

Chapter 39

Sika Deer in Continental Europe

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Abstract In this chapter I review the history of introduction of sika to continental Europe by country and summarize their acclimatization to the local environment. Beginning about 150 years ago sika deer were introduced into most of the countries in western, central, and eastern Europe; northern and southern countries were less affected. Besides free-ranging feral populations, there are an unknown number of deer parks, zoological gardens, and farms containing sika deer. With consistent growth of deer farming in Europe, there is increased interest in captive breeding of sika. Due to anatomical and behavioral features, sika appear to be successful competitors with local deer species. Although characterized as sedentary, they have the capability to migrate long distances. Frequently lone individuals, usually males, appear in areas with no established sika deer where they join red deer. In the beginning, imported sika occasionally interbred with other species, such as red deer, hog deer, and axis, mostly by coincidence. Most published records described the hybrids as due to a break of the geographical isolation between species. Nevertheless, sika and red deer (Manchurian wapiti, *Cervus elaphus xanthopygus*) hybridize naturally where they overlap in Far East Russia. In many areas where sika coexist with red deer, it is still believed by many hunters that no interbreeding has occurred, despite massive evidence to the contrary, including modern genetic techniques. Disregard of hybridization has resulting in introgression of sika and red deer genes in many areas. Still, there is no general wildlife management strategy in continental Europe to realize the danger and to solve the situation, and free-ranging sika populations further increase in numbers.

History

The history of sika deer in Europe began some 150 years ago. At that time many exotic animal and plant species were introduced as enrichment to European fauna and flora. Various deer species and subspecies were introduced to make new game animals available. However, in several European countries for example, red deer was a “royal species” which could be hunted only by privileged individuals.

The first translocations of sika deer were from their distant native range (Fig. 39.1). According to Eick (1995d), the main importer and supplier of sika deer in continental Europe was Hagenbeck of Hamburg. The geographical origin of these deer can no longer be ascertained, as the Hagenbeck archive was destroyed during World War II. In addition, the company of Mohr, in Ulm, has been occasionally reported as a supplier. Nevertheless, it is not clear if this company ever imported any sika from their native territories.

In the beginning, it was not recognized that the imported animals could have belonged to various subspecies; in fact, it was entirely ignored (Eick 1995e). In part this was because the first imports of sika subspecies to Europe were parallel with the discovery of the species itself. First descriptions of the holotype were often based on fragmented material. For example, Swinhoe (1864) described his *Cervus nippon hortulorum* from “three skins of two bucks and one doe.” Moreover, after import to Europe, various subspecies had been mixed and intercrossed. As a result, in Europe generally only the large *hortuloid* types and the smaller *nipponoid* types can be distinguished (Eick 1995e). Recent studies using microsatellite and mitochondrial DNA analyses have revealed the origin of sika deer in the United Kingdom (Goodman et al. 2001). This is promising for further reconstruction of the history of sika introductions.

The history of individual countries is presented in alphabetical order. Figure 39.2 shows distribution of sika deer in Europe with earliest dates of the first occurrences of the species. Estimates of numbers of sika deer are shown in Table 39.1.

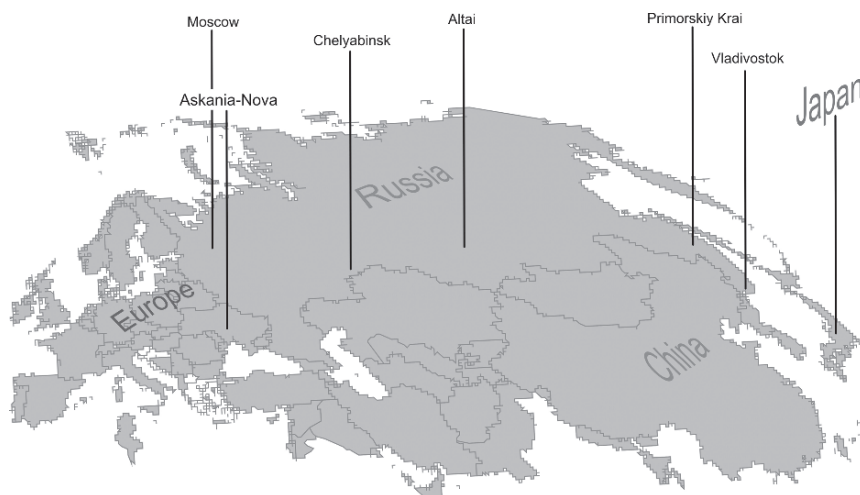


Fig. 39.1 A map showing the distribution of the basic locations from which sika deer were imported and/or acclimatized during the translocation to Europe.

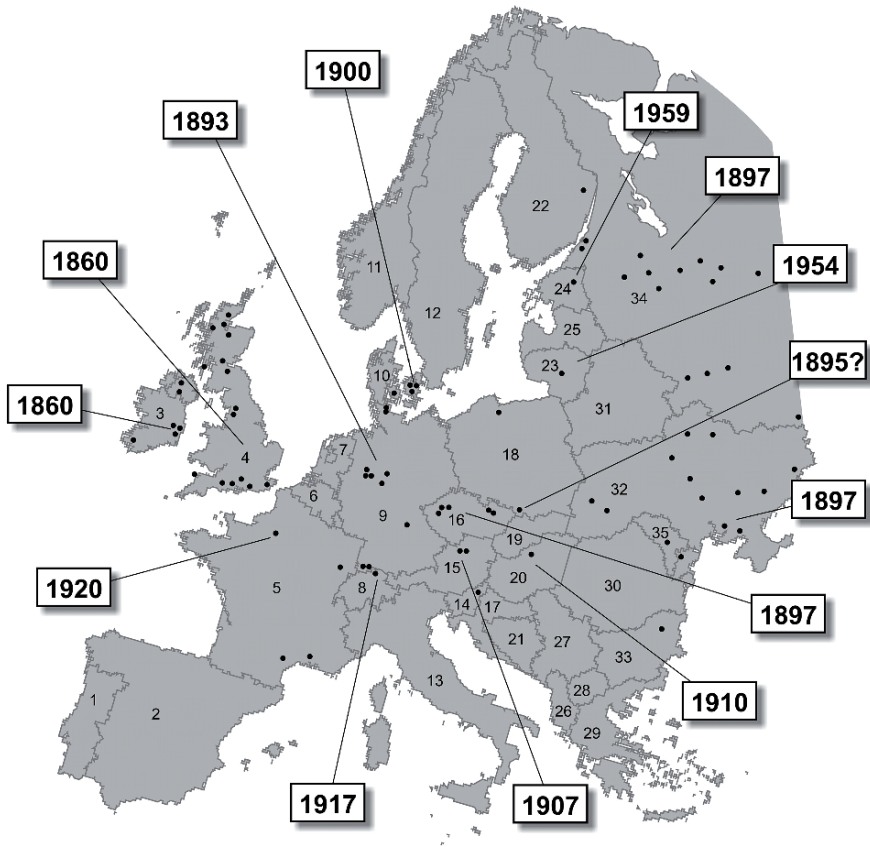


Fig. 39.2 Distribution of sika deer in Europe with earliest dates of the first occurrences of the species. (1-Portugal; 2-Spain; 3-Ireland; 4-United Kingdom; 5-France; 6-Belgium; 7-The Netherlands; 8-Switzerland; 9-Germany; 10-Denmark; 11-Norway; 12-Sweden; 13-Italy; 14-Slovenia; 15-Austria; 16-Czech Republic; 17-Croatia; 18-Poland; 19-Slovak Republic; 20-Hungary; 21-Bosnia-Herzegovina; 22-Finland; 23-Lithuania; 24-Estonia; 25-Latvia; 26-Albania; 27-Yugoslavia; 28-Macedonia; 29-Greece; 30-Romania; 31-Belarus; 32-Ukraine; 33-Bulgaria; 34-Russia; 35-Moldova).

Austria

There are two feral populations of sika in Austria, both located along the Danube River, west and north-west from Vienna, in the Persenburg-Ostrong and Preuwitz-Tulln Danube Meadows (Eick 1995a). The animals of the first population, said to come originally from Japan, were imported from the Kluk enclosure, near Poděbrady (east from the capital, Prague), Czech Republic (Niethammer 1963). Because various sika deer subspecies were crossed in this enclosure (Kokeš 1970), however, the stock can be hardly called of Japanese origin. Subsequently Emperor Franz Josef I of Austria received two stags and five hinds as a gift from the Emperor

Table 39.1 Numbers of free-living sika deer in Continental Europe. (Adapted from Eick et al. 1995 if not stated otherwise.)

Country	Year of census	Area	Number
Austria	1983	Persenburg–Ostrong	150
	1997 ^a	Preuwitz-Tulln	700
		Total:	850
Czech Republic	1988	Plzeň North	1,000
	1988	Bouzovsko	450
	1988	Total:	1,450
	2003 ^b	Total:	4,954
Denmark	1977 ^c	Total:	500
Estonia			
France	1980	Rambouillet	90
	1980	Forêt de la Harth	70
		Total:	160
Germany	1995	Glücksburg	25
	1990	Hochrhein	350
	1995	Hütten and Duvenstedt Mountains	70
	1989	Möhnesee	800
	1991	Ostangeln, Schwansen	150
	1977 ^d	Schlitz	35
	1984	Weserbergland	70
	Total:	1,500	
Hungary	1985	Fehérvárcsurgó Total:	115
Lithuania	1970 ^e	Total:	704
Poland	1981	Kadyny	160
	1981	Kobiór	30
		Total:	190
Russia and Ukraine	1984 ^f	Total:	12,000
Switzerland	1988	Südranden, Total:	90

^aActualized in Bartoš et al. (2003).

^bAccording to changes in the system of monitoring population dynamics, data for the numbers according to areas of sika deer distribution has no longer been available. Hence, for the purpose of this chapter, numbers for the two main Czech sika areas were adapted from earlier records; the total numbers were obtained from the recent official statistics of the country.

^cCompiled from Bennetsen (1977).

^dProbably now extinct (Eick 2003, personal communication).

^ePopulation is probably now extinct (Baleisis et al. 2002).

^fCompiled from Uloth (1984).

of Japan in 1907 via Hagenbeck in Hamburg and released them into the enclosure in Persenburg. When the enclosure fell into disrepair, the animals dispersed into the wooded areas of the Ostrong (Eick 1995a). The second population is based on sika imported from the Czech Republic into the enclosure at Neuaiigen, north of Tulln. The enclosure was destroyed at the end of the war in 1945 and the deer escaped into the wild (Eick 1995a).

Czech Republic

In 1891 sika were first released into the Kluk enclosure near Poděbrady (Kokeš 1970). In the late nineteenth and early twentieth century, sika were frequently imported for deer parks. The origins were allegedly Japan, eastern China, Korea, and southeastern Siberia, Russia (around the Ussuri River). These sika were regarded to belong to both Japanese (*Cervus nippon nippon*) and Dybowski's sika (*Cervus nippon hortulorum*) subspecies (Wolf and Vavruněk 1975–1976). Additional sika were also imported through Hagenbeck; these originated for the most part from Japan and Russia (Komárek 1945). There were also imports from estates in England and Austria (Kokeš 1970). Sika were maintained in enclosures where they prospered until the 1940s. During World War II and subsequent political changes in the country after the war, some deer parks were destroyed and sika escaped (Vavruněk and Wolf 1977). This was the case of two parks, Lipí in Manětín, Bohemia, with sika kept since 1897 (Doležal 1960) and Čemíny, with sika kept since the beginning of the century. These escaped sika were the base of the west Bohemian sika population around Plzeň (Pilsen) North. Migrating sika colonized further territories, such as Slavkovský les (Wolf and Vavruněk 1975–1976; Vavruněk and Wolf 1977). In the 1970s, numbers of feral sika in this area reached 1,000. Since that time sika numbers have multiplied.

Sika deer in the second main area in Czechia, Bouzovsko, northern Moravia, came from a deer park adjoining a castle on the estate Žádlovice belonging to the Dubský family. Sika deer were allegedly imported from Hagenbeck (Babička et al. 1977). The first deer who escaped from the park were harvested in 1918 (Hošek 1982). In 1945, after World War II, the park fences were destroyed and 14 sika deer (four stags and 10 hinds) escaped and became the base of the current population (Babička et al. 1977; Hošek 1982).

Denmark

Sika were first introduced in Denmark as park deer in 1900 (Bennetsen 1977). One stag and one hind were released in an enclosure on the estate of Svenstrup. The origin of these sika is not known for certain, but some evidence suggests that they may have come from Ireland. In 1909 some sika from Hagenbeck in Hamburg were released in a deer park on the estate of Knuthenborg. These two releases seem to have formed the basis for all other Danish populations. Yet some doubt exists about the origin of the population on the estate of Frijsenborg. This was the first free-ranging population in Denmark. It seems that sika were released there several times between 1900 and 1910. They may have come from Hagenbeck, from Svenstrup, or from both. Apart from two herds, Mejgaard and Ormstrup-Tange, founded by sika that in all probability immigrated from Frijsenborg, all other sika herds were established by stocking or by deer which broke out of deer parks. It is evident that the stags are migratory.

France

In 1890, the Emperor of Japan gave a gift of one stag and three hinds from Nara Park, Japan, to President Carnot of the Third Republic. The animals were released into a 900 ha enclosure in Rambouillet. The population reached 200 animals, but has been reduced to about 90. Sika share space with roe deer (*Capreolus capreolus*) (Legrand 1988; Eick 1995c); the environment is said to be too dry for red deer (Eick 2003, personal communication). Sources of sika in the second location, Forêt de la Harth, were Mulhouse Zoo and the Huttenheim enclosure (southwest of Strasbourg). In 1953 a pair of sika from Mulhouse Zoo was placed into a 3 ha enclosure and further deer were imported from the Huttenheim enclosure two years later. The Forêt de la Harth enclosure was later enlarged to 230 ha and further in 1976 to 290 ha. In 1970, 10 sika were released into the wild. The herd reached some 250 deer of which 30 were free-ranging. These numbers were then reduced to some 70 animals. Surplus sika were used to establish new herds in Alsace, Massif Central, Burgundy, and Switzerland (Cailmail 1988).

Germany

Seven areas with sika are recognized in Germany: Möhnesee (east of Dortmund) (Eick 1988), Hochrhein (near Waldshut, in the south close to the border with Switzerland) (Wicki 1988), Ostangeln and Schwansen (in the north, close to the Denmark border) (Rumohr-Rundhof 1988), and several smaller areas—Schlitz (Ueckermann 1988), Glücksburg (north of Ostangeln) (Eick 1995d), the Hütten and Duvenstedt Mountains (Eick 1995d), and Weserbergland (southwest of Hannover) (Hake 1988). This information has been summarized by Eick (1995d).

The largest German sika population in Möhnesee was derived from sika from Hagenbeck and from the Hellabrun Zoo, Munich. In 1893, Baron von Donner released six to 10 sika into an 800 ha enclosure near Neuhaus, Möhnesee. The enclosure also contained red deer, axis (*Cervus axis*), sambar (*Cervus unicolor*), hog-deer (*Cervus porcinus*), barasingha (*Cervus duvauceli*), mouflon (*Ovis musimon*), and antelope (Feaux De Lacroix 1913, cited in Eick 1995d). Eick (1995d) further cited information from Holtkotte (1941 in Eick 1995d) reporting "... Dybowski and sika stags were imported from Manchuria... In 1928 and 1930 several Dybowski were imported into the same park... Unfortunately, after two years, the Dybowski stags were inadvertently shot." Sika got out of the enclosure first in 1936, when the fence was broken by snow. Allegedly, the majority of the escaped animals returned to the enclosure. Sika finally left the enclosure in 1945; at first they spread eastward and later westward as well. They share the environment with red deer, roe deer, and wild boar (Eick 1995d).

The second largest population is located at Hochrhein (Wicki 1988). In 1911 the sika were imported and released into a 180 ha enclosure with fallow deer (*Dama dama*),

mouflon, and ibex (*Capra ibex*) at Rohrof, near Waldshut. These sika originated from Basel Zoo, St. Peter Game Park in Freiburg, and Hagenbeck, Hamburg. In 1939 the sika were released from the enclosure (Eick 1995d). The third largest German population, at Ostangeln, Schwansen, was started by Paul von Schiller in 1928. He purchased seven sika deer from Hagenbeck and released them into a 9 ha enclosure at Buckhagen. The first deer escaped at the beginning of World War II, but were caught again. As the war continued, it was difficult to maintain the enclosure and the deer were released into the wild. The escaped sika have established themselves quite well. The other deer species in the area are fallow and roe deer (Rumohr-Rundhof 1988).

The Weserbergland population was established by Karl Freiherr von Wolff-Metternich of Haus Amelunxen, who bought in 1933 four sika deer from Carl Hagenbeck. He released them into a 31 ha enclosure originally used for keeping roe deer. The first individuals escaped here during World War II as well. In 1945 up to 40 deer were released into the wild. Further sika were imported later—in 1968 from the Frankfurt Zoo, in 1972 from Nürnberg, and in 1976 from Zoo Wuppertal and from the deer park Schirmecke (Hake 1988).

In the Hütten and Duvenstedt Mountains, sika were imported as a substitute for fallow deer. In 1964, Hans Peter Greve of Holzbunge, introduced three sika from Mohr, Ulm, into a small 0.30 ha enclosure. One hind escaped shortly afterwards, but remained in the vicinity of the pen. In 1965 another enclosure, owned by Claus Kuhr in Hegelholz, Neu-Duvenstedt, was stocked with three sika from Mohr, Ulm. Since that time, offspring of sika in these enclosures have been continually released into the wild (Eick 1995d). Almost no information is available for the origin of the population at Schlitz. The origin of the deer is unknown, but sika appeared in the wild in 1960 (Ueckermann 1988). It is not sure, however, if the population still exists (Eick 1995d). The most recently established feral population is the one in Glücksburg. In the 1970s a display was erected and stocked with sika probably from Denmark. Due to heavy snow, the animals escaped in the winter of 1978/79. Since the beginning, migration between Glücksburg and Ostangeln has been recorded (Eick 1995d).

Hungary

The only place with sika in Hungary is Fehérvárcsurgó (southwest of Budapest). In 1910, sika deer from Hagenbeck were introduced into the deer park at Fehérvárcsurgó belonging to the Count Gyula Károlyi. As in other areas, sika were doing very well and their numbers reached some 200 deer by the 1940s. Nevertheless, during World War II the population was decimated and a few remaining deer escaped into the Bakony Mountains. In 1946 a further pair of sika was released. Throughout following two decades, the population was supported by further imports from Budapest Zoo—seven in 1958 and five in 1969. The origin of these sika was the former USSR. In 1975 they imported a further 28 deer from the USSR (Markovic 1988).

Poland

Sika deer were introduced into the present territory of Poland at the turn of the nineteenth century, perhaps in 1895 a smaller *nipponoid* type in Kobiór (southern Poland), and in 1910 a larger *hortuloid* type in the Kadyny (northern Poland) (Matuszewski 1988). Other reports give 1905 for the first introduction of sika to Kobiór from England via Hagenbeck (Niethammer 1963; Matuszewski and Sumiński 1984; Eick 1995f). The original Kadyny sika were imported via Hagenbeck from Japan (Niethammer 1963; Eick 1995f). The acclimatization in both locations was similar: individuals were first kept in enclosures and then released into the wild (Matuszewski 1988).

Russia and Ukraine

According to Eick (1995b), the translocation of sika deer from the Russian far east was realized in several steps. The first sika deer came from Primorsky Krai, an area of natural sika occurrence, mostly from deer farms around Vladivostok (Fig. 39.1). Further imports were a mix of continuing transports from the far east. Around 1909 deer were brought to Askania-Nova, Ukraine (Fig. 39.1), which became the source for many releases in the former Soviet Union (USSR) and internationally.

There were two basic reasons for translocation of sika deer from the Russian far east. In the second half of the nineteenth century, the numbers of wild sika deer began to decline. In 1924, harvesting free-living sika deer became prohibited (Zhirnov et al. 1978). Because the situation did not improve, in 1938 240 deer were released into several nature reserves in central Asian regions of the former USSR, southwest of Chelyabinsk and further to the west. These reserves were in Busuluk Bor (northwest of Orenburg), Kuibyshev, an area northeast of Riazan, in Mordvin, in the Khoper reserve, an area southwest of Borisoglebsk, and in Teberda in the Caucasus. In some of the locations climate conditions were extremely hostile, snow cover in particular, and the deer did not establish themselves. The second reason for translocation was increasing demand for medical products from antlers. Around 1933, sika were used for velvet production in Altai region, where they were crossed with marals (Siberian wapiti, *Cervus elaphus sibiricus*).

More recently, further transports followed (Eick 1995b). From 1918 to 1972, approximately 2,400 sika deer were released in eastern Europe (Pavlov et al. 1974). In its natural range, sika was decreasing in number and its hunting was banned (Makovkin 1999; Baskin and Danell 2003). In the European part of the former USSR, it has been bred for game and used for sport hunting (Baskin and Danell 2003). Today, sika deer are well-established in the European part of Russia and in Ukraine in a number of locations including near Moscow and near Kiev (Eick 1995b). According to Baskin and Danell (2003), recent introduced populations of introduction are in Voronezh Oblast, Oksky Nature Reserve, Khopersky Nature

Reserve, Mordovsky Nature Reserve, and Ilmensky Nature reserve (the latter located in the Asian part of Russia).

Switzerland

In Südranden in northern Switzerland, sika immigrated from the population in Hochrhein, Germany. The first animal was recorded in 1917. Nevertheless, the main immigration occurred after the Rohrof deer park was opened in 1939 and sika deer were released. A relatively stable population has established. Wandering sika deer may be seen also in other areas (Schoenberger et al. 1988).

Other Countries

According to anonymous information on the internet, in Estonia sika deer were introduced in 1956 in Vääna Forest District. Later single individuals dispersed to Alutaguse from the population in neighboring areas of Russia, introduced there in 1987. At present the introduced sika population is probably extinct. In eastern Estonia single immigrants from neighboring areas may occur.

According to Baleisis et al. (2002), 24 sika deer were brought to Lithuania to be acclimatized in 1954 from the Chelyabinsk farm in the Gorno-Altai Region (Russia; Fig. 39.1) and released in the Dubrava forest (Kaunas district). Several years later the numbers of sika in the forest was augmented to 60 to 70 individuals. In the 1970s, however, the population settled at this level and later started decreasing. Dispersal of the sika deer to the neighboring forests was not observed. Since 1992 there are no data on the numbers of this species in the Dubrava forest. Sika are also listed among six nonnative species introduced to Lithuania (Baškyte et al. 1997). On the other hand, they are not included among “legal game” species nor among “natural resources” (as are, e.g., fallow deer). Therefore, it is unlikely that sika deer would have any significant meaning these days in the wild in Lithuania.

A well-studied sika population exists in Moldova (Prisyazhnyuk and Tchegorko 1990), but no data are available on its current situation. There are internet advertisements for hunting sika deer in other countries not mentioned here, such as Finland, Bulgaria, and Slovenia, suggesting the existence of the species there as well.

Captive Sika in Europe

Besides free-ranging sika populations, there are an unknown number of deer parks, zoological gardens, and other enclosures and farms containing sika deer of various origin in Europe. These numbers and locations continually change over time. Only

fragmentary information is available and it is difficult to get any reliable data and/or trend estimates. According to the ISIS (International Species Information System) website, there are 29 zoological gardens in Europe keeping 417 sika of various subspecies (listed as: *Cervus nippon*, *C. n. nippon*, *C. n. dybowskii*, *C. n. hortulorum*, *C. n. pseudoaxis*, and *C. n. taiouanus*). Most countries with feral populations of sika deer have this species also in enclosures. For example, sika can still be found in most deer parks in Denmark (Herlevsen 2003, personal communication). Switzerland has an insignificant number of free-ranging sika (Table 39.1). In 1997, a survey of captive deer in that country reported 13 deer parks with about 130 sika deer and almost 30 farms with over 200 additional sika (Daenzer 2003, personal communication).

With consistent growth of deer farming in Europe (Bartoš and Šiler 1994; Reinken 1998; Audenaerde 2002), there is increased interest in the captive breeding of sika. An exception is Denmark. In a new regulation issued in 1993, the species of deer which could be legally farmed were reduced to red and fallow deer. Existing herds of sika deer could stay, but it was prohibited to sell livestock or increase numbers of deer on farms (Herlevsen 2003, personal communication). No constraints exist in the majority of other countries. In Belgium, during the last six years there have been several imports of sika from Ireland and Germany. These sika have been distributed over several hobby parks in the country. The largest holding has some 60 animals now (Audenaerde 2003, personal communication). In Lithuania, about 1,000 sika deer are farmed in the Kaunas and Klaipeda districts (Malakauskas and Grikieniene 2002 and Grikieniene 2003, personal communication).

Interspecific Interactions

Ungulate species from outside Europe have often been introduced and become naturalized. These species are not likely to have co-evolved with the indigenous species, and as such may have overlapping niches which result in competition. Accounts of such apparent competition often involve sika deer (Latham 1999). Due to anatomical and behavioral features, sika deer appear to be particularly efficient in breaking down fibrous food (even of poor quality) and in building up energy reserves (Hofmann 1988, 1989; Takatsuki 1988).

Interspecific sika behavior is rather flexible. Intolerance by sika deer toward other species has been reported from several places in Europe (Bartoš and Žirovnický 1982). Primarily, they dominate the smaller roe deer (e.g., Rowland 1967; Cadman 1980; Opluštil 1980). Danilkin (1996) cited instances of sika deer chasing roe deer from feeding sites and links this to a decline in roe deer numbers as sika deer increased following their introduction. Sika appeared aggressive and a successful competitor with fallow deer in the Czech Republic. Within 12 years after sika appeared in the wild, the formerly well-established fallow deer in the West Bohemia area have almost entirely disappeared, surviving only at the periphery of the area (Wolf and Vavruněk 1975–1976; Vavruněk and Wolf 1977). On the

contrary, in Ostangeln, Germany, fallow deer seem to be successful competitors with the feral sika deer, outnumbering sika in the area (Rumohr-Rundhof 1988). Sika are also reported to disturb red deer rutting (Wolf and Vavruněk 1975–1976). Sumiński (1964 cited in Matuszewski 1988) suggests that Kadyny sika dominate red deer “because of their greater bravery.” According to Matuszewski and Sumiński (1984), mainly during the rut, young red stags have been attacked by older sika males. In their natural habitat, sika seem to compete successfully with much larger Manchurian wapiti (*Cervus elaphus xanthopygus*). Although the Manchurian wapiti is behaviorally dominant, sika deer is the dominant ecological competitor (Makovkin 1999). As with red deer, wherever there is a high population density of sika deer there is a decline in the population of roe deer. This occurs because sika deer rapidly exhaust the food supply (Makovkin 1999).

The interspecific competition usually occurs on a “non-visible” basis, which may lead human observers to the opinion that no interspecific competition between local species and exotic sika deer exists. Putman (1996) has a good illustration from the New Forest area based on unpublished results of his students. In Boxall’s four-year study of fallow, roe, sika, and red deer in Roydon Wood, individuals of two or more species were recorded in the same sampling unit (1 ha grid square) on only 30 occasions in 2,580 observations (Boxall 1990, cited in Putman 1996). However, animals of different species were commonly recorded within different patches of the same habitat, and there was no evidence of interference to exclusion. Similar conclusions are reported by Sharma (1994, cited in Putman 1996), who examined the potential for direct interaction between fallow and roe deer where they occur in sympatry, assessing from transect data the expected number of transect walks on which no deer of either species were seen, the number on which only roe, or only fallow were seen, and the number in which both roe and fallow might be encountered within the same site. Observed frequencies were compared against these expected values; no tests showed a significant difference between observed and expected values, offering no evidence that either species makes any attempt to avoid a site because of the presence of the other (Sharma 1994, cited in Putman 1996). Levels of overlap calculated (0 = none, 1 = complete) in relation to habitat use were universally high, with overlaps in excess of 0.66 recorded between all pairs of deer species in all seasons, with summer values being highest (0.89 for roe, 0.82 for fallow, and 0.72 for red deer). The potential for interaction between sika and other deer in the New Forest was also indicated by overlap in diets based on fecal analysis and direct feeding observations. Again, the overlaps were high ((0.49 for roe, 0.89 for fallow, and 0.95 for red deer).

Large variation in rutting activity for sika deer has been reported across Europe and also within very small areas. Matuszewski (1988) reported the start of the rut in mid-September in the south, while mid-October in the north of Poland. According to Bennetsen (1977), in Denmark the rutting season varies considerably from one herd to another. In Frijsenborg the rut normally starts about 1 September, whereas it starts as late as 1 November or even later in other districts. In addition to this it seems that the rut covers a considerably longer period in each individual herd than is the case for red deer and fallow deer. As a result, the calving period may range

from 27 March to 5 October (Bennetsen 1977). This is very similar to the situation in the south of Switzerland (Schoenberger et al. 1988). In the Czech Republic, in Weserbergland and Möneseesee, Germany, Forêt de la Harth, France, and in the areas of origin, rutting usually starts in mid-October and persists often until December (Wolf and Vavruněk 1975–1976; Cailmail 1988; Hake 1988; Baskin and Danell 2003). An extended period of rut resulting in late births may be a good indication of adaptability of the species in the given conditions. In general, late deliveries may be caused by the fact that females who fail to conceive in the early stage must be in a good condition to persist in estrous cycling as approaching winter brings worsened conditions (e.g., Bartoš 1982). Thus, sika may be able to overcome severe environmental conditions sometimes better than the local species. Introduced sika deer have often higher condition ratings than local species in other continents also, such as North America (Armstrong 1980; Butts et al. 1982; Keiper 1985; Harmel and Armstrong 1987; Richardson and Demarais 1992; Feldhamer and Armstrong 1993) and elsewhere.

Migration

Although sika have been characterized across Europe as sedentary and faithful to a given location, they have the capability to migrate a long distance. In Poland, the Kadynia sika were recorded to migrate 80–160 km (Matuszewski and Sumiński 1984). Movement over long distances during the rut in particular has also been reported from Russia (Sokolov 1959; Yevtushevskiy 1974; Makovkin 1999). Nevertheless, published evidence based for example on radiotelemetry of sika in continental Europe is rare (Kistler 1995). It happens frequently that a wandering single animal, mostly a stag, occurs in an area with no established sika deer. Such an individual usually approaches and joins red deer. In the Czech Republic it has happened a number of times that a sika stag breaks into an enclosure containing red deer. His origin is usually not known (Bartoš 2008). Those sika stags that are migratory are often seen roaming together with red deer (Bennetsen 1977). Sika stags joining red deer groups have been reported also from Poland (Bartoš 1982; Matuszewski 1988) and the Czech Republic (Bartoš and Žirovnický 1982; Bartoš 2008).

Hybridization

At the beginning, imported animals were not recognized according to their sub-specific origin. They were kept in mixed stocks and bred in zoos and game preserves. Occasionally, sika were interbred with other species, such as red deer, hog deer, and axis (Powerscourt 1884; Benirschke 1967; Bartoš 1991). Eick (1995d) cited from his personal correspondence with H. Heck from early 1940s:

“I myself know of hybrids of sika both with red deer and six-pointers (hog-deer, axis) both as half-blood and three-quarters blood. It can also be assumed that in the case of such crossbreeding infertility does not occur ... under natural conditions it is rather exceptional for stags to exhibit such infidelity. Hybrids have always occurred in small reserves.” Sika were hybridized both intra- and inter-specifically for improvement in antler size to increase velvet production on farms. As such, it has been well-documented and published, though usually only on a local basis (Menard 1930; Mirolyubov 1936, 1949; Mirolyubov and Ryashchenko 1948; Makovkin 1999). More recently in Ireland Harrington has experimentally produced sika and red deer hybrids under controlled research conditions (Harrington 1973, 1974, 1982). In Europe various breeders intentionally crossed red and sika deer for trophy improvement of sika as well, but have rarely documented or published this (Niethammer 1963; Whitehead 1995; Eick 1995e). Instead it has been frequently better kept in secret. My experience illustrates this approach. Seeking material for our study on hybridization in the early 1980s, I received photos of F1 hybrids between sika and red deer from a small enclosure in Germany. Later the hybrid male was sold to another estate as a “good trophy sika stag” (Eick, 1985).

Most of the published records on hybridization describe the hybrids as a natural curiosity caused by a break of the geographical isolation of both initial species. Nevertheless, red deer (Manchurian wapiti) and sika deer are in natural contact along the Ussuri River on the Russia-China border. Hybridization is a common occurrence in that region (Flerov 1952; Sokolov 1959; Heptner et al. 1961). Chinese hunters have a special name for it, *chin-da-guiza*, and are fully aware that it is a hybrid (Mirolyubov 1949). The first European explorers such as Maak and Przewalski who saw the hybrid even described it as a subspecies of sika deer (Maak 1859; Przhevalski 1870). In Europe, in mixed populations a sika stag occasionally joins a red deer harem during the rut. Under such circumstances, red deer males usually ignore the presence of the sika stag and only chase away other red stags. They will even ignore sika stag attempts to mate a hind in the harem and produce hybrids (Bartoš and Žirovnický 1982; Bartoš 2008).

In Europe, hybrids were recorded as far back as 1884, when Powerscourt (1884) reported that, “The Japanese deer here have undoubtedly interbred with the red deer; there are three to four deer in the park here which are certainly hybrids, the red hind in each case being the dam.” Since then hybridization has been widely recorded from many countries such as Ireland (Harrington 1973, 1974, 1982; Herzog 1987; Herzog and Harrington 1991; Herzog and Krabel 1993; Herzog and Krabel 1993; Herzog and Herzog 1995; Nagata et al. 1998; Gehle and Herzog 1998; Nagata et al. 1998; Gehle and Herzog 1998); Britain (Millais 1897; Brooke 1898; F.W.B. 1902; Lydekker 1915; Whitehead 1950, 1964; Delap 1968; Whitehead 1972; Lowe and Gardiner 1974, 1975; Ratcliffe 1987; Hunt 1987; Whitehead 1988; MacNally 1988; Abernathy 1994; Goodman et al. 1999); Czech Republic (Bartoš and Žirovnický 1981, 1982; Bartoš et al. 1981; Bartoš and Vitek 1993); Germany (Rocholl 1967; Herzog 1987; Gehle et al. 1998); Lithuania (Baleisis et al. 2002); the former Soviet Union (Menard 1930; Sarkisov 1944; Mirolyubov and

Ryashchenko 1948; Mirolyubov 1949; Flerov 1950, 1952; Sokolov 1959; Heptner et al. 1961; Salganskiy et al. 1963; Steklenyev 1986; Prisyazhnyuk and Tchegorko 1990; Makovkin 1999); China (Yu 1986); New Zealand (Davidson 1973, 1987; Challies 1985); and elsewhere. In New Zealand hybrid zones have also developed between North American wapiti (*Cervus elaphus nelsoni*) and sika deer (Nugent et al. 1987). Only occasionally genetic analysis may have shown there is not yet large-scale in situ hybridization occurring between the sika and red deer feral populations (Diaz et al. 2006).

Despite the massive evidence, a high proportion of European hunters still do not seem at all convinced of the possibility of this interspecific hybridization. In hunting magazines in countries with sika in their territory, we can see recent articles repeatedly doubting any possibility of the cross. In many areas where sika coexist with red deer, it is obstinately believed that no interbreeding has ever occurred (e.g., Bennetsen 1977; Eick 1995d). Where a detailed investigation was made, evidence appeared that hybridization in that particular region did occur, sometimes to an extent of progressed introgression between the two species (Bartoš 1991). This happened for example in Great Britain (Lowe and Gardiner 1975; Abernathy 1994; Goodman et al. 1999), in Ireland (Harrington 1973, 1974, 1982), and in the Czech Republic (Bartoš et al. 1981). For decades it had been believed that sika in the largest German population at Möhnesee has never crossed with sympatric red deer (Eick 1995d), until Gehle and Herzog (1998) showed evidence of the opposite. Even in Ireland, where a hybrid population at Wicklow is famous and well-documented (Harrington 1973, 1974; Herzog and Harrington 1989; Herzog and Harrington 1991; Herzog and Herzog 1995), in other Irish areas such as the Killarney National Park with sympatric sika and red deer, it is still believed that “there is no evidence to date to suggest that hybridization has occurred in Killarney” (O’Donoghue 1991). In 1994, we visited Killarney National Park for other purposes and observed various hybrid signs especially in the local red deer population. We even videorecorded a young red deer stag flicking his extraordinary elongated tail in a way characteristic for sika. Still, local rangers argued there is no sign of hybridization.

Disbelief in the existence of interspecific hybridization, so widespread across continental Europe, is perhaps because only F1 hybrids look really suspicious. According to European hunters’ tradition of performing a “selective harvest,” such F1 hybrid males roaming with red deer may be culled as “poor red deer,” without any particular interest of the hunter in unusual phenotype traits other than smaller body size and possibly “poor antlers.” F1 hybrid females integrated in red deer herds may be culled as well, but traditional lower interest in females may cause them to survive unnoticed. Also, extra-nuclear heredity, called a maternal effect, may have been involved (Bartoš and Žirovnický 1981). As known from reciprocal crosses of farm animals remarkably different in size (Walton and Hammond 1938 and others), hybrids are often closer in size to the mother’s dimension, thus reducing the difference in appearance of the hybrid from its mother. In addition, heterosis effect (Ashby 1937) may also be involved. It may further decrease the body size difference if the mother of the calf is a red deer (Bartoš 2008 unpublished). If the hybrid comes from a sika mother, such an individual has good chances for survival.

For European hunters large body size and unusually larger and abundantly branched antlers of such a “sika” individual are signs of “good genes” worthy of protection. In the F2 generation and later, these hybrids are not necessarily recognizable according to their phenotype (Harrington 1974; Bartoš and Žirovnický 1981, 1993). Moreover, some of the traits of red deer designated of hybrid origin with sika deer (Bartoš and Žirovnický 1981) may be duplicated from other species or subspecies, e.g., wapiti, maral, etc., the species imported to Europe for centuries and contaminating the gene pool of the original populations (Powerscourt 1884; Benirschke 1967; Gray 1971; Herzog and Harrington 1991).

Another firmly held tradition in Europe is that an unusual phenotype and/or antler appearance of a “sika deer” has come from previous crosses between various sika subspecies. Concurrently, no attempts have usually been made to ask how the result of such crosses should look. Earlier descriptions of large *Cervus nippon hortulorum* refer to only eight-point antlers, with more points being an exception (Flerov 1950, 1952; Sokolov 1959; Heptner et al. 1961; Prisyazhnyuk 1972). During the period between 1936 and 1949, Bromley found (1956) only two exceptions of antlers having more than eight points in the Tsudsukhinskiy Zapovednik (Tsudsukhinsk Reserve). In Mordovskiy Zapovednik (Mordovsk Reserve) only one antler with five and two antlers with six points out of 53 was found (Shtarev 1966). In contrast, Eick (1995e) cited his correspondence with H. Heck, who confirmed that since the beginning of sika introductions, over eight-pointed antlers were exceptional in Japanese sika, whereas with Dybowski stags 10- and 12-pointers were not at all rare. Moreover, the sika populations in the former USSR have changed over time. Antlers with five points on a single antler could sometimes be found in the introduced population of Tchernomorskiy Zapovednik (Black Sea Reserve) (Verestiennikov 1968). Even in the natural range of sika deer, Lazov district, Primorsky Krai in the Far East, we can follow gradual changes in antler appearance. Despite the earlier descriptions of eight-point antlers as the sika deer standard (Flerov 1950, 1952; Sokolov 1959; Heptner et al. 1961), Prisyazhnyuk (1971) analyzed 40 pairs and 97 single antlers and recognized 35 antlers with various anomalies including those bearing numerous points. Twenty per cent of these showed extra points in distal and/or top points. In another study from the same area, Prisyazhnyuk (1972) found 12% of antlers bearing more than eight points, the maximum being 13 points. The problem is, however, that in South Primor'ye (Primorsky Krai), there are numerous farms containing sika and Manchurian deer together (Prisyazhnyuk 1972). Occasional escapes from the farms are unavoidable. Even the seven or more kilometers separating the Isle of Askold in the Sea of Japan from the Primorsk mainland is not a barrier for the deer (Prisyazhnyuk 1978, personal communication). Thus, changes in the number of antler points in sika deer may result from interspecific hybridization. Alternatively, the status of sika deer subspecies on mainland Asia is a matter of debate, with some authors suggesting that the larger “hortuloid” subspecies are principally of hybrid origin (e.g., Lowe and Gardiner 1975). More recent studies dealing with karyotypes would support the suggestion about the hybrid origin of the “hortuloid” subspecies (Bartoš and Žirovnický 1981; Herzog 1987, 1995; Herzog and Harrington 1991).

Larger antlers with surplus points may be also indicate previous hybridization with red deer for the smaller “Japanese” sika deer. In the Czech Republic, in the late 1970s, sika deer in the Plzeň North population still differed according to their origin more than 30 years after the deer established themselves in the wild (Vavruněk 1978, personal communication). Those coming from the Čemíný enclosure had strong antlers with a maximum of eight points, while those coming from the Lipí deer park had longer antlers tending to have more tines. The difference between the two enclosures was that in Čemíný sika shared the enclosure with mouflon and roe deer, but no red deer. In contrast, in Lipí there were red deer living together with sika (Doležal 1960; Wolf and Vavruněk 1975–1976; Vavruněk and Wolf 1977). Many other signs of previous or recent hybridization in the population have been documented (Bartoš and Žirovnický 1981, 1982; Bartoš and Vítek 1993).

The disregard of scientific evidence characteristic of hunters’ approach across many European countries has led to the fact that introgression of sika and red deer gene pools has been occurring in many areas without receiving any attention.

Conclusion

Sika have established themselves in the European fauna and seems to be a stabilized component. With its high potential to compete with autochthonous species and readiness to hybridize with native red deer, the sika deer has represented a real threat to original European deer populations for over a century. European hunters’ interests may be the main factor leading to ignoring the threat of sika deer presence. Warnings about the danger have not been taken too seriously. The first discoveries of the danger of sika red deer hybridization on a scale of whole populations were reported around 30 years ago (Harrington 1973, 1974; Lowe and Gardiner 1975; Bartoš et al. 1981; Bartoš and Žirovnický 1981, 1982). Conclusions of these earlier studies have been fully supported by recently available genetic techniques (Herzog and Harrington 1991; Abernathy 1994; Herzog and Herzog 1995; Goodman et al. 1999). Still, there is no general wildlife management strategy in continental Europe to rectify the situation. In some European countries, such as the Czech Republic, harvest tends to increase (according to published statistics, harvested numbers have been almost doubled over the last seven years). On a national level, however, the reports on total numbers suggest an increase in sika population rather than reduction (Table 39.1), despite the fact we could question the reliability of the estimates of free-ranging populations used in official statistics.

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