



Range-wide Monitoring of the Mojave Population of the Desert Tortoise

2001-2005 Summary Report



Status of Report

- Complete
 - USGS policy review – Oct 24
- Posted to DTRO website
 - http://www.fws.gov/nevada/desert_tortoise/dt_reports.html
- Data
 - MDEP database



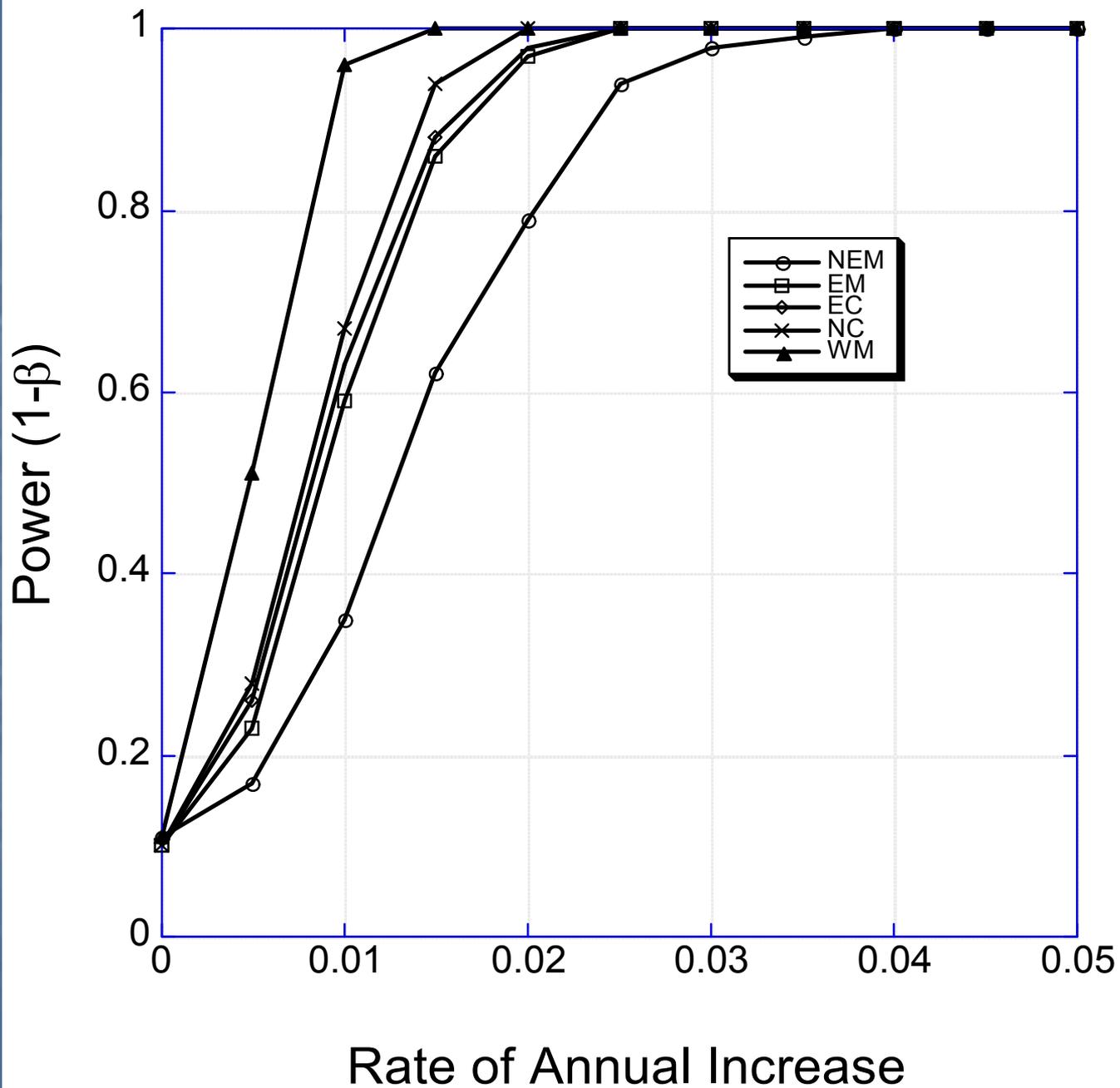
Summary of Changes

- Editorial
 - Executive Summary
 - Format
- 2005 Data
- Revised power analysis
- Focal tortoise data
- Expanded discussion/recommendations



Annual Results: 5 RUs

Year	Xsects	Length (km)	Torts	Enc. Rate	D (km ²)	CV (%)
2001	1631	2660	279	0.17	5.83	8.1
2002	1010	4007	289	0.07	5.55	10.0
2003	990	3874	354	0.09	5.08	9.6
2004	610	6576	445	0.07	4.99	7.3
2005	745	8564	489	0.06	5.43	6.8



What Does It All Mean?



- Established baseline densities
 - Not trends within 5 years
 - Year-to-year variability
 - RU-to-RU variability



Future Directions

- Study plan
- Stratification
- Variance components (P_{ai} , G_0)
- Occupancy
- Spatial scale
- Habitat and threats
- Spatial analyses
- Recovery implementation/effectiveness
- Stabilize budget



Desert Tortoise Range-Wide Monitoring

General Themes in Desert Tortoise Monitoring

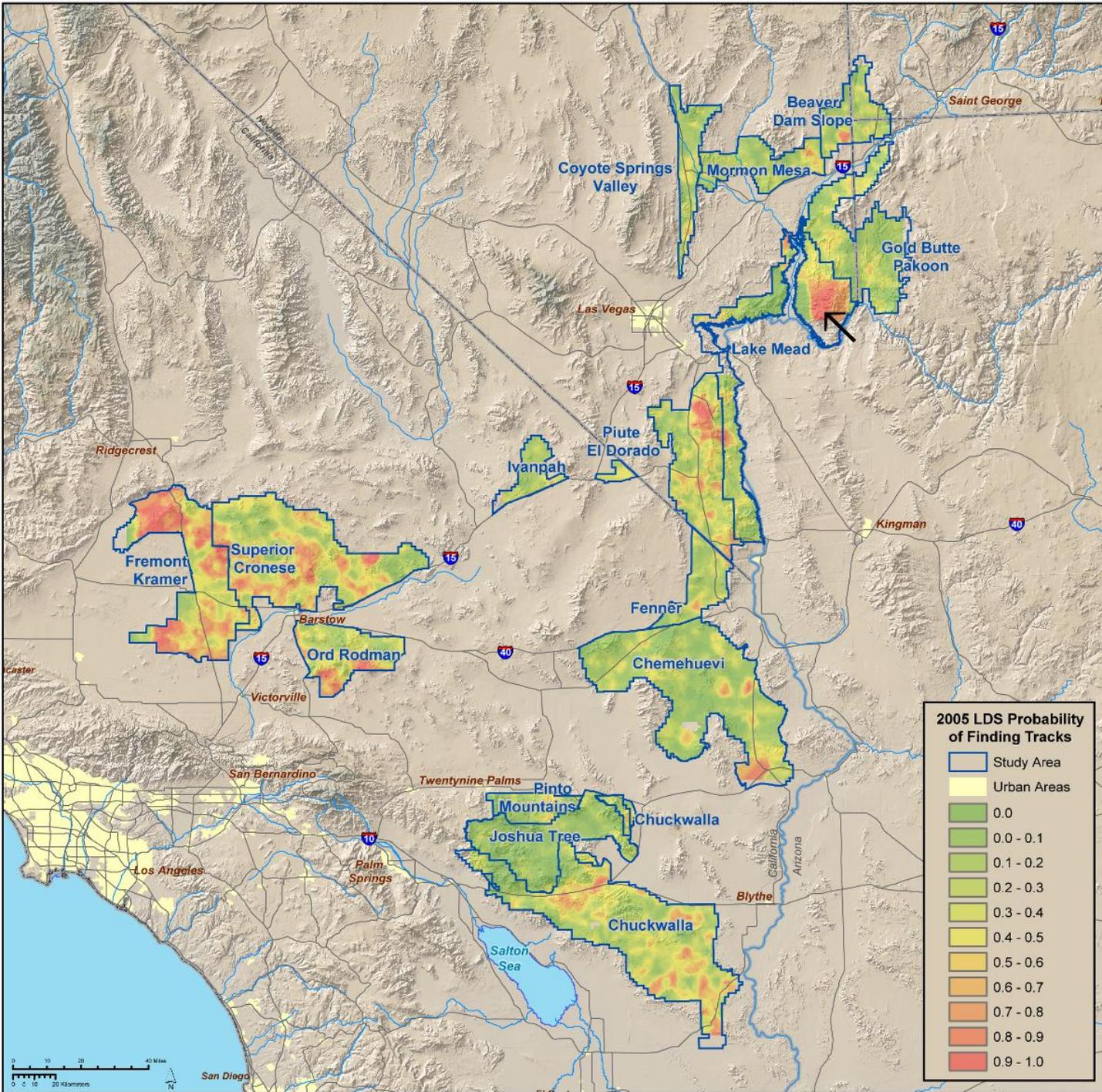


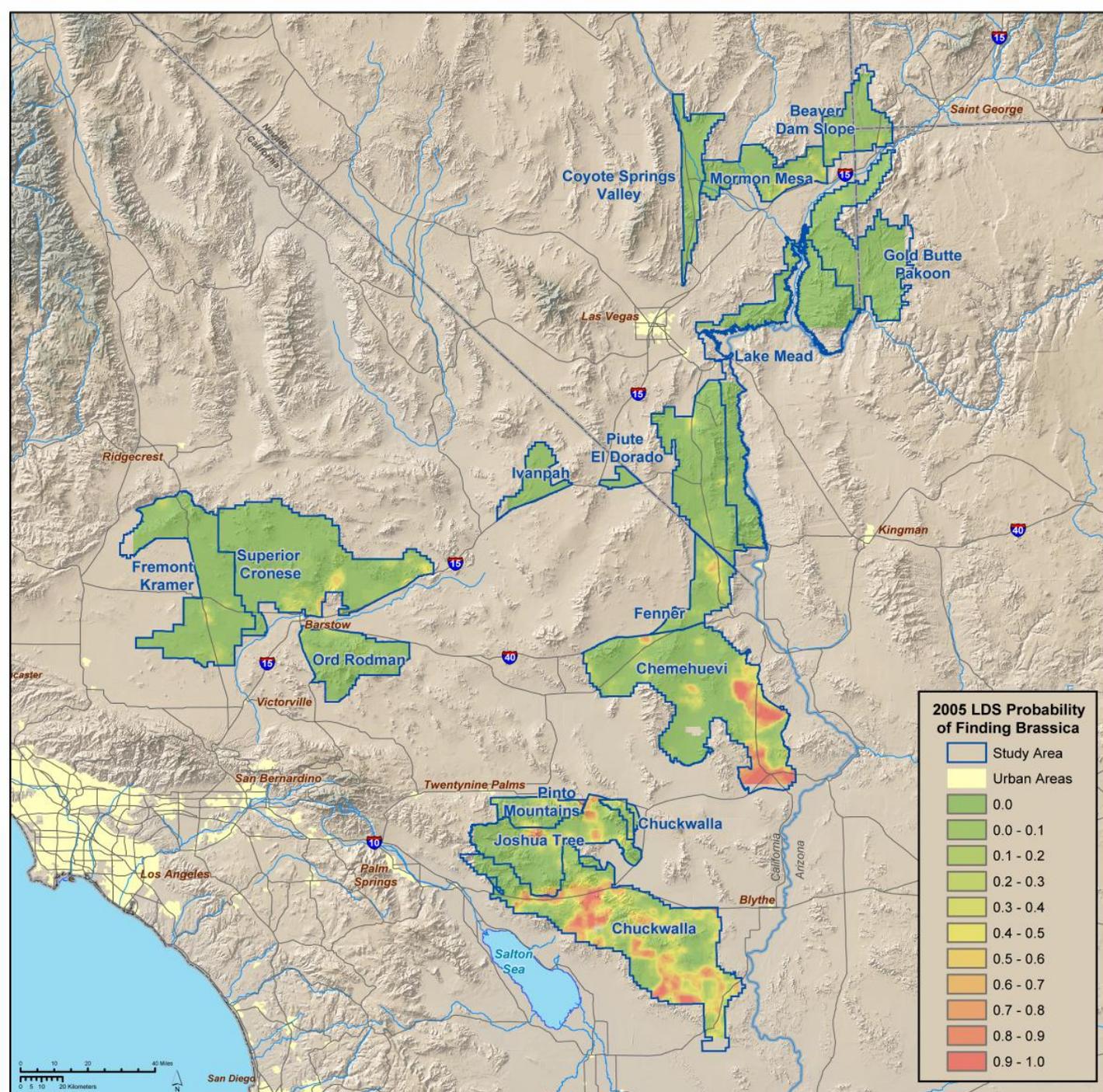
1. Products from the monitoring effort to date
2. Five years of monitoring, can we discern trends in the future?
3. How do we go forward?

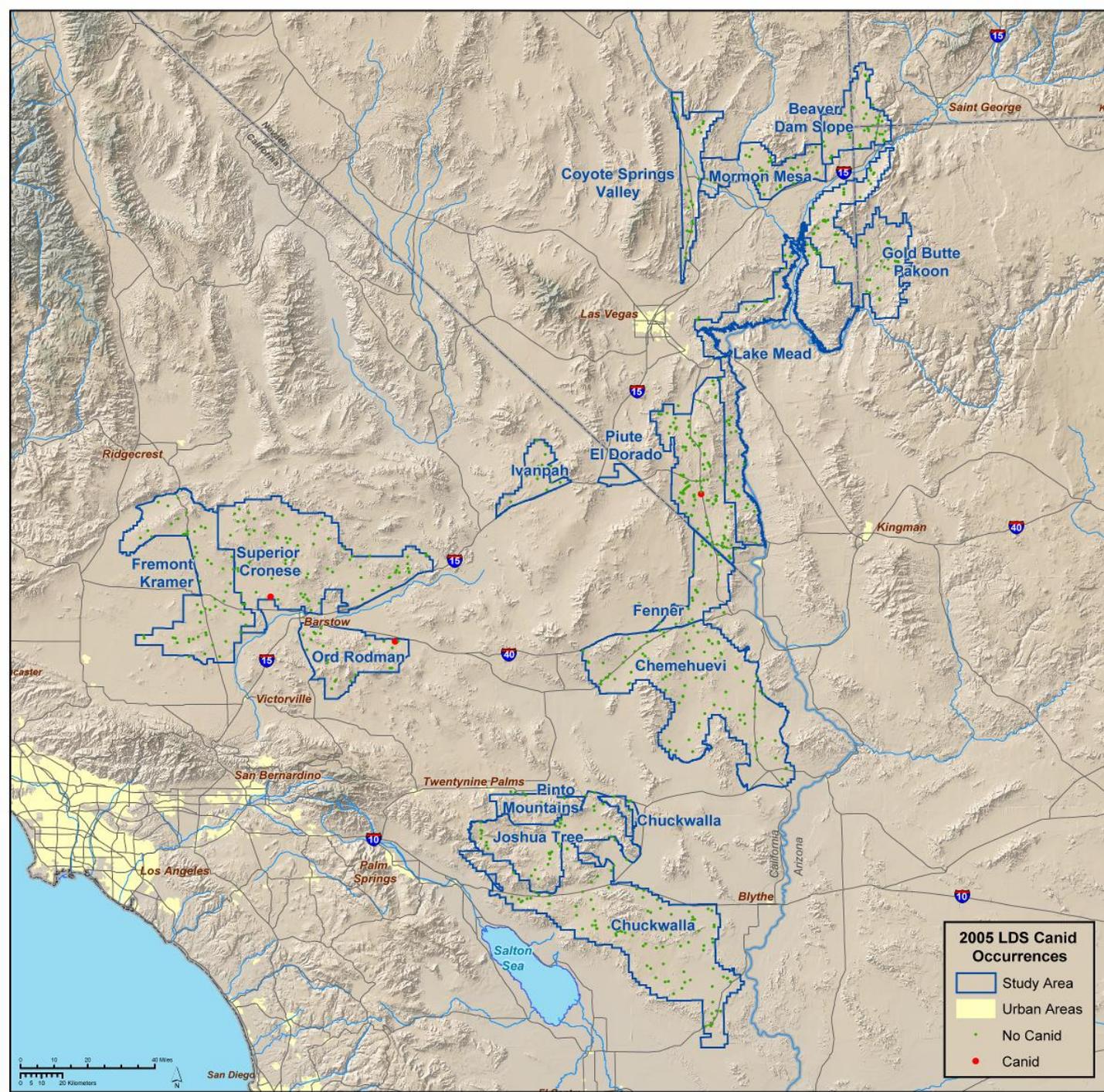
General Themes in Desert Tortoise Monitoring

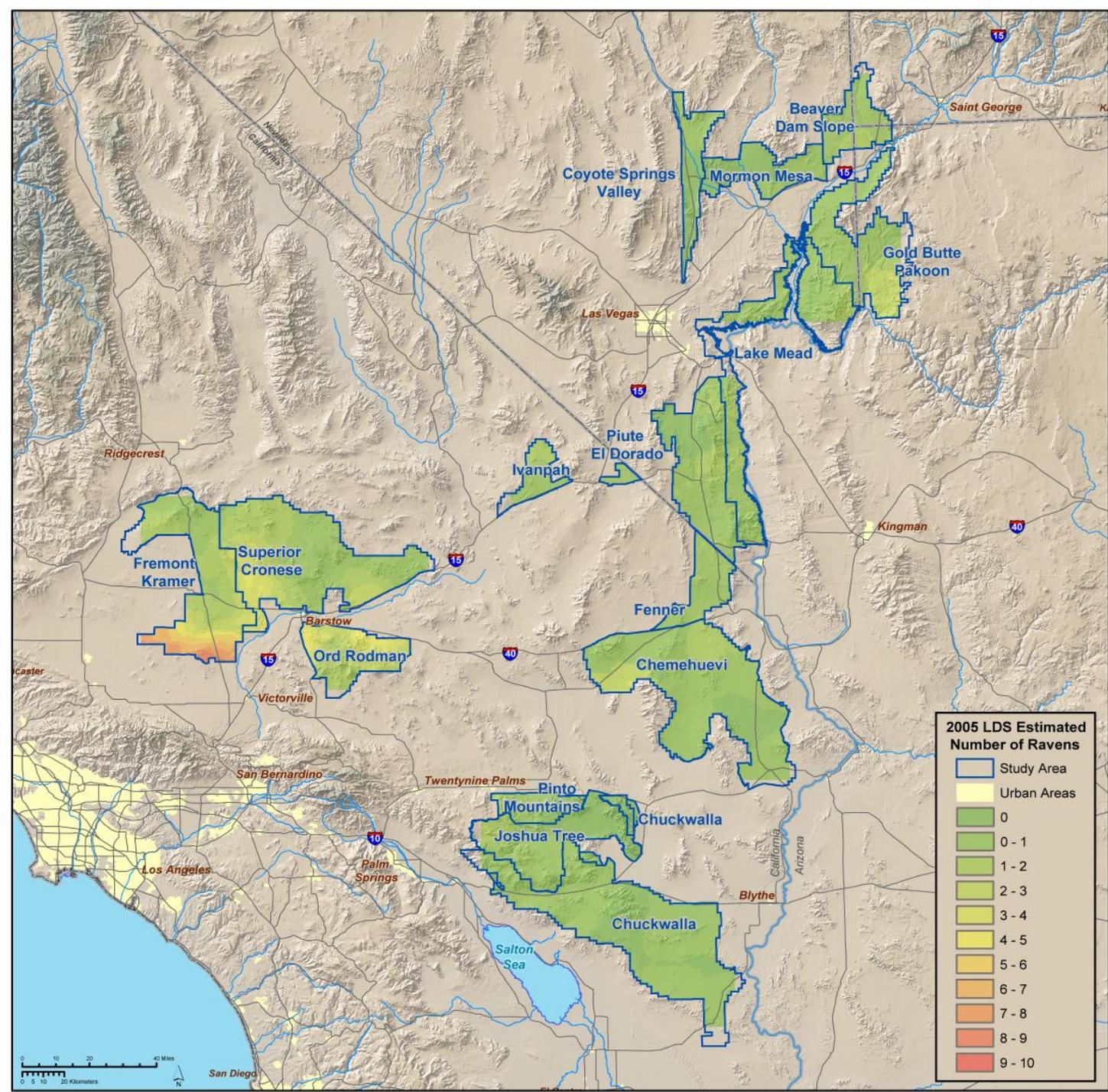


1. Products from the monitoring effort to date
 - Summary Report on density estimates by recovery unit
 - Draft spatial analysis of threat distribution
 - Data to create (2001-05) and validate (2007-08) range-wide habitat models









General Themes in Desert Tortoise Monitoring



2. Five years of monitoring, can we discern trends in the future?
 - Power analysis in the draft Summary Report indicated difficulty detecting trends
 - What do we get for the high cost of tracking tortoises with radios?
 - How do we compare data between years when the sampled areas were changed?

Power to detect trends

Anderson and Burnham (1996)



Actual trend per year	CV	Total Years	Years Between	Power
-12%	0.15	4	1	0.78
+2%	0.15	25	1	1.00
+1%	0.15	25	1	0.86
+2%	0.35	25	1	0.72
+2%	0.15	25	2	0.99



What factors affect precision?

- Variation in detection rate (P_a)
- Variation in visibility (G_o)
- Variation in encounter rate (counts per transect)



Variance component analysis for density estimates

Original analysis from 2005 assuming:

$$G_0 = 0.84$$

$$SE(G_0) = 0.018$$

Detection probability	11.5
Encounter rate	87.0
G_0	1.5



Variance component analysis for density estimates

Reanalysis with 2005 data, assuming:

$$G_0 = 0.84$$

$$SE(G_0) = 0.18$$

Detection probability	4.6
Encounter rate	34.7
G_0	60.7



How will comparisons be made across years?

- Different monitoring sites were used in each of the pilot years
- Within monitoring sites, different rules were used to place transects each year

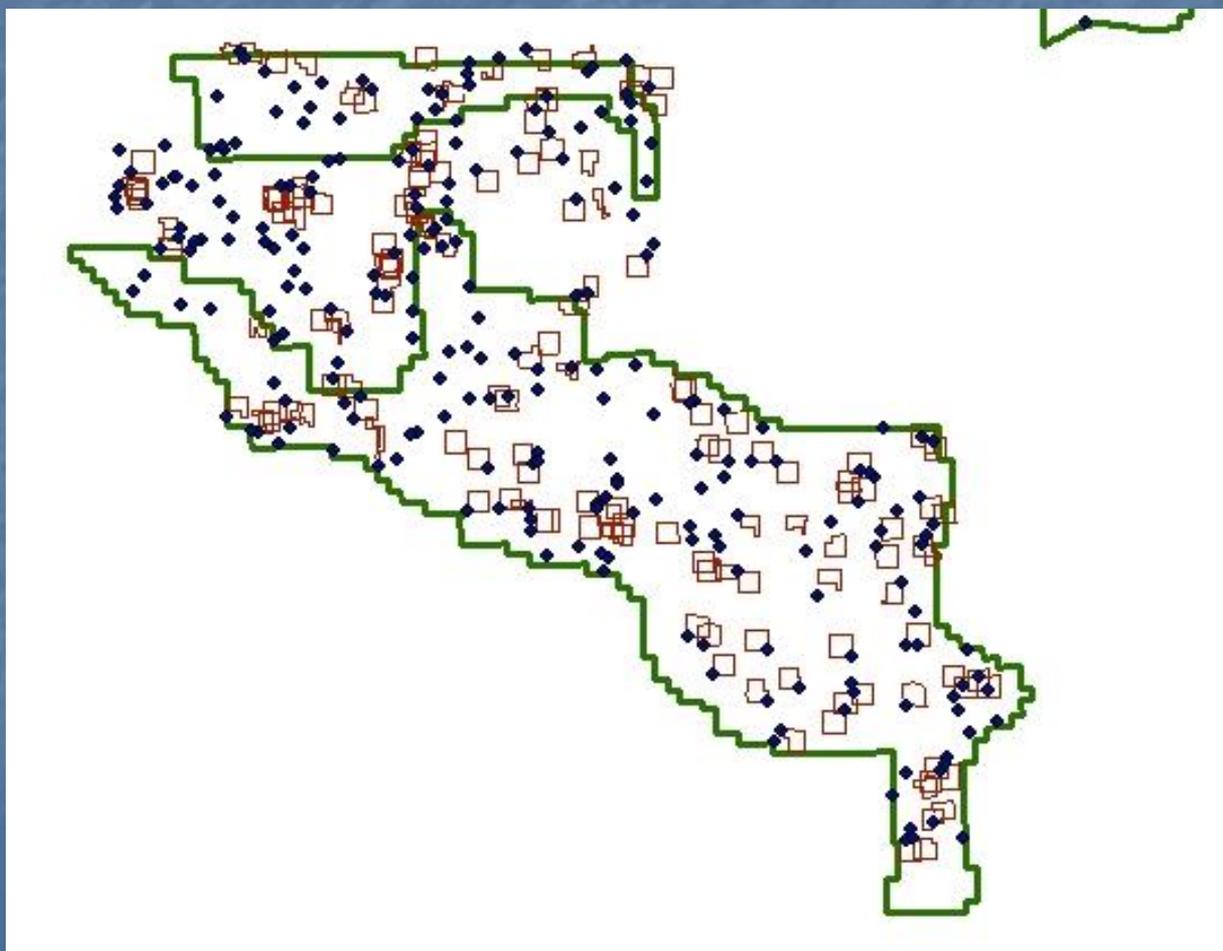
Eastern Mojave Areas (km²)



Site	2001	2002	2003	2004	2005
Fenner	1383	1259		1833	1857
Ivanpah	1991	1240		2112	2565
Mojave NP	1606				
Lake Mead S	615				824
Piute	1527	735	735	2072	1949



Selected and Surveyed Transects



Eastern Colorado 2005

Black diamond:
Selected start point

Red lines:
Surveyed transects

General Themes in Desert Tortoise Monitoring



3. How do we go forward?

- Existing funding to monitor Upper Virgin River and Northeast Mojave recovery units
- Sampling effort in California as in 2005 (supplement for MNP)
- Expand sample sites to adjacent public lands based on habitat
- Less-than-full funding applied to recovery units that most affect precision



Transect Allocations

Recovery Unit	Site	2005	2007
Western Mojave	Fremont-Kramer	56	41
	Joshua Tree	50	30
	MCAGCC	0	35
	Ord-Rodman	26	19
	Pinto Mtns	13	10
	Superior-Cronese	84	59
Northern Colorado	Chuckwalla	94	79
Eastern Mojave	Fenner	24	31
	Ivanpah	14	42
	Mojave NP	0	21
	Lake Mead S	26	14
Eastern Colorado	Chemehuevi	91	97





Annual Results: NE Mojave

Year	Xsects	Length (km)	Torts	Enc. Rate	D (km ²)	CV (%)
2001	136	255	9	0.035	2.32	34.0
2002	75	293	3	0.010	0.84	56.6
2003	189	699	39	0.056	3.01	15.4
2004	96	947	18	0.019	1.42	24.2
2005	166	1754	40	0.023	2.15	18.6



Annual Results: E Mojave

Year	Xsects	Length (km)	Torts	Enc. Rate	D (km ²)	CV (%)
2001	224	372	17	0.046	3.00	26.2
2002	284	1120	56	0.050	4.11	17.0
2003	59	215	11	0.051	2.76	31.7
2004	140	1511	113	0.075	5.57	13.4
2005	165	1840	108	0.059	5.54	11.8



Annual Results: E Colorado

Year	Xsects	Length (km)	Torts	Enc. Rate	D (km ²)	CV (%)
2001	205	328	54	0.165	10.80	15.9
2002	104	417	42	0.101	8.28	20.2
2003	108	432	32	0.074	4.00	19.3
2004	132	1414	102	0.072	5.38	12.7
2005	91	1094	74	0.068	6.38	16.6



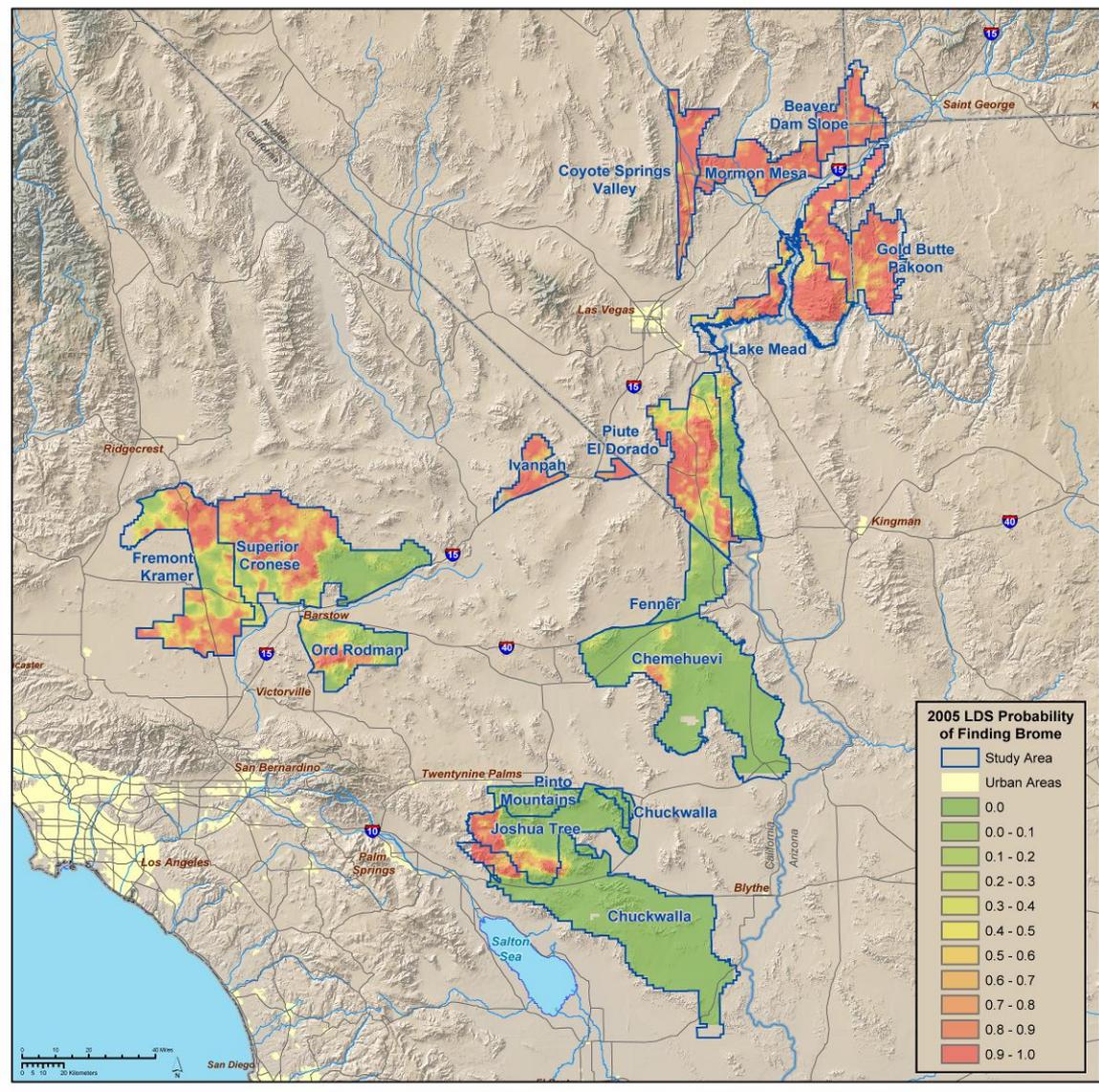
Annual Results: N Colorado

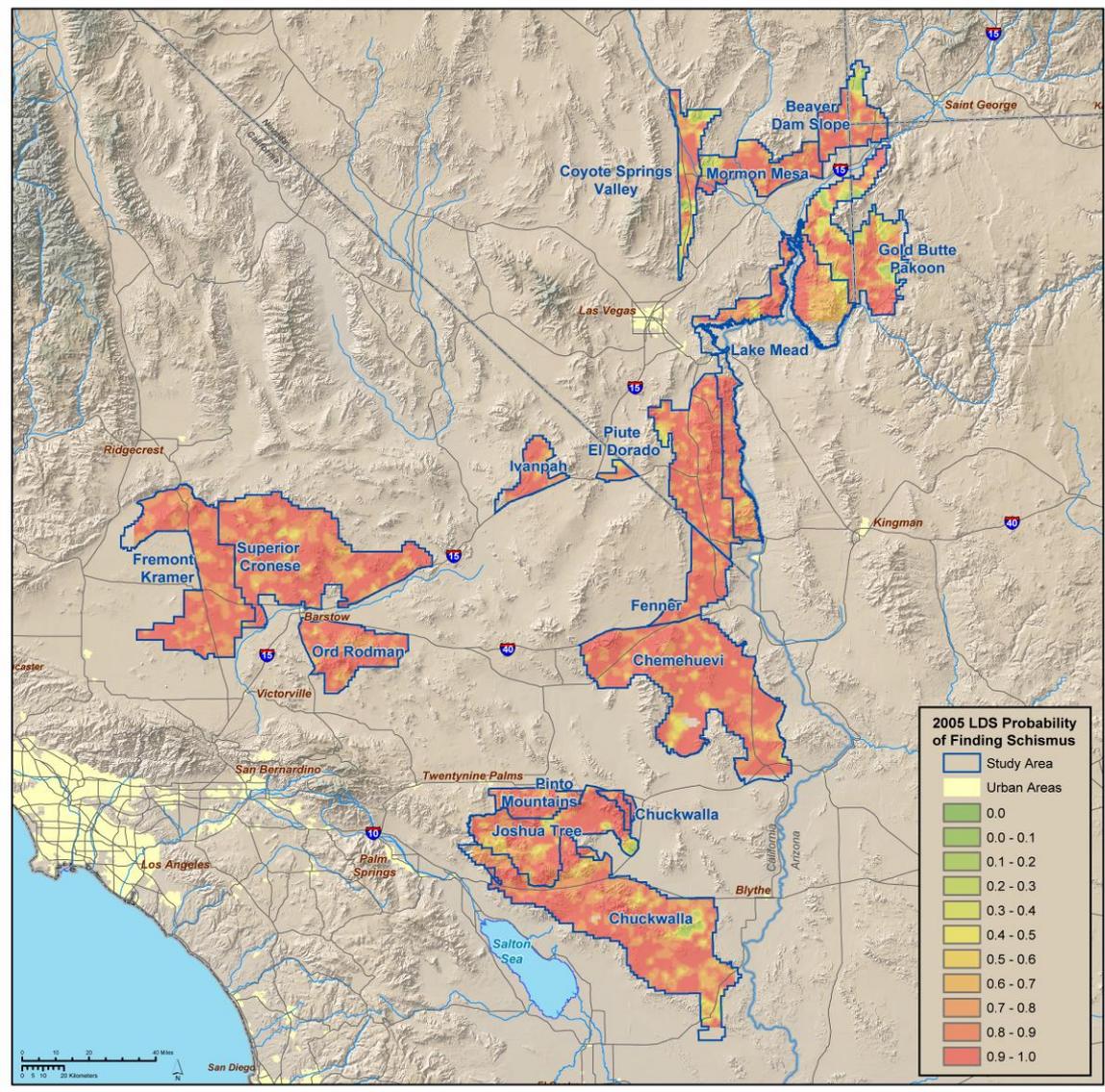
Year	Xsects	Length (km)	Torts	Enc. Rate	D (km ²)	CV (%)
2001	201	322	39	0.121	7.95	17.5
2002	--	--	--	--	--	--
2003	112	445	54	0.121	6.55	17.1
2004	76	836	79	0.095	7.04	15.6
2005	94	1129	94	0.083	7.86	12.8



Annual Results: W Mojave

Year	Xsects	Length (km)	Torts	Enc. Rate	D (km ²)	CV (%)
2001	865	1384	160	0.116	7.58	9.4
2002	547	2177	188	0.086	7.10	10.6
2003	522	2083	218	0.105	5.65	8.8
2004	166	1868	133	0.071	5.31	12.5
2005	229	2747	173	0.063	5.95	10.3





Variance Components Analysis for G_0



Component	2001	2002	2003	2004	2005
Var(Recovery Unit)	0.002	0.000	0.011	0.015	0.015
Var(Site nested in RU)	0.046	0.012	0.000	0.002	0.000
Var(Error) = Var(Day)	0.015	0.030	0.026	0.015	0.025
Total Variance	0.063	0.042	0.037	0.032	0.040
Standard Deviation	0.251	0.205	0.192	0.179	0.200

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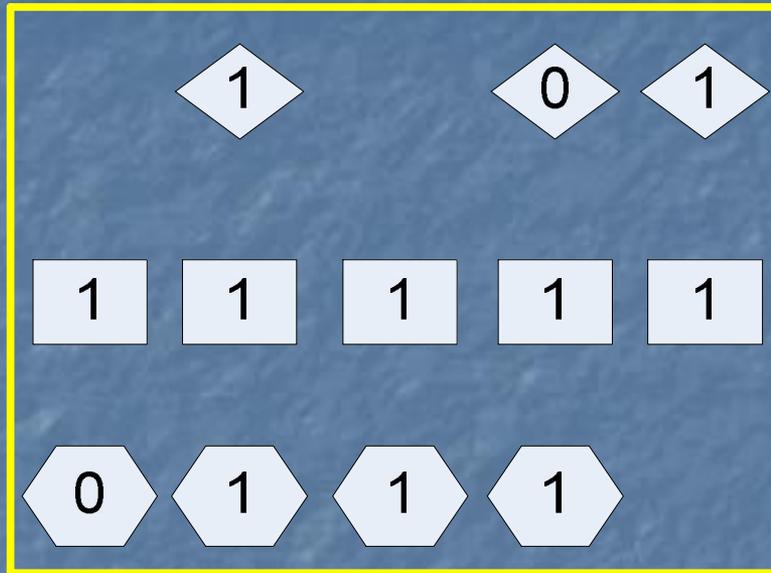


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+1%	0.20	25	1	0.71
+1%	0.20	25	2	0.55

Estimating G_0

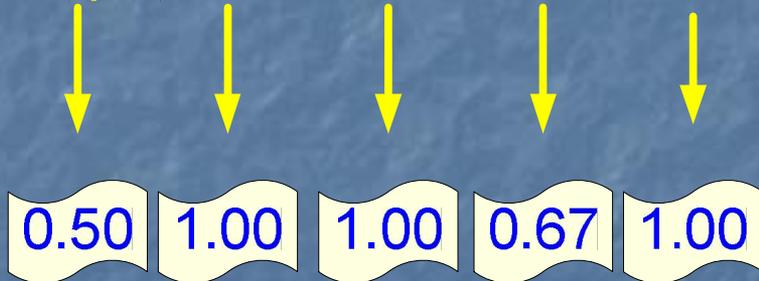


Individual observations
(visible/not)



1 April

1 June



Avg availability on each date

Overall RU
availability (G_0)



Avg site availability
over 2 months