

MONARCHWATCH.ORG



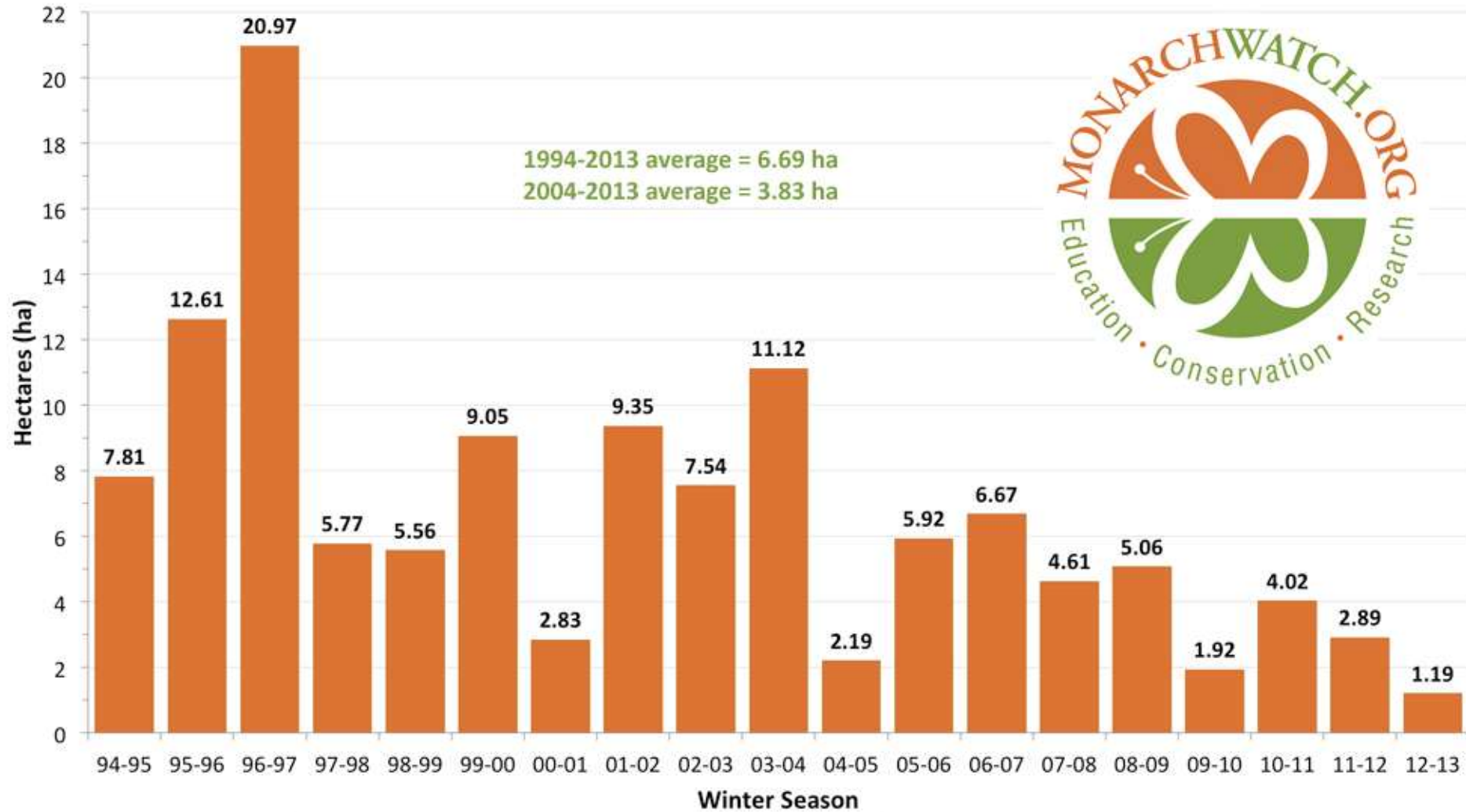
Education • Conservation • Research



Re-colonization of northern breeding areas and monarch production

Vijay Barve, Orley R. Taylor, Janis
Lentz and Elizabeth Howard

Total Area Occupied by Monarch Colonies at Overwintering Sites in Mexico



Data for 1994-2003 collected by personnel of the Monarch Butterfly Biosphere Reserve (MBBR) of the National Commission of Natural Protected Areas (CONANP) in Mexico. Data for 2003-2013 collected by World Wildlife Fund Mexico in coordination with the Directorate of the MBBR.

Year to year variation in size of the overwintering population

Factors

Temperature, rainfall, degree days

Analysis

Regression, multiple regression

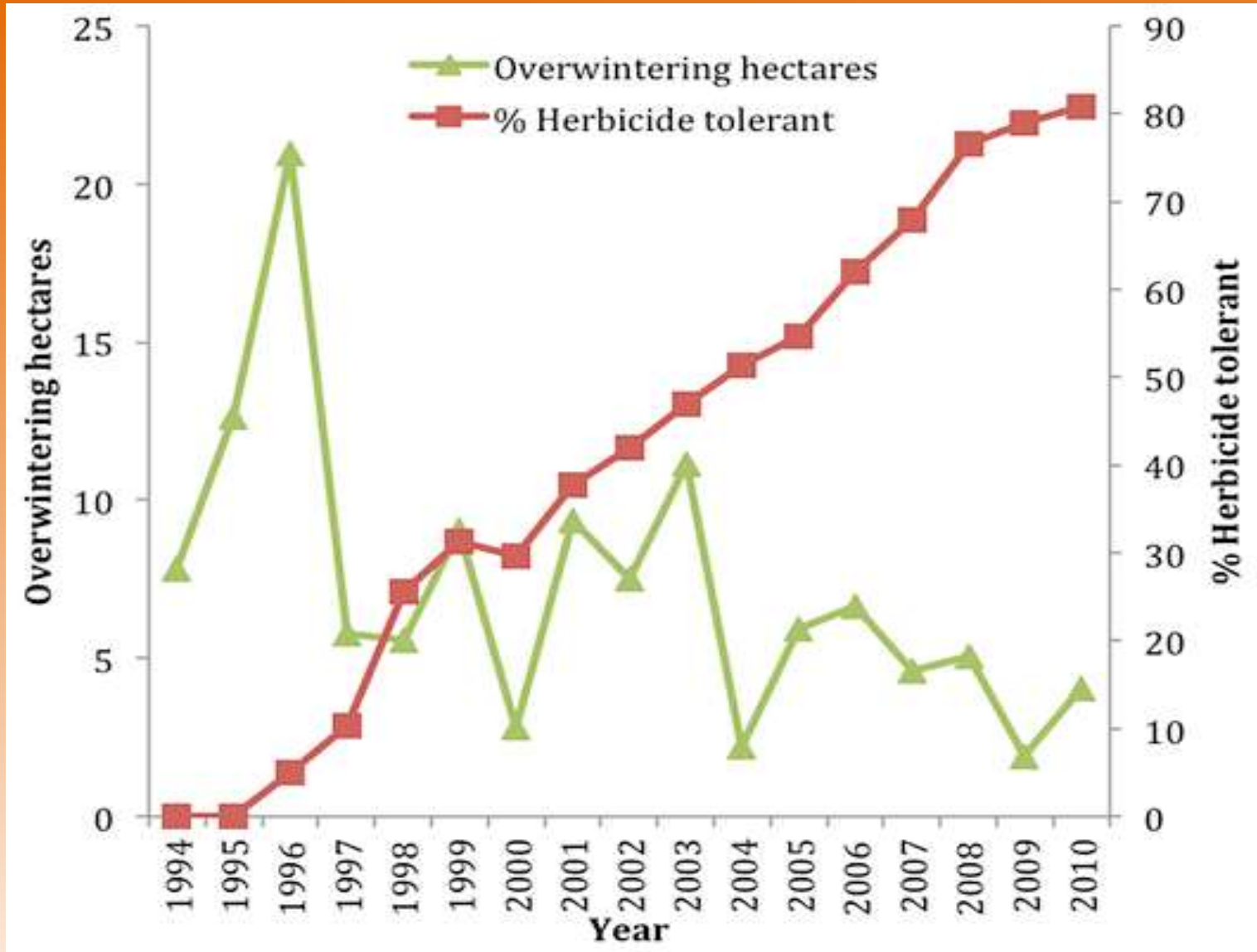
Results

Regressions diminishing - declining habitat

New focus

Timing and results of re-colonization

Adoption of herbicide tolerant crops vs decline in monarch overwintering population



First Sightings

- Three Regions

Q1 100W – 90W N=34

Q2 90W – 80W N=50

Q3 80W – 70W N=35

40N – 48N Lat

N=weather stations

- Four Periods

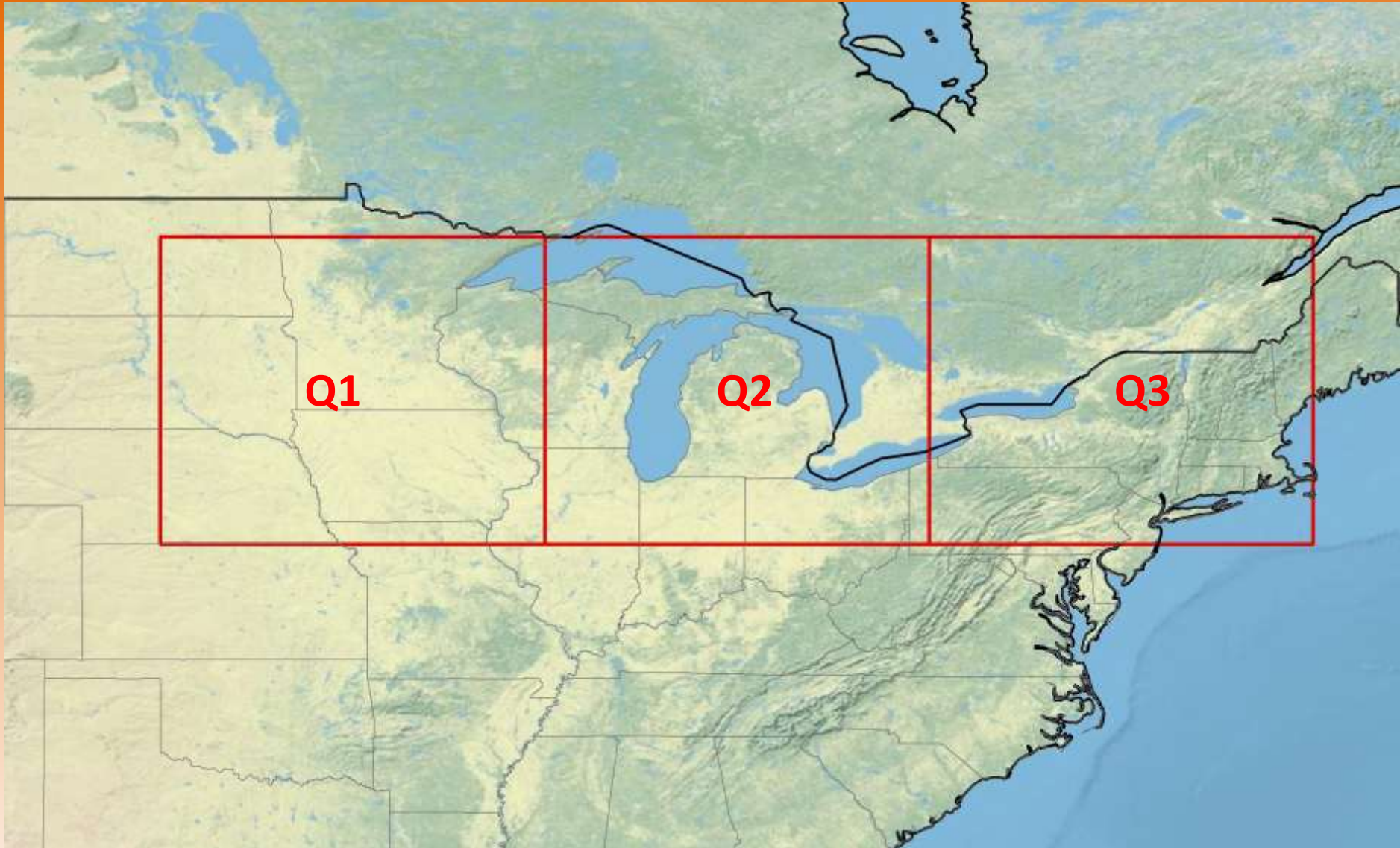
P1: 1-10 May

P2 : 11-20 May

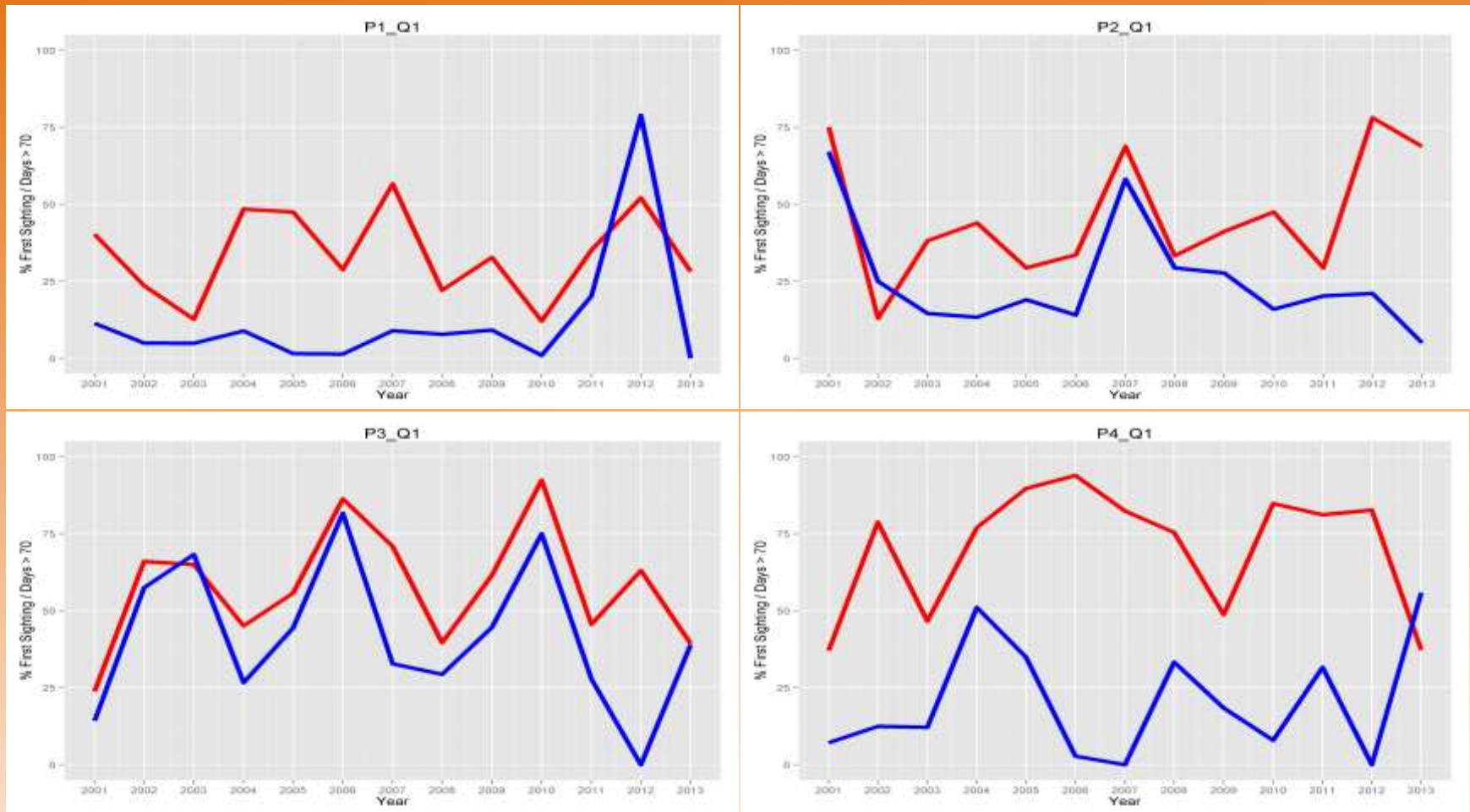
P3 : 21-30 May

P4 : 31 May -9 June

Regions for first monarch sightings analysis

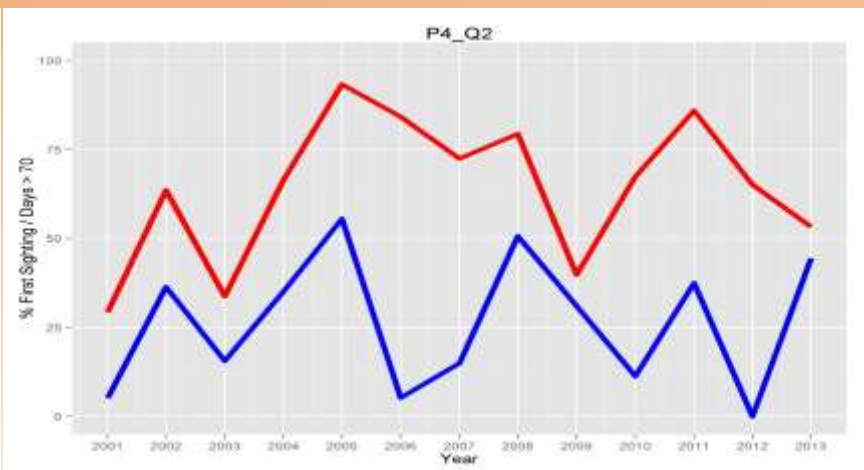
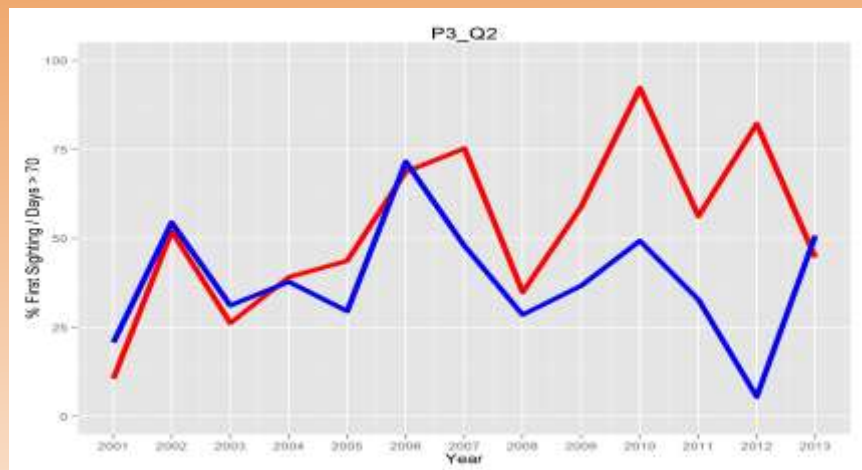
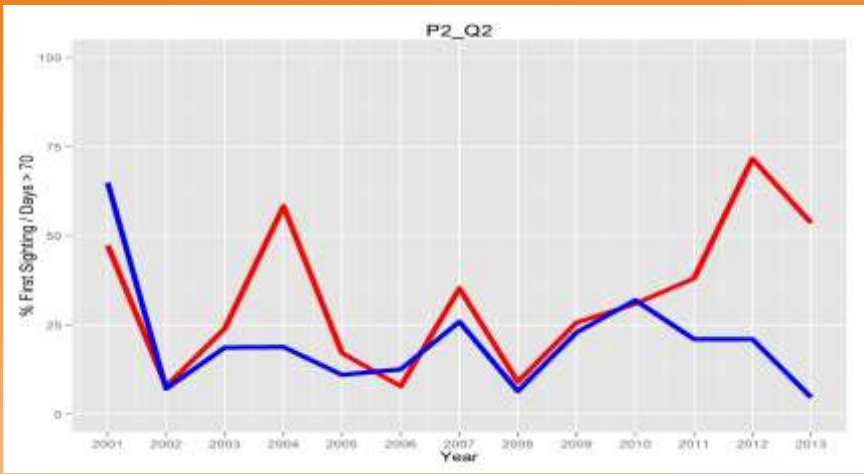


First sightings and # 70 Degree days Q1



 FS  70DD

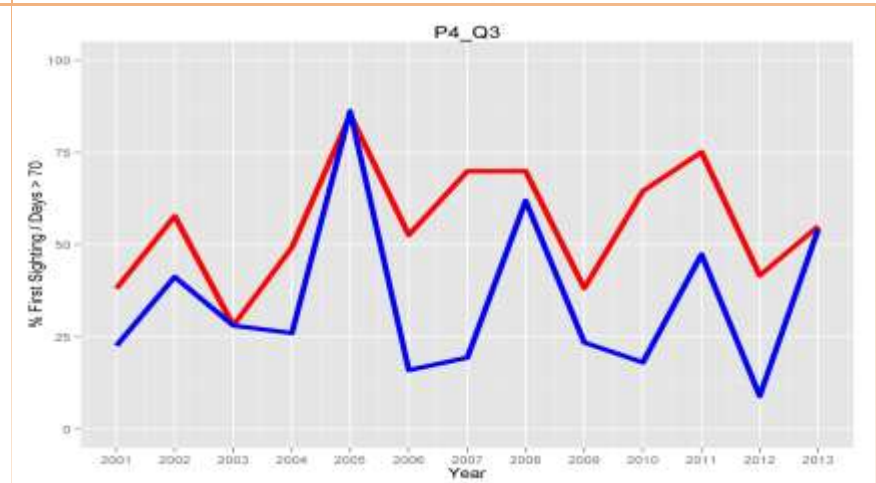
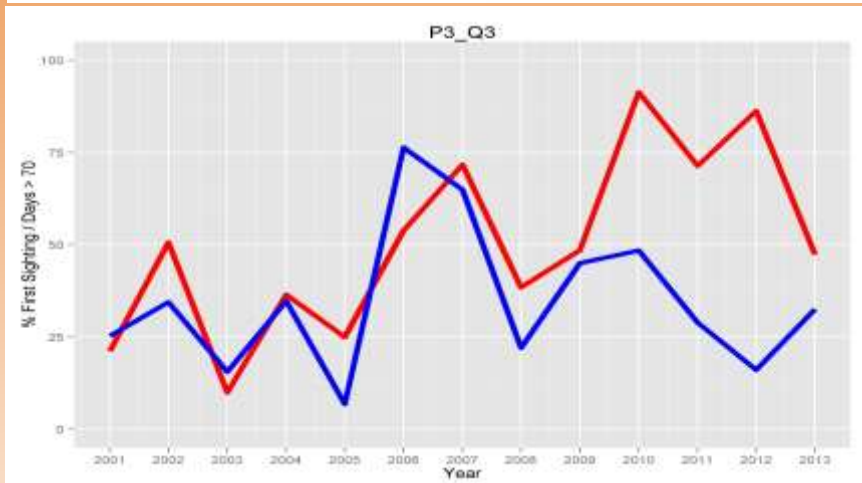
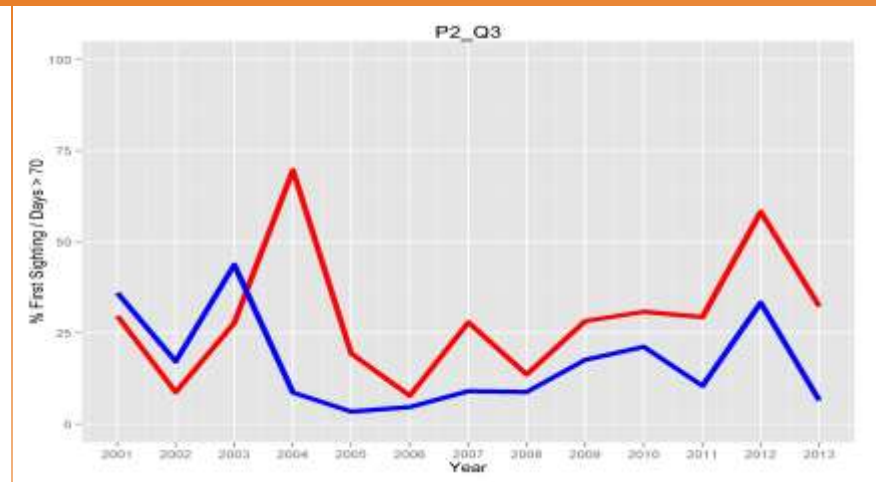
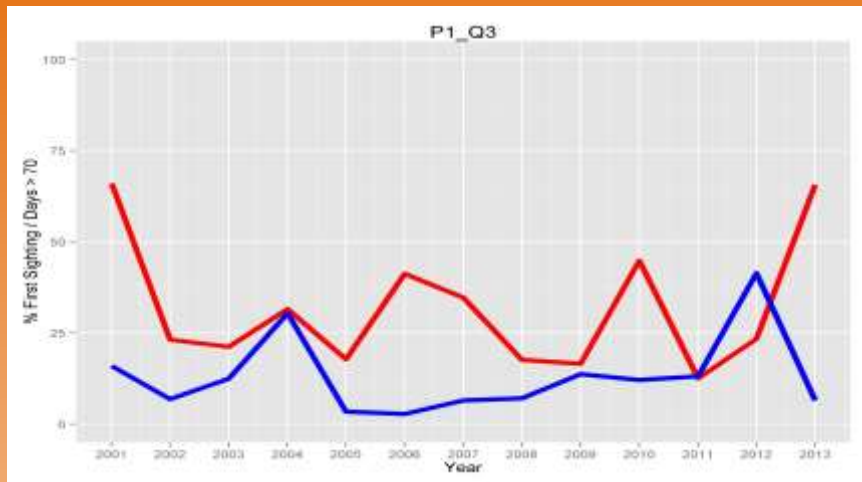
First sightings and # 70 Degree days Q2



 FS  70DD

First sightings and # 70 Degree days

Q3



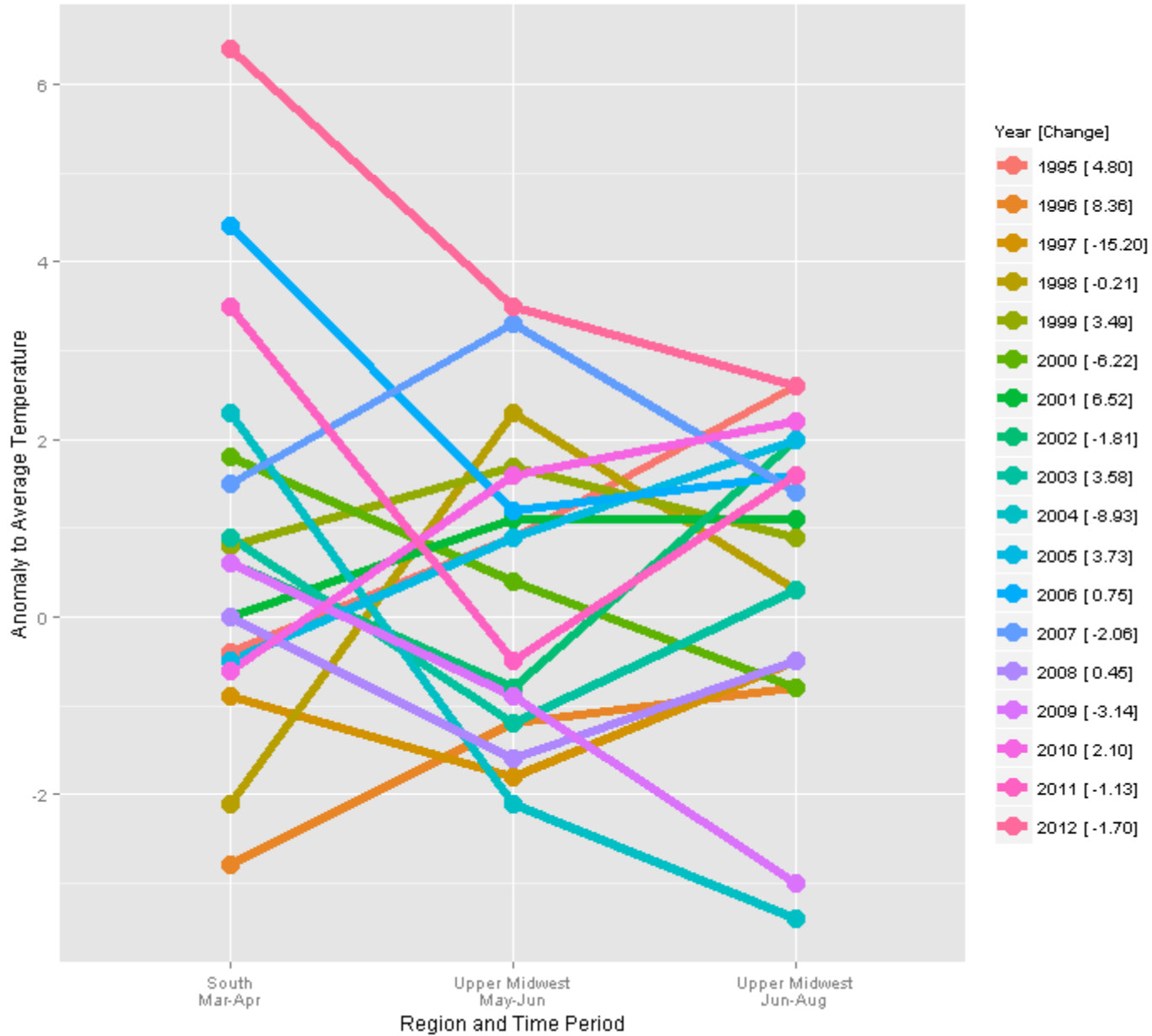
FS 70DD

Distribution of first sightings by region and time interval

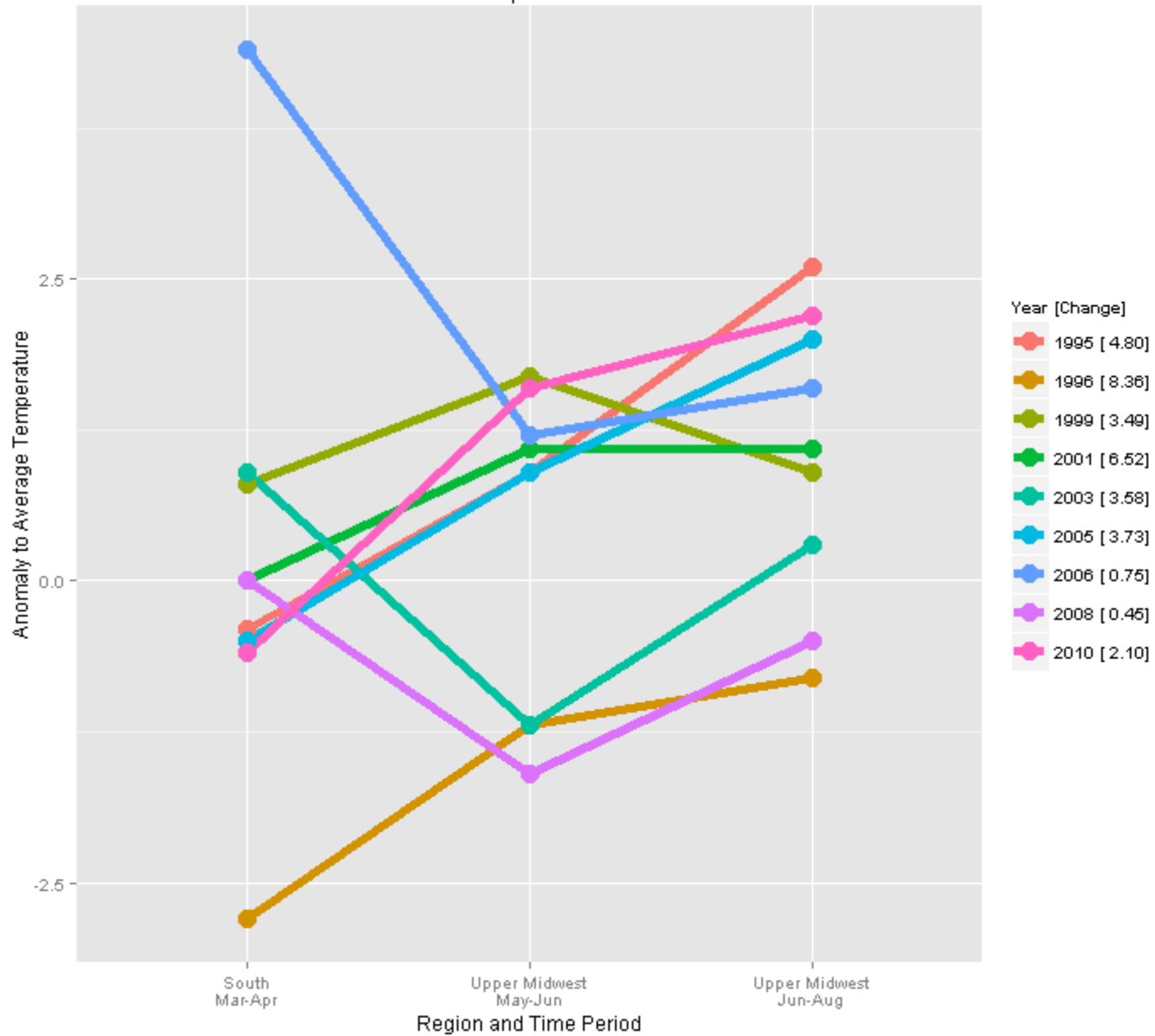
Year	P12_Q1	P34_Q1	P12_Q2	P34_Q2	P12_Q3	P34_Q3
2010	17.0	83.0	39.3	60.7	33.3	66.7
2011	40.5	59.5	29.7	70.3	23.7	76.3
2012	100.0	0.0	94.4	5.6	74.7	25.3
2013	5.1	94.9	4.8	95.2	13.0	87.0

Year	P23_Q1	P23_Q2	P23_Q3	Population
2010	91.0	81.3	97.8	+2.10
2011	48.1	53.9	61.8	-1.13
2012	21.1	26.7	21.8	-1.70
2013	44.1	55.6	83.4	????

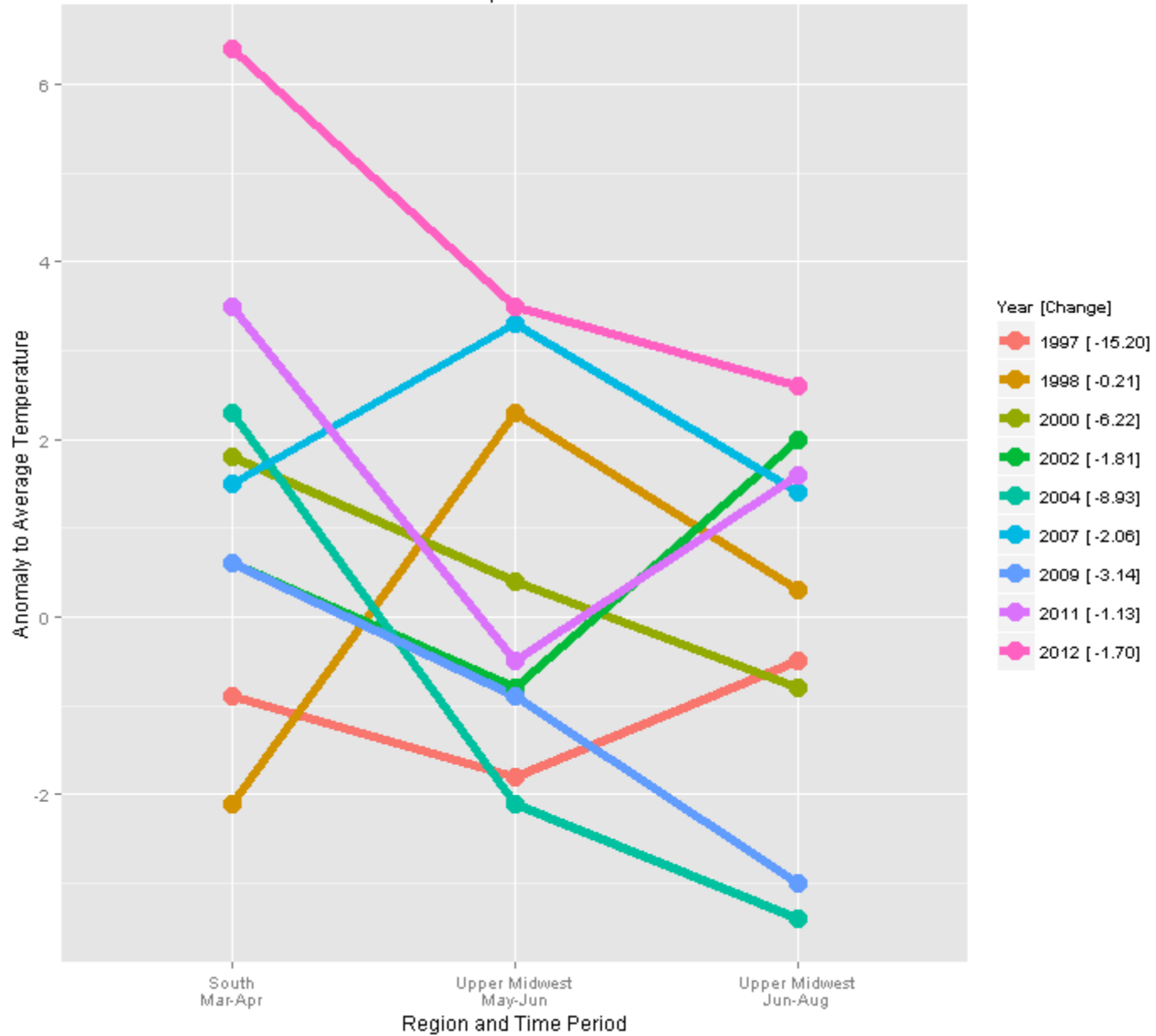
All Years



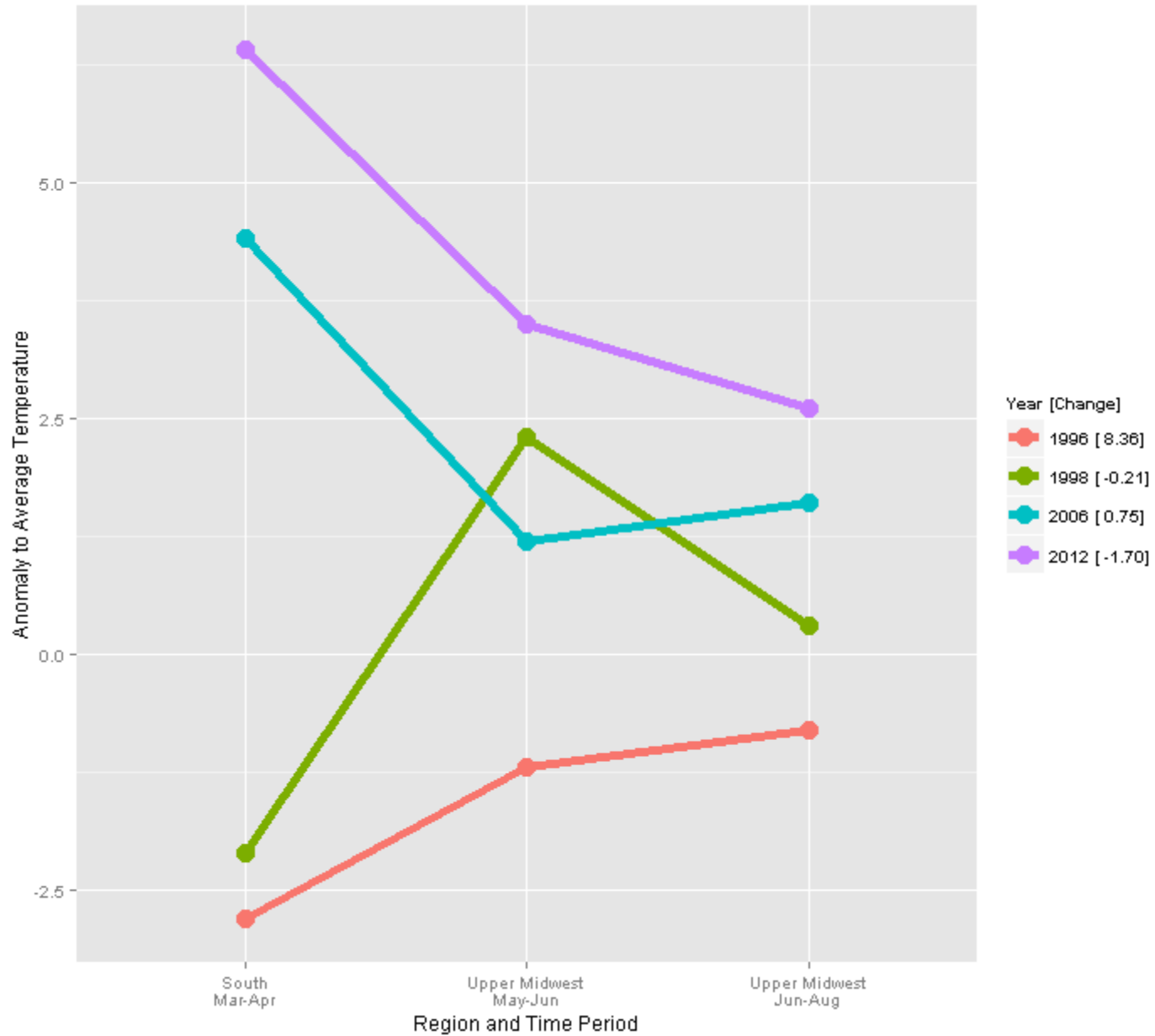
Years with Population Increase



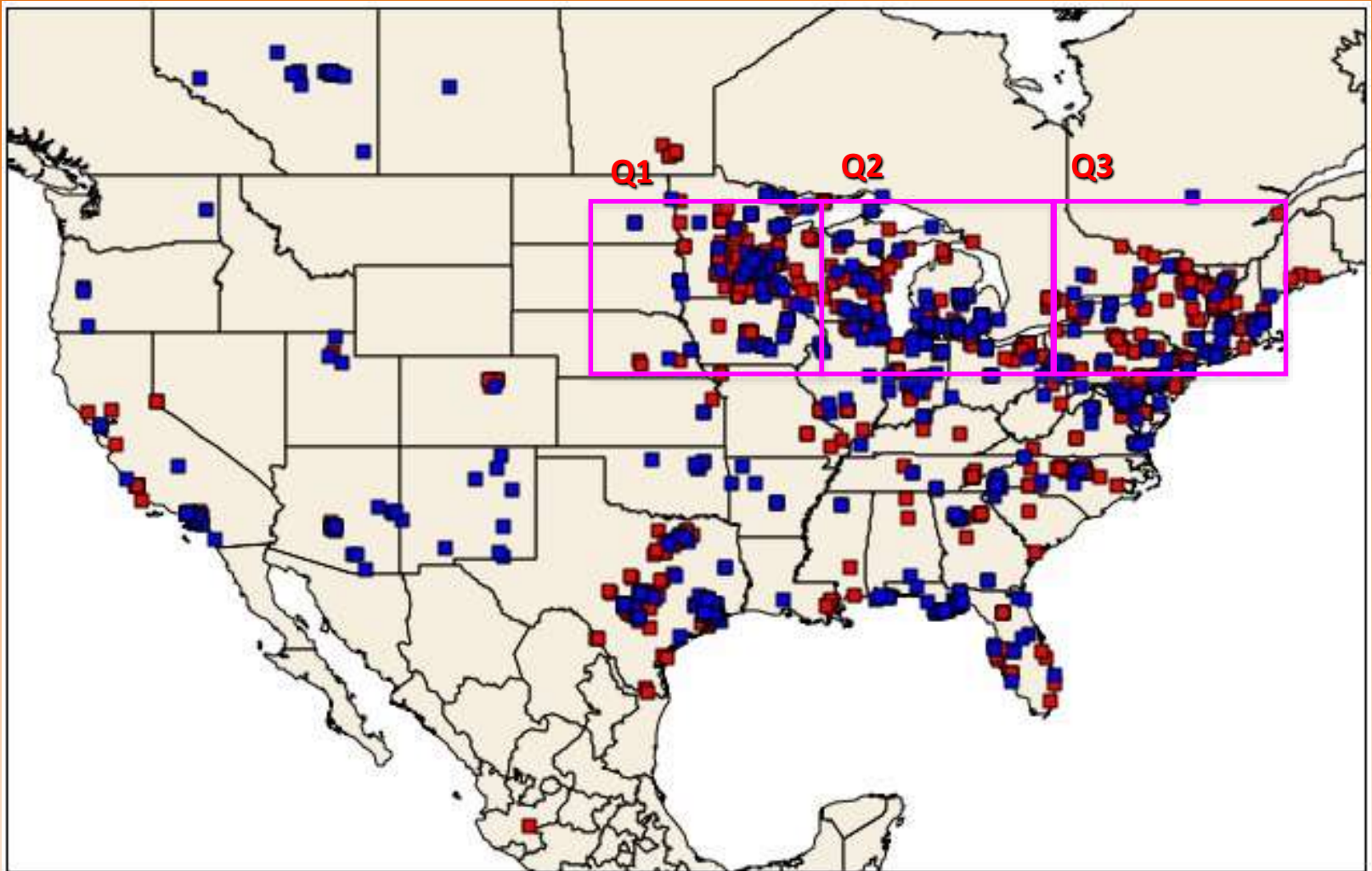
Years with Population Decrease



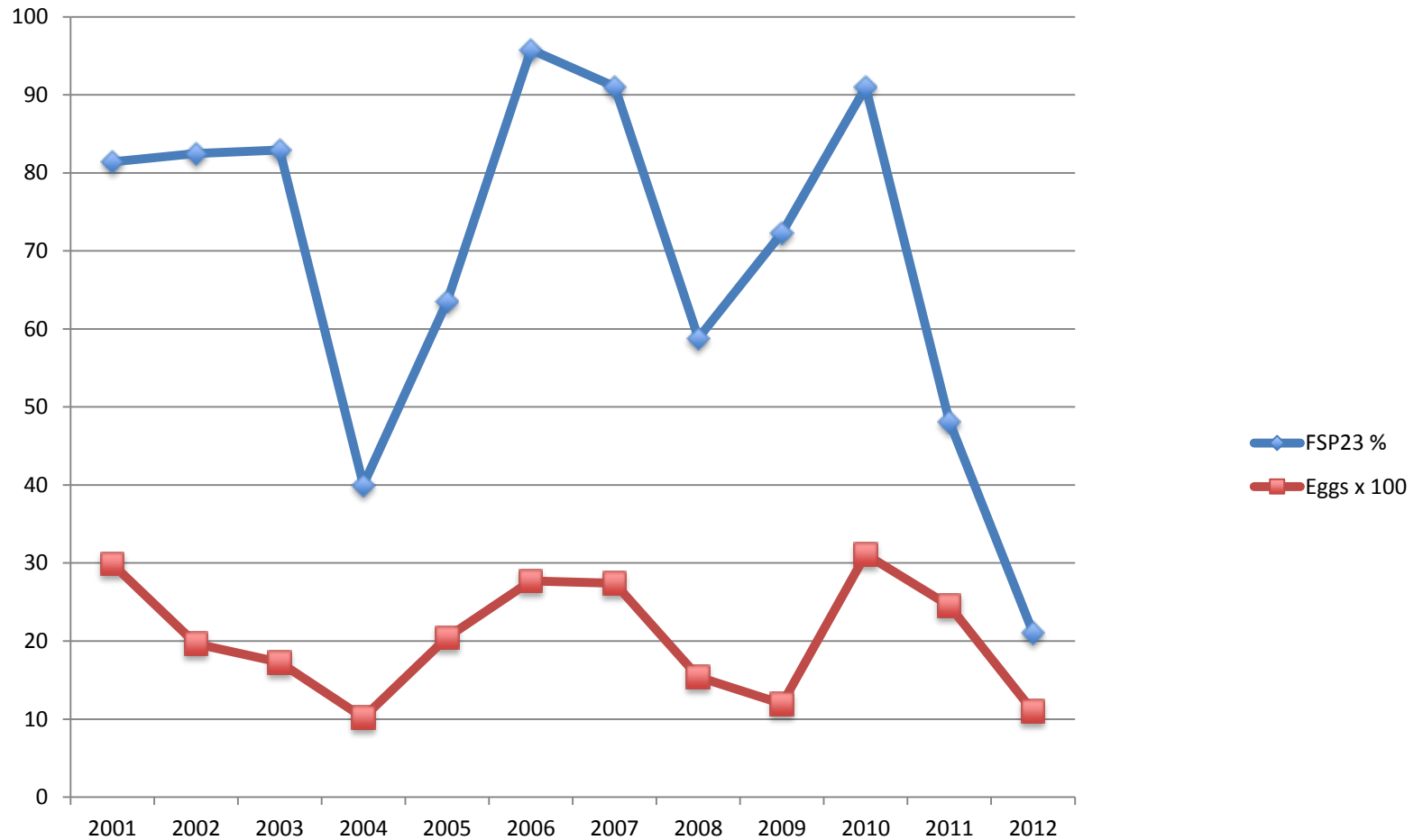
Years with Extreems



Regions for Eggs production analysis

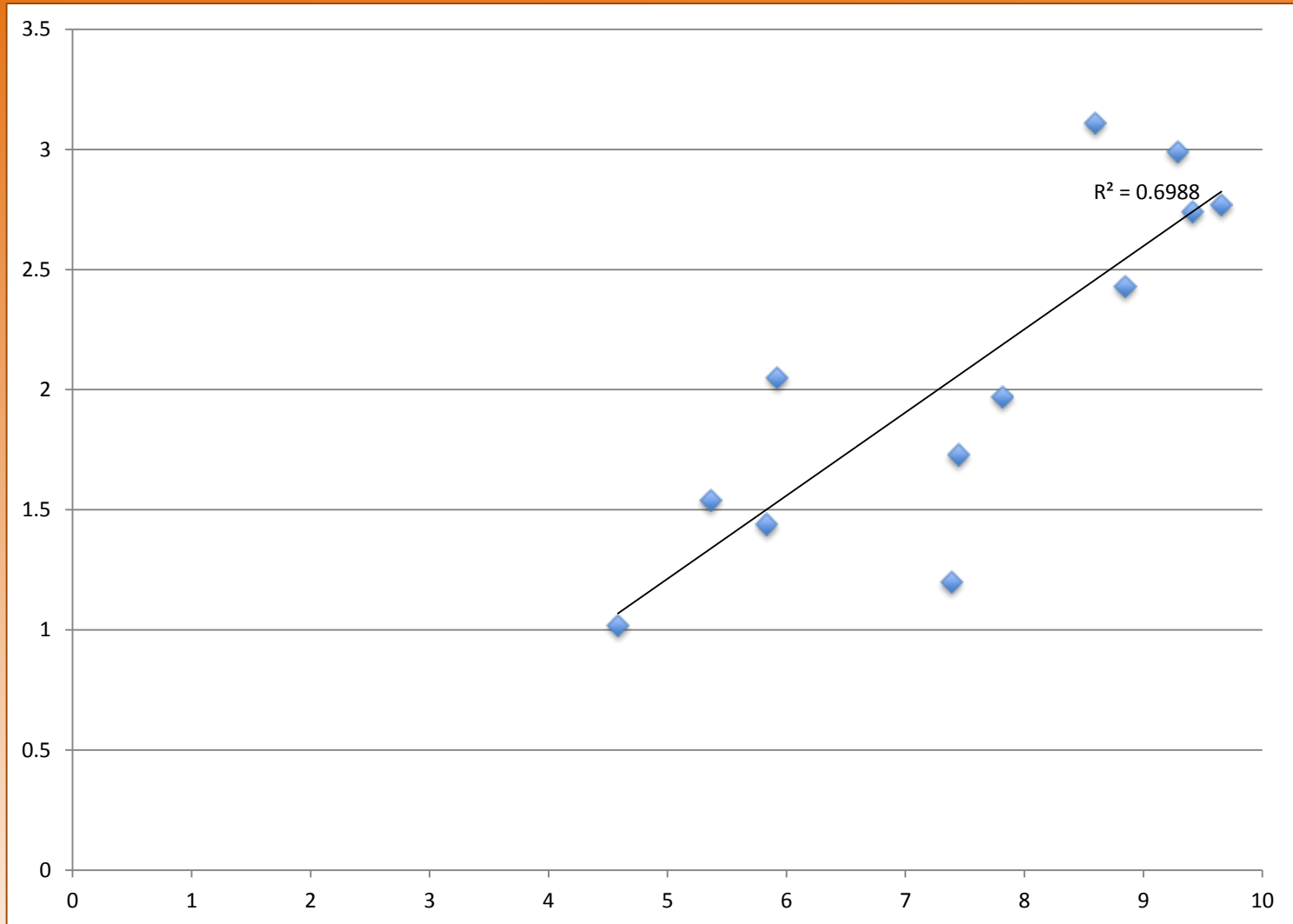


first sightings periods 2+3 vs eggs per stem on non-ag milkweeds

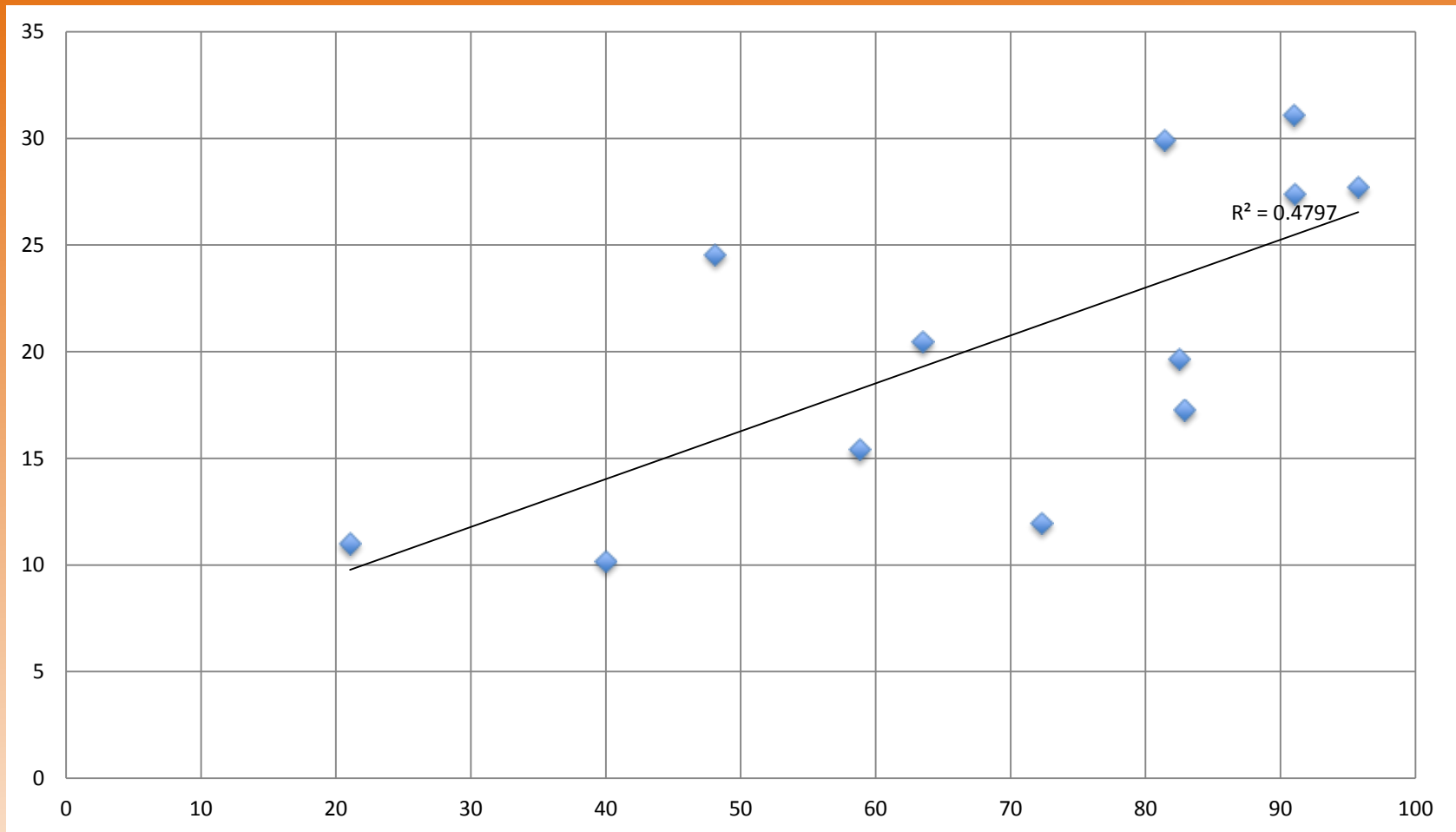


Egg data from Pleasants and Oberhauser

Eggs production vs First Sighting Periods 2 & 3 (ENC)



Eggs production vs First Sighting Periods 2 & 3 (Q1)



Predicting egg and overwintering numbers

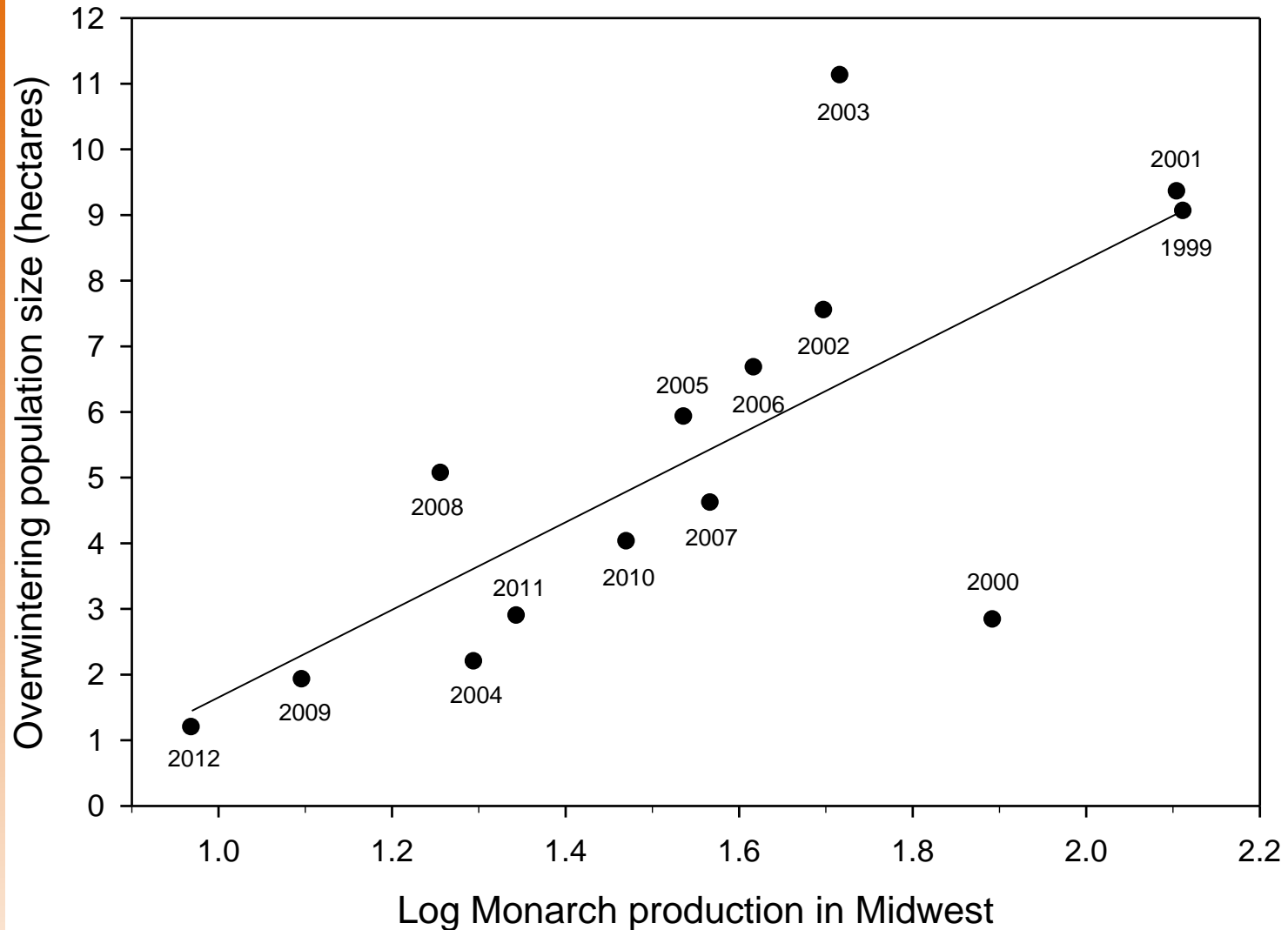
- $2Pa70 + 3Pa70 + \text{Summer T}$ – predicts egg number
- Egg number (predicted or measured) x habitat(Hb) - predicts OWha

Multiple regression

Egg production with Summer T and 70F days, arrivals 11-30 May or May T

Formulae	Adjusted R ²	P-value
eggs ~ Sum_ENC + p2a70 + p3a70	0.8827	0.0001260
eggs ~ Sum_ENC + p2p3	0.7907	0.0003558
eggs ~ Sum_ENC + ENC_May	0.8206	0.0001780

Midwest monarch production (log) vs Size of the overwintering population



Key factors in monarch production

and condition of monarchs arriving in TX – minor

Conditions for reproduction in TX– major

first generation adults moving N– major

days 70 or more/or May temperatures – major

monarchs arriving 11-30 May – major

Summer temperatures in ENC (MN, IA, WI) – major

Area of habitat in ENC & C - major

Conclusions

- Optimal time of arrival in the northern breeding areas – too early or too late usually leads to lower production
- Re-colonization occurs from west to east - differences of about a week from ENC to Central to Northeast regions in some years
- Number arriving in peak periods is likely to affect production and perhaps time of the migration in the Northeast region
- Eggs on stems of non-ag milkweeds are correlated with FS, days with 70F in May, and mean May and summer temperatures
- Due to declines in habitat and monarch numbers - regression values using physical factors have declined and are less useful
- Degree days alone are not sufficient to explain monarch numbers

Acknowledgements

- Monarch Joint Venture
- Jim Lovett
- Ann Ryan
- WWFMexico and Eduardo Rendon
- Eligio Garcia
- John Pleasants
- Karen Oberhauser

MONARCHWATCH.ORG



Education • Conservation • Research



Distribution of First sightings by region and time intervals

