An outbreak of *Salmonella* Javiana associated with amphibian contact— Mississippi, 2001

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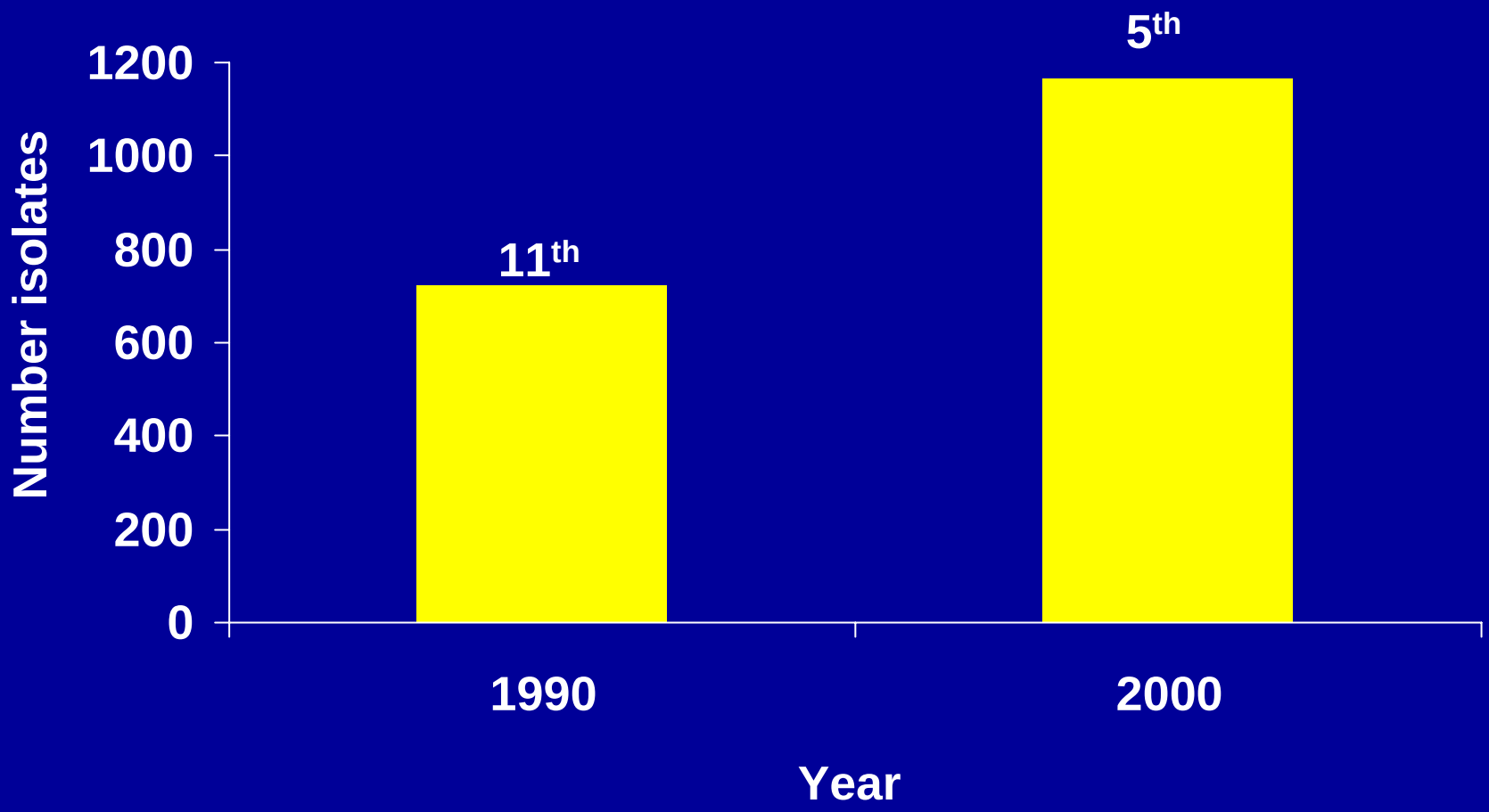
Salmonellosis

- 1.4 million illnesses annually in US
- Gastrointestinal illness
- Results from ingestion of foods of animal origins
- Fresh produce, water, reptiles also implicated
- 2500 *Salmonella* serotypes

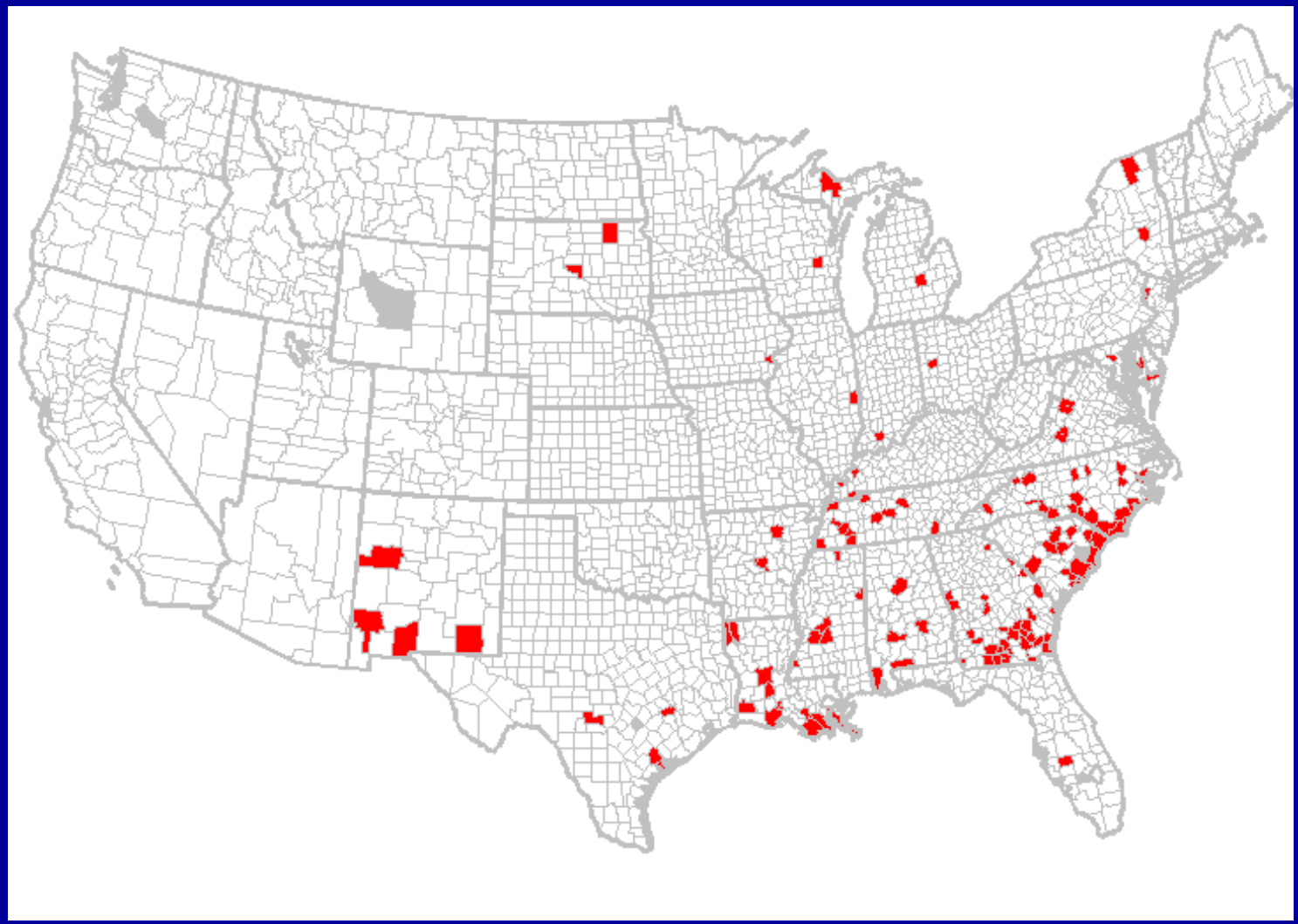
Salmonella Javiana, an emerging pathogen, 1990-2000



Salmonella Javiana

- 40% infections occur in children aged < 5 years
- Occurs almost exclusively in late summer
- Highest incidence in Southeastern United States

Incidence of *S. Javiana* by county, 2001

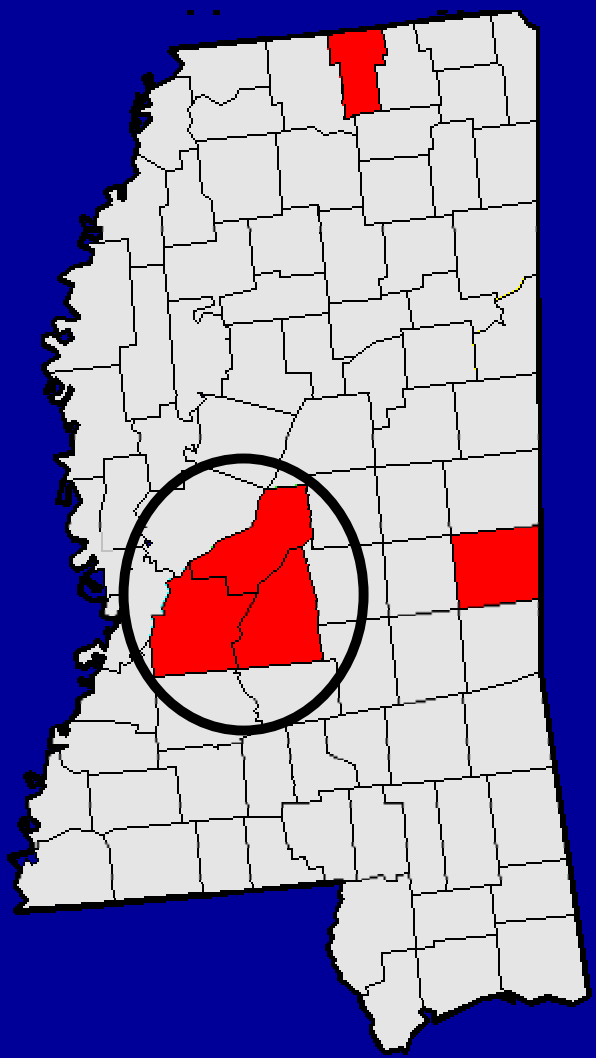


■ = Counties with incidence of > 1.4/100,000 population

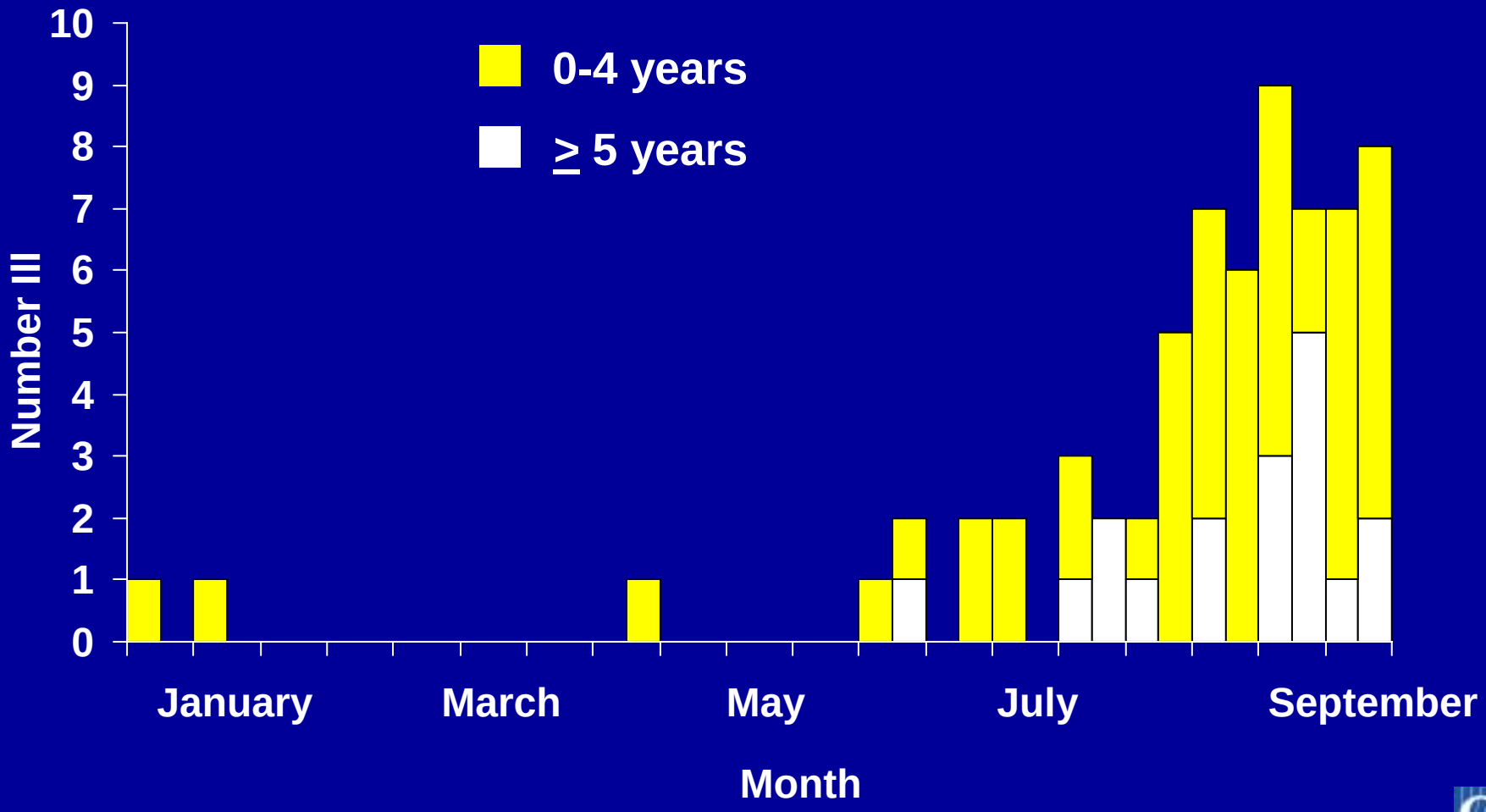
CDC

Outbreak in Mississippi, September 2001

- 66% of cases in Jackson metropolitan area
- Incidence in Jackson area =13/10^5 population



S. Javiana infections by week, Mississippi, 2001



Case-control study definitions

- Case: culture-confirmed *S.* Javiana infection between August and September 2001 in a MS resident
- Control:
    - <5 years old
      birth registry
      matched to month, year, county
    - ≥5 years old
      sequential digit dialing
      matched by age, county
- 2 controls per case

Case-control study methods

- Written questionnaire
  - Food, water, environmental exposures
  - Patients: 7 days before illness
  - Controls: 7 days before interview

- 55/57 eligible patients matched to 104 controls

Characteristics of patients (n=55)

- 31 (56%) female
- Median age 24 months (range 3 months-70 years)
- Median duration of illness: 7 days
- Symptoms:
  - Fever (86%)
  - Abdominal pain (83%)
  - Bloody diarrhea (44%)
- 40 (73%) received antibiotics
- 9 (16%) hospitalized
- No deaths

Univariate analysis

Potential Risk Factor	Patients (N=55)	Controls (N=104)	mOR	*p*-value
Private Insurance	76.4%	57.7%	2.5	0.025
Watermelon	11.8%	1.0%	9.1	0.045
Orange Juice	49.1%	31.4%	2.9	0.016
Lake/Pond	40.0%	18.3%	2.8	0.006
Snakes	14.6%	2.9%	7.3	0.013
Turtles	18.2%	3.8%	6.2	0.006
Frogs/Toads	54.6%	28.8%	2.6	0.004

Multivariate analysis

Potential Risk Factor	Patients Exposed N (%)	Odds Ratio	*p*-value
Private Insurance	42/55 (76.4%)	2.5	0.019
Watermelon	6/51 (11.8%)	10.4	0.057
Turtle exposure*	10/55 (18.2%)	5.1	0.023
Frog/Toad exposure	30/55 (54.6%)	2.3	0.021

* 8/10 also had exposure to frogs/toads

Age subgroup analysis

Age Group	Frog/Toad Exposure N (%)	Matched Odds Ratio	95% Confidence Interval
<6 months	1/4 (25)	1.0	0.09-11.0
6 months- 3 years	**17/26 (65)**	**3.7**	**1.4-9.8**
4 years-15 years	10/18 (56)	2.9	0.84-9.6
>15 years	2/7 (29)	1.0	0.16-6.4

Laboratory investigation

- All isolates pan-susceptible
- Molecular subtyping (PFGE) at LA State Public Health Laboratory and CDC
- 51 isolates
  - 18 distinct patterns
  - Not a point-source outbreak
  - Most common pattern found in 20/51 (39%)

    no common epidemiologic link

Animal testing

- 23 frogs and toads collected from patients' yards
- *S.* Javiana not isolated
- *S.* Newport isolated from toad

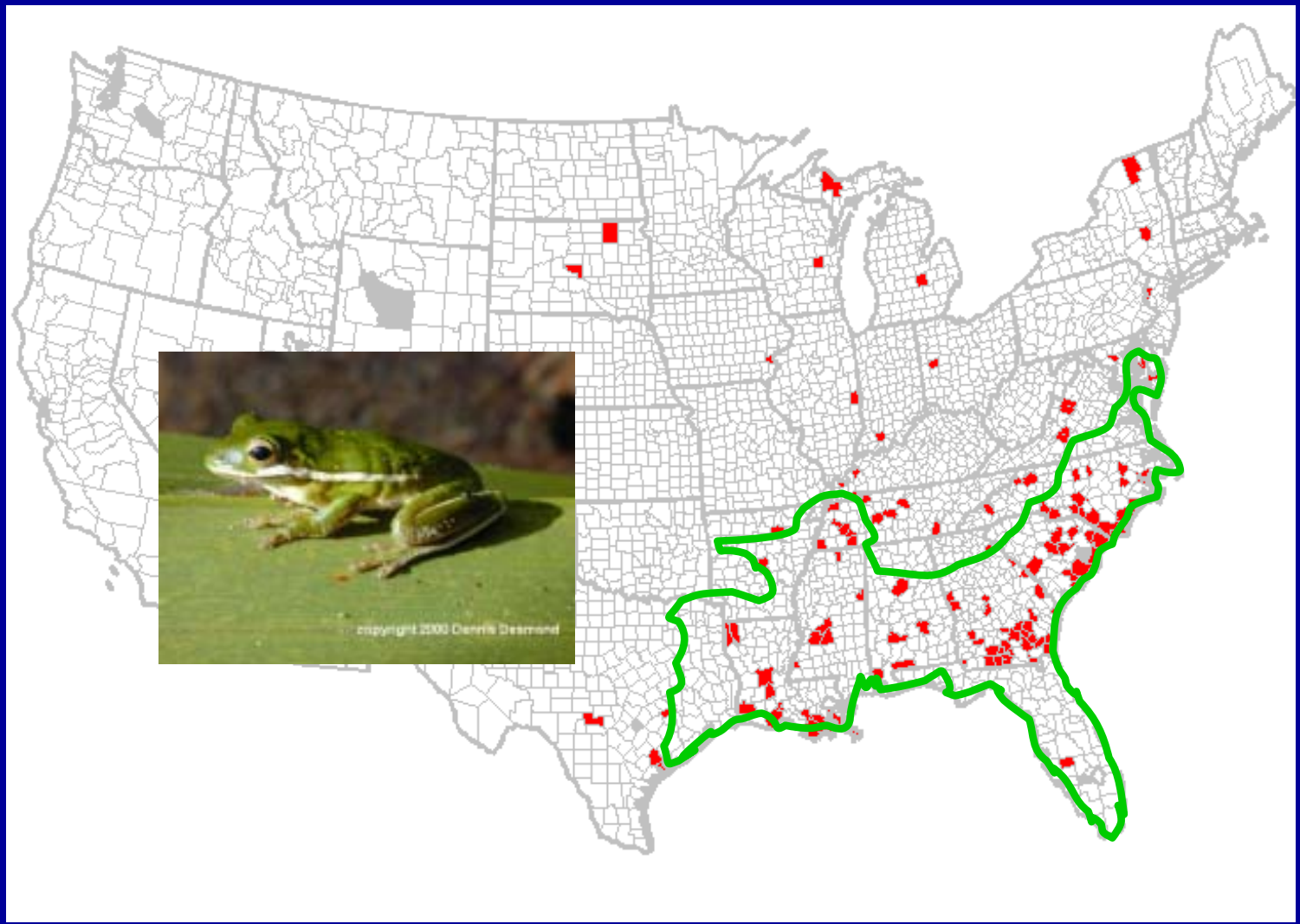
Limitations

- Exposure to frogs and toads includes indirect contact- may be surrogate for another exposure
- Limited number of frog and toad samples collected
- Limited number of frog and toad species collected may not include species that may be reservoirs for *S.* Javiana

Conclusions

- Contact with amphibians and their environment may be risk factors for infection
- Indirect exposure to frogs/toads may explain increased incidence of *S.* Javiana among toddlers and young children
- Amphibian reservoir may explain seasonality and geographic distribution of *S.* Javiana

Geographic distribution of *S.* Javiana and green treefrog



Recommendations

- Consider amphibians along with reptiles as potential sources of salmonellosis
- Promote handwashing after contact with amphibians
- Further studies to better determine distribution of *Salmonella* serotypes in amphibian reservoirs

Acknowledgements

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Exposure to frogs/toads by month

Time Period	Patients with exposure to frogs/toads N (%)	Controls with exposure to frogs/toads N (%)
August and September 2001	30/55 (54.6%)	30/104 (28.8%)
August 2001	15/26 (57.7%)	12/48 (25.0%)
September 2001	15/29 (51.7%)	18/56 (32.1%)
Late September 2001	7/13 (53.9%)	8/24 (33.3%)

Age of residence among patients, N=55

Patient group	Median age of home	*p*- value
Exposure to frogs/toads	15 years	0.0264
No exposure to frogs/toads	22 years	