(2) Nature in Japan

2-1) Topography

2-1-1) Geographical Features and Geological History

a) Geographical Features

The topography of the Japanese Archipelago is intensely undulating with mountainous areas, occupying some three fourths of the country. Most of these mountainous areas are steeply formed because of the erosive effect of the many. There are about 200 volcanoes, forming the volcanic belts of Chishima, Chokai, Nasu, Fuji, Norikura, Daisen and Kirishima. Earthquakes occur frequently in the archipelago.

b) Geological History

The Japanese Archipelago was part of the Eurasian Continent until the Tertiary period. The archipelago then separated from the continent and moved toward the Pacific Ocean in the Neogene period, during which time the Japan Sea was formed. It is thought that these islands gradually formed a shape similar to the present archipelago during the Diluvial epoch after an age when there were many islands of various sizes. The islands were at various times connected or severed from each other as the ground repeatedly rose or sank, and the glacial and inter-glacial periods came and went. All these geological and climatic changes greatly influenced formation of the diversified flora and fauna now found in the archipelago.

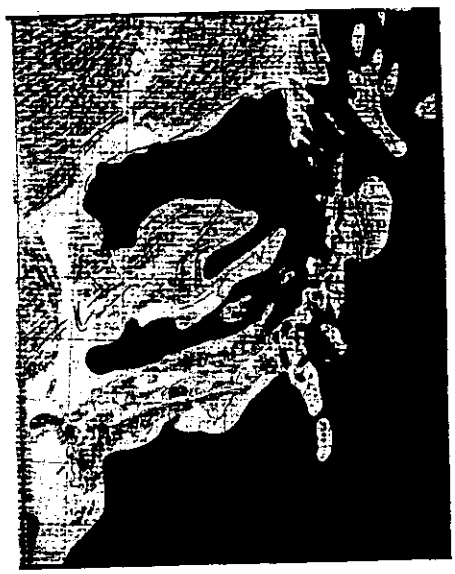
c) Climate

The Japanese Archipelago ranges a considerable distance from north to south and has mountainous areas with high elevation. Because of this there are varied climatic zones throughout the archipelago: the subarctic zone, the temperate zone and the subtropical zone. In the temperate zone, which occupies the largest area of the archipelago, seasonal changes in temperature are abrupt, and form four distinct seasons: spring, summer, autumn and winter. As for rainfall, the archipelago receives long rains during the early half of summer and autumn and heavy snows along the Japan Sea in winter.

湊 正雄 監修（１９７７）： 日本の自然, 平凡社
中村一明 他（1987）**：日本の自然** 1 **火山と地震の国、岩波書店**
市川浩一郎 他 編（1970）**：日本列島地質構造発達史、 築地書館**
安田喜憲 他（1998）**：図説 日本植生史、 朝倉書店**
中村和郎 他（1986）**：日本の自然** 5 **日本の気候、岩波書店**

1) 30 million Y.B.P.

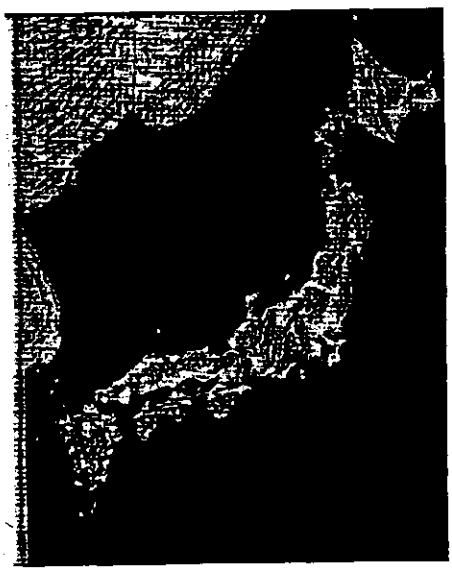
2) 14 million Y.B.P.



3) 380 thousand Y.B.P.

4) 20 thousand Y.B.P.

5) 6 thousand Y.B.P.



市川浩一郎 他 編（1970）：日本列島地質構造発達史、 築地書館

(2) Nature in Japan

2-1) Topography

2-1-2) Biogeographic Regions and Japan

a) Biogeographical Region of the World and Japan

Biogeographical region is a biological division of the Earth's surface embracing both faunal and floral characteristics. The distribution of plants and animals can be influenced both by the ecological and geographical factors. The former is their adaptability to the environment and the latter is the geographical barriers limiting their distribution. Hence, when studying the reasons for distribution, the analysis should be done, theoretically, species by species.

However, when handling larger taxonomic units, distribution areas common to all species belonging to the unit are recognised and division into regions becomes possible. The division is based on the resemblance of life forms of species and their systematic closeness, which is related to geological history.

Zoogeographically the earth is generally divided into the six regions shown on the map. This division is applicable to a larger number of animal groups, though there are some other ways of division differing according to the group of animals concerned.

Similarly, phytogeographically the earth is divided into six regions related more closely to latitude than zoologeographical regions.

Most of the Japanese Archipelago belongs to the Palaearctic region for animals and the Holarctic floral kingdom for plants, but Nansei Islands are thought to be part of the Oriental region for animals and the Southeast Asian region for plants. Honshu, Shikoku and Kyushu Islands have characteristics of the transition zone between the Palaearctic region and the Oriental region for animals: for example, Japanese serows, Japanese monkeys and Japanese giant flying squirrels inhabit in the northern end of Honshu Island.

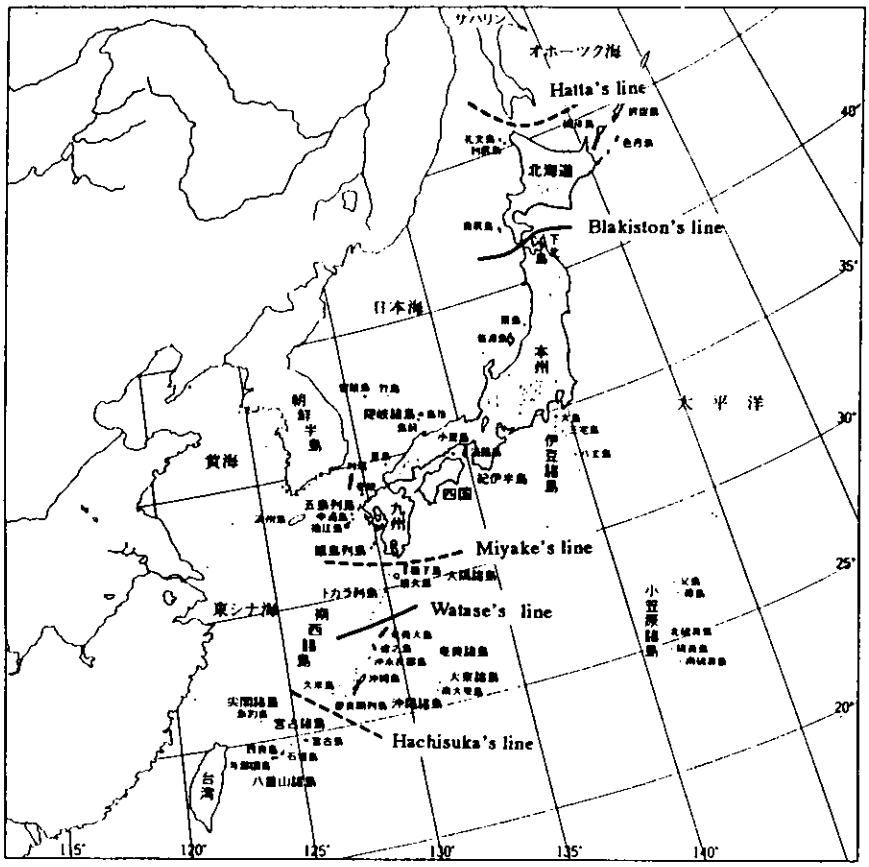
b) Biogeography in Japanese Archipelago

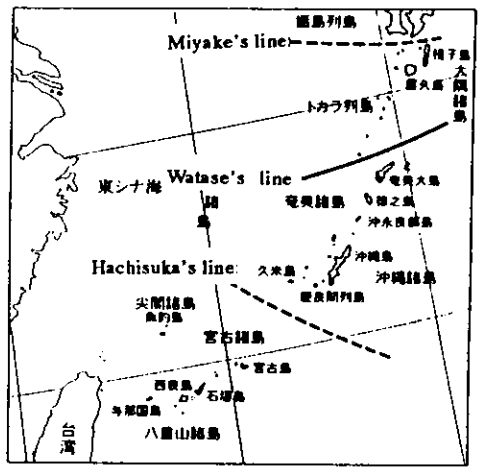
Straits between the islands are the boundaries of distribution for most of the species living in the Japanese Archipelago: the Tsugaru Straits and the Tokara Straits are particularly important. The boundaries regulating the species distribution are as follows:

- Blakiston's line (Tsugaru Straits): for mammals;
- Watase's line (Tokara Straits): for mammals, reptiles, amphibians and spiders: the Palaearctic region in the north and the Oriental region in the south;
- Hatta's line (Soya line): for reptiles, amphibians and freshwater invertebrates;
- Hachisuka's line: for birds;

- Miyake’s line: for insects: Japanese endemic species in the north and tropical species in the south.

環境庁 （1982）： 日本の自然環境
日高敏隆 監修（1996）： 日本動物大百科、 平凡社





◀▲日本の動物地理区
ブラキストン線　津軽海峡線ともいう．ブレーキストンとプライアーが1880年に『日本鳥類目録』で提唱した．この線より北をシベリア亜区，南を満州亜区とする．哺乳類の分布境界がこの線と合致するものが多い．
渡瀬線　1912年に渡瀬庄三郎が確認．この線より北を旧北区，南を東洋亜区とする．哺乳類・両生類・爬虫類・クモ類などの分布境界と合致するものが多い．
八田線　宗谷線ともいう．この線より北をシベリア亜区，南を満州亜区とする．両生類・爬虫類・淡水無脊椎動物の分布境界と合致するものが多い．
蜂須賀線　この線より北を全北区，南を旧熱帯区とする．鳥類の分布境界と合致するものが多い．
三宅線　これより北は日本特産の昆虫，南は熱帯型の昆虫が多い．

- Blakiston's line (Tsugaru Straits): for mammals;
- Watase's line (Tokara Straits): for mammals, reptiles, amphibians and spiders: the Palaearctic region in the north and the Oriental region in the south;
- Hatta's line (Soya line): for reptiles, amphibians and freshwater invertebrates;
- Hachisuka's line: for birds;
- Miyake's line: for insects: Japanese endemic species in the north and tropical species in the south.

日高敏隆 監修（1996）： 日本動物大百科、 平凡社

(2) Nature in Japan

2-2) Mammals

a) Characteristics of Mammals in Japan (I): Diversity and Endemism

In Japan, mammals are very rich in species due to both the diversified ecological environment, extending from the arctic zone to the subtropical zone, and complex processes that formed the Japanese Archipelago during which the islands were repeatedly connected and disconnected with the Asian continent. Indigenous mammals number 23 families, 60 genera and 109 species, of which terrestrial mammals comprise 20 families, 60 genera and 99 species. These numbers represent 2.4 to 2.6% of all mammal species currently found in the world.

In comparison with China, which has 414 mammal species, the number of terrestrial species in Japan is only 23.9% that of China. However, if the number of species is compared per unit area, Japan has six times more species than China since the land area of Japan is only 4% of that of China. In comparison between Britain and the Honshu Island, of which area sizes are similar, the ratio of number of species of terrestrial mammals is 48 in England and 58 in the Honshu Island. These comparisons show that the Japan has relatively high species diversity of mammals.

In addition, many of Japan's mammal species are endemic: 39 species of terrestrial mammals, comprising 39.4% of all the terrestrial species in the country, can be found nowhere else. In comparison, Britain has no endemic species of mammals. It is thought that a reason for this difference is derived from differences in formation and structure of the land itself. In he case of Britain, the most likely explanation is that no significant or specific evolution occurred in animals due to the fact that the vegetation and animal habitats were largely destroyed by glacial action in the Diluvial epoch and animals had not been able to survive for a long time. In Japan, on the other hand, animals were able to avoid extinction by taking advantage of the long, north-south orientation of the archipelago, and moved toward south during the cold glacial period northwards or into mountainous areas during the warm inter-glacial period.

b) Characteristics of Mammals in Japan (II): Qualitative

In comparison with the Asian Continent on the same latitude, mammals in Japan can be characterised as follows:

- No species inhabiting in grasslands or deserts; forest ecosystems are well established but arid ecosystems did not because of the rich rainfalls;
- No large carnivore species (tigers, leopards and lynxes);
- No species belonging to the Family Mustelidae (rasses, genettes and mongooses).

c) Distribution of Mammals in Japan: Mammal Geographic Zones

Japan is located over two faunal geographic zones: the Old Northern Zone and the Oriental Zone. The Old Northern Zone includes the main islands of Japan, north of Tokara Islands, in which the main species originated from the temperate and arctic zones. The Oriental Zone includes Amami Islands and Nansei Islands, south of the Watase's line, where the main species originated from the subtropical and tropical zones.

In Hokkaido, there are very few endemic species of mammals. While sixty-one percent of the Japan's mammal species are distributed only in Hokkaido and its associated islands, the same species also inhabit the northern areas of Sakhalin and Siberia.

In Honshu, Shikoku, Kyushu and their associated islands (with the exception of Tsushima), the basic species compositions of mammals are the same. At least 42% of the indigenous species are endemic with very old origins and comprise the originator species of the mammals now found in the main islands. Mammals inhabiting the main islands are roughly divided into two groups: one group having related species in North Korea, north-eastern China and further north, while the other group is related to species found in south China, the Himalayas and further south. The Mammals on Tsushima Island include several endemic species originating from North Korea.

In the Nansei Islands, mammals evolved and specialised because most of the islands are very small and have been isolated from the continent for a long time, since the early Diluvial epoch at least. Fifty-six percent of the indigenous species on the islands are endemic and some of them are so even on the genus level.

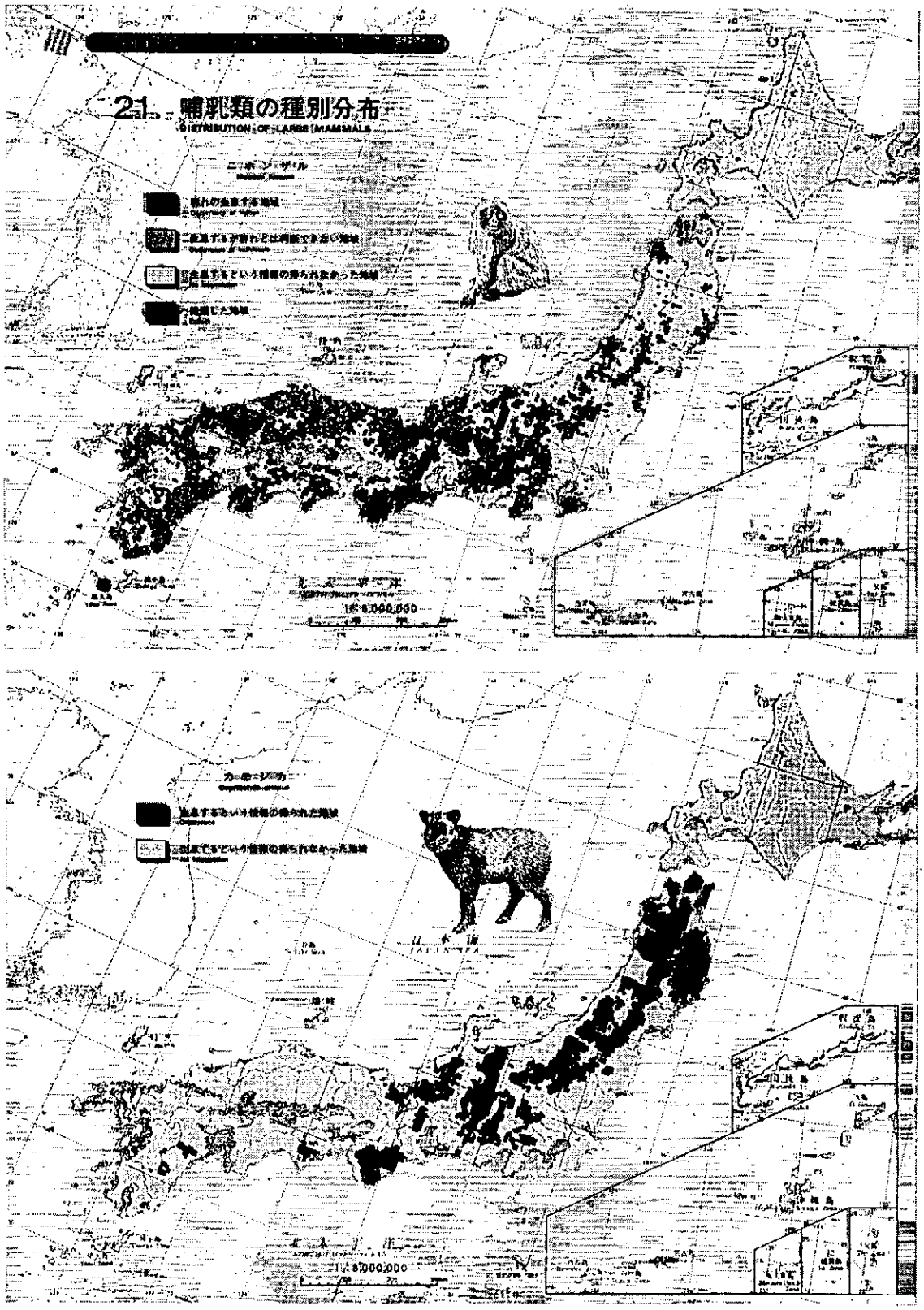
阿部 永（1998）：日本の哺乳類の多様性とその保護、モグラたち、そして野生動物たちの今は ― 野生動物の保護をめざす「もぐらサミット」報告書、 比和町立自然科学博物館・比婆科学教育振興会、

日高 敏隆 監修（1996）： 日本動物大百科、１ 哺乳類、 平凡社

阿部 永 監修（1994）： 日本の哺乳類、 東海大学出版会

金子之史（1998）： 哺乳類の生物学 １ 分類、 東京大学出版会 （参照資料）

(2) Nature in Japan 2-2) Mammals



「日本の自然環境」環境庁 1982 年

(2) Nature in Japan

2-3) Birds

a) Migration of Birds

A great number of migratory birds seasonally flock from various breeding or wintering areas such as the Arctic circle, Alaska, Kamchatka Peninsula, Siberian Continent, Chinese Continent, Korean Peninsula, Malaysia, the Philippines, Australia etc to the Japanese archipelago, which stretches from 20 N to 45 N, and lies on the coast of the Eurasian Continent. According to the checklist of Japanese Birds, more than 600 species of birds including 100 subspecies have been recorded in Japan.

These birds are conveniently categorised into five types by moving pattern as follows. The residents, such as *Passer montanus, Phasianus colchicus, Corvus macrorphynchos* and others stay continuously in the same area all year around. The wanderers such as *Cettia diphone cantans, Garrulus gladarius japonicus, Troglodytes troglodytes fumigatus* and others that visit the Japanese archipelago in summer and go back to the wintering area across the sea are called summer visitors.

The following birds that come down and stay during the winter season in Japan are categorised as winter visitors: *Turdus naumanni eunomus, Anser albifrons, Cygnus cygnus*, etc. Birds such as *Calidris ruficollis, Arenaria interpres, Xenus cinereus, Pluvialis dominica*, etc. that just visit the Japanese Islands temporarily are called transients. *Otis tetrax*, *Zonotrichia leucophrys*, etc., which are found accidentally in Japan, are classified as stray birds.

b) Features of Japanese Avifauna

The percentage of migratory birds and the residents is 60 % and 40 %, respectively, in Honshu, Shikoku and Kyushu. In Hokkaido and the Ryukyu Islands the migratory birds occupy more than 80 % of the population and the rest are a resident. These percentages mean that the Japanese Islands are indispensable to migratory birds, and this is one of the avifaunal characteristics of the Japanese Archipelago.

Another characteristic of the Japanese avifauna is that many sea birds can be seen in and around the islands. Some of them, such as *Puffinus tenuirostris, Melanitta fusca* just pass through the vicinity of Japanese Islands, and the others spend a couple of months during the breeding season on scattered islands around Japan.

c) Zoogeography

Zoogeographically, most of the Japanese Islands are located at the south-eastern end of the Palaearctic region and part of the Ryukyu Islands is considered to belong to the Oriental Region

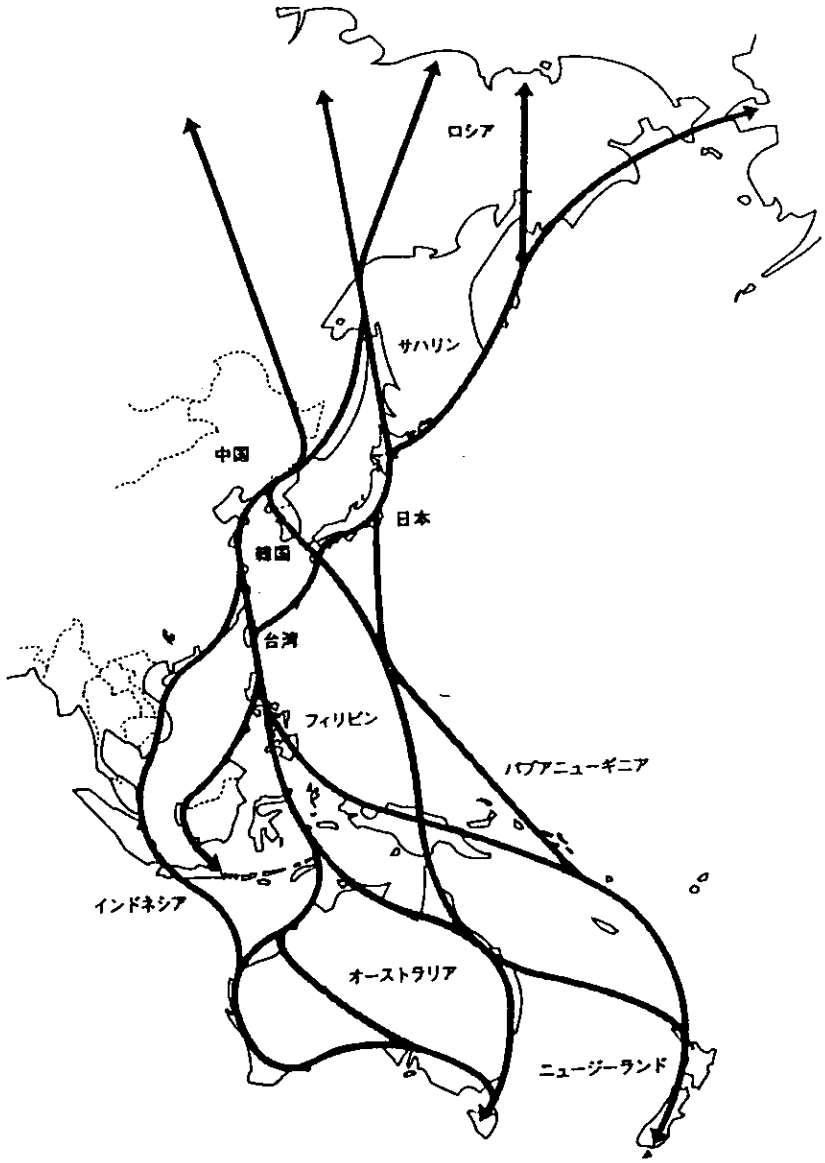
from the view point of Mammalian distribution. Birds that belong to the Oriental Region are observed in and around Ryukyu Islands, Siberian avifauna is distributed in Hokkaido, and Asian Continental birds can be seen in Honshu, Kyushu and Shikoku.

There are two important avian-geographical lines in the long Japanese archipelago: the Blakiston Line located between Hokkaido and Honshu and the Watarase Line located between Yaku Island and the Amami Islands.

There is significant difference in avifaunal distribution between Hokkaido and Honshu. For instance, *Picoides tridactylus, Ketupa blakistoni*, and *Pinicola enucleator*, are exclusively distributed in Hokkaido, while *Picus awokera* and others can be seen only in Honshu, and *Garrulus Iidthi, Scolopax mira, Sapheopipo noguchii* and others are distributed in the Amami Islands. Since the Japanese Islands were separated from the continent several billions of years ago, there are many endemic species and subspecies of birds in Japan. They are as follows: *Phasianus soemmerringii, Phasianus colchicus, Shynthiboramphus wumizusume, Picus awokera, Mottailla gradis, Erithacus akahige, Erithacus komadori, Prunella rubida, Turdus celaenops, Parus varius, Emberiza sulphurata, Garrulus Iidthi, Sapheopipo noguchii,* and *Megalurus pryeri*. The Izu Islands, Bonin Islands, Torishima Islands and Daito Islands in the Pacific Ocean far from the Japanese mainland each has peculiar avifauna such as *Turdus celaenops, Apalopteron familiare hahasima, Diomedea albatrus*, and *Otus scops interpositus*.

阿部 學（1982）：**日本の鳥類、日本の自然環境、 環境庁**

(2) Nature in Japan 2-3) Birds



Migration route of shore birds in the Eastern Asia - Australasia

世界自然保護基金日本委員会(1995):東アジア渡り鳥ルートツアー報告書