

A SURVEY OF HERPETOLOGICAL INTRODUCTIONS IN THE UNITED STATES AND CANADA

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ABSTRACT

A search of the literature reveals that 75 exotic species have been imported into the United States (including Hawaii) in sufficient abundance and in territories of sufficient potential hospitability to enable them to survive. Excluded are the myriad "waif" releases of single specimens or of more than one in clearly inhospitable habitats. Thirty-two endemic species are known to have been introduced into areas where they do not now normally occur. Monitored introduction of exotic species that are regarded unlikely to displace native species should be encouraged. Introduction of endemics into areas where they do not now occur should not be permitted; introductions of specimens from one part of a species' range into another are especially objectionable. Augmentation by man of biotic diversity achieved by resource-partitioning among exotic and native species is a desirable calculated product insofar as it can be achieved, since it utilizes niche potentials to a degree not otherwise approachable. Specific regulations are suggested. The introduced species of amphibians and reptiles are listed and categorized, and references are given to the literature on each. Trans. Kansas Acad. Sci., vol. 80 (1-2), 1977.

Introduction of amphibians and reptiles into the United States have been monitored in the past on a very marginal scale, largely because of reluctance of herpetologists either to publicize the growing invasions, or to become even a distant party to a practice almost universally regarded as reprehensible. Thus disregarded, the number and variety of introductions have proliferated to an astonishing degree, virtually unnoticed and largely unrealized, until today the list has reached a total of 107 species and subspecies, including 75 exotics, without taking into consideration the surely nearly equal number of releases that have gone unreported in the accessible literature.

Compilers of data such as these, on the number of introductions, are acting basically as collectors and must make the same sort of decisions as any other collectors on borderline examples. Certain inclusions of the present compilation are admittedly controversial. Nevertheless there is a rationality of sorts behind every questionable inclusion; in any given case that rationality may or may not be deemed sufficient in the eyes of reviewers. It has been construed however that this compilation, like any

other, has the obligation to include questionable as well as unquestionable categories, for the benefit of future considerations and to eliminate oversight of them should new information warrant their ultimate incontrovertible inclusion.

The surprising total of 107 introduced species and subspecies requires an almost equally unexpected degree of categorization in order to permit sound comparisons and contrasts. Ten categories seem appropriate at the present time, with a fundamental distinction being recognized between exotic species, not occurring naturally within the boundaries of the United States, and species termed "endemic," in this context simply meaning indigenous or autochthonous—the species native to the United States, although not necessarily limited thereto. It has been considered desirable to include the "endemics," in this sense, as well as the exotics, because one of the primary considerations in conducting this survey has been to re-examine the arguments both for and against any introduction of any population samples into any region where they do not naturally occur, whether in the same country or a different one. In this context it is necessary to construe "introduction" to include both endemic and exotic species and subspecies.

The ten categories into which these 107 species and subspecies seem logically to fall are as follows:

1. *Exotic differentiated taxa*—taxa that have differentiated sufficiently since introduction to be regarded as different, subspecifically or specifically, from the parent population. No species fall into this category, but 3 subspecies of lizards are thought likely to belong here (*Anolis c. carolinensis*, *A. distichus floridanus*, *Sphaerodactylus n. notatus*). No categorical claim of finality in this allocation is intended, for clearly the proposal is strictly hypothetical, subject to future rejection, confirmation or modification. All of these 3 taxa are basically West Indian species, although two of them were discovered and named first on the basis of U.S. material. Although all may have been introduced by man, at least two of them were likely conveyed before the advent of European colonization; only *A. distichus* seems to be a recent introduction (shortly before 1948?), but even it could have been unobserved for many years. The prevailing winds, toward Florida, possibly were instrumental in bringing either *A. carolinensis* or *S. notatus*, or both, into the country as flotsam, since they frequently prowl littoral debris. They were described in 1832 and 1859 respectively—so early that, if introduced by man at all, they were probably distributed by travels of aborigines, as indeed is true of most of the Hawaiian lizards. The Hawaiian lizards did not differentiate subspecifically, whereas *A. carolinensis* and *S. notatus* did, but the Hawaiian species are essentially pan-Pacific, not given to regional subspeciation or, if so, it has not been detected. Quite possibly, if their geographic variation were as intensively studied as that of West Indian species, particularly at such competent hands as those of Albert Schwartz or his students, numerous subspecies could be recognized that are now unknown.

There is no intrinsic reason why *A. carolinensis*, *A. distichus* and *S. notatus* could not have differentiated after introduction to this country, particularly if the founder population was small (as is likely); only a few generations might suffice. Schwartz (1968) has conjectured that *A. distichus floridanus* might represent some as yet inadequately sampled population of Andros Island, Bahamas; if not, it would seem to have differentiated *in situ* in Florida, after introduction from the vicinity of Andros Islands.

The huge range of *Anolis c. carolinensis* does not in itself preclude introduction by man, for a successful founder population can spread with extraordinary rapidity if conditions are favorable; it does suggest, however, that the introduction, if it occurred at all, took place some time ago—a matter of 200 or more years since it already had a considerable range when described 144 years ago.

2. *Exotic breeding* populations now in existence. This is the largest group (36) here recognized, including 9 anurans, 1 turtle, 25 lizards and 1 snake. The Hawaiian Islands and Florida each have 16 introduced species, in this group, although two *Bufo m. marinus*, *Hemidactylus garnoti*) occur in both areas. Hawaii and California share one species (*Gehyra mutilata*.) Additionally, Florida has 3 anurans (*Eleutherodactylus coqui*, *E. p. planirostris*, *Hyla septentrionalis*) and 11 lizards (*Ameiva a. petersi*, *Anolis c. cybotes*, *A. distichus dominicensis*, *A. e. equestris*, *A. sagrai ordinatus*, *A. s. sagrai*, *Gonatodes albogularis fuscus*, *Hemidactylus t. turcicus*, *Leiocephalus carinatus armouri*, *Sphaerodactylus a. argus*, *S. cinereus*); Hawaii has 4 anurans (*Bufo g. gargarizans*, *Dendrobates auratus*, *Rana n. nigromaculata*, *R. rugosa*), 1 turtle (*Trionyx s. sinensis*), 8 lizards (*Anolis carolinensis porcatus*, *Cryptoblepharis boutoni poecilopleurus*, *Emoia cyanura*, *Hemidactylus frenatus*, *Hemiphyllodactylus t. typus*, *Leiopisma metallicum*, *Lepidodactylus lugubris*, *Lipinia n. noctua*), and 1 snake (*Typhlina bramina*).

Apparently, none of Florida's introductions were planned; most fall into the category of expediency, as dealers released excess animals rather than killing them. Most of Hawaii's introductions were either strictly inadvertent (most if not all the lizards) or planned (most anurans) for insect control; only *Dendrobates* seems to fall in the expedience category. All but two (the two *Hemidactylus*) of Florida's introductions (in this category) are American, and most of them West Indian, whereas Hawaii's introductions are Asiatic or East Indian, with the exceptions of the anole, *Bufo marinus* (South American) and *Denrobates* (Panamanian). Thus most of the Floridian introduced lizards are iguanids or geckonids, whereas most in Hawaii are skinks or geckos. Even the hand of man has been significantly guided by natural distribution.

The speed with which a species can extend its range once it is introduced where conditions are favorable is exemplified by *Hemidactylus turcicus*, which was first reported in Florida in 1915 and subsequently has enlarged its range steadily westward through the Gulf States and Texas and was recently reported in Arizona. Its appearance in

California seems to be only a matter of time, when it will have spanned the continent in less than three-quarters of a century. Of course some colonies may have been established independent of the Florida invasion; Davis (1974) attributes the Texas population to radiation via truck lines following introduction at Brownsville about 1945.

Somewhat similarly, *Gehyra mutilata*, which was established long ago in Hawaii, also became entrenched on the west coast of Mexico, and has been working its way northward rather rapidly. Its ultimate appearance in southwestern United States (Shaw, 1946), was to have been expected in due time, although persistence of the colony has not been confirmed by subsequent records. As observed by Taylor (1940: 444), this species probably arrived in the Western Hemisphere several centuries ago, "when the Spanish galleons carried trade between Acapulco and the Philippines." The wide distribution of another Asiatic species, the blind snake *Ramphotyphlops bramina*, in western Mexico clearly indicates an introduction of considerable antiquity, for the burrowing habits of the species would not be conducive to rapid enlargement of range, dependent as it is primarily upon accidental transport by man in bundles of soil. The geckos, on the contrary, utilize vehicles of transport far more readily accessible than soil, and indeed have spread much more rapidly and widely. Assuming an introduction more or less coinciding with that of *Ramphotyphlops*, both *Hemidactylus frenatus* and *Gehyra mutilata* were probably present in western Mexico by some time in the 16th century.

In only a few other areas have introduced exotics become established. Two are limited to southern California, one with a firm foothold (*Xenopus l. laevis*), the other with a tenuous one (*Ctenosaura hemilopha*). *Ctenosaura pectinata* seems to be established in southern Texas (Conant, pers. comm.). Two species of *Lacerta* complete the list, one (*L. s. sicula*) on Long Island and one (*L. viridis*) in Topeka, Kansas.

These established colonies, although severely criticized as examples of "biotic pollution," may have some offsetting potential value as sources of material for experimental studies that might be impossible to carry out otherwise under restrictions that may be imposed on importation of exotic species. Indeed, they might well be nurtured to that end, insofar as they appear not to jeopardize the native biota. Even their adaptation for survival in strange surroundings constitutes a fertile field for study, whatever uses the animals may have otherwise. In any event, they are a biological resource of many potentially positive values, and the ingenuity of biologists should be directed more toward their exploitation, and less toward lamenting or concealing their existence.

3. *Exotic released.* The next largest but nearly equal category of introduced species embraces known releases of considerable magnitude in areas of at least marginal survival potential. Most of the 32 species and subspecies falling into this category have been released in Florida and to a lesser extent also elsewhere. Included is a much wider range of representation than in any of the other categories, with 1

salamander (*Cynops p. pyrrhogaster*), 6 anurans (*Atelopus varius zeteki*, *Bombina bombina*, *Bufo blombergi*, *Eleutherodactylus portoricensis*, *Hymenochirus boettgeri*, *Pachymedusa dacnicolor*), 9 turtles (*Chelus fimbriatus*, *Chrysemys dorbignyi*, *C. scripta callirostris*, *C. s. ornata*, *C. terrapen malonei*, *Kinosternon s. scorpioides*, *Podocnemis lewyana*, *P. sextuberculata*, *P. unifilis*), 14 lizards (*Ameiva a. ameiva*, *Anolis c. conspersus*, *A. distichus ignigularius*, *B. basiliscus*, *Cordylus c. niger*, *Cyclura c. cornuta*, *Gekko g. gecko*, *Hemidactylus brooki*, *H. picturatus*, *Iguana iguana*, *Leiocephalus carinatus coryi*, *Ophisaurus apodus*, *Sphaerodactylus macrolepis*, *Tupinambis rufescens*), 1 snake (*Boa constrictor*) and 1 crocodylian (*Caiman crocodylus*).

Any of these may possibly be successful in establishing a breeding colony, and if they do they will add greatly to the diversity of the available American biota—assuming that their success consists of partitioning environmental resources, and not the elimination of native competitors. There is little limit to the extent of biotic diversity possible in a tropical or semitropical environment; the limitations that do exist are inherent primarily in the partitioning capacity of the members of the biota. The role of supervision by man may well be directed toward assurance that no species is introduced that is so dominant that it eliminates its competitors rather than sharing with them.

Although Carr and Goin (1955: v, 8) emote proudly over the unquestionably rich ectotherm fauna of Florida, none of the Gulf states can be viewed as having even approached their niche potential at least for the herpetofauna. Amphibians are capable of a much greater diversity in equally small areas, and the reptilian fauna is depauperate since most of its members are of xeric or semixerix origin: the rich mesic reservoirs of reptilian diversity in tropical America have been largely cut off by the vast Gulf of Mexico, the narrow funnel of Central America, and the barriers directly or indirectly provided by the huge Mexican highlands (especially by its resultant xeric or semixerix filter in the area of junction of Mexico and the United States). Kiester (1971: 130-131) depicts amphibian and reptilian density contours for continental United States, and shows the tip of the Florida peninsula as about on a par with northern Illinois in species density in both groups. The faunistic deprivation of southern Florida is reflected as much in mammals (Wilson, 1974: 127-129) and birds (MacArthur and Wilson, 1967: 116) as in amphibians and reptiles. The impassioned appeal by King (1968) for exercise of perceptive restraint in consideration of introductions of any sort that might endanger the native biota is completely sound, but it should not be construed as a proposal for prevention of properly monitored introductions. The case is made for protection of the native biota, but judicious efforts to complement the existent flora and fauna by addition of harmonious exotics is not contraindicated. The basic precautions to be exercised are spelled out in some detail in King's (1968) essay, adapted from Craighead and Dasmann's (1966) recommendation for control of importation of big game animals. Most important are the propositions (1) that "An introduc-

tion should not be considered if there is any danger, even apprehension, over the action leading to drastic reduction or regional displacement of indigenous populations;" that (2) "Every effort be made to assure disease-free introductions;" that (3) "Precautions against hybridization should be taken;" and that (4) "Positive assurance should be obtained that adequate control methods can be instigated" if needed.

4. *Exotic expected*. The remaining exotic introductions fall into two categories: expected and extinct. The "expected" category here includes one gecko, *Hemidactylus mabouia*, known as an efficient colonizer, with established headquarters in Mexico, the West Indies and South America, and which therefore in due time may be expected to appear northward in the United States.

No doubt others could be placed in this category, on the basis of known or suspected escapes (category 9), but it has seemed expedient to include only those whose success elsewhere and close approach already to our borders make the invasion appear imminent.

5. *Exotic extinct*. Three taxa have been at one time introduced into the country, and either bred successfully for a time or seemingly had favorable conditions for development of breeding colonies, but have subsequently become extinct. *Hyla aurea* in Hawaii, *Leiocephalus carinatus virescens* in Miami, Florida, and *Lacerta sicula campestris* in Philadelphia belong in this category. The *Leiocephalus* and *Lacerta* colonies were indeed successfully breeding for a time; the *Hyla* may never have bred successfully. No doubt many of the preceding categories 2 and 3 will ultimately be allocated here.

Categories 6-9 pertain to endemic species only. Introductions in these categories have not evoked the interest or attention that exotics have generated. Thus records are extremely scanty, representing only 33 species and subspecies as opposed to 75 for exotic species (1 species counted in both categories) whereas it is likely that in fact introduced endemics far outnumber exotics, although most of them may fall in the "waif" category (10) in which it is futile to attempt to list species.

6. *Endemic breeding* populations now in existence—the equivalent of category 2 for exotic populations. Category 1, for differentiated exotics, has no endemic equivalent so far as known, although of course it remains a potentially viable category it may be necessary to recognize in the future. The 13 species of category 6 include 1 salamander (*Ambystoma tigrinum*, various subspecies), 4 anurans (*Bufo boreas halophilus*, *Hyla gratiosa*, *Rana catesbyiana*, *Rana clamitans melanota*), 4 turtles (*Chelydra serpentina*, *Chrysemys scripta troosti*, *Trionyx spiniferus emoryi*, *T.s.spiniferus*), 3 lizards (*Anolis c.carolinensis*, *Phrynosoma cornutum*, *Sceloporus undulatus hyacinthinus*) and 1 snake (*Natrix fasciata pictiventris*). *A. tigrinum* has been introduced widely into western states as fish bait, and although breeding introduced colonies are not known, the species already exists in the area and survival of introduced specimens is thus highly probable. Here, however, we encounter one of the most undesirable aspects of introductions: break-

down of subspecies distinctions by dilution of the native genome. It would be tragic to so disturb the genetic balance of geographic subspecies by large-scale releases of non-native subspecies that their very status is threatened. In the frighteningly pervasive mixtures created by irresponsible releases of *A. tigrinum* larvae from all over the West into fishing grounds equally widely dispersed, we approach close to the brink of irreparable disturbance. If the introductions were only monitored, to the extent of recording whence released animals came, their number, where and when the release occurred, there would be at least a chance to observe the test in nature of the theory of adaptive correlation of subspecific differences, but the unknown factors prevent even this salvage of scientific value. Mixture of genetic stocks in this way is thus highly regrettable—the most deplorable aspect of introductions of amphibians or reptiles into non-native areas.

Rana catesbyiana has likewise been introduced over much of western United States where it did not occur even 50 years ago; it has even been introduced into Mexico, Canada, and Hawaii. Here no problem of genetic disturbance exists, for no subspecies are recognized, although competition with native species (e.g., *Rana fischeri*) is a concern except in Hawaii where no native frogs exist. *R. clamitans* and *Bufo boreas halophilus* have also been introduced into Hawaii. The former has been recorded in Utah and Washington, and may be expected to put in an appearance at other western localities where *R. catesbyiana* has been introduced, simply because of their confusing similarity. *Hyla gratiosa*, *Chrysemys scripta troosti* and *Trionyx s. spiniferus* have become established in New Jersey, *Sceloporus undulatus hyacinthinus* in New York; with the possible exception of the *Chrysemys*, which may be hybridizing with another imported subspecies, *C. s. elegans*, none of these pose any known threat to the native biota. *Chelydra serpentina* has established itself in California, and *Trionyx spiniferus emoryi* in the lower Colorado River. *Anolis carolinensis* and *Phrynosoma cornutum* releases have been marginally successful in numerous continental areas, with firm records of the latter for Colorado and of the former for Texas and Kansas. *Natrix fasciata pictiventris* has established itself in extreme southern Texas.

All these introductions confuse the picture of natural distribution, and have little merit in any context, even of diversification and niche multiplication.

7. *Endemic released* populations are the equivalent of category 3 for exotic species. The releases are of sufficient magnitude and/or in areas of such apparently favorable habitats that establishment as breeding colonies must be considered at least possible even if marginal. Most of the 12 recorded species released have involved Florida (7), although 1 of these 7 (*Chrysemys scripta elegans*) was also released in California, Kentucky, Maryland, Michigan, Ohio, West Virginia and Hawaii. Two involve California alone (*Gopherus berlandieri*, *Sceloporus cyanogenys*), two New Jersey (*Masticophis flagellum*, *Thamnophis*), and

one Kansas (*Desmognathus fuscus*, of uncertain subspecies). The strictly Floridian introductions include one salamander (*Notophthalmus v. viridescens*), 3 turtles *Chrysemys picta belli*, *C. p. dorsallis*, *Graptemys kohni* and 2 lizards (*Sceloporus magister*, *S. poinsetti*, both of uncertain subspecies).

Conant (1962) has pointed out that the Pine Barrens of New Jersey are a severely harsh habitat for many species. Populations of numerous taxa on occasion wander or migrate into the area only to die out shortly, because either they or their progeny cannot survive in the acid waters (Gosner and Black, 1957). The introduced *Masticophis* and *Thamnophis* very likely would not survive over a long period. "The native gartersnake itself, *T. sirtalis*, is scarce, perhaps in part because of the paucity of earthworms, and because alternative food sources are more efficiently exploited by *Natrix sipedon*, which is abundant. *Masticophis* might fare better, although edaphic and climatic factors would probably work against it. The same might be suggested in the cases of *Ophisaurus apodus* and *Bombina bombina* of Category 3 (exotic released). There is no evidence that any of these have become established in the Pine Barrens." (Conant, pers. comm.)

Turtles are surprisingly preponderant (5 in 12) in category 7, and even salamanders (2) are more abundant than in any other category. The lizards (3) are even less than expected.

8. *Endemic release probable* but uncertain. *Cryptobranchus a. alleghaniensis* is an excellent example of the confusion attendant upon endemic introductions, for its occurrence in Missouri where *C. a. bishopi* is a clear-cut relic of a long-standing isolation from the more eastern populations poses a fundamentally significant question of its natural occurrence. Introduction seems quite possible in Missouri, despite its firm establishment there, is almost certain in adjacent Kansas, and is suspected or confirmed in Georgia and New Jersey. Conant (pers. comm.) doubts the validity of the New Jersey "record" stemming from Abbott (1868), but Nickerson and Mays (1973: 63) cite other alleged introductions into the Delaware River, although no populations there are thought to have survived to the present time. *Micrurus fulvius* in Ohio and Indiana (Link, 1951) is a comparable enigma, but following Conant (1951: 8, 204-5) we regard it as a "waif" (category 10). *Natrix r. rhombifera*, *Alligator mississippiensis* of extreme southern Texas, where they may have occurred in the recent past but have certainly now established themselves through introductions, are also uncertainties now perhaps impossible to clarify (Conant, 1975, 1976).

9. *Endemic extinct*. This is the equivalent of category 5 for exotics—endemics introduced and apparently established at one time in an area outside of normal range, but now extinct there. Actual successful establishment of a breeding colony at any time is a question in every case but the possibility is accepted. One frog (*Rana sylvatica cantabrigensis* in Kansas) and 2 snakes (*Agkistrodon piscivorus* of uncertain sub-

species, *Crotalus atrox* and *C. v. viridis*, all in extreme eastern Kansas, and *C. atrox* also in southwestern Wisconsin) are represented.

10. *Waif* introductions embrace releases of single specimens or 2 or more of one sex only, in any area, or of any number in clearly inhospitable regions where they could not possibly survive long enough to establish a breeding colony. Clearly such introductions are legion and thereby defy and fail to justify enumeration. Discovery of a single live *Elaphe obsoleta quadrivittata* in a preserve in central Illinois is an example, as are the "banana imports" that have occurred by the thousands in large cities all over the country during the past several decades. Such introductions may be unfortunate for the animals involved, but they pose no threat to the composition of the local fauna even on a temporary basis. The report of 1 *Andrias* in the Sacramento River near Walnut Grove, California, and of 2 presumably Australian skinks near San Mateo, California (Myers, 1951: 179-180) presumably fall into the "waif" category. So also do the pythons that escaped (and were later recaptured) near Brownsville, Texas, some years ago (King, 1964, via Conant, 1976), and perhaps *Sphaerodactylus lineolatus*, reported by Mount (1975: 25) to have been taken once in Mobile, Alabama.

The following list summarizes the salient facts and sources pertinent to introductions of amphibians and reptiles in the United States. The category into which each species or subspecies falls is indicated immediately after each scientific name as a parenthetical number.

The first report of the introduction of any given taxon is indicated among the cited sources—usually the earliest date. The normal range is indicated for exotics, but derivations for introduced endemics are indicated only if known for the particular population sampled. The parenthetical figure following the place of introduction is the number released, where known.

Order Caudata

Family Ambystomatidae

1. *Ambystoma tigrinum* (Green), subspecies various (6). *To*: many western states, introduced as fish bait, especially in Arizona; range altered elsewhere, e.g. Texas. *Sources*: Conant, 1975; Thomas, 1974 (Texas).

Family Cryptobranchidae

2. *Cryptobranchus a. alleganiensis* (Daudin) (8). *To*: Georgia? Kansas? Missouri? New Jersey? *Sources*: Abbott, 1868; Alexander, 1927; Collins, 1974; Dundee, 1971; Hall and Smith, 1947; Nickerson and Mays, 1973; Surface, 1913.

Family Plethodontidae

3. *Desmognathus fuscus* (Green), subspecies uncertain (7). *To*: SE Kansas. *Source*: Collins, 1974.

Family Salamandridae

4. *Cynops p. pyrrhogaster* (Boie) (3). *To*: Hialeah, Fla. (200), from Japan. *Source*: King and Krakauer, 1966.

5. *Notopthalmus v. viridescens* (Rafinesque) (7). To: Hialeah, Fla. (200). Source: King and Krakauer, 1966.

Order Anura

Family Bufonidae

6. *Atelopus varius zeteki* Dunn (3). To: Dade County, Fla., from Panama. Source: King and Krakauer, 1966.
7. *Bufo blombergi* Myers and Funkhouser (3). To: Broward County, Fla., from South America. Source: King and Krakauer, 1966.
8. *Bufo boreas halophilus* Baird and Girard (6). To: Oahu, Hawaii. Source: Oliver and Shaw, 1953.
9. *Bufo g. gargarizans* Cantor (2). To: Kauai, Hawaiian Islands, from Japan. Sources: Cochran and Goin, 1970; Oliver and Shaw, 1953; Svihla, 1936.
10. *Bufo m. marinus* Linnaeus (2). To: Hawaiian Islands (Hawaii, Kauai, Maui, Molokai, Oahu) and southern Florida, from South America. Sources: for Hawaii, Hunsaker and Breese, 1967; Oliver and Shaw, 1953; Pemberton, 1934; for Florida, Bartlett, 1967; Cochran and Goin, 1970; Conant, 1975; King, 1968; King and Krakauer, 1966; Leviton, 1970; and Neill, 1957.

Family Dendrobatidae

11. *Dendrobates auratus* Girard (2). To: Oahu, Hawaiian Islands, from Panamá. Sources: Cochran and Goin, 1970; Hunsaker and Breese, 1967; McMorris, 1970; Oliver and Shaw, 1953; Tinker, 1941.

Family Discoglossidae

12. *Bombina bombina* (Linnaeus) (3). To: New Jersey (Pine Barrens) (150); from Europe. Source: Rothman, 1964.

Family Hylidae

13. *Hyla aurea* Lesson, subspecies uncertain (5). To: Oahu, Hawaiian Islands, from Australia. Sources: Oliver and Shaw, 1953; Tinker, 1941.
14. *Hyla cinerea cinerea* (Schneider) (8). To: Texas (Brownsville); from south-eastern U.S. Source: Conant, 1976.
15. *Hyla gratiosa* Le Conte (6). To: New Jersey (Bennett, Cape May Counties); from southeastern U.S. Sources: Black and Gosner, 1958; Conant, 1975.
16. *Hyla septentrionalis* Boulenger (2). To: Southern Florida, from West Indies. Sources: Barbour, 1931b; Bartlett, 1967; Cochran and Goin, 1970; Conant, 1975; King, 1968; King and Krakauer, 1966; Leviton, 1972.
17. *Pachymedusa dacnicolor* (Cope) (3). To: Hialeah, Florida (10), from western Mexico. Source: King and Krakauer, 1966.

Family Leptodactylidae

18. *Eleutherodactylus coqui* Thomas (2). To: Fairchild Tropical Garden, Miami, Florida, from Puerto Rico. Source: Austin and Schwartz, 1975.
19. *Eleutherodactylus portoricensis* Schmidt (3). To: Dade Co., Fla., from Puerto Rico (or Tortola or St. John). Source: King and Krakauer, 1966.
20. *Eleutherodactylus planirostris planirostris* (Cope) (2). To: Florida, virtually entire state, from Bahama Islands. Sources: Bartlett, 1967; Carr and Goin, 1955; Cochran and Goin, 1970; Conant, 1975; Cope, 1863; Goin, 1947; King, 1968; King and Krakauer, 1966; Leviton, 1972.

Family Pipidae

21. *Hymenochirus boettgeri* (Tornier) (3). To: Hialeah, Florida (1000), from West Africa. Source: King and Krakauer, 1966.
22. *Xenopus laevis laevis* (Daudin) (2 and 3). To: Southern California (confirmed in Los Angeles, Riverside, Orange, San Diego counties, rumored to be more widespread), rumored only in Arizona, Colorado, Nevada, New Mexico, Utah, Wyoming; released at Hialeah, Florida (200). From South Africa. Sources: King and Krakauer, 1966 (Florida); Mahrtdt and Knefler, 1973 (Calif.); St. Amant, 1975 (Calif.); St. Amant and Hoover, 1969 (Calif.).

Family Ranidae

23. *Rana catesbyiana* Shaw (6). To: All of western U.S., southwestern Canada British Columbia), northern Mexico, and in Hawaii on Hawaii, Kauai, Maui, Molokai, Oahu. Sources: Bryan, 1915 (Hawaii); Cochran and Goin, 1970 (North America); Conant, 1975 (North America); Hunsaker and Breese, 1967 (Hawaii); Leviton, 1972; Oliver and Shaw, 1953 (Hawaii); Stebbins, 1951, 1954, 1966, 1972 (western U.S., Canada); Thomas, 1974 (Texas).
24. *Rana clamitans melanota* (Rafinesque) (6). To: Oahu, Hawaiian Islands; British Columbia and Newfoundland, Canada; Utah, Washington. Sources: Behle and Irwin, 1962; Cochran and Goin, 1970; Conant, 1975; Hunsaker and Breese, 1967; Leviton, 1972; Oliver and Shaw, 1953; Stebbins, 1951, 1954, 1955; Tinker, 1941.
25. *Rana n. nigromaculata* Hallowell (2). To: Oahu, Hawaiian Islands, from China or Japan. Sources: Cochran and Goin, 1970; Oliver and Shaw, 1943; Tinker, 1941.
26. *Rana rugosa* Schlegel (2). To: Hawaiian Islands (Hawaii, Maui, Oahu), from Japan. Sources: Cochran and Goin, 1970; Hunsaker and Breese, 1967; Oliver and Shaw, 1953; Svihla, 1936.
27. *Rana sylvatica cantabrigensis* Baird (9). To: Lyon County, Kansas. Source: Breukelman and Smith, 1946.

Order Testudines

Family Chelidae

28. *Chelus fimbriatus* (Schneider) (3). To: Broward County, Florida (5), from South America. Source: King and Krakauer, 1966.

Family Chelydridae

29. *Chelydra serpentina* (Linnaeus), subspecies uncertain (6). To: Fresno, Calif. Sources: Conant, 1975; Stebbins, 1972.

Family Emydidae

30. *Chrysemys dorbignyi* (Duméril and Bibron) (3). To: Hialeah, Fla. (20), from southeastern South America. Sources: Bartlett, 1967; King and Krakauer, 1966.
31. *Chrysemys picta belli* (Gray) (7). To: Hialeah, Florida (25). Source: King and Krakauer, 1966.
32. *Chrysemys picta dorsalis* Agassiz (7). To: Hialeah, Florida (25). Source: King and Krakauer, 1966.
33. *Chrysemys scripta callirostris* (Gray) (3). To: Hialeah, Florida (20), from northern South America. Source: King and Krakauer, 1966.

34. *Chrysemys scripta elegans* (Wied) (7). To: Hawaii, California, Florida (Miami), Kentucky, Maryland, Michigan, Ohio, West Virginia. Sources: Bartlett, 1967; Conant, 1951, 1975; Edgren, 1943, 1948; Gordon and Fowler, 1961; Harris, 1975; King, 1968; King and Krakauer, 1966 (Florida); Oliver and Shaw, 1953 (Hawaii); Stebbins, 1972 (California).
35. *Chrysemys scripta troosti* (Holbrook) (6). To: Maryland. Source: Harris, 1975.
36. *Chrysemys scripta ornata* (Gray) (3). To: Hialeah, Florida (150), and Broward County, Florida (20), from Mexico or Central America. Sources: Bartlett, 1967; King and Krakauer, 1966.
37. *Chrysemys terrapen malonei* Barbour and Carr (3). To: Hialeah, Fla., (20), from Bahamas. Source: King and Krakauer, 1966.
38. *Graptemys kohni* (Bauer) (7). To: Hialeah, Florida (100). Sources: Bartlett, 1967; King and Krakauer, 1966.

Family Kinosternidae

39. *Kinosternon s. scorpioides* (Linnaeus) (3). To: Hialeah, Florida (25), from northern and central South America. Source: King and Krakauer, 1966.

Family Pelomedusidae

40. *Podocnemis lewyana* Duméril (3). To: Hialeah, Florida (10), from north-western South America. Source: King and Krakauer, 1966.
41. *Podocnemis sextuberculata* Cornalia (3). To: Hialeah, Florida (10), from northern South America. Source: King and Krakauer, 1966.
42. *Podocnemis unifilis* Troschel (3). To: Hialeah, Florida (250), from north-eastern South America. Sources: Bartlett, 1967; King and Krakauer, 1966.

Family Testudinidae

43. *Gopherus berlandieri* (Agassiz) (7). To: Southern California. Source: Stebbins, 1972.

Family Trionychidae

44. *Trionyx s. sinensis* Wiegmann (2). To: Kauai, Hawaiian Islands, from south-eastern Asia. Sources: Brock, 1947; Cochran and Goin, 1970; Ernst and Barbour, 1972; Oliver and Shaw, 1953.
45. *Trionyx spiniferus emoryi* (Agassiz) (6). To: Lower Colorado River in California and Arizona. Sources: Miller, 1946; Stebbins, 1972; Webb, 1962.
46. *Trionyx spiniferus spiniferus* Le Sueur (6). To: New Jersey. Sources: Conant, 1961, 1975; Edgren, 1943, 1948; Fowler, 1907; Gordon and Fowler, 1961.

Order Lacertilia

Family Anguidae

47. *Ophisaurus apodus* (Pallas) (3). To: New Jersey (Pine Barrens) (10); from Europe. Source: Rothman, 1964.

Family Cordylidae

48. *Cordylus cordylus niger* Cuyier (3). To: Hialeah, Florida (10); from South Africa. Source: King and Krakauer, 1966.

Family Gekkonidae

49. *Gehyra mutilata* (Wiegmann) (2). *To*: Hawaiian Islands (Hawaii, Kauai, Kahoolawe, Maui, Molokai, Oahu), and San Diego, California; from southern Asia, East Indies, northern Australia. *Sources*: Cochran and Goin, 1970; Girard, 1858a; Husaker and Breese, 1967; McMorris, 1970; Oliver and Shaw, 1953; Shaw 1946.
50. *Gekko gecko gecko* (Linnaeus) (3). *To*: Florida (Cocoanut Grove, Gainesville, Miami), from southern Asia or East Indies. *Sources*: Bartlett, 1967; King, 1968; King and Krakauer, 1966.
51. *Gonatodes albogularis fuscus* (Hallowell) (2). *To*: southern Florida, from West Indies, Central and South America. *Sources*: Bartlett, 1967; Carr, 1939, 1940; Carr and Goin, 1955; Cochran and Goin, 1970; Conant, 1975; King, 1968; King and Krakauer, 1966; Leviton, 1972.
52. *Hemidactylus brooki* Gray (3). *To*: Dade County, Florida, to be expected in southern Texas, established in northeastern Mexico; from Africa, India, Indo-Australian Archipelago, northern South America, Antilles. *Source*: King and Krakauer, 1966.
53. *Hemidactylus frenatus* Duméril and Bibron (4). *To*: Hawaii, Maui and Oahu, Hawaiian Islands; expected in Texas, Arizona, California; established both slopes of Mexico, northward to Colima and San Luis Potosí; from Africa, Asia, Australia, Polynesia. *Sources*: Hunsaker, 1967 (Hawaii); Hunsaker and Breese, 1967 (Hawaii); McCoy and Busack, 1970; McMorris, 1970; personal.
54. *Hemidactylus garnoti* Duméril and Bibron (2). *To*: Miami, Florida; Hawaiian Islands (Hawaii, Kauai, Maui, Molokai, Niihau, Oahu); from East Indies. *Sources*: Cochran and Goin, 1970 (Hawaii); Conant, 1975 (Fla.); Girard, 1858a (Hawaii); Hunsaker and Breese, 1967 (Hawaii); King, 1968 (Fla.); King and Krakauer, 1966 (Fla.); McCoy, 1972 (Fla.); McMorris, 1970 (Hawaii); Oliver and Shaw, 1953 (Hawaii). A parthenogenetic species, therefore a potentially efficient colonizer.
55. *Hemidactylus mabouia* (Moreau de Jonnes) (4). *To*: expected in southern U.S.; from Africa, Madagascar, West Indies, northern South America. *Source*: personal.
56. *Hemidactylus picturatus* (Peters) (3). *To*: Hialeah, Florida (40); from South Africa. *Sources*: Bartlett, 1967; King and Krakauer, 1966. Both sources actually list the name *Cnemidophorus picturatus*. There is no such species, and we have guessed that *Hemidactylus picturatus* was intended.
57. *Hemidactylus t. turcicus* (Linnaeus) (2). *To*: numerous localities in southern tier of states, from Florida through Texas to Arizona; from India, southern Europe, northern Africa. *Sources*: Anonymous, 1955, 1959; Bartlett, 1967; Carr, 1940; Carr and Goin, 1955; Cochran and Goin, 1970; Conant, 1955, 1975, 1976; Conzelmann and Thomas, 1971; Davis, 1974; Dixon, 1958; Fowler, 1915; King and Krakauer, 1966; Leviton, 1972; McCoy, 1970, 1971; Mount, 1975; Ruan and Gehlbach, 1972; Robinson and Romak, 1973; Thomas, 1974; Treadwell, 1962.
58. *Hemiphyllodactylus t. typus* Bleeker (2). *To*: Hawaiian Islands (Hawaii, Kauai, Oahu); from southern Asia, East Indies. *Sources*: Cochran and Goin, 1970; Hunsaker and Breese, 1967; Oliver and Shaw, 1953; Stejneger, 1899.
59. *Lepidodactylus lugubris* (Duméril and Bibron) (2). *To*: Hawaiian Islands (Hawaii, Kauai, Maui, Molokai, Oahu); from East Indies. *Sources*: Cochran and Goin, 1970; Hunsaker and Breese, 1967; McMorris, 1970; Oliver and Shaw, 1953; Stejneger, 1899. A parthenogenetic species, therefore a potentially effective colonizer.

60. *Sphaerodactylus a. argus* (Gosse) (2). *To*: Key West, Florida; from Jamaica, Cuba, Corn Island. *Sources*: Cochran and Goin, 1970; Conant, 1975; King, 1968; King and Krakauer, 1966; Savage, 1954.
61. *Sphaerodactylus cinereus* Wagler (2). *To*: southern Florida, from Cuba, Navassa, Hispaniola. *Sources*: Carr, 1940; Carr and Goin, 1955; Cochran and Goin, 1970; Conant, 1975; King, 1968; King and Krakauer, 1966; Leviton, 1972; Stejneger, 1922.
62. *Sphaerodactylus macrolepis* Günther (3). *To*: Dade County, Florida; from West Indies. *Source*: King and Krakauer, 1966.
63. *Sphaerodactylus n. notatus* Baird (1). *To*: southern Florida; 4 other subspecies in Cuba, Isla de Pinos, Great Inagua, Morant, Little Swan, Bahamas. *Source*: Baird, 1859; Bartlett, 1967; Carr, 1940; Carr and Goin, 1955; Cochran and Goin, 1970; Conant, 1975; Leviton, 1972; Schwartz, 1966.

Family Iguanidae

64. *Anolis c. carolinensis* (Voigt) (1, 6). *To*: southeastern United States; other subspecies in West Indies; secondary introduction into Kansas, Texas, elsewhere. *Sources*: Collins, 1974 (Kansas); Conant, 1976; Thomas, 1974 (Texas); personal interpretation for southeastern U.S.
65. *Anolis carolinensis porcatus* Gray (2). *To*: Oahu, Hawaiian Islands, and Key West, Florida; from Cuba. *Sources*: Allen and Slatten, 1945; Cochran and Goin, 1970; Hunsaker and Breese, 1967; Oliver and Shaw, 1953; Shaw and Breese, 1951.
66. *Anolis c. conspersus* Garman (3). *To*: Dade County, Florida; from Grand Cayman Island. *Source*: King and Krakauer, 1966.
67. *Anolis c. cybotes* (Cope) (2). *To*: Miami, Florida; from Hispaniola. *Sources*: Conant, 1975; King and Krakauer, 1966; Ober, 1973.
68. *Anolis distichus dominicensis* Reinhardt and Lütken (2). *To*: Miami, Florida; from Hispaniola. *Sources*: Bartlett, 1967; Cochran and Goin, 1970; Conant, 1975; King, 1968; King and Krakauer, 1966; Leviton, 1972; Schwartz, 1968.
69. *Anolis distichus floridanus* Smith and McCauley (1). *To*: Miami, Florida; possibly differentiated subsequent to introduction, introduced from Bahama Island, possibly Andros. *Sources*: Bartlett, 1967; Carr and Goin, 1955; Cochran and Goin, 1970; Conant, 1975; King, 1968; Leviton, 1972; Schwartz, 1968; Smith and McCauley, 1948 (some of these sources use the name *A. d. distichus*).
70. *Anolis distichus ignigularis* Mertens (3). *To*: Dade County, Florida; from Dominican Republic. *Source*: King and Krakauer, 1966.
71. *Anolis e. equestris* Merrem (2). *To*: southern Florida; from Cuba. *Sources*: Bartlett, 1967; Cochran and Goin, 1970; Conant, 1975; Johnston, 1967; King, 1968; King and Krakauer, 1966; Leviton, 1972; Neill, 1957.
72. *Anolis sagrai ordinatus* (Cope) (2). *To*: southern Florida; from Bahamas. *Sources*: Bartlett, 1967; Bell, 1953; Carr and Goin, 1955; Cochran and Goin, 1970; Conant, 1975; King, 1968; King and Krakauer, 1966; Oliver, 1948, 1950.
73. *Anolis s. sagrai* (Duméril and Bibron) (2). *To*: southern Florida, from Cuba, Isla de Pinos, Jamaica. *Sources*: Barbour, 1931; Bartlett, 1967; Bell, 1953; Carr and Goin, 1955; Cochran and Goin, 1970; Conant, 1975; Garman, 1887 (under the name of *A. ordinatus*); King, 1968; King and Krakauer, 1966; Leviton, 1972; Oliver, 1950; Ruibal, 1964.
74. *Basiliscus basiliscus* (Linnaeus) (3). *To*: Broward County, Florida (4); from southern Central America, northern South America. *Source*: King and Krakauer, 1966.

75. *Ctenosaura hemilopha* (Cope), subspecies uncertain (2). *To*: near Fullerton California; from southern Baja California, southern Sonora, northern Sinaloa, western Chihuahua. *Source*: Stebbins, 1972.
76. *Ctenosaura pectinata* (Wiegmann) (2). *To*: Brownsville, Texas; from western Mexico (probably Colima). *Sources*: Conant, 1975, 1976; Raun and Gehlbach, 1972; Thomas, 1974.
77. *Cyclura c. cornuta* (Bonnaterre) (3). *To*: Dade County, Key Biscayne, Florida; from Hispaniola, La Gonave, Petit Gonave, Beata islands. *Sources*: Bartlett, 1967; King, 1968; King and Krakauer, 1966.
78. *Iguana iguana* (Linnaeus) (3). *To*: Miami and elsewhere in southern Florida; from Mexico to Brazil and Paraguay, West Indies. *Sources*: Bartlett, 1968; King, 1968; King and Krakauer, 1966.
79. *Leiocephalus carinatus armouri* Barbour and Shreve (2). *To*: Palm Beach Florida; from Bahama Islands. *Sources*: Cochran and Goin, 1970; Conant, 1975; Duellman and Schwartz, 1958; King, 1968; King and Krakauer, 1966; Leviton, 1972.
80. *Leiocephalus carinatus coryi* Schmidt (3). *To*: Key Biscayne, Florida; from Bimini, Bahama Islands. *Source*: King and Krakauer, 1966.
81. *Leiocephalus carinatus virescens* (Stejneger) (5). *To*: Miami, Florida; from Bahama Islands. *Sources*: Barbour, 1936; Carr and Goin, 1955; King and Krakauer, 1966.
82. *Phrynosoma cornutum* (Harlan) (6). *To*: southern Florida, numerous localities; Alabama; north-central Colorado; Georgia; Hawaii; Texas. *Sources*: Allen and Neill, 1955 (Florida); Bartlett, 1967 (Florida); Carr, 1940 (Florida); Carr and Goin, 1955 (Florida); Cochran and Goin, 1970 (Florida); Conant, 1975 (Florida); De Sola, 1934 (Florida); Goff, 1935 (Florida); Hunsaker and Breese, 1967 (Hawaii); King, 1968 (Florida); King and Krakauer, 1966 (Florida); Martof, 1956 (Georgia); Mount, 1975 (Alabama); Rodeck, 1936 (Colorado); Thomas, 1974 (Texas).
83. *Sceloporus cyanogenys* Cope (7). *To*: Palm Desert, Riverside County, California. *Source*: Stebbins, 1972.
84. *Sceloporus magister* Hallowell, subspecies uncertain (7). *To*: Hialeah, Florida (6). *Source*: King and Krakauer, 1966.
85. *Sceloporus poinsetti* Baird and Girard, subspecies uncertain (7). *To*: Hialeah, Florida (6). *Source*: King and Krakauer, 1966.
86. *Sceloporus undulatus hyacinthinus* (Green) (6). *To*: Staten Island, New York; from southern New Jersey (39). *Sources*: Kauffeld, 1946, 1948, 1955.

Family Lacertidae

87. *Lacerta sicula campestris* (de Betta) (5). *To*: Philadelphia, Pennsylvania; from south-central Europe. *Sources*: Conant, 1959; Kauffeld, 1931; Smith, 1946. The latter two sources cite the Philadelphia population under the name *Lacerta melisellenis fiumana*. Conant (1959) provides the proper nomenclature, and in Oct., 1975 (pers. comm.) concludes from personal investigation that the colony has been exterminated by a combination of habitat destruction, predation especially by cats and man, and repeated exposure to herbicides. It is remarkable that the colony persisted as long as it did in such a restricted, inhospitable niche.
88. *Lacerta s. sicula* Rafinesque (2). *To*: western Long Island (West Hempstead); from southern Italy, Sicily, Lipari Islands. *Source*: Gossweiler, 1975.
89. *Lacerta viridis* Linnaeus, subspecies uncertain (2). *To*: Kansas; from western Europe. *Source*: Collins, 1974.

Family Scincidae

90. *Cryptoblepharis boutoni poecilopleurus* (Wiegmann) (2). *To*: Hawaiian Islands (Hawaii, Kauai, Maui, Molokai, Niihau, Oahu); from East Indies. *Sources*: Cochran and Goin, 1970; Girard, 1958a; Hunsaker and Breese, 1967; Oliver and Shaw, 1953.
91. *Emoia cyanura* (Lesson) (2). *To*: Hawaiian Islands (Hawaii, Molokai, Oahu); from East Indies. *Sources*: Cochran and Goin, 1970; Oliver and Shaw, 1953; Stejneger, 1899.
92. *Leiopisma metallicum* (O'Shaughnessy) (2). *To*: Hawaii and Oahu, Hawaiian Islands; from Australia, Tasmania, Loyalty, New Hebrides. *Sources*: Cochran and Goin, 1970; Hunsaker and Breese, 1967; Loveridge, 1939; McCoy and Busack, 1970; McMorris, 1970; Oliver and Shaw, 1953; Quay, 1973.
93. *Lipinia n. noctua* (Lesson) (2). *To*: Hawaiian Islands (Hawaii, Kauai, Maui, Oahu); from East Indies. *Sources*: Cochran and Goin, 1970; Hallowell, 1861; Hunsaker and Breese, 1967; McMorris, 1970; Oliver and Shaw, 1953.

Family Teiidae

94. *Ameiva a. ameiva* (Linnaeus) (3). *To*: Dade County, Florida; from northeastern South America. *Sources*: Bartlett, 1967; Conant, 1975; King, 1968; King and Krakauer, 1966.
95. *Ameiva ameiva petersi* Cope (2). *To*: Miami, Florida; from upper Amazon basin (Colombia). *Sources*: Cochran and Goin, 1970; Conant, 1975; Duellman and Schwartz, 1958; King, 1968; King and Krakauer, 1966.
96. *Tupinambis nigropunctatus* Spix (3). *To*: Dania, Broward County, Florida (25 from Wild Cargo dealership, early 1970's). *Source*: Personal.

Order Serpentes

Family Boidae

97. *Boa constrictor* Linnaeus, subspecies uncertain (3). *To*: numerous localities in Florida, no doubt elsewhere; from Mexico to Argentina, Antilles. *Source*: King and Krakauer, 1966.

Family Colubridae

98. *Masticophis flagellum* (Shaw) (subspecies uncertain) (7). *To*: New Jersey (Pine Barrens) (47); from "northern Arizona." *Source*: Rothman, 1964.
99. *Natrix fasciata pictiventris* Cope (6). *To*: Texas (Brownsville); from Florida. *Source*: Conant, 1976.
100. *Natrix rhombifera rhombifera* (Hallowell) (8). *To*: Texas (Brownsville); from south central U.S. *Sources*: Conant, 1969, 1976.
101. *Thamnophis* (species "mixed") (7). *To*: New Jersey (Pine Barrens) ("several dozen"). *Source*: Rothman, 1964.

Family Typhlopidae

102. *Ramphotyphlops bramina* (Daudin) (2). *To*: Oahu, Hawaiian Islands; from southern Asia. *Sources*: Cochran and Goin, 1970; Oliver and Shaw, 1953; Slevin, 1930. Parthenogenetic, therefore a potentially efficient colonizer.

Family Viperidae

103. *Agkistrodon piscivorus* (Lacepede), subspecies uncertain (9). *To*: Boulder, Colorado. *Source*: personal.

104. *Crotalus atrox* Baird and Girard (9). To: southeastern Kansas (2 localities) southwestern Wisconsin (2 localities). Sources: Hall and Smith, 1947 (Kansas); Pope, 1928 (Wisconsin).
105. *Crotalus v. viridis* (Rafinesque) (9). To: Pittsburg, Crawford County, Kansas. Source: Hall and Smith, 1947.

Order Crocodylia

Family Alligatoridae

106. *Alligator mississippiensis* (Daudin) (8). To: Texas (Brownsville); from southeastern U.S. Sources: Conant, 1975, 1976.
107. *Caiman crocodilus* (Linnaeus), subspecies uncertain (3). To: throughout Florida, other Gulf states; from Central America to central South America. Sources: Bartlett, 1967; Conant, 1975; King, 1968; King and Krakauer, 1966; Leviton, 1972.

The accompanying table summarizes the systematic distribution of the members of each of the proposed 9 categories of introductions that justify enumeration. The preponderance of lizards—nearly half of the total—is impressive, as in the third rank of turtles, although far less numerous than lizards. The absence of rhynchocephalians and amphisbaenids, the small number of salamanders and crocodylians, and the second rank for anurans are all more or less as expected. Surprising is the extremely small number of snakes, only two of which have secure beachheads (*Natrix fasciata pictiventris*, *Ramphot. bramida*). Rumors borne of sensationalism of other species released in Florida and elsewhere where they might really survive are not substantiated; cobras are a common subject for such rumors but neither these nor any other species, exotic or endemic, are reliably known to have established themselves. The frequency with which at least native snakes are shipped all over the country and inadvertently escape would seem sufficient to result in numerous records of founder colonies. Resource-sharing may be more difficult for snakes than for lizards or anurans, or their adaptability may be of lesser magnitude. Of course they are less readily detected than other reptiles or amphibians, but it is difficult to accept this as an adequate explanation for their small proportion of recorded introductions. It is notable that one (*Ramphot.*) of the two snakes with confirmed success in colonization is a notoriously secretive as well as parthenogenetic species; it nevertheless has spread rapidly to a virtually worldwide tropical distribution.

The genera represented by 2 or more species or subspecies are: 2-*Ameiva*, *Ctenosaura*, *Crotalus*, *Natrix*; 3-*Eleutherodactylus*, *Podocnemis*, *Trionyx*, *Leiocephalus*, *Lacerta*; 4-*Bufo*, *Hyla*, *Sphaerodactylus*, *Sceloporus*; 5-*Rana*; 6-*Hemidactylus*; 8-*Chrysemys*; 10-*Anolis*. Clearly *Hemidactylus* is the most successful genus in creating founder colonies on its own; most other introductions are a product of deliberate transportation by man, although a large proportion of them escaped inadver-

tently or were released through expediency. *Bufo* and *Rana* owe most of their numbers to introductions for economic reasons—insect control or food. The most popular genus for commercial purposes obviously is *Anolis*, and among turtles *Chrysemys*. Both of the latter genera owe their popularity to a considerable degree to their individual abundance, complemented by their exceptional taxonomic diversity—the greatest in their respective orders, in the Western Hemisphere.

Summary. The significant recorded introductions of amphibians and reptiles in the United States represent 106 species and subspecies; 1 other is imminently anticipated, making a total of 107, falling into 9 categories. Consideration of the impact of introduced taxa requires inclusion of endemic as well as exotic species, although records are far less complete for the former and embrace 32 species and subspecies as opposed to 75 exotics (one species is counted in both categories).

The view is proposed that introduction of exotic species has considerable merit providing it results in a reasonably harmonious resource-partitioning with native species. Interactions in nature are of course difficult to anticipate with invariable accuracy, but can be predicted with reasonable reliability. The potential for man-guided diversification is tremendous and if exploited intelligently would result in a much larger proportion of successes than failures. The unoccupied niches that exist for co-existence of species in tropical, subtropical and warm temperate areas, as in southern United States, where access by potential inhabitants has been severely limited by natural barriers, are certainly numerous but very crudely understood. Hasty attempts to fill some of them could be disastrous, but careful appraisal with the broadest possible perspectives could lead gradually to a very satisfying enrichment yielding important information on many evolutionary processes as well as providing ready access to a wide variety of materials for laboratory and field study. Utilization of resources that already exist and are available for betterment of the environment, not only for man but for a more richly diverse biota than already exists, has scarcely been touched. Vital is the realization, however, that native diversity is a precious heritage any diminution of which diminishes ourselves; the greatest hazard of introductions that must be meticulously avoided is a reduction of biotic diversity.

In this context introductions of populations of endemic species into other areas occupied by the same species is the most deplorable of all, for they threaten the integrity of the delicately maintained diversity of geographic races. Importation of populations of endemic species into adjacent areas naturally unoccupied by those species is less deplorable, but is rarely desirable for it holds little prospect for increase of diversity; in such cases, as a rule, the species already occupy the areas to which they are adaptable, because for the most part other areas are or have been accessible for them, and have been found unsuitable. The only

TABLE 1. Summary of Herpetological Introductions *

Category (see text for explanation)	Caudata	Anura	Gymnophiona	Testudines	Rynchocephalia	Lacertilia	Amphisbaenia	Serpentes	Crocodylia	Total
1. Exotic differentiated						3(1)				2.5
2. Exotic breeding		9		1		25		1		36
3. Exotic released	1	6		9		14		1	1	32
4. Exotic expected						1				1
5. Exotic extinct		1				2				3
6. Endemic breeding	1	4		4		3(1)			1	12.5
7. Endemic released	2			5		3		2		12
8. Endemic release suspected	1	1						1	1	4
9. Endemic extinct		1						3		4
10. Waif	?	?	?	?	?	?	?	?	?	?
Totals	5	22	0	19	0	50	0	9	2	107

exceptions pertain to geographically isolated segments such as Hawaii, or ecologically isolated physiographic units. The editorial discouragement of proposed endemic introductions, as of *Hyla andersoni* from the New Jersey pine barrens into the higher-altitude Stokes State Forest of northern New Jersey (Rothman, 1962), Texas kingsnakes into the Pocono Mountains of Pennsylvania (Rothman, 1960), and of *Lampropeltis getulus floridana* hatchlings into non-native areas (Auffenberg, 1958) was fully justified.

Random introductions even of exotics pose a very real danger to diversity and should be discouraged. Nevertheless the rather widespread abject fear of all introductions is unjustified. They should be encouraged when preliminary, thorough, broadly perceptive appraisal suggests a high probability of success and a minimum risk to existent diversity. Thorough documentation of approved introductions should be provided, and progress should be carefully monitored.

Man's role in introductions of exotic herps into the United States in the past is not as random—not as completely “non-natural”—as might be supposed. His introductions are preponderantly representatives of families that most readily might contribute species to the augmented area by “natural” means—scincids and geckonids in Hawaii, iguanids in continental U.S.

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