Dispersal

What is it?

Intergenerational movement (Kenward et al 2002)

Permanent movement of an individual from place of birth to place of reproduction (Howard 1960)

Natal dispersal : movement from nest (birth) site to site of 1st reproduction

Breeding dispersal: movement between breeding locations (Greenwood and Harvey 1982)

Methods of Studying Dispersal

Markers:

Passive: paint, colorbands, tattoos, etc

Active: PIT tags, GPS-collars, VHF radios

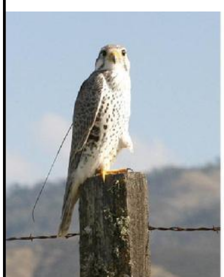
Genetic: F_{st}

Populations with > F_{st} are less genetically similar, suggesting lower rates of successful dispersal than those with < F_{st}

Others?

Maximum dispersal distance experiments

The nature of passive versus active markers can yield a different picture of the dispersal process:



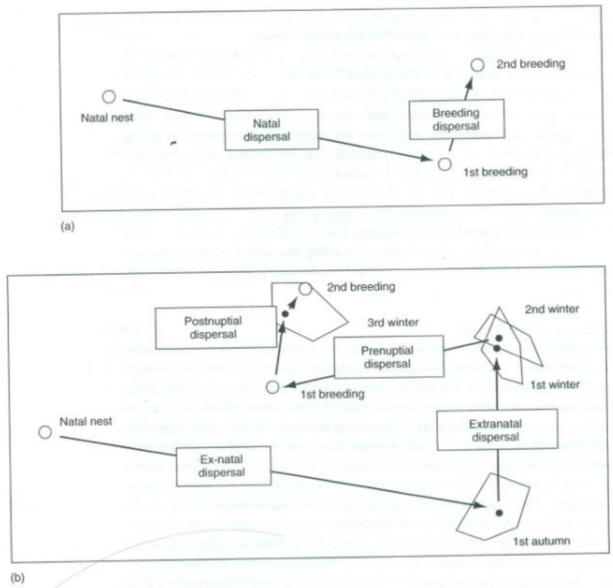


Figure 3.1 Differences in definition of lifetime movements available from: (a) banding–recapture, and (b) radio tracking. Open circles represent nest sites and polygons surrounding filled circles represent home ranges.

Importance/Roles of Dispersal:

Thoughts?

Persistence of species locally and rangewide

Metapopulation theory – rescue, recolonization

sources and sinks

Reducing competition locally (density dependent disp.)

Expansion of range – new colonization and establishment

current issues that make this important?

Genetically - maintenance / source of genetic variation within and between species

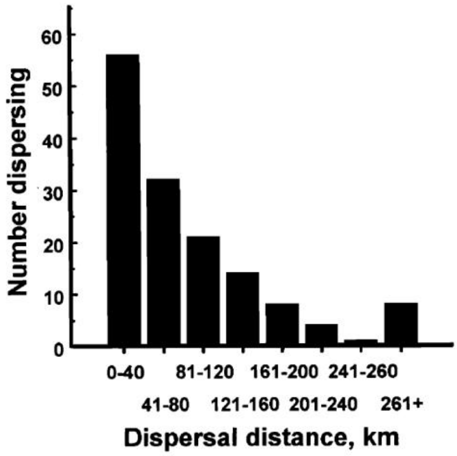


Figure 2. Dispersal distances in Barn Owls banded as nestlings in northern Utah.

Marti (1999) Studied Barn Owls in N. Utah from 1977-1996, following nests and using passing markers (colorbands) to follow individuals.

Based on his results, what is the general pattern for dispersal distances?

Do there appear to be differences in dispersal patterns between male and female Barn Owls?

Females disperse farther on average than males. Possible ecological explanations for this?

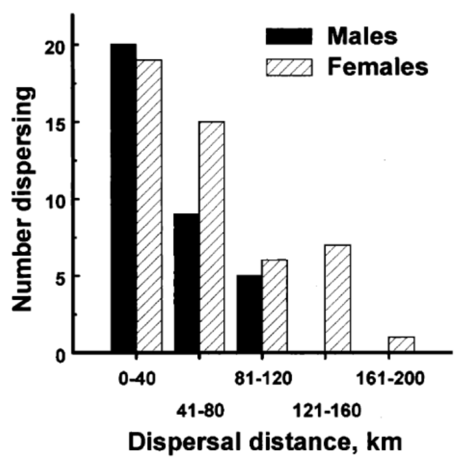


Figure 3. Comparison of dispersal distances between breeding male and female Barn Owls banded as nestlings in northern Utah.

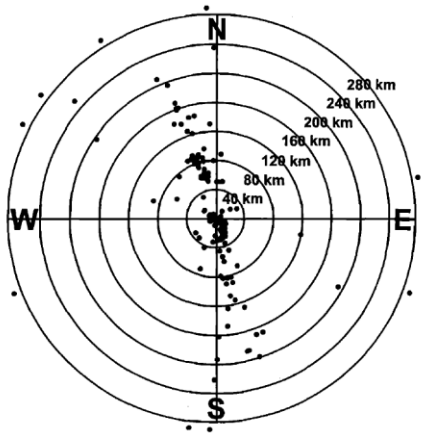


Figure 4. Direction and distance of natal dispersal in Barn Owls in northern Utah.

Figure 5. Long-distance natal dispersal by Barn Owls banded as nestlings in a northern Utah population.

How about directionality of dispersal?

Estimating dispersal distances from telemetry data.

What constitutes dispersal?

A set movement distance ?

A set time out of home range core?

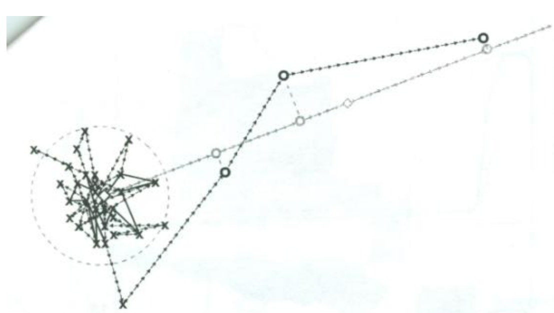


Figure 3.2 Dispersal detection along a vector (grey line) through the mean (grey diamond) of the last three locations (open circles) from the mean (black diamond) of the previous locations (black crosses). Dispersal has occurred because the perpendicular distances of the three locations along the vector are all beyond the 95% confidence limit of a circular normal distribution for the previous locations.

Estimating dispersal distances from telemetry data.

Can get direction and rate of movement

Can build utilization distribution and link to landcover/habitat information to build a resource utilization function to understand how habitat variables influence movement rates, stop times, etc.

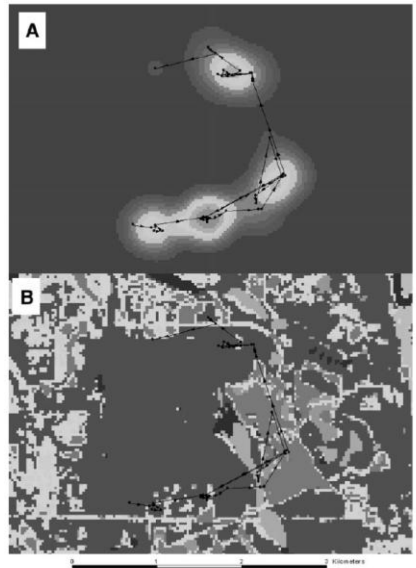
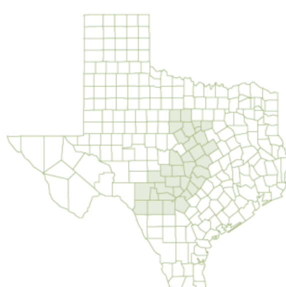


FIG. 2. Movement pathway (black line) of a juvenile American Robin superimposed on its (A) utilization distribution and (B) land-cover map. Contours of highest relative use are the lightest color (A). The resource utilization function (RUF) relates relative use to land cover at each point within the utilization distribution (traveled area).

Whittaker and Marzluff 2009)

Golden-Cheeked Warbler (*Dendroica chrysoparia*)



- breeds in closed-canopy woodlands, primarily Ashe juniper and oak
- declined due to habitat loss and fragmentation from clearing of juniper for urban expansion, agriculture, and commercial harvest

Modeling Different Dispersal Scenarios in Golden-cheeked Warblers

(Horne et al. 2011)

Scenario	Description
NoD	No dispersal
SymD	15% symmetric dispersal
SurvD	15% symmetric dispersal; disperser survival declines with distance
KD	Excess individuals above K become dispersers
KSurvD	Same as KD; disperser survival declines with distance
KSurvDVitals	Same as KSurvD; Larger pops. have higher survival and fecundity

Used stochastic, demographic based modeling approach to determine effect of these scenarios on metapopulation mean final abundance (mfa), and ran sensitivity analyses for each scenario to determine most important demographic parameters.

TABLE 4. Golden-cheeked Warbler metapopulation viability.

Scenario‡	MFA	Sensitivity§ *S*	*F*	*K*	IA
NoD	11 182	0.88 (0.88)	0.10 (0.10)	0.01 (0.02)	0.00 (0.00)
SymD	9870	0.87 (0.88)	0.11 (0.11)	0.01 (0.01)	0.00 (0.00)
SurvD	7884	0.87 (0.88)	0.11 (0.11)	0.01 (0.01)	0.00 (0.00)
KD	13 037	0.86 (0.87)	0.11 (0.12)	0.02 (0.02)	0.00 (0.00)
KSurvD	12 212	0.86 (0.87)	0.12 (0.12)	0.02 (0.02)	0.00 (0.00)
KSurvDVitals	16 879	0.86 (0.87)	0.11 (0.12)	0.02 (0.02)	0.00 (0.00)

Notes: Viability was measured by mean final abundance (MFA). Scenarios reflect various assumptions of dispersal and patch-specific vital rates as described in *Methods: Model scenarios.* Sensitivity of MFA to changes in mean survival (*S*), mean fecundity (*F*), carrying capacity (*K*), and initial abundance (IA) was measured as the proportion of variance in MFA explained using Fourier amplitude sensitivity analysis (FAST). Values are first-order indices with total indices in parentheses.