layer in three separate thin transparent parts – one of them peels off from the terminal part, the other two from the base. No data are given about the lower mandible.

Figure 81. Whiskered auklet, Aethia pygmaea, in summer

Adult male and female in summer. Crown, sides of head, and upper parts slate-black. Base of upper mandible feathered, with narrow slate-black stripe extending to posterior ends of nares. Behind it, from a bunch of narrow white feathers, rise two tufts of extremely elongated white feathers, one passing upward above the eye, the other below the eye bending downward across the cheeks. These tufts also cover the lores. On the forehead is a dark-brownish crest of hair-like plumes curving forward. Extending backward behind the eye is a narrow white stripe of elongated feathers. Chin, throat and foreneck grayish brown; crop, front of chest and flanks brownish gray and lighter colored. Center of chest and abdomen, and also under tail coverts white or whitish. Rectrices, remiges, and upper coverts dark brownish; under coverts and axillaries light brownish. Iris white. Bill bright red, tip white with bluish tinge. Feet bluish gray. Adult male and female in winter similar to whiskered auklets in summer. In the fall the white feathers on both sides of head and on the lores are short, and the crest is absent, but in December all the ornamental head feathers attain their normal size. Base of upper mandible brownish. Downy nestling dark brownish above, lighter and more grayish in center of abdomen. Young birds in first plumage donned after down stage. Upper parts similar to those of adults. Throat and sides of head above and beneath eye pale brownish gray, considerably lighter on crown. Broad dark-slate stripe beneath eye. Short whitish feathers at base of bill. Entire lower part pale gray, lighter than in adults; faintly indicated white margins at tips. With the decline of the winter this attire is exchanged for adult plumage, in which a young bird can be distinguished only by the relatively shorter head feathers and the shape and color of the bill, which is less deep than in adults, the upper mandible curving very gradually downward. The bill is uniformly brownish. Iris bluish gray.

Measurements: wing length of males and females 106.2 to 117.7 mm; tarsus 19 to 24 mm. Bill from rictus 9 to 10 mm.

135 Distribution. It nests on the Commander Islands (predominantly on Mednyi Island), on the Kurils, where colonies of whiskered auklets were found on the central islands of Raikoke, Shimushiru and Uruppu. On Sakhalin nesting was not established, but Gizenko (1955) recorded them in June and July in Terpenie Bay and Aniwa Bay. Was once captured in Kamchatka in Avachinskaya Bay. Outside the USSR it ranges on St. Lawrence Island, possibly on the Aleutian Islands eastward to Unalaska. Was frequently found wintering on the Commander Islands, the Kuril Islands, and the coasts of Japan (Figure 82).

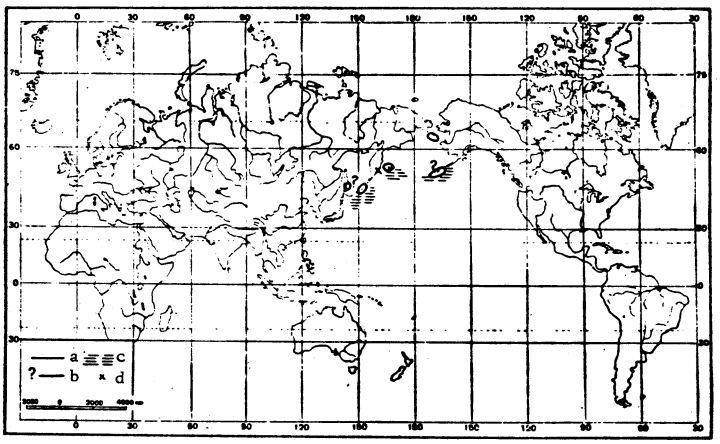

Figure 82. Distribution of the whiskered auklet, Aethia pygmaea

a-boundaries of nesting sites; b-assumed though not proven nesting sites; c-migration routes; d-places visited by passage migrants

Habits. Seasonal migration of whiskered auklets apparently does not extend far beyond their breeding range. The majority winter near the Commander Islands and the Kuril Islands, but some continue south to the coasts of Japan. Stejneger (1885) found them rare in February in the region of the Commander Islands, and almost nonexistent in March and April. In winter they stay in small groups, gathering in several pairs over an area of 5 to 10 km, occasionally close to coastal cliffs. The diet consists of small crustaceans - amphipods, isopods, decapods, etc. They form small colonies among crevices of cliffs, frequently in the neighborhood of crested auklets. On Mednyi Island they occupy sheer basaltic rocks on the seacoast. Because of their cautiousness it is not easy to observe them, especially since on land they hide most of the time inside their crannies, flying out only to feed in the sea. The breeding season begins at the end of May or early in June. In late June Stejneger already found nestlings on the Commander
136 Islands, but there were no more eggs. The clutch contains one dull-white

egg, 45.2 to 48.0 mm long and 32.0 to 33.5 mm wide. Both parents participate in incubation, the length of which is not known. A nestling a few days old was found on 28 June on Mednyi Island, and a fledgling with remiges half the normal size and with down remaining on the tips was found on 12 July. ZIN AN materials contain a young bird from Mednyi Island captured on 4 August whose remiges and rectrices were poorly developed. On the basis of his records Stejneger declared that complete molt of adults begins on the Commander Islands during the last 10 days of July when the upper coverts and the greater inner wing feathers are changing, but feeding of the nestlings still continues. Partial spring molt terminates in the first half of May. On 6 May a bird from Bering Island (according to the description of Stejneger, 1885) had new papillae appearing on abdomen, neck and head. Young birds change their first plumage for the first nuptial plumage very early, judging by Stejneger's report of having found molting young in the first days of January.

3. Aethia pusilla (Pall.)—LEAST AUKLET

Uria pusilla Pallas, 1811, Zoographia Rosso-Asiat., II: 373 (Kamchatka). -Simorhynchus pusillus (Pall.), Stejneger, 1885, Bulletin U.S. National Museum, 29: 35; Bent, 1919, Life histories of North American diving birds: 128; Bailey, 1948, Birds of Alaska, Colorado Museum of Natural History, 8: 260; Dement'ev, 1951. -Ptitsy Sovetskogo Soyuza, 2: 223.

The base of the upper mandible is covered from the crest to the upper edge of the naris by a soft membranous skin, and in the spring a fairly large vertical knob develops on the crest itself. This knob is laterally compressed and resembles a helmet. In the fall it diminishes considerably, or disappears altogether, leaving a wrinkled patch of tiny skin creases. A hard horny layer ensheathes the tips of the upper mandible and extends along its narrow lower edge beneath the nares to the corners of the mouth. The lower mandible has a single horny cover up to the rictal feathers.

Adult male and female in summer. Upper parts and sides of head grayish black. Cheeks gray. One or two grayish-white feathers among scapulars. Some white elongated hairlike plumes can be distinguished among the generally grayish-black feathers on forehead, crown, lores, and rictus, and extend in a white stripe behind the eye. Throat pure white; chin gray. Rest of under parts white with dark-brown margins, forming a generally spotted pattern, but are more evenly distributed on the almost black-brown foreneck and flanks. Remiges and rectrices dark brownish, inner secondaries tipped with whitish. Under coverts are mostly white or whitish gray. Iris white; bill red projecting knob at base brownish; feet dark gray. Adult male and female in winter. Upper parts the same as in summer, including white head plumes, but scapulars have more grayish-white feathers. Under parts entirely white or with a few brown spots at tips. Chin gray. Bill blackish brown; projection at base absent. Downy nestling smoky brown above; under parts have more grayish coloring, and are lighter. Young birds in first juvenile plu-
137 mage, acquired immediately after the down stage, in general resemble adults in winter, but deeper black above. Some lighter dark-gray feathers

are conspicuous among the black scapulars instead of the white-gray feathers in adults. Separate narrow, short, light-gray feathers appear in winter on the forehead. Under parts white; gray-tipped feathers on foreneck and crop form a single front piece of separately marked spots. Under coverts either dark brown or gray-brown, but not white. Upper mandible completely straight. One-year-old birds are distinguished from adults after the partial spring molt by the wide dark-brown margins on the white feathers, which produce the effect of a uniformly dark-brown throat, and the lower part of the body is also more speckled with brown. The white plumes on the forehead are short, and the knob very small. Bill uniformly brownish.

Measurements: wing length of males and females 89.5 to 97.1 mm; tarsus 17.2 to 19.5 mm; bill from rictus 7.8 to 9.9 mm. Weight approximately 93 g.

Distribution. It nests on the north and east coasts of Chukot Peninsula, northwest to Cape Serdtse-Kamen', on the Diomede Islands in Bering Strait. ZIN AN materials contain a group of birds in molting stage taken in Providence Bay in September. Gizenko has observed the least auklet in early September at Aniwa Bay (Sakhalin), and according to Japanese observers it was captured near Tyulenii Island in Terpenie Bay, near Korsakov, and on the Kuril Islands (Iturup, Uruppu, Shimushiru, and Paramushiru). It is encountered in winter and spring (until May) near the Commander Islands and Koryatskaya Zemlya in the Bering Sea. Outside the USSR it ranges along the west coast of Alaska north to Cape Lisburne, on St. Lawrence, St. Matthew, Pribilof, and the Aleutian Islands. Was captured near Cape Barrow on 1 April, 13 July, late in August and up to the end of September.

In winter it travels along the Commander Islands, is occasionally encountered near the coasts of the Maritime Territory and Japan, also on the Aleutian Islands, along the American coast south to the state of Washington (Figure 83).

Habits. Least auklets fly swiftly and well. They circle overhead, particularly during the nesting season, when flocks composed of hundreds often swarm above their colonies. They dive with lightning speed, though not to a great depth. Their voices when raised sound like a lively twittering, occasionally more like a whistle. Spring arrival at the breeding grounds in the southern parts of their range takes place about 1 May, but in Bering Strait individual birds settle among ice floes not earlier than 22 May; their number increases markedly at the beginning of June. In the fall they are captured in Providence Bay until the end of September.

In winter, and more particularly during the summer, they stay at sea in very large groups, and also breed in densely packed colonies. They feed on small crustaceans obtained in the upper layers of the water. They nest among large boulders or in crevices, frequently penetrating deep into passages between rocks, and usually settle in the neighborhood of crested and paroquet auklets. The single egg is laid on pebbles unprotected by lining. The egg is dull white, 33.5 to 43.0 mm long and 27.0 to 33.5 mm wide. Freshly laid eggs were found on the Little Diomede Island on 12 June and in mid-July, also later, on 26 August, but no information is given here on the
138 incubation stage. Hatching generally occurs in July. The parents feed the nestling on small crustaceans, which they bring in their neck pouch. By the end of August, young birds are already fully fledged.

On the southeastern Chukot coast, adults undergo complete molt in the second half of September; small and large feathers begin changing at the same time. Large numbers of birds at the peak of their molt were found on 24 September in Emma Bay (Providence Bay) – on back and under parts many new feathers were protruding from papillae, but the secondaries, the three outer greater primaries, and also the rectrices had not changed. The inner greater primaries were new but not of normal size. The date of partial spring molt is not precisely known. Near Bering Island the captured birds still wore winter plumage without any traces of molt in the last 10 days of March. From this it may be concluded that the short body feathers do not change before April.

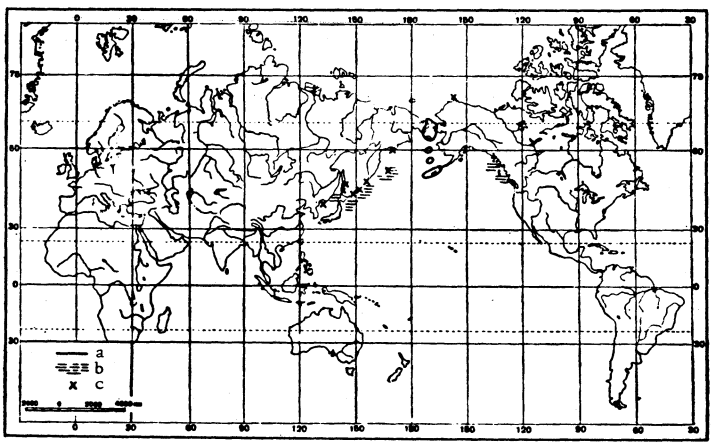

Figure 83. Distribution of the least auklet, Aethia pusilla

a-boundaries of nesting sites; b-migration routes; c-places visited by passage migrants

Because of their tasty meat, hundreds of least auklets are captured by the local inhabitants. Large nets are spread near the bird colonies to block the route of low-flying flocks. Because of their swift flight the birds notice the trap too late to slow down or turn aside, and crash in their scores and hundreds into the meshes, falling to the ground, where they are covered with nets.

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