Chasing the Dragon: Investigating an Outbreak of Rare Salmonella Serotypes Linked to Pet Bearded Dragons

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Outbreak Response and Prevention Branch

InFORM – Phoenix, Arizona
November 19, 2015
Inland Bearded Dragon
*Pagona vitticeps*

- Native to Australia
- Lifespan
  - 3 – 10 years (or more)
- Size
  - 12 – 24 inches
- Pet industry breeding population
  - Australia prohibits export of native wildlife
  - Original breeding stock smuggled out of country

*Smithsonian National Zoological Park, Inland Bearded Dragon Fact Sheet

Source: http://beardeddragon.org
Inland Bearded Dragon

*Pagona vitticeps*

- Increasingly popular pet
  - Docile
  - Pleasing colors
  - Easy to keep
  - “Personality”

- Retail
  - Entry-level reptile
  - Sold as juveniles

- Hollywood effect

*Smithsonian National Zoological Park, Inland Bearded Dragon Fact Sheet*
Salmonella Cotham and Salmonella Kisarawe outbreak investigation
One Health

- One Health approach
  - Detection
  - Control
  - Prevention

- Integration of human, animal, and environmental health
Initial Notification
January 22, 2014

- **Wisconsin Division of Public Health**
  - 11 cases of *Salmonella* Cotham since January 2012
  - 10/11 (91%) reported bearded dragon exposure
  - Median age of 4 years

- **Five households purchased at pet retail chains**

- **Two infants linked to same bearded dragons**

- **Isolated from bearded dragon in case household**
Digging for Background

- **SEDRIC data on *Salmonella* Cotham**
  - 114 isolates uploaded to PulseNet since 2004
  - Median age 1 year old (<1 – 79)
  - Rare serotype

- **Temporal increase in isolates**
The Chase Continues…

- Isolated from lizards

**Prevalence and antimicrobial susceptibility of salmonellae isolates from reptiles in Taiwan**

Chun-Yu Chen, Wan-Ching Chen, Shih-Chien Chin, Yen-Hsueh Lai, Kwong-Chung Tung, Chien-Shun Chiou, Yuan-Man Hsu, Chao-Chin Chang

- Isolated from bearded dragon and 8 month old infant

**Evidence for the transmission of *Salmonella* from reptiles to children in Germany, July 2010 to October 2011**

M Pees (pees@vmf.uni-leipzig.de), W Rabsch, B Plenz, A Fruth, R Prager, S Simon, V Schmidt, S Münch, P G Braun

1. Clinic for Birds and Reptiles, University of Leipzig, An den Tierkliniken, Leipzig, Germany
2. National Reference Centre for Salmonella and other bacterial Enterics, Robert Koch Institute, Wernigerode, Germany
3. Institute of Food Hygiene, An den Tierkliniken, Leipzig, Germany
Laboratory Based Enteric Disease Surveillance (LEDS)

- **Human Salmonella isolates (1964 – 2014)**
  - 1,720,978 total
  - 221 (0.01%) Cotham
  - First isolate in 1994

- **Non-human Salmonella isolates (1968 – 2012)**
  - 542,986 total
  - Five (0.001%) Cotham
  - First isolate in 2000
  - Two from reptiles
An Outbreak is Born…

Case definition

- Diarrheal illness in a person
- Clinical specimen yielding *Salmonella* Cotham isolate
- All matching cases from January 1, 2012
International Scope

- **UK** – at least one case with bearded dragon exposure

- **Germany** – nine cases with information
  - 8/9 (89%) reptile exposure
  - 6/8 (75%) bearded dragons

- **Canada** – nine cases, four with information
  - 4/4 (100%) reptile exposure
  - 3/4 (75%) bearded dragons

- Mostly children and infants
Early Outbreak Description

- **133 cases of *Salmonella* Cotham**
  - Onset dates ranged from February 20, 2012 until March 17, 2014
  - 32 states
  - Median age 2 years (<1 – 79)
  - 52% female
  - 48 PFGE patterns

Source: www.foodpoisonjournal.com/
National Veterinary Services Laboratories (NVSL)

- One Health investigation

- Offer of assistance for specimen testing
  - *Salmonella* isolation
  - Serotyping
  - PFGE
  - Antimicrobial resistance testing
Traceback

Pet Industry Partnership
- Traceback
  - Primarily through Petco – halted sales in response
  - Limited from other retail chains
  - Purchase date ranges and store locations
- PIJAC – emergency alert issued
Supplemental Questionnaire

Bearded Dragon Colors

Standard Colors
Standard colors of bearded dragons are generally a mix of green, tan, yellow, and red colors. Most bearded dragons come in these shades and you generally only find solid colored bearded dragons from selective breeders.

Red
The following is a list of bearded dragons that have a mostly red appearance:

- Red bearded dragon
- Blood-red bearded dragon
- Ruby red bearded dragon

Red
Blood-Red

Section A. Background Information

1. Date of illness onset (MM/DD/YYYY): __ / __ / ______
2. Did your child have diarrhea (defined as 3 or more loose stools in a 24 h period) during this illness? Yes ☐ No ☐ DK ☐
   a. If YES, when did the diarrhea start (MM/DD/YYYY): __ / __ / ______
   b. If YES, did your child have bloody diarrhea? Yes ☐ No ☐ DK ☐
3. How many days did your child’s illness last? _____ days Illness Ongoing
4. Did your child take antimotics for your illness? Yes ☐ No ☐ DK ☐
5. Were you on antimotics for this illness? Yes ☐ No ☐ DK ☐
   a. If YES, how many nights were you on your child hospitalized? _____ nights
6. Did your child develop severe illness resulting from this infection (e.g. blood stream infection, brain infection, etc.)? Yes ☐ No ☐ DK ☐
   a. If yes, please describe:

Section B. Reptile Exposure Information

1. Did your child attend day care or school during the 7 days prior to illness onset? Yes ☐ No ☐ DK ☐ NA ☐
   a. Address:
2. Does your child’s school or day care keep pets in the classroom? Yes ☐ No ☐ DK ☐ NA ☐
   a. If yes, please list type(s) of pet (check all that apply):
      - Snake (please specify)
      - Lizard (please specify)
      - Turtle (please specify)
      - Rodent (please specify)
      - Bird (please specify)
      - Fish (please specify)
      - Other (please specify)
3. In the week prior to your child’s illness, did you have ANY contact with reptiles or their habitat (cage or enclosure), or were you in a location where reptiles were kept? (Reptile: snake, lizard, turtle, etc.)
   Yes ☐ No ☐ DK ☐
   a. If yes, please specify which contact occurred:
      - Reptile: Reptile Habitat
      - Both Pet and Reptile Habitat
   b. If your child had contact with a reptile, please specify which contact occurred:
      - Pet Reptile
      - Wild Reptile
      - Both Pet and Wild Reptile
   c. Please specify the type of contact (mark all that apply):
      - Contact with the reptile habitat (e.g. spoiled water, opening, closing, changing, the water)
      - Touched animal
      - Held animal
      - Fed animal
      - Kissed animal
      - Allowed animal to crawl or sit on lap
      - Allowed animal to crawl or sit on shoulders or head
      - Reptiles are kept in a home, classroom or other place where your child spent time
      - Other (please specify)

This section is for interviewees who had any REPTILE exposure. If the Interviewee did not have any reptile exposure, please skip to ‘Section E. Rodent Exposure Information’. Otherwise, please continue to question 3a.
Salmonella Kisarawe

- Bearded dragon serotype in separate investigation

- NVSL reported five from January 2012
  - All in bearded dragons

- WI identifies past isolates
  - Human case (2010) – household had three bearded dragons

- TX case patient bearded dragon
  - Isolated both *Salmonella Cotham* and *Salmonella Kisarawe*

Source: www.beardeddragon.org
Persons Infected with *Salmonella* Cotham or *Salmonella* Kisarawe, by Date of Illness Onset*

*n=166 includes reported and estimated dates as of July 21, 2014*
Persons infected with the outbreak strains of *Salmonella* Cotham or Kisaware, by state of residence, as of July 21, 2014 (n=166)
### Characteristics of Persons Infected with *Salmonella* Cotham and Kisarawe

<table>
<thead>
<tr>
<th>Demographics</th>
<th>#</th>
<th>n (range)</th>
<th>%</th>
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<tbody>
<tr>
<td>Age, median</td>
<td>3</td>
<td>(&lt;1 - 79)</td>
<td>n/a</td>
</tr>
<tr>
<td>Age, ≤5 years</td>
<td>93</td>
<td>165</td>
<td>56</td>
</tr>
<tr>
<td>Female</td>
<td>92</td>
<td>165</td>
<td>56</td>
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<table>
<thead>
<tr>
<th>Outcomes</th>
<th>#</th>
<th>n</th>
<th>%</th>
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<tr>
<td>Hospitalizations</td>
<td>44</td>
<td>118</td>
<td>37</td>
</tr>
<tr>
<td>Hospitalizations, ≤5 years</td>
<td>26</td>
<td>44</td>
<td>59</td>
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Characteristics of Persons Infected with *Salmonella* Cotham and Kisarawe

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<th>Exposures</th>
<th>#</th>
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<th>%</th>
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<tbody>
<tr>
<td>Any Reptile</td>
<td>86</td>
<td>104</td>
<td>83</td>
</tr>
<tr>
<td>Lizard</td>
<td>87</td>
<td>112</td>
<td>78</td>
</tr>
<tr>
<td>Bearded Dragon</td>
<td>71</td>
<td>94</td>
<td>76</td>
</tr>
<tr>
<td>Lizard and Bearded Dragon</td>
<td>71</td>
<td>74</td>
<td>96</td>
</tr>
</tbody>
</table>

*P* <0.001
Onsite Breeder Sampling
**Sampling Protocol**

- **Sample Types**
  - Bedding
  - Cloacal swab
  - Egg
  - Environmental swab
  - Droppings
  - Feed
  - Tissue
  - Water
# Sampling Results

<table>
<thead>
<tr>
<th>Sample Location</th>
<th># Pos</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breeder A</td>
<td>77</td>
<td>89</td>
<td>87</td>
</tr>
<tr>
<td>Breeder B</td>
<td>154</td>
<td>186</td>
<td>83</td>
</tr>
<tr>
<td>Breeder C</td>
<td>30</td>
<td>108</td>
<td>28</td>
</tr>
<tr>
<td>Retail A</td>
<td>59</td>
<td>71</td>
<td>83</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>320</td>
<td>454</td>
<td>71</td>
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## Sampling Results

<table>
<thead>
<tr>
<th>Sample Location</th>
<th>Cotham</th>
<th></th>
<th>Kisarawe</th>
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</thead>
<tbody>
<tr>
<td></td>
<td># Pos</td>
<td>%</td>
<td># Pos</td>
<td>%</td>
</tr>
<tr>
<td>Breeder A (n=89)</td>
<td>14</td>
<td>16</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Breeder B (n=141)</td>
<td>13</td>
<td>9</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Breeder C (n=108)</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Retail A (n=71)</td>
<td>17</td>
<td>24</td>
<td>6</td>
<td>9</td>
</tr>
<tr>
<td>Total (n=409)</td>
<td>46</td>
<td>11</td>
<td>23</td>
<td>6</td>
</tr>
<tr>
<td>Sample Type</td>
<td># Pos</td>
<td>n</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>-------</td>
<td>-----</td>
<td>----</td>
<td></td>
</tr>
<tr>
<td>Bedding</td>
<td>19</td>
<td>23</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td>Cloacal swab</td>
<td>12</td>
<td>42</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Egg</td>
<td>34</td>
<td>40</td>
<td>85</td>
<td></td>
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<tr>
<td>Environmental swab</td>
<td>128</td>
<td>167</td>
<td>77</td>
<td></td>
</tr>
<tr>
<td>Droppings</td>
<td>59</td>
<td>71</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td>Feed</td>
<td>5</td>
<td>19</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Tissue</td>
<td>59</td>
<td>71</td>
<td>83</td>
<td></td>
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<tr>
<td>Water</td>
<td>4</td>
<td>21</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>320</strong></td>
<td><strong>454</strong></td>
<td><strong>71</strong></td>
<td></td>
</tr>
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</table>
Recommendations for Stakeholders
One Health Approach to Zoonotic Salmonellosis Prevention and Control

- Industry
- Consumers
- Health professionals
Recommendations for Industry: Breeding Facilities

- Retain a veterinary consultant

- Biosecurity
  - Cleaning and disinfection
  - Personal protective equipment
  - Improved pest control
  - Improved husbandry
  - Employee workflow controls

- Critical control points
  - Egg incubation
  - Juvenile handling
  - Environmental controls

- Routine monitoring and evaluation

www.beardeddragon.org
Recommendations for Industry

- Strengthen the National Reptile Improvement Plan
  - Focus on Best Management Practices for breeders and retail
  - Include monitoring requirements
  - Increase industry education

- Increased consumer education
  - Point of sale
  - Specialty workshops
  - Retail educational materials
  - One Health - support public / private partnerships
Recommendations for Consumers

- Do not let reptiles roam in household

- Wash your hands right after
  - Touching reptiles
  - Contacting anything in the area where they live and roam
  - Cross-contamination

- Certain groups should not handle reptiles
  - Children younger than 5 years of age
  - Older adults
  - People with weak immune systems
Recommendations for Consumers

- Clean reptile equipment or materials outside the house

- Do not
  - Snuggle or kiss reptiles
  - Touch your mouth, eat, or drink around reptiles

- Avoid household environmental contamination
  - Do not let your reptile roam in the household

Source: www.beardeddragon.org
Love the Pets, Not the Germs: CDC Update on Enteric Zoonoses

Date: Thursday, July 17, 2014
Time: 2:00 – 3:00 PM (Eastern Time)

Presenter(s)

Kara Jacobs Slifka, MD, MPH
Epidemic Intelligence Service Officer
Division of Foodborne, Waterborne, and Environmental Diseases
National Center for Emerging & Zoonotic Infectious Diseases
Centers for Disease Control and Prevention

Colin Basler, DVM, MPH
Epidemic Intelligence Service Officer
Division of Foodborne, Waterborne, and Environmental Diseases
National Center for Emerging & Zoonotic Infectious Diseases
Centers for Disease Control and Prevention

How to protect patients, families from enteric zoonoses

by Karen P. Neil, M.D., M.S.P.H., FAAP

Pediatricians can alert children and their families to emerging issues they may not be aware of that can help prevent illness. One such issue is an increased number of enteric illness outbreaks detected by public health surveillance that are linked to pet ownership and animal contact.

Roughly 74 million U.S. households have one or more pets, according to the American Veterinary Medical Association. Pet ownership and other types of animal contact provide many benefits to people. However, certain animals are not appropriate pets for high-risk groups, including children under 5 years of age, immunocompromised persons, adults over 65 years of age.

Enteric illnesses such as Salmonella, Escherichia coli O157:H7 and Campylobacter are most commonly transmitted through contaminated food. However, these bacteria are among the many zoonotic pathogens that pets and other animals can spread to people. Illnesses and outbreaks of enteric zoonotic diseases (i.e., zoonoses) have been linked to exposure to many different kinds of animals in public and private settings (MMWR Recomm Rep. 2011;60(RR-04):1-234).

In addition to pet ownership, public venues such as animal exhibits, farms, stores, schools and child care facilities offer opportunities for children to contact animals. Petting zoos and backyard poultry flocks also are becoming increasingly popular.

While pets can provide many benefits, some animals can carry enteric zoonotic pathogens that can spread to people. Pediatricians have a role in educating patients and their families about the risks for contracting Salmonella infection associated with certain pets, including rodents such as mice, hamsters and guinea pigs.
Gastrointestinal (Enteric) Diseases from Animals

Animals provide many benefits to people. However, some animals can carry diseases that can be shared with people. Zoonotic diseases or zoonoses are diseases caused by germs (pathogens) that can be spread between animals and humans. Many germs have been responsible for illnesses and outbreaks, including Salmonella, E. coli 0157:H7, and Cryptosporidium. These germs can come from many types of animals, including pets, wild animals, and farm animals. Did you know that infected animals can make you sick, even if they appear healthy and clean?

Zoonotic diseases can cause many different illnesses in people. Gastrointestinal (enteric) zoonoses are one type of illness that can upset the digestive system (stomach and intestines) and can make people sick.

**Outbreaks**
Selected Multistate Outbreak Investigations Linked To Animals and Animal Products

**Animals**
Information for Selected Animals and Animal Products

**Places**
Information about Common Places Germs Are Spread

**Education**
Educational Materials and Other Resources
Conclusions

- Human salmonellosis associated with pet reptiles is an important and preventable public health issue
  - Serious human illness
  - Young children, people with weakened immune systems, seniors at higher risk for serious illness

- Prevention and control depends on a One Health approach

- Interventions at breeding facilities and retail stores to reduce human illnesses

- Industry actions and public education critical for improvements
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  - Jeffrey Davis

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  - Elizabeth Roberts
  - Vi Peralta
  - Curtis Fritz
  - Annie Kao
  - Ernie Awa
  - Nikos Gurfield
  - Mark Lundberg
  - Linda Lewis
  - Kiyomi Bird

- **Multiple state and local health departments**
  - Multiple state departments of agriculture

- **Pet Industry**
  - Tom Edling
  - Petco
  - Pet Industry Joint Advisory Council (PIJAC)
  - Multiple bearded dragon breeders

- **European Centre for Disease Prevention and Control**
  - Public Health Agency of Canada
  - U.S. Fish & Wildlife Service

**Institutions**

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  - Casey Barton Behravesh
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  - Ian Williams
  - Rob Tauxe
  - Chris Braden
  - EDLB
  - PulseNet
  - NARMS
  - DFWED
  - PulseNet
  - USDA-APHIS
  - Thomas Gomez
  - NVSL
  - Matthew Erdman
  - Linda Schlater
  - Kristina Lantz
  - Naval Medical Research Unit-6
  - Luis Lugo

**Persons**

- Casey Barton Behravesh
- Craig Kiebler
- LaToya Simmons
- Colin Basler
- Patrick Ayscue
- Laura Burnworth
- Kate Heiman
- Matt Wise
- Ian Williams
- Rob Tauxe
- Chris Braden
- EDLB
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Thank You

For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA  30333
Telephone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348
E-mail: cdcinfo@cdc.gov  Web: http://www.cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.
### Supplemental Questionnaire results of Persons Infected with *Salmonella* Cotham and Kisarawe

<table>
<thead>
<tr>
<th>Reptile Ownership</th>
<th>#</th>
<th>n</th>
<th>%</th>
</tr>
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<tbody>
<tr>
<td>Owned reptile previously</td>
<td>15</td>
<td>22</td>
<td>68</td>
</tr>
<tr>
<td>Lizard ownership &gt;1 year</td>
<td>13</td>
<td>14</td>
<td>93</td>
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<tr>
<td>Reptile and <em>Salmonella</em> awareness</td>
<td>23</td>
<td>32</td>
<td>72</td>
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</table>

<table>
<thead>
<tr>
<th>Husbandry</th>
<th>#</th>
<th>n</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>Bearded dragon roams outside its enclosure</td>
<td>8</td>
<td>29</td>
<td>28</td>
</tr>
<tr>
<td>Bearded dragon ill w/in 2 weeks prior to patient illness</td>
<td>1</td>
<td>29</td>
<td>3</td>
</tr>
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Reptile Industry

- U.S. reptile exports and imports (Jan 2009 – Apr 2014)
  - Shipments: 82,142
  - Reptiles: 51,119,380

Source: https://www.beardeddragon.org
U.S. Bearded Dragon Industry

- U.S. Bearded Dragon Exports and Imports (Jan 2009 – Apr 2014)
  - Shipments: 1,417
  - Dragons: 259,967

• U.S. Fish & Wildlife Service - LEMIS
Antimicrobial Susceptibility Testing (AST)

- Wisconsin Division of Public Health
  - Single isolate resistant to 11 different antimicrobials
  - Confirmed by CDC/NARMS
  - Ceftriaxone resistant
  - 5 month old patient

- Additional NARMS AST Results
  - 10 human isolates from 7 states pan-susceptible
  - 2 bearded dragon isolates pan-susceptible
Sampling Scope

- Direct sampling at **Breeders A, B, C**

- **Breeder A**
  - Receives hatchlings for grow-out from **Breeder B**
  - Bearded dragons purchased from **Breeder D**
    - Isolated from rest of stock
    - Cannot rule out cross-contamination
  - Indirect sampling of **Breeder B and Breeder D**

- **Retail Store A**
  - Bearded dragons from stores in 33 states

- All testing conducted by **NVSL using standard methodology**
  - Some samples were not serotyped
  - No appreciable antimicrobial resistance
Sampling Protocol

- CDC has no approved reptile sampling protocol

- Guidelines developed through CDC, NVSL, and state collaboration

- Naval Medical Research Unit (NAMRU-6)
  - Lima, Peru
  - All sampling at Breeder B

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**RECOMMENDED GUIDELINES FOR COLLECTING SPECIMEN FOR CULTURE FROM REPTILES DURING SALMONELLOSIS INVESTIGATIONS**

April 2014

Contact your local public health laboratory, Environmental Health, and/or Veterinary Health section before collecting and submitting specimens so they can provide you with specific information on the services they offer as well as specimen collection, storage, and shipment guidelines that may pertain to your particular investigation.

**Recommended specimens to collect (testing of the environment has the best yield):**
- Swabs of reptile environment including (but not limited to) water dishes, food dishes, bedding material, gravel or other bedding at bottom of tank, inside surfaces of enclosure such as side walls and surfaces beneath bedding
- Swabs of reptile’s body (cloacal area, skin, mouth)
- Stool specimens from each reptile or combined fecal samples from enclosure with multiple animals
- Swabs of any containers that held or transported reptile food (feeder insects, crickets, worms, etc.)
- Reptile food specimens (pellets, feeder insects, crickets, worms, etc.)
- Dry material (sand, soil, bedding material)

**General Guidance for Collection of Reptile Specimens:**

1. Collection Supplies (ideally do not reuse any materials present in the household)
   a. Gloves and autoclave bag for depositing of contaminated waste (gloves and tongue depressors)
   b. Ice chest and frozen ice packs
   c. Swabs
      i. Sterile water or saline or pH 7.0 buffer or transport medium (Carol Blair) or sterile broth medium such as peptone, TSB, skim milk
      ii. Alternatives for swabbing
         1. Sterile cotton- or polyester-tipped swabs and sterile screw capped tubes or tubes of transport medium
         2. Gauze squares and Whirl-Pak bags or zip-lock bags for larger surfaces
         3. Sterile sponges (Spongi-Sponges for larger surface areas)
            [http://www.fsboresci.com/scomm/servlet/productDetail_10662_772518_1.0]
   d. Fecal specimens or animal bedding or dry food – alternatives for collection
      i. Tongue depressors for scooping up material (e.g., pinch, new, never-used plastic spoons can be used as long as these are not from household being sampled)
      ii. Whirl-Pak or zip-lock bags or new, never-used plastic food containers (Tupperware type)
   e. Water Collection Alternatives (at least 100 ml volume)
      i. Sterile or new/never-used plastic wide mouth bottles (ideally)
      ii. On a new plastic container that has never been used because it is not likely to be contaminated with salmonella
      iii. Whirl-Pak bags (double bag)
      iv. Urine collection containers
      v. Conical Centrifuge Tubes (50 ml)
      vi. Drinking water bottles (new and never opened) of purified drinking water (unchlorinated) such as Aquafina (pour out water first)
      vii. Never used (not contaminated with chlorine) water bottles from a pool supply store for testing water

2. Swabs of the reptile environment, especially in areas where fecal material may be concentrated, should be taken. Wet surfaces are best to culture. Thoroughly wet the swab by rolling it along the surface you are culturing. Limit excessive amounts of organic matter or debris on the swab as this can cause false negatives.

3. For large enclosures, such as reptile breeding facilities, swabs may be taken from the bottom of shoes worn at the site, or any object that had contact with the enclosure’s ground, such as wagon