27.3

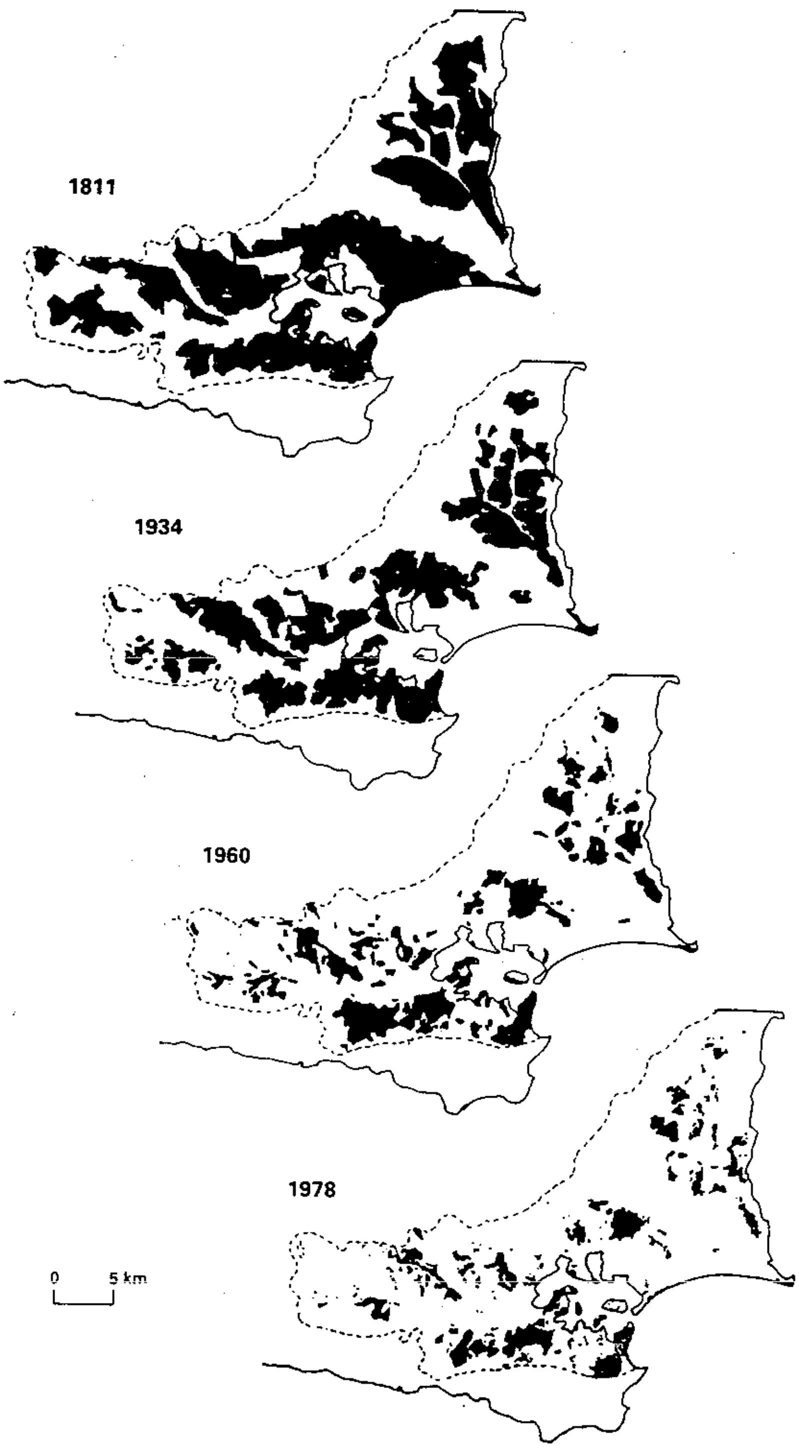


Fig. 18.3. Loss and fragmentation of heathland in the pool basin, Dorset. (From Webb and Haskins 1980.)

FRAGMENTATION <u>WITHIN</u> A "RELATIVELY INTACT" AREA : DORSET HEATHS

EQUILIBRIUM THEORY OF ISLAND BIOGEOGRAPHY

In Theory

$$\lambda_S = \lambda_0 - \alpha S$$

$$\mu_S = \beta S$$

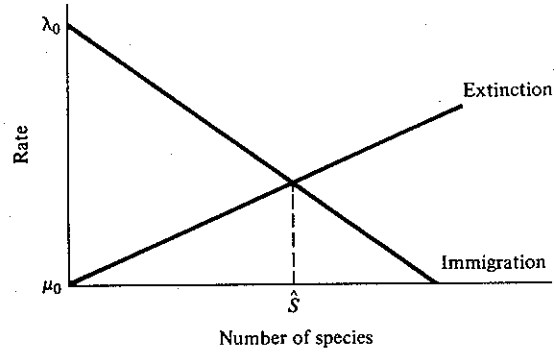


Figure 2.11 Immigration and extinction rates that change linearly with island species density. Equilibrium species density, $\hat{S}$, is a simple function of the slopes and intercepts of the two lines.

Actual Data for birds in Solomon Islands

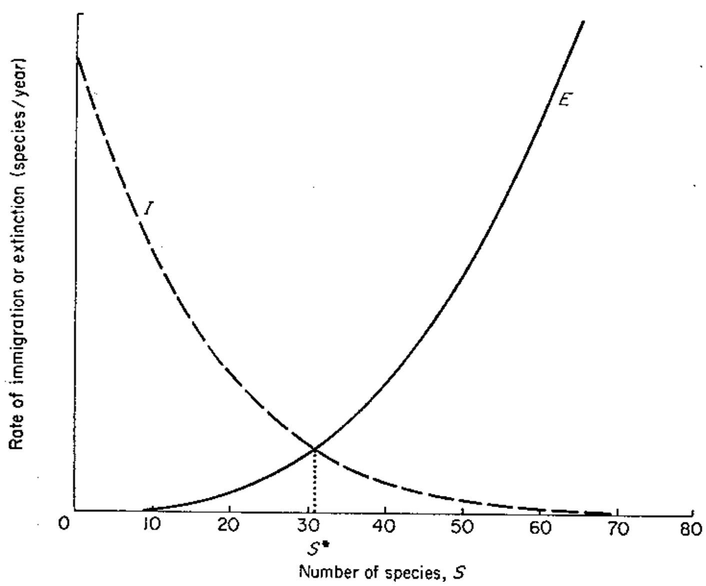


Fig. 9.7. The actual extinction (solid line) and immigration (dashed line) curves for the avifauna on Three Sisters, one of the smaller Solomon islands: the rates are plotted as relative number of species to go extinct, or to immigrate, per year as a function of the number of species on the island.

276

Species-Area

$\log S = \log C + z \log A$

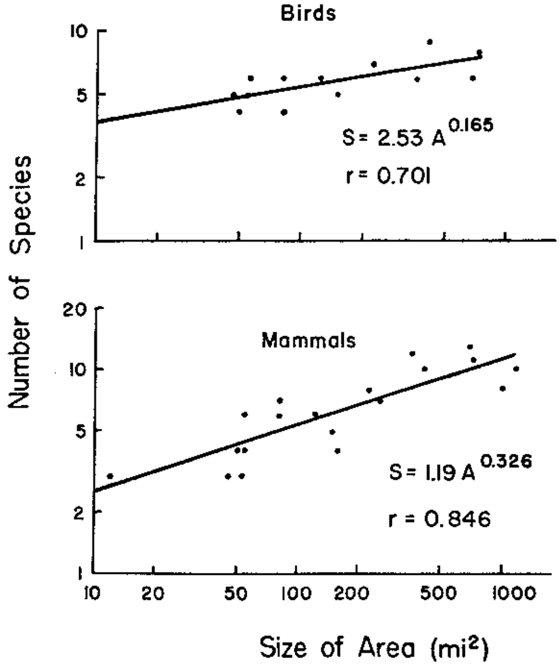


Figure 6.5 Relation between number of permanent resident boreal bird species, the number of small, boreal mammal species, and the size of isolated mountain ranges (>7,500 ft, 2,300 m elev.) in the Great Basin (modified from Brown 1978).

Birds + Mammals on great basin mtn. tops

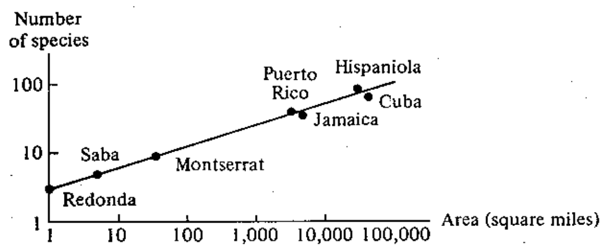
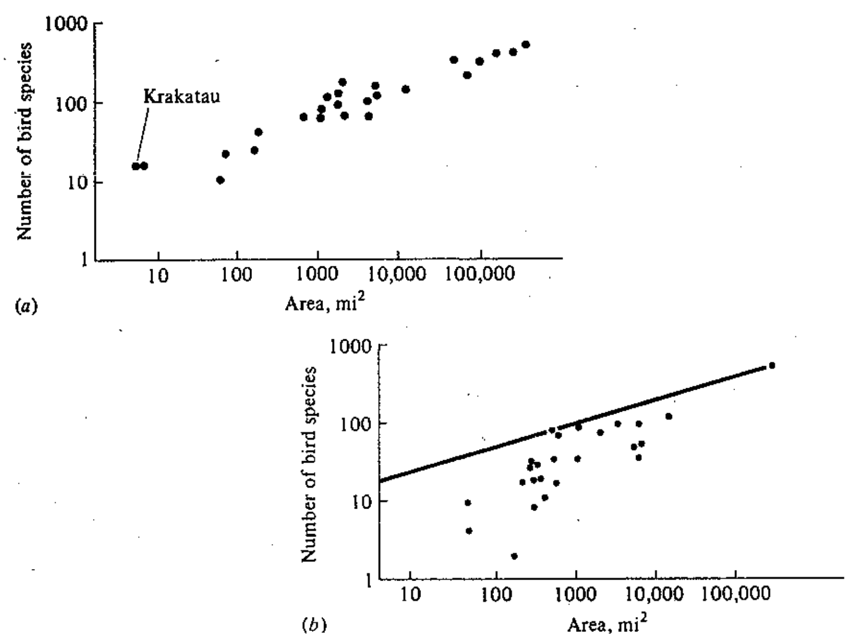


Fig. 5-17

The area-species curve of the West Indian herpetofauna (amphibians plus reptiles). (From MacArthur and Wilson, 1967.)

W. Indies Reptiles + Amphibians



Birds in S.E. Asian Ocean

Birds in S. Pacific

The Distance Effect: more isolated islands hold fewer species

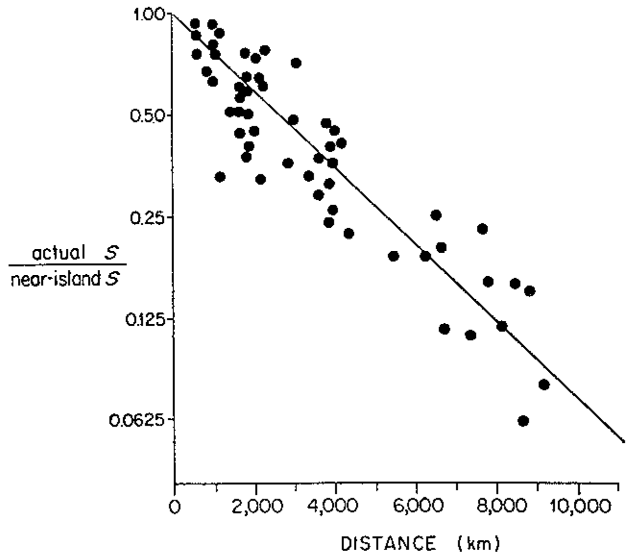


Fig. 9.2. An example of the relation between species number and island distance from the colonization source, for birds on tropical islands of the Southwest Pacific. The ordinate (logarithmic scale) is the number of resident, nonmarine, lowland bird species on islands more than 500 km from the larger source island of New Guinea, divided by the number of species on an island of equivalent area close to New Guinea. The abscissa is island distance from New Guinea. The approximately linear relation means that species number decreases exponentially with distance, by a factor of 2 per 2600 km. (From Diamond, 1974).

Birds in SW Pacific

Distance Effect

Theory

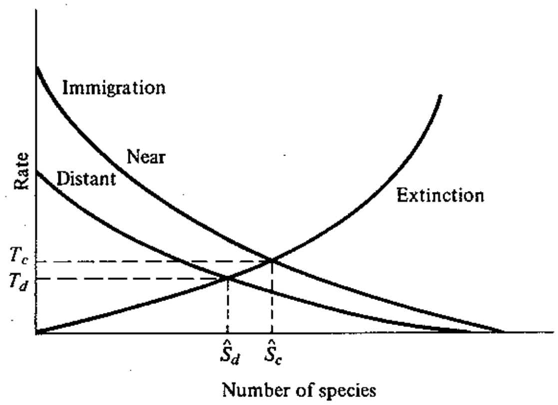


Figure 2.13 Immigration rates should decrease with increasing distance from source areas so that distant islands should reach equilibrium with fewer species, $\hat{S}_d$, than close-in islands, $\hat{S}_c$, all else being equal. Moreover, turnover rates should also be higher on nearby islands than on comparable but more distant islands ($T_c > T_d$).

DATA

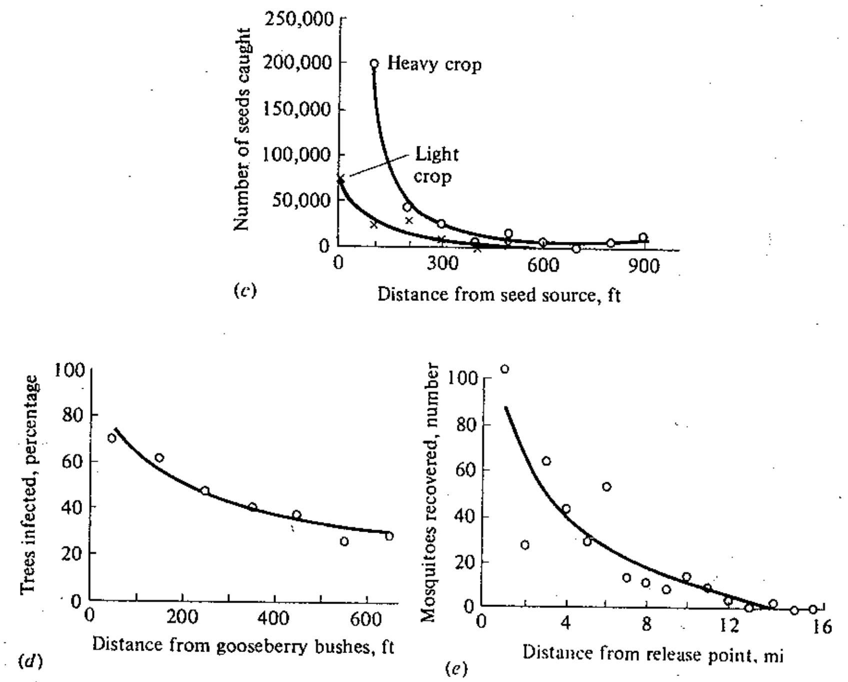
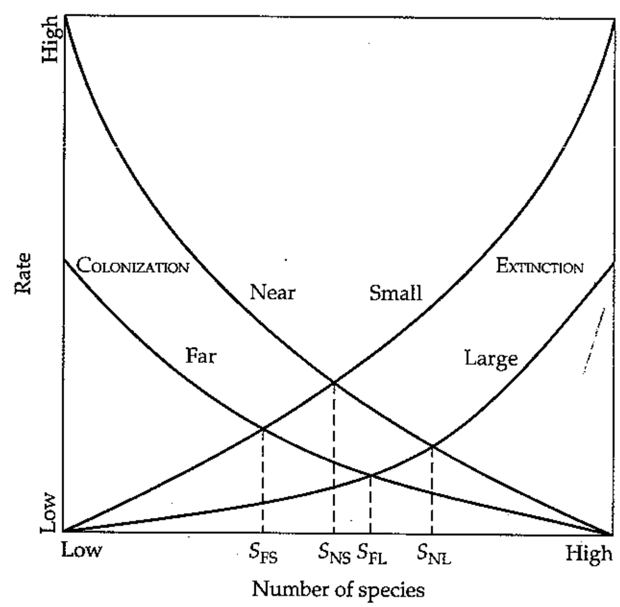


Figure 2.12 Some actual patterns of dispersal, both vertical and horizontal. The number of organisms decays rapidly at first and then more and more slowly with increasing distance. [From Odum (1959) after Wolfenbarger.]

Combined Distance / Area Effects



Implications for reserves?

Island Size Effect

Theory

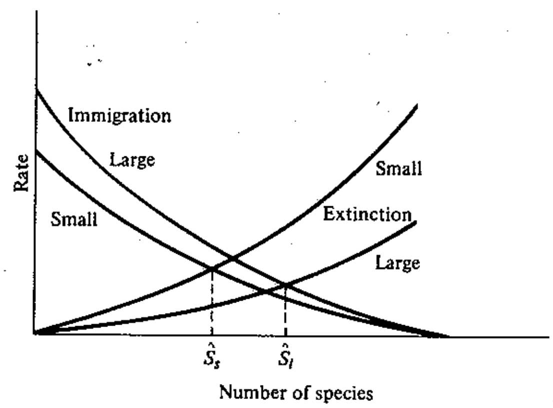
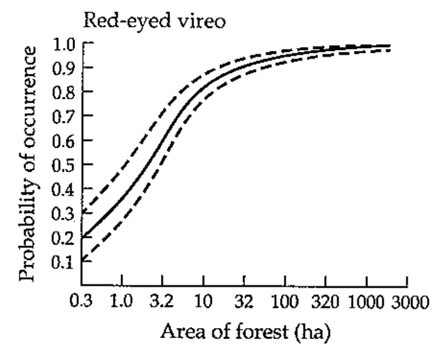
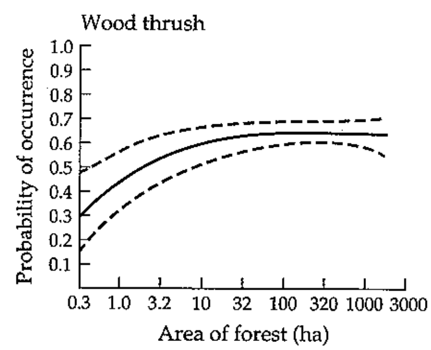


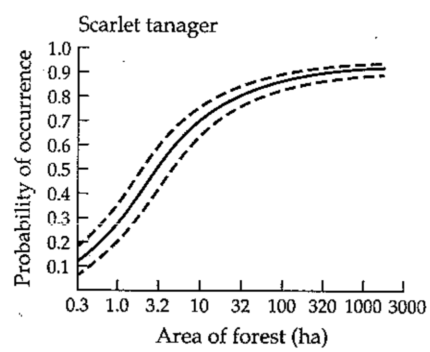
Figure 2.14 Extinction rates should be little affected by distances from source areas, but they should often vary inversely with island size, complexity, or both. Immigration rates may also be slightly higher on larger islands because they present a larger "target" for potential invaders. Thus, all else being equal, a small island should equilibrate with fewer species, $\hat{S}_s$, than a larger island, $\hat{S}_l$.

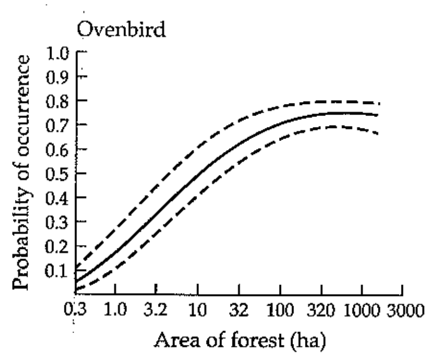
Data

Figure 9.6 Probability of four species of common forest-interior Neotropical migrant birds nesting in United States mid-Atlantic forests of various sizes, based on point counts. Dotted lines indicate 95% confidence intervals. (From Robbins et al. 1989.)









27.13

SIMBERLOFF & WILSON'S MANGROVE 'DEFAUNATION' EXPTS.

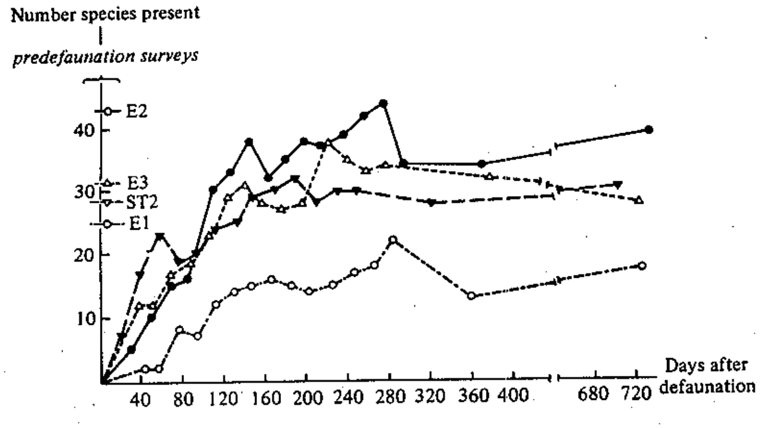


Fig. 5-2

The colonization curves of four small mangrove islands in the lower Florida Keys whose entire faunas, consisting mostly of arthropods, were removed by methyl bromide fumigation. The species numbers just before defaunation and at intervals following it are shown. The number of species is an inverse function of the distance from the nearest source. This effect was evident in the predefaunation census and was preserved when the faunas regained equilibrium after defaunation. Thus, the near island E2 has the most species, the distant island E1 the fewest, and the intermediate islands E3 and ST2 intermediate numbers of species. (From Simberloff and Wilson, 1970.)

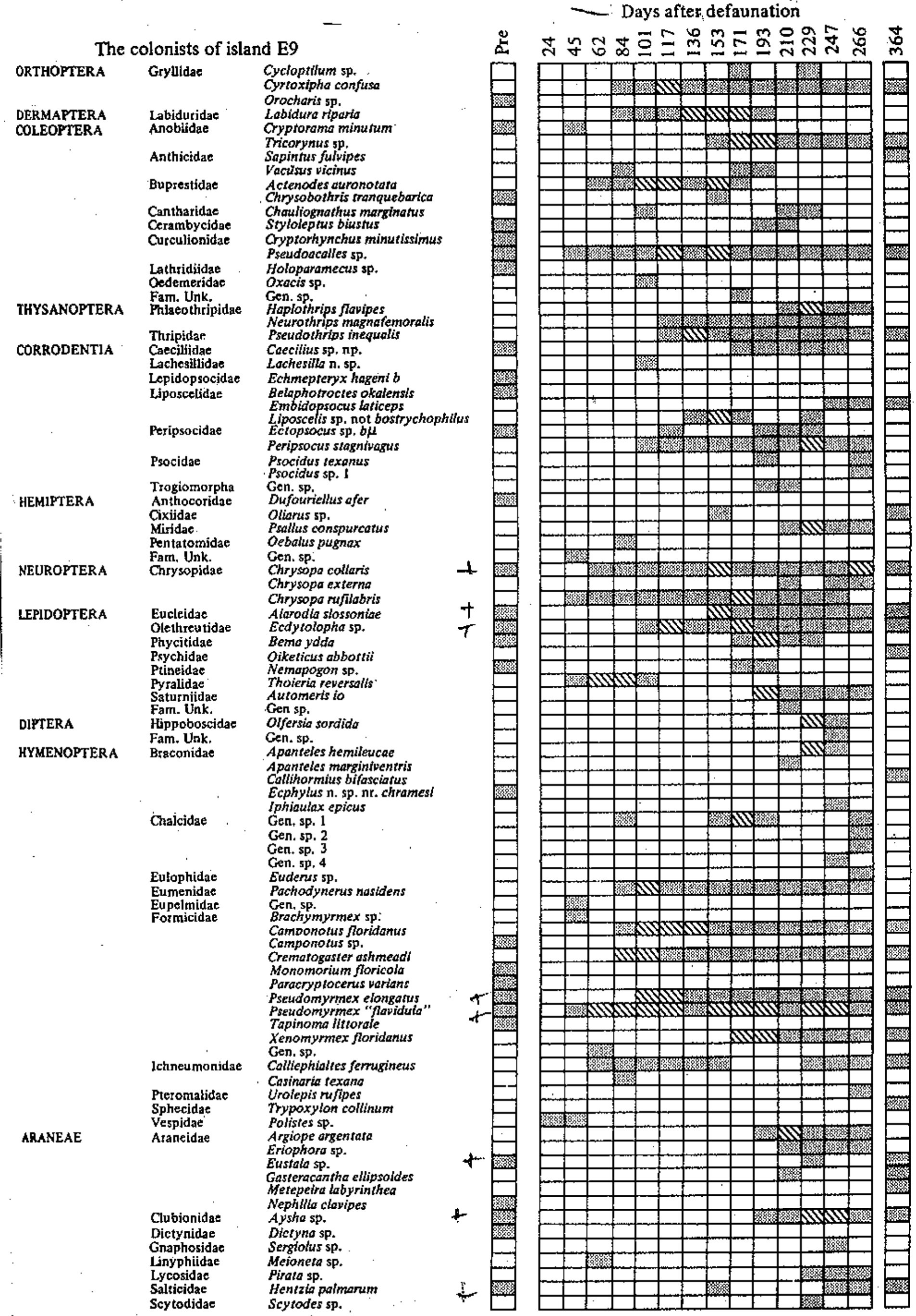


Fig. 5-3

History of the colonization of E9, another typical experimental island in the Florida Keys. "Pre" is the predefaunation census. Solid entries indicate that a species was seen; shaded, that it was inferred to be present from other evidence; open, that it was not seen and was inferred to be absent. (From Simberloff and Wilson, 1969.)

29 spp Before 24 spp After
8 of these same spp

27-M

SIMBERLOFF'S MANGROVE EXPT'S

CHANGE OF ISLAND SIZE

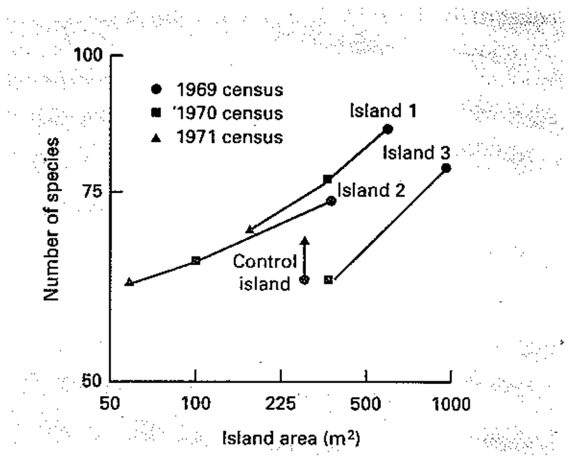


Figure 23.7 The effect on the number of arthropod species of artificially reducing the size of mangrove islands. Islands 1 and 2 were reduced in size after both the 1969 and 1970 censuses. Island 3 was reduced only after the 1969 census. The control island was not reduced, and the change in its species richness was attributable to random fluctuations. (After Simberloff, 1976.)

EDGE EFFECTS – COWBIRD NEST PARASITISM

Table 3. Summary of studies investigating cowbird parasitism rates (% nests parasitized) of natural avian nests as a function of distance from an edge.

Distance from edge (m)										Habitat			
0	25	50	75	100	200	300	500	1000	>1000	P[a]	N[b]	type[c]	References
		65		46	36	18				0.004	105	DF	Brittingham and Temple 1983[d]
	17	5	0	0	0					0.013	171	PR	Best 1978[e]
		25	14							0.015	350	PR	Johnson and Temple 1990
7	0	19	6							0.216	62	DF	Chasko and Gates 1982
15	8		14							0.445	40	DF	Chasko and Gates 1982
12	10	3	6							0.395	164	DF	Gates and Gysel 1978

[a] *Likelihood ratio (G^2) testing whether parasitism rates were independent of distance from an edge.*
[b] *Total number of nests.*
[c] *DF = deciduous forest, PR = prairie.*
[d] *Edge was considered any gap in the forest canopy ≥0.2 ha (not 0.02 ha in the paper, S. Temple, personal communication).*
[e] *Based on my analysis of Best 1978, Figure 4.*