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Author(s): Jacoby Carter and Billy P. Leonard

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A review of the literature on the worldwide distribution, spread of, and efforts to eradicate the coypu (*Myocastor coypus*)

Jacoby Carter and Billy P. Leonard

Abstract We conducted a literature review of coypu (*Myocastor coypus*) introduction and eradication efforts worldwide. The coypu (also called nutria) has been introduced from its origins in South America to every continent except Australia and Antarctica. While perceived in some regions as a valuable resource, in most regions the animals are considered a pest species. Coypus have caused damage to water control structures, crops, and marsh systems and are considered a disease host. Eradication efforts have met with varying degrees of success. For those efforts to be successful, the coypu populations must be isolated to prevent reintroduction, harsh winters are necessary to reduce their populations, and intensive trapping efforts must be sustained until the last coypu has been removed.

Key words coypu, eradication, exotic species, furbearer, herbivory, *Myocastor coypus*, nonindigenous species, nutria, trapping, wetlands

A tahnka form poem transliterated from Japanese:

“Shirasagi mo Sugamo mo Koi mo kechirashite,
Sasagase gawa wo Nutoria yuku.”

—Ito Shinsuke, Okayama, Japan
Asahi Shimbun, 14 April 1996

The English translation:

“Pushing away white herons, ducks, and carp,
the nutria goes his way in the River Sasagase.”

The coypu (*Myocastor coypus*), also called nutria, is an aquatic rodent native to South America south of 23° latitude, including Argentina, Bolivia, southern Brazil, Chile, Paraguay, and Uruguay (Ehrlich 1967, Banfield 1974, Kinler et al. 1987, Kinler 1992a). Coypus have long been valued as furbearers, which has led to their introduction into many countries outside of their native range.

The last review of coypus worldwide was by Aliev (1967). Since then coypus have been introduced into several other countries and their status has changed. Our purpose was to review the history of their introduction outside their native range, and efforts to control or eradicate them in regions where they have become feral. There is documentation for the introduction of coypus into every continent and major temperate region except Australia, Antarctica, and New Zealand (A. Buchanan, Tasmanian Herbarium, Australia, personal communication; T. Robinson, Ministry of Research, Science, and Technology, New Zealand, personal communication).

The first attempt at coypu farming occurred in France in the early 1880s, but the first extensive establishment of coypu farms occurred in South America in the 1920s (Evans 1970). The success of

Address for Jacoby Carter: United States Geological Survey, National Wetlands Research Center, 700 Cajundome Blvd., Lafayette, LA 70506, USA; e-mail: jacoby_carter@usgs.gov. Address for Billy P. Leonard: Department of Biology, University of Louisiana, Lafayette, LA 70504, USA; present address: United States Forest Service, Rocky Mountain Research Station, 333 Broadway SE, Suite 115, Albuquerque, NM 87102, USA.

these operations led to expansion of coypu farm operations in Europe and North America (Evans 1970). These farms became the source for wild populations of coypus around the world. Coypus from these farms often escaped, or in many cases they were deliberately released into the wild to provide a game animal or to remove aquatic vegetation (Dozier 1952, Evans 1970, Kinler 1992b, Bounds 2000). In many systems coypus have become a nuisance species because their feeding activities destroy marsh vegetation, their burrows undermine water control structures, and they feed on agricultural crops (Linscombe et al. 1981, Grace 1992, Linscombe and Kinler 1997). Coypus also have been associated with parasites that affect humans and livestock (Moutou 1997) and can adversely affect wildlife (Gebhardt 1996). However, in many countries the coypu is considered a welcome resource as a furbearer (Aliev 1967). Their classification as a pest often depends on the price of their pelts (Lowery 1974). High fur prices and subsequent trapping reduce the population, mitigating some of the environmental damage that coypus can cause, and bring money into the local economy (Kinler et al. 1987). Low fur prices usually result in a reduced fur harvest, which allows coypu populations to exceed the carrying capacity of their habitat (Gosling and Baker 1987, Kinler et al. 1987, Carter et al. 1999). We reviewed published literature on coypus and queried experts to summarize coypus' worldwide distribution and expansion patterns. We also documented efforts to eliminate them from

systems where they are considered a nuisance species.

Methods

Between March and August 1998 we searched for articles on *Myocastor coypus* using electronic databases, including Cambridge Scientific Abstracts, The Web of Science, Wildlife Worldwide, and Wilsdisk

Table 1. Coypu introduction and status by country in the eastern hemisphere.

Region-Country	Date of introduction	Method of introduction	Current status
Africa			
Kenya	1950	escape, released	extinct
Zimbabwe, Zambia, and Botswana	before 1958	unknown	never established
East Asia			
China	1960s	escape, released	present
Japan	1910	escape	present
South Korea	unknown date	unknown	present
Thailand	1993	escape	never established
Central Asia and the Middle East			
Armenia	1940	released	present 1967
Azerbaijan	1930 to 1932	released	present 1967
Georgia	1930 to 1932	released	present 1967
Israel	1948-1966	escape, released	present 1967
Russia	1926	released	present
Tajikistan	1949	released	present 1967
Turkey	before 1984	released	present 1967
Turkmenistan	1930 and 1932	released	present 1967
Europe			
Austria	1935	escape	present
Belgium	1930s	escape	present
Bulgaria	unknown	unknown	present
The Czech Republic and Slovakia	before 1950s	escape	present
Denmark	1930s and 40s	escape	extinct
England	1929	escape	eradicated 1989
Finland	before 1967	escape 1990s	extinct
France	1882	escape	present
Germany	1926	escape, released 1930s	present
Greece	before 1948	escape	present
Hungary	unknown	escape	present
Ireland	before 1967	unknown	extinct
Italy	1928	escape by 1960	present
Netherlands	1930	escape by 1940	present
Norway	before 1946	unknown	extinct
Poland	unknown	escape 1948	present
Romania	unknown	unknown	present
Spain	before 1967	escape	extinct
Sweden	before 1967	unknown	extinct
Switzerland	after 1967	unknown	present
The Former Federal Republic of Yugoslavia	before 1967	escape	present

CD-ROM. We also performed Internet searches on the Worldwide Web using the Metacrawler search engine. Search terms included “*Myocastor*,” “*coypus*,” “*coypu*,” and “*nutria*.” After compiling a bibliography of articles located through the database search and from previous research, we acquired additional information using reference tracing, focusing on articles that discussed *Myocastor coypus* distribution, introduction, control, or eradication. Additional information requests were posted on several electronic bulletin boards. Several experts (L. Foote University of Alberta, Canada; M. Gosling, Ministry of Agriculture, Fisheries and Food, England; G. Piero, I’Istituto Nazionale per la Fauna Selvatica, Italy) were contacted directly. These experts also provided both information and additional bibliographic resources.

All of the articles were reviewed for date of coypu introduction, distribution, method of control or eradication, economic cost or benefit, and damage. We summarized the information on a map (Figure 1) to assist visualization.

Results

The distribution of coypus outside their home range in South America resulted mainly from attempts to breed them for their fur (Harris 1956, Aliev 1967, Kinler 1992a). In favorable habitats coypus often escaped and became feral. In some countries they have been released deliberately and managed in a semicaptive state (i.e., not caged but placed in areas where the habitat is managed intensively for their benefit) (Aliev 1967). In other countries, escaped coypus have not survived in the wild. In general these are places with harsh winters. Coypus are generally considered vulnerable to cold weather (Ehrlich 1967, Gosling et al. 1983, Kinler et al. 1987, Reggiani et al. 1995). However, they also exhibit a behavioral flexibility that allows them to survive and move into areas that were previously considered too cold for them to exist in the wild (Ehrlich 1962, 1967; Doncaster and Micol 1990). Some countries, after assessing the economic and

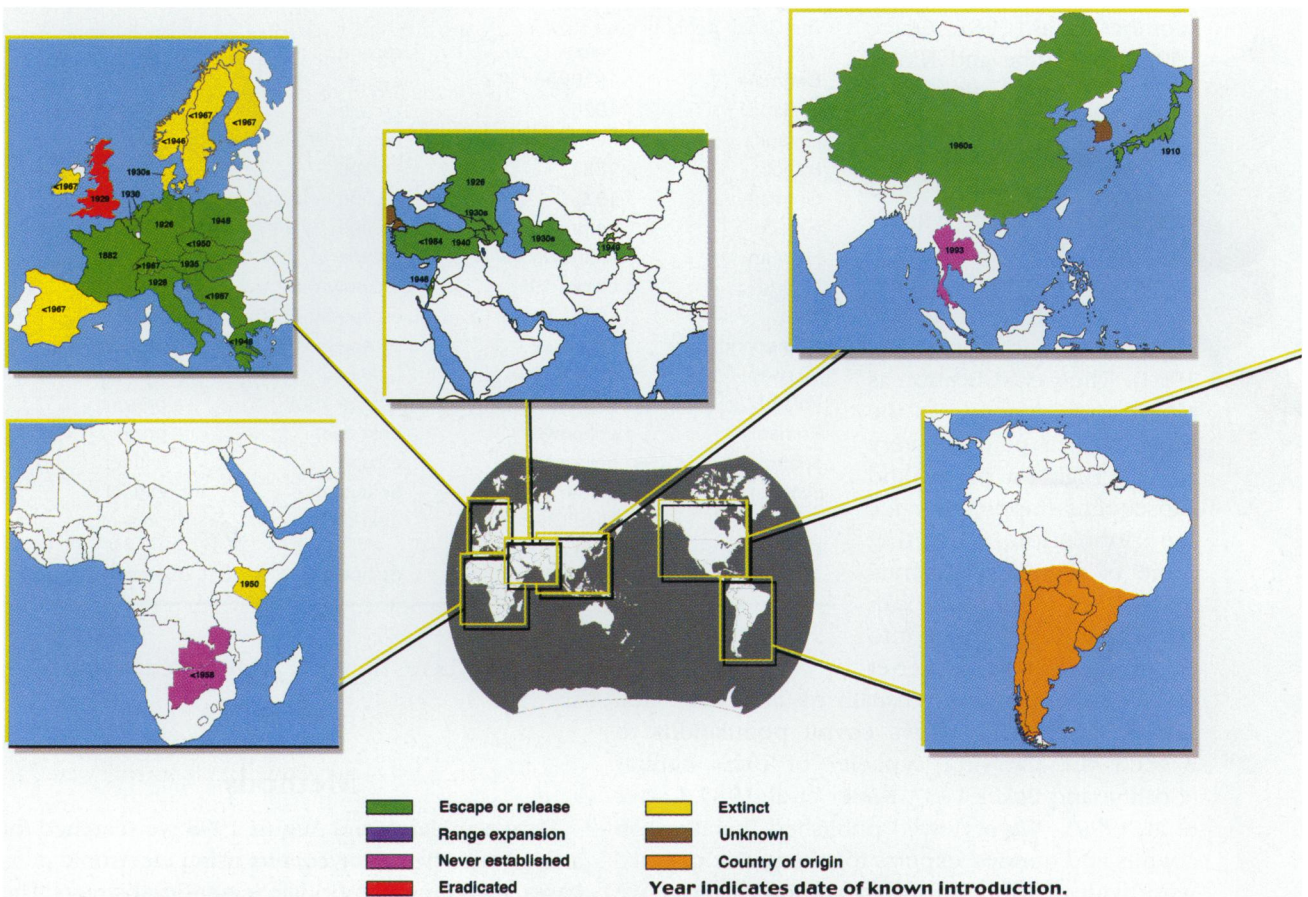


Figure 1. A color-coded map of coypu distributions around the world by Carey Hamburg and Jacoby Carter.

environmental burden that uncontrolled wild coypus have placed on their society, have labeled the animal a pest species and attempted to eradicate it (Gosling and Baker 1989). In other instances coypus are not considered enough of a problem to warrant an eradication campaign, or eradication is viewed as an unattainable goal (Wilner 1982). In fact, during the 1950s at least one United States Fish and Wildlife Service biologist (Dozier 1952) regarded coypus as less of a nuisance and more of an economic benefit than native muskrats (*Ondatra zibethicus*).

Primary methods of eradication fall into 3 categories: trapping, poisoning, and shooting (Gosling 1981, Gosling et al. 1988, Stevens 1992, Moutou 1997). These methods are often most effective when used in combination with baiting and artificial islands or rafts (Wilner 1982, Baker and Clarke 1988, LeBlanc 1994). Aliev's (1967) review had a breeding distribution map of coypus in the Eastern

Hemisphere. It is implied, but is by no means clear, that the map represented wild populations. For purposes of this study we assumed that it did, unless evidence to the contrary was presented. Because amount of information on coypu introductions in North America is more extensive than for elsewhere in the world, this review is divided into 2 parts, the Eastern Hemisphere and North America. Table 1 summarizes information by country on when and how coypus were released and their current status for the Eastern Hemisphere; Table 2 summarizes North American information. What follows are regional and national summaries of coypu introduction, distribution, control, and eradication.

Eastern hemisphere

Africa

We did not find a comprehensive review of coypus in Africa. They have been reported in Kenya and in an area of south-central Africa where the countries of Botswana, Zambia, and Zimbabwe meet (Table 1). Kinler et al. (1987) placed them in Africa, and Woods et al. (1992) asserted that they were present in East Africa.

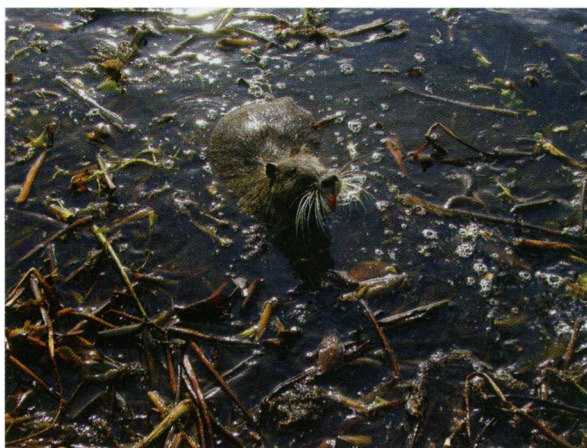
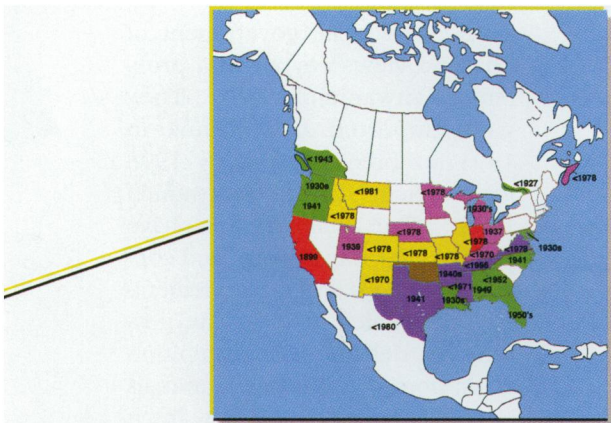
Kenya. Coypus were imported to the Kinangop Plateau for fur farming in 1950 (Harper et al. 1990). By 1965 some individuals had escaped and arrived at Lake Naivasha, and by 1970 a large population was established (Harper et al. 1990). Pythons (*Python rebae*) were introduced for biological control, but they were ineffective (Harper et al. 1990). However, for reasons unknown, the coypu population was declining there in 1980 and none have been seen since 1984 (Harper et al. 1990).

Zimbabwe, Zambia, and Botswana. Aliev (1967) reported coypus in Zimbabwe and possibly Botswana and Zambia, although the date of introduction is unknown. According to J. du Toit (Mammal Research Institute, University of Pretoria, South Africa, personal communication), coypus are not feral anywhere in southern Africa, and he suggested that this was due to the high predator density.

East Asia

We found no comprehensive reviews of coypus in East Asia. Most of the information was scattered in a variety of sources covering specific countries. Coypus are known to have been introduced into China, Japan, Korea, Thailand, and Taiwan (Table 1). Most of the information is anecdotal.

China. Coypus were introduced into China in the early 1960s for fur farming (W. S. Xie, Institute of Zoology, Chinese Academy of Science, China,



A coypu in a Louisiana marsh. Photo by Thomas G. Hargis.

Table 2. Coypu introduction and status by state and province in the North America.

Region-Country	Date of introduction	Method of introduction	Current status
United States			
Alabama	1949	released	present
Arkansas	1940s after 1960	unsuccessful release range expansion	present
California	1899	escape	eradicated
Colorado	before 1978	escape	extinct
Delaware	unknown	range expansion	present
Florida	1950s	range expansion, escape, & release	present
Georgia	before 1952	release	present
Idaho	before 1978	escape	extinct
Illinois	unknown	escape	extinct
Indiana	before 1978	escape	eradicated
Kansas	before 1978	unknown	extinct
Kentucky	before 1970	released	never established
Louisiana	1930s	released, escape	present
Maryland	1930s	escape	present
Michigan	1930s	escape	never established
Minnesota	before 1978	escape	never established
Mississippi	before 1971	range expansion & released	present
Missouri	before 1978	unknown	extinct
Montana	before 1981	unknown	extinct
Nebraska	before 1978	escape	never established
New Mexico	before 1970	escape	extinct
North Carolina	1941	introduced	present
Ohio	1937	escaped	never established
Oklahoma	unknown	unknown	present
Oregon	1941	escape	present
Texas	1941	escape, released & range expansion	present
Tennessee	before 1996	range expansion	present
Utah	1939	unknown	never established
Virginia	before 1978	range expansion	present
Washington	1930s	escape	present
Canada			
British Columbia	before 1943	escape	present
Ontario	unknown	unknown	present
Nova Scotia	before 1978	unknown	never established
Quebec	after 1927	unknown	present
Mexico			
Northern Mexico on Texas Border	before 1980	range expansion	present

personal communication). Originally introduced to northern China, they also were introduced to southern China (Xie and Li 1999). Later attempts were made to export them from China to other Asian countries for fur farming (Kanwanich 1998). After a drop in fur prices, coypus were released or escaped and now wild populations exist in South

China. Coypus are now considered an agricultural pest (Xie and Li 1999).

Japan. Coypus were introduced into Japan in 1910 (Miura 1976). The Japanese military encouraged breeding them on small fur farms because of the high quality of their pelts (Miura 1976). When pelt prices dropped, the coypus were either killed or released (Miura 1976). Since 1963, coypus have been hunted as an eradication and control method (Miura 1976). Japan's largest concentrations occur in the Okayama prefecture (Miura 1976).

South Korea. Coypus have been documented in South Korea (Han et al. 1999), although the date of introduction and present status are unknown.

Thailand. The government of Thailand views coypus as a problem (Kanwanich 1998). They were imported from China in 1993 for breeding, and by 1998 were seen in the wild (Kanwanich 1998). The local residents have eaten some, but no organized control program has been implemented (Kanwanich 1998). The government debated the prohibition of importing additional animals into the country (Kanwanich 1998) and decided not to promote coypu farming operations (Ridmontri 1998, Tunyasiri 1998).

Central Asia and the Middle East

Coypus have been introduced throughout central Asia and Israel (Table 1). The last review of coypus in Asia and the Middle East was by Aliev (1967).

Armenia. Aliev (1967) reported coypus in Armenia. A trial of raising coypus semicaptive in the wild was begun in 1940 (Aliev 1967). Semicaptive raising of coypus, as practiced in the Caucasus and in Eastern Europe, consists of managing the habitat so that the animals do not experience the detrimental effects of harsh winters. Ponds are drained

and vegetative cover is provided. In some places coypus are even fed over winter (Ehrlich 1962, Aliev 1967, Suvegova et al. 1994). Coypu acclimatization was a success on the upper sections of irrigation canals near springs (Aliev 1967).

Azerbaijan. Vinogradov and Argiropulo (1941) reported coypus acclimatized in Azerbaijan. Animals were released from 1930 to 1932 on reservoirs (Aliev 1967). Breeders raised a pedigreed group called Azerbaijan white coypus (Aliev 1967).

Georgia. Coypus were introduced in Georgia between 1930 and 1932 (Aliev 1967, Vinogradov and Argiropulo 1941). During periods of high population density, coypus have leveled the herbaceous cover in marshy areas (Laurie 1946).

Israel. Coypus are present in Israel. From 1948 to 1966 they were observed living in various habitats and under various environmental conditions (Ehrlich 1967). Originally, they were raised on farms; now escaped, they cause damage to fishponds (Aliev 1967).

Kazakhstan. Coypus were released on reservoirs in Kazakhstan between 1930 and 1932 (Aliev 1967, Vinogradov and Argiropulo 1941); their current status is unknown.

Russia. Coypus were successfully introduced on a large scale in 1926 (Laurie 1946). Farms were established in the Krasnodar Territory of Russia from 1933 to 1934 (Aliev 1967). Coypus were released between 38° and 45° N latitude and became acclimatized in lakes and floodplains of large rivers in that region (Vinogradov and Argiropulo 1941).

Tajikistan. A successful experiment was set up by government agencies to acclimatize coypus to reservoirs in the valley of the River Vakhsh in 1949 (Aliev 1967).

Turkey. Coypus were established in large reed swamps and fens in the northeastern corner of the country (Kinler et al. 1987); their current status is unknown.

Turkmenistan. Coypus were released on reservoirs between 1930 and 1932 (Aliev 1967, Vinogradov and Argiropulo 1941); their current status is unknown.

Europe

Coypus have been introduced throughout most of Europe (Table 1). In general they are considered a pest in western European countries and a resource in eastern European countries where fur is more valued. Most European studies of coypus in the wild come from Italy, France, and England. The

most recent review of their distribution in Europe is by Mitchell-Jones et al. (1999).

Austria. Coypus have been bred in Austria (Laurie 1946). The capture of free-living coypus began in 1935 (Aliev 1967). Wild populations are still present (Mitchell-Jones et al. 1999).

Belgium. Coypus have been bred in captivity since the 1930s and are now feral (Laurie 1946, Aliev 1967, Litjens 1980). The population was healthy enough to have dispersers move into neighboring Holland (Litjens 1980).

Bulgaria. Aliev (1967) gave no indication of coypus in Bulgaria. Mitchell-Jones et al. (1999) reported the animals along the borders with Greece and Romania.

The Czech Republic and Slovakia. According to Aliev (1967) and Kinler et al. (1987), coypus were raised in captivity in Czechoslovakia. They are currently in both republics, with more populations in the Czech Republic (Mitchell-Jones et al. 1999).

Denmark. Stubbe (1989) reported that coypus were observed in the wild in Denmark in the 1930s and 40s but succumbed to the harsh winters there. Currently no coypus are reported in Denmark (Mitchell-Jones et al. 1999).

England. The first coypus were imported into Great Britain in 1929 for fur farms (Laurie 1946). The first trapping campaigns were in the early 1940s (Laurie 1946), and efforts to reduce their numbers occurred in the 1960s (Norris 1967*a, b*). In 1981 a 10-year eradication campaign employing 24 trappers commenced (Gosling and Baker 1987). On 10 January 1989 no coypus had been trapped in 21 months and the trapping campaign was declared a success and terminated (Gosling and Baker 1989).

Finland. Aliev's (1967) range map indicated wild coypu populations here. In the early 1990s coypus escaped from fur farms and a wild population existed in the south of Finland near Turku (K. Jutila, personal communication). Coypus are currently listed as a game animal (Hunters' Centralorganisation 2000). However, they are now classified as extinct in the wild (Mitchell-Jones et al. 1999). It is hypothesized that they could not tolerate the harsh winters (K. Jutila, personal communication).

France. Coypus were introduced into France as early as 1882, and fur farming began in earnest between 1925 and 1928 (Bourdelle 1939). Some coypus escaped captivity and became feral (Bourdelle 1939). By 1979 they were officially classified as pests (Reggiani et al. 1993). From 1974 to 1985,

they increased in number and are now the subject of many eradication campaigns (Lagaude 1975, Abbas 1991, Moutou 1997), in part because they host liver flukes (*Fasciola hepatica*) and are thought to spread the disease to cows (Moutou 1997, Menard et al. 2000). Coypus are found throughout France (Moutou 1997), but the population tends to be concentrated in central and west-central France (Lagaude 1975, Dagault and Saboureau 1990).

Germany. Coypus were first introduced to Eastern Germany in 1926 (Stubbe 1992). Some time afterward they escaped captivity, and by 1935 small wild colonies began to appear in the Elbe-Trave Canal; however, these colonies were generally short-lived (van den Brink 1968, Stubbe 1992, Gebhardt 1996). West Germany had a hunting season for coypus by the 1950s and was attributing economic damage (e.g., undermining of dams) to them (Stubbe 1989). Even so, releases continued and in 1991 over 400 coypus were illegally released in the Brandenburg region of East Germany (Stubbe 1992). The range of coypus continues to expand, and recently they appeared in the Dresden area (Feiler et al. 1999). Today populations are generally low because they are kept in check by cold winters and are caught in the heavy hunting for muskrats, which are more populous and are considered more of a pest than coypus (Stubbe 1989, 1992; Gebhardt 1996). They are considered more of a pest in the former West Germany than in the former East Germany, where trapping is greater (Stubbe 1989, 1992; Gebhardt 1996).

Greece. Coypus were raised in captivity in Greece (Aliev 1967). Between 1948 and 1966 they were observed in the wild in a variety of habitats such as ponds, lakes, ditches, rivers, swamps, marshes, meadows, and wooded areas (Ehrlich 1967). There are currently wild coypu populations in the northern part of Greece (Mitchell-Jones et al. 1999).

Hungary. Coypus have been farmed in Hungary (Sztojkov et al. 1982, Kinler et al. 1987, Sályi et al. 1988) and today are present in southern Hungary on the border (Mitchell-Jones et al. 1999).

Ireland. Aliev's (1967) range map showed their presence here, but he provided no further information. Mitchell-Jones et al. (1999) reported them as not being present.

Italy. Coypus were first imported into Italy in 1928 for commercial use (Cocchi and Riga 1999), and were first reported in the wild in 1960 (Reggiani et al. 1993). They have spread throughout

Italy, including Sicily and Sardinia, and are presently regarded as a pest because of the damage they cause to rice farms (Velatta and Ragni 1991a and b; Gariboldi 1993; DeCiechi and Prigioni 1997; Cocchi and Riga 1999). Italy's emphasis is on controlling the populations to reduce damage (Spacone et al. 1991).

Netherlands. Coypus were introduced here around 1930 for fur farming and by 1940 were observed in the wild (Litjens 1980). Because they damage levees and the sugar beet crop, they were considered a candidate for eradication by European agencies (Litjens 1980, Barends 1998). Control is by trapping (Litjens 1984, Barends 1998). Despite population losses from trapping and harsh winters, they persist in the Netherlands because thermal pollution in rivers allow some to survive harsh winters and because they immigrate from Belgium and Germany (Litjens 1980).

Norway. Captive coypu breeding has been practiced in Norway (Laurie 1946). Aliev's (1967) distribution map did not show breeding populations present. It is unknown whether they ever escaped, but currently no wild populations exist (Mitchell-Jones et al. 1999).

Poland. Coypus are bred in captivity but also are managed in a semiwild state on ponds (Ehrlich 1962, Kinler et al. 1987, Labecka 1990). The animals were first observed in the wild in 1948 (Ehrlich 1967). In a semicaptive system, ponds are drained in winter to protect the coypus from freezing on the ice (Ehrlich 1962). Today coypu farms are an important industry in Poland (Niedzwiadek et al. 1988), and wild populations are also present (Mitchell-Jones et al. 1999).

Romania. Aliev's (1967) review did not indicate the animals were in Romania. In his review of coypus in Germany, Stubbe (1989) reported that they had been observed in the wild in Romania. Populations are on the southern border with Bulgaria and along the Black Sea (Mitchell-Jones et al. 1999).

Spain. Coypus were bred in Spain, and Aliev's (1967) range map showed wild stock present. Currently they are not in the wild (Mitchell-Jones et al. 1999).

Sweden. Aliev's (1967) range map indicated wild populations of coypus here. They continue to be raised on fur farms, but Mitchell-Jones et al. (1999) indicated that wild populations no longer existed.

Switzerland. Mitchell-Jones et al. (1999) reported coypus within Switzerland, although Aliev (1967) did not.

The Former Federal Republic of Yugoslavia. Aliev (1967) reported that coypus were raised in captivity in Yugoslavia, although he did not indicate where. Currently they are found in Macedonia near the borders with Greece and Albania, Croatia, and the current borders of the Federal Republic of Yugoslavia (Mitchell-Jones et al. 1999).

North America

The coypu is widely established in North America (Table 2). The first recorded effort to establish a population in North America was at Elizabeth Lake, California, in 1899; the effort failed because the animals did not reproduce (Evans 1970). The first successful reproduction occurred in Quebec in 1927 (Evans 1970). We could find no attempts to introduce coypus into Mexico. Most introductions in the United States and Canada were the results of escapes from fur farms and occurred in the 1930s and 1940s. Coypus were introduced in the United States to remove nuisance aquatic vegetation.

United States

During the 1930s coypu ranches were established in Louisiana, Michigan, New Mexico, Ohio, Oregon, Utah, and Washington. These ranches failed during World War II because of poor pelt prices (Kinler et al. 1987), and the animals were often simply released. Starting in the 1930s and 1940s, entrepreneurs promoted coypus as weed cutters and transplanted them throughout the Southeast (Dozier 1952, Evans 1970). State and federal agencies purposely released coypus in Alabama, Arkansas, Georgia, Kentucky, Maryland, Mississippi, Oklahoma, and inland Texas and Louisiana to promote the fur trade and control aquatic vegetation (Dozier 1952, Evans 1970).

Coypus have been introduced or have migrated into 30 states (Table 2, Evans 1970, Deems and Pursley 1978, Bounds 2000). The most recent survey of coypus in the United States was completed by Bounds (2000), who contacted federal wildlife refuge managers and representatives of state natural resource agencies to determine presence and status of coypus in their respective jurisdictions. The respondents reported coypus in 15 states. Most studies of coypus in the wild in the United States have taken place in Louisiana and Maryland.

Alabama. Coypus were brought into Alabama by the state's Department of Conservation and by private individuals in 1949 as weed control agents (Lueth 1949, Dozier 1952, Evans 1970). A viable feral population now exists in Alabama (Deems and

Pursley 1978), and it is increasing (Bounds 2000).

Arkansas. Coypus were imported here in the late 1940s as weed control agents (Evans 1983). They must not have formed a viable population at that time because they were not noted again until the early 1960s, when they reentered the state by range expansion from Louisiana (Bailey and Heidt 1978). They are now feral throughout much of Arkansas (Bailey and Heidt 1978) and are increasing (Bounds 2000).

California. The first coypus imported into the United States were to Elizabeth Lake, California, for fur farming in 1899 (Evans 1970). Although this attempt was not successful, subsequent importations must have been made because by 1940 California had a small feral population (Schitoskey et al. 1972). Conditions there are generally not favorable for coypus in the wild. A small eradication program was successful, and Deems and Pursley (1978) reported the animals were eradicated by 1978.

Colorado. Coypus were imported into Colorado for fur farming, and Deems and Pursley (1978) reported a small feral population. However, Bounds' (2000) survey found no coypus there.

Delaware. Bounds (2000) reported that coypu populations in Delaware were expanding. We have no information on when they might have been introduced; however, it seems likely they came in from Maryland. There have been feral coypu populations in Maryland since the 1930s (Paradiso 1969, Wilner et al. 1979), and there are no barriers to coypu movement between the two states.

Florida. Coypus moved into Florida by range expansion and via escapes or releases from fur farms in the 1950s (Brown 1975). They have escaped captivity or have been released and are now feral (Brown 1975, Deems and Pursley 1978, Bounds 2000).

Georgia. Coypus were introduced here for weed control by state and federal agencies (Dozier 1952; Evans 1970, 1983). They are now feral (Deems and Pursley 1978) and their population is stable (Bounds 2000).

Idaho. A small feral population existed (Deems and Pursley 1978) but is now reported extinct (Bounds 2000).

Illinois. Coypus were reported in Illinois (Kennedy and Kennedy 1998). Bounds' (2000) survey did not find any.

Indiana. Coypus were imported into Indiana for fur farming; some escaped but were eradicated (Deems and Pursley 1978).

Kansas. Coypus were imported into Kansas for

fur farming (Deems and Pursley 1978). Bounds' (2000) survey found none.

Kentucky. Coypus were introduced by state and federal agencies for weed control, but they did not survive (Evans 1970, 1983; Deems and Pursley 1978).

Louisiana. Coypus were first introduced near New Orleans in the early 1930s, but they were quickly trapped out (Evans 1970, Bailey and Heidt 1978). The species was brought back into Louisiana in 1938 for fur farming, and some escaped in 1940 by burrowing out of pens and climbing over fences damaged by a hurricane (Evans 1970, Lowery 1974, Bailey and Heidt 1978). These animals quickly expanded their range, and in less than 2 years coypus were reported in Lacassine National Wildlife Refuge near Lake Arthur, approximately 78 km by water from their purported release site (Dozier 1952). Coypus are feral in the state and are chiefly controlled by trapping and alligators (Lowery 1974, Deems and Pursley 1978, Wolfe and Bradshaw 1987). During the 1960s and 1970s, coypu populations were controlled by fur trappers; however, as fur prices dropped in the 1980s, so did the number of coypus caught (Kinler et al. 1987; Louisiana Department of Wildlife and Fisheries, unpublished report). The drop in trapping resulted in a large increase in the coypu population and loss of marsh due to overgrazing (Kinler et al. 1987; Louisiana Department of Wildlife and Fisheries, unpublished report). To increase trapping pressure, the state of Louisiana is now promoting coypu meat as a low-fat, nutritious product for retail and specialty markets (E. Mouton, Louisiana Department of Wildlife and Fisheries, personal communication).

Maryland. In the late 1930s and early 1940s, coypu care and breeding experiments were conducted by the United States Army at Blackwater National Wildlife Refuge in Dorchester County (Paradiso 1969). Prior to 1949 the state of Maryland did not keep accurate records of annual fur catches. Paradiso (1969) reported that in 1949 trappers reported 4 coypus taken, but no other animals were reported until 1956. Wilner et al. (1979) reported that feral coypus were first detected in 1952. By 1969 Paradiso (1969) stated that coypus existed only in Dorchester County and were precariously established. Ten years later, Wilner et al. (1979) reported that eradication efforts were unsuccessful and that the population had dispersed throughout the state into all suitable habitats. In 1982 Wilner (1982) noted that trapping and long, cold winters

kept coypu densities below a level at which significant damage could occur. Since that time, the drop in fur prices has reduced hunting pressure and a succession of mild winters has occurred. Coypu populations are now considered too high, and studies are underway to determine the best strategy for eradicating them from Maryland's wetlands (Haramis and Colonas 1999).

Michigan. Coypus were first farmed in Michigan in the 1930s (Evans 1970, 1983); although some were accidentally released, they did not survive in the wild (Deems and Pursley 1978, Bounds 2000).

Minnesota. Coypus have been present in Minnesota on fur farms (Hazard 1982). Some were accidentally released into the wild but did not survive (Deems and Pursley 1978).

Mississippi. Coypus entered this state via range expansion from Louisiana and importation by private individuals (Wolfe 1971, Deems and Pursley 1978, Kennedy and Kennedy 1998). Their population is stable (Bounds 2000).

Missouri. Coypus were present here (Deems and Pursley 1978, Kennedy and Kennedy 1998), but Bounds (2000) reported that they no longer are.

Montana. Hall (1981) mentioned coypus in Montana, but Bounds' (2000) survey reported they are no longer present.

Nebraska. Coypus were reported in Nebraska, but none have survived in the wild (Deems and Pursley 1978, Hall 1981).

New Mexico. Coypus were introduced here for fur farming (Evans 1970, 1983; Deems and Pursley 1978) and there were small feral populations (Deems and Pursley 1978). However, Bounds (2000) reported they are no longer present.

North Carolina. In 1941 a hunting club introduced coypus to Hatteras Island and they quickly spread (Milne and Quay 1967). Deems and Pursley (1978) reported a small viable feral population. Currently it is expanding (Bounds 2000).

Ohio. Coypus were imported for fur farming in 1937 (Bednarik 1961). Some escaped or were released into the wild. No wild populations currently exist (Bednarik 1961, Deems and Pursley 1978, Bounds 2000).

Oklahoma. Coypus have been recorded in Oklahoma and are present in low numbers (Deems and Pursley 1978). Their population is currently stable (Bounds 2000).

Oregon. Coypus were imported for fur farming in 1937; some escaped and feral ones were officially recorded as early as 1941 (Larrison 1943).

Currently a viable wild population exists (Deems and Pursley 1978) and is expanding (Bounds 2000).

Texas. A hurricane is thought to have scattered coypus into east Texas from Louisiana in 1941 (Evans 1983). Starting around 1947–1948, private individuals introduced the animals throughout east Texas because of their value as a furbearer and reputation as a “weed cutter” (Dozier 1952). They are now reported in every region of Texas except the high plains (Deems and Pursley 1978, Hollander et al. 1992). Recently they have moved up the Rio Grande Valley as far east as Big Bend National Park and are threatening wetlands along the river. Bounds (2000) reported the population as stable.

Tennessee. The first coypu was observed here in 1996; there is a small wild population (Kennedy and Kennedy 1998), reported to be expanding (Bounds (2000)).

Utah. Coypus were imported for fur farming in 1939 (Evans 1970, 1983), and although some may have escaped, they did not survive in the wild (Deems and Pursley 1978, Bounds 2000).

Virginia. It is hypothesized that coypus expanded into Virginia from North Carolina (Deems and Pursley 1978, Pagels 1989). Currently the population is stable (Bounds 2000).

Washington. Coypus were imported in the late 1930s and early 1940s for fur farms (Larrison 1943), and feral individuals were reported as early as 1941 (Larrison 1943). Currently a viable wild population exists (Deems and Pursley 1978) and is expanding (Bounds 2000).

Canada

British Columbia. Coypus were introduced for fur farming, and the earliest record of feral coypus is from 1943 (Holdom 1944). A feral population is still present (Deems and Pursley 1978).

Ontario. Coypus are feral in the Ottawa River drainage of Ontario (Banfield 1974).

Nova Scotia. Coypus were imported for fur farming and some were accidentally released into the wild, but currently no wild populations are known to exist (Deems and Pursley 1978).

Quebec. The earliest record of successful reproduction of fur-farmed coypus in North America was reported from Quebec, with animals imported from Germany in 1927 (Evans 1970). They were feral in the Ottawa River drainage of Quebec (Banfield 1974).

Mexico

A range map presented by Schwandt-Arbogast (2000) showed coypus in northern Mexico, in states along the border with Texas and along the Gulf of Mexico. Eyewitnesses have reported seeing them in Rio Grande Valley on both sides of the United States–Mexico border in the Big Bend region (J. Carter, personal observation). Because of their distribution pattern, we hypothesize that the animals entered Mexico through range expansion from Texas.

Discussion

The coypu has been introduced to every continent outside of its native South America except Antarctica and Australia. It has become established in new areas outside its native range primarily by 3 processes: deliberate introductions into new areas, escape or release from fur farms, and range expansion. Though not all initial coypu invasions are successful, as in the case of Arkansas, subsequent invasions may succeed (Bailey and Heidt 1978, Evans 1983).

The primary reason coypus are brought to a new area is for their pelt. Another is their ability to control aquatic weeds (Dozier 1952; Evans 1970, 1983),



Coypu enclosures on Blackwater National Wildlife Refuge in Maryland illustrate the effects of coypu on marsh loss. Photo taken November 2000 by Jacoby Carter.

but this ability has limited effectiveness because the animals do not necessarily eat targeted weed species and often find nontargeted plants more palatable (Evans 1970, 1983). Early studies in the southern United States indicated that coypus caused only minor or localized marsh damage and they were considered less destructive than native muskrats (Dozier 1952, Harris and Webert 1962). However, those early studies were done in years with extensive trapping. As pelt prices fell, so did trapping activity and coypu populations increased (Kinler et al. 1987; Louisiana Department of Wildlife and Fisheries, unpublished report). Later studies indicate that coypus can cause extensive marsh loss (Wilner et al. 1979, Foote and Johnson 1993, Linscombe and Kinler 1997). Problems associated with high coypu populations fall into several categories: destruction of marsh habitat, destruction of water control structures such as dykes and levees, destruction of agricultural crops, and the fact that the animals can serve as repositories of a variety of diseases (Evans 1983, Howerth et al. 1994, Moutou 1997, Linscombe and Kinler 1997). Economic damage caused by coypus has prompted government agencies to implement control or eradication programs (Gosling 1989). However, coypus are generalist feeders, have a high birthrate, and their habitat requirements are not very rigid (Evans 1983). Because of these factors, control and eradication are often hard to implement.

Not all of the countries that have imported coypus have had problems with them. In eastern Europe and the Caucasus, the coypu is highly regarded for its pelt (Aliev 1967). These countries have breeding programs to produce high-quality pelts and have established pedigrees (Aliev 1967). So while Louisiana and Argentina have the greatest harvest of feral animals, the highest quality and quantity of coypu pelts in the world come from semicaptive populations in eastern Europe and the Caucasus (Kinler et al. 1987).

Cold winters seem to be the most effective mechanism to limit coypu population expansion in the wild (Ehrlich 1967, Stubbe 1992, Bounds 2000). For example, though coypus were either introduced or escaped into the wild in all the Scandinavian countries, currently no wild populations exist in the region (Mitchell-Jones et al. 1999). In contrast, muskrats, an ecologically similar but more cold-hardy species from North America, are successful throughout Scandinavia (Mitchell-Jones et al. 1999). In regions with mild winters and suffi-

cient wetland habitat, coypu eradication efforts have seldom been successful.

The first successful coypu eradication effort occurred in California (Evans 1970). However, the best-documented example of a successful eradication campaign is from England (Gosling 1989). Eradication is difficult because very few coypus are needed to establish a population if suitable habitat is present, and once established, their populations can grow quickly. Once large populations are in place, it is difficult to assemble enough resources to completely eliminate them. Thus, coypu populations that are isolated from reinvasion and are reduced to a manageable level by adverse weather are most susceptible to eradication. The 3 conditions needed for a successful eradication effort are: the population should be isolated from sources of new immigration, inclement weather or harsh conditions are needed to reduce large populations, and trapping must be continued until no coypus are left.

These factors present some interesting choices for management. In south Louisiana, the coypu population is large and well dispersed. Even if an appropriate weather event occurred to greatly reduce the population, the probability is high that individuals would escape an intense removal campaign or invade from neighboring states. An eradication campaign is much more likely to be successful in Big Bend National Park, because the park contains limited coypu habitat and the invasion route into it is through a narrow, controllable corridor, the Rio Grande.

Coypu distribution throughout North America presents some interesting issues. The animals have been introduced to 30 states but currently are present in only 15, mostly southern states. The states where coypus do not currently exist probably represent areas where winters are harsh or wetland habitat is limited. Harsh winters cannot be the entire story, however, because coypus are reported in the Ottawa River drainage in the Canadian provinces of Quebec and Ontario. It is also interesting to note that coypus are not reported as being in South Carolina, even though they are present or expanding in neighboring Georgia and North Carolina (Bounds 2000).

Coypus have been transported all over the world due to perceptions about their economic value and our limited understanding of the effects that non-indigenous species can have on habitats. Although some areas have benefited, others have suffered. Once coypus are introduced, their eradication is

not always possible. In fact, without the 3 conditions listed above, eradication is not possible with current technology, and managing the population to reduce damage to habitat and crops is the best that can be achieved.

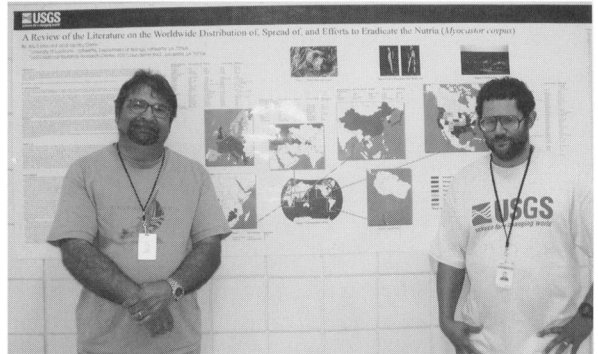
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Jacoby Carter (right) has been an ecologist at the United States Geological Survey's National Wetlands Research Center in Lafayette, Louisiana, since 1995. Dr. Carter received a BS in zoology and a BS in botany from the University of Washington, Seattle, in 1982. In 1992 he received an MS in ecology from Cornell University in Ithaca, New York, and in 1995 a Ph.D. in wildlife management from the University of Massachusetts, Amherst. His primary research interest is in using simulation models as a tool for ecological research. Current research projects include determining per-capita impact of nutria on marsh loss, modeling forest lost in the Xalapa region of Mexico, monitoring and modeling submerged aquatic vegetation in brackish waters of the Gulf of Mexico, modeling harvest impacts on map turtles (*Graptemys* sp.) in north Louisiana, and evaluating fire behavior models in coastal marshes. He is also interested in developing new technologies to aid in ecological research. Two recent projects are evaluating the use of light-induced fluorescence to assess plant health and a new design for nutria enclosures. A member of The Wildlife Society since 1990, Dr. Carter is also secretary of the Asian Ecology Section and chair-elect of the International Affairs Section of the Ecological Society of America. **Billy P. Leonard** (left) recently received his M.S. in biology from the University of Louisiana, Lafayette, where he was also awarded a B.S. in resource biology and biodiversity. Billy is primarily interested in avian ecology as it relates to habitat preferences. By press time Billy will be working at a new job doing bird surveys for the US Forest Service.

