Salmonellosis

Salmonellosis *is a Class B Disease and must be reported to the state within one business day.*

Salmonellosis is an infection caused by Gram-negative bacteria in the genus *Salmonella.* As of 2004, more than 2500 serovars of *Salmonella* have been described; some of these are pathogenic for both animals and humans. The primary habitats of *Salmonella* are the intestinal tracts of mammals (cattle, swine, rodents, dogs and cats), birds (poultry), reptiles (lizards, iguanas and turtles), amphibians (frogs and toads), and insects. The majority of *Salmonella* organisms have a wide range of possible hosts.

Epidemiology

The main mode of transmission of *Salmonell*a is ingestion of bacteria from contaminated food or water. Direct contact with animals and human carriers has also been implicated. The most frequent sources of *Salmonella* infection are contaminated poultry, eggs, meat, dairy products, fruits and vegetables. Up to 90% of *Salmonella* infections in the U.S. are food-borne in origin. Typical food-borne transmission is the result of two events: first, contamination of the food product; second, improper handling of the food that that fosters sufficient bacterial growth to reach an infectious dose.

Direct contact with infected animals is a route of transmission in some cases. In recent years, there have been several multi-state outbreaks linked to pet turtles and backyard flocks of chickens and ducks. Pet bearded dragons, lizards, snakes, salamanders and other reptiles as well as aquarium fish have also been responsible for several cases. Pet birds may also be a source.

Neonates are at a greater risk for fecal-oral transmission secondary to achlorhydria (absence of gastric acid) or lower levels of gastric acid secondary to consumption of large quantities of milk or formula with characteristically strong buffering properties. A mother who has not properly washed her hands may deliver a low dose of *Salmonell*a to the baby; this low dose could survive stomach passage and cause infection.

Food handlers who are infected with *Salmonella* may contaminate foods they prepare when they do not wash hands after using the restroom. Some food-borne outbreaks have involved food handlers who were infected with *Salmonella* and who prepared the food while ill with the bacteria; however, most were probably infected from contact with the food rather than being the source of the bacteria that precipitated the outbreak. In fact, routine surveillance has recorded very few cases among food handlers.

Incidence

In the U.S., an estimated 1.2 million people are infected with non-typhoid *Salmonella* annually.

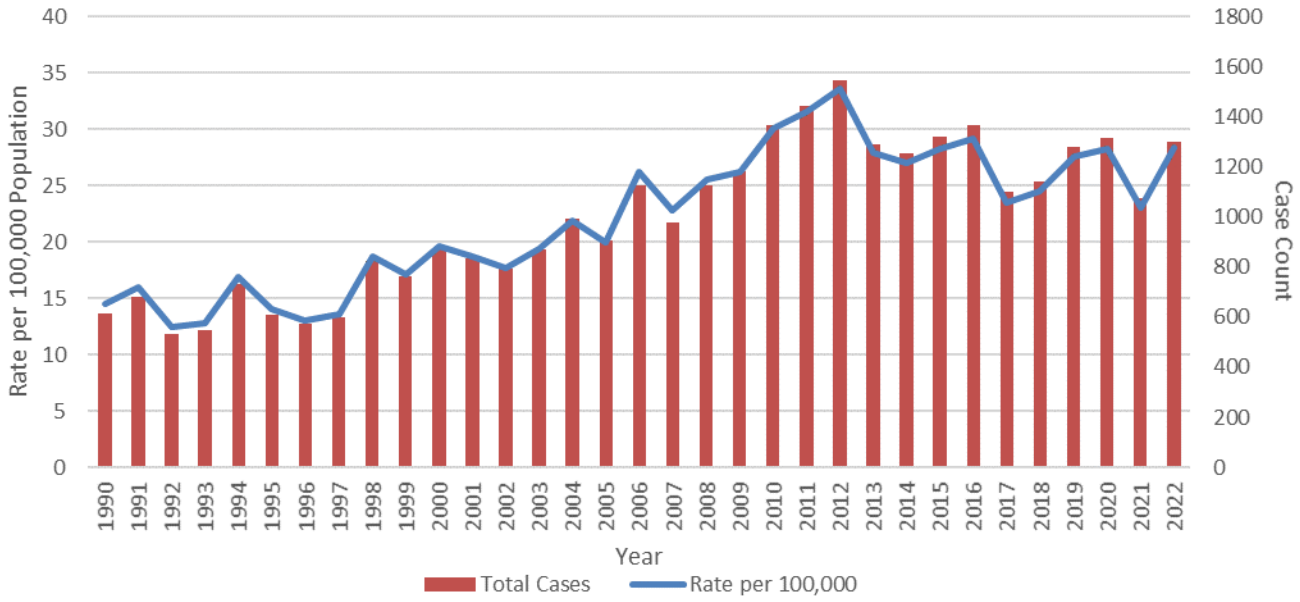
According to FoodNet data, incidence rates for *Salmonella* (2017) in the U.S. are as follows:

- The incidence rate reported among all age groups combined was 16.01 cases per 100,000 population.

- The highest incidence rate reported was among children younger than five years of age and was 59.03 cases per 100,000 population in 2017.
- Based on Centers for Disease Control and Prevention (CDC) estimates, there are about 20,500 cases of Salmonella infections occurring every year in Louisiana, with 95% caused by food-borne transmission (about 20,000 cases). Of these estimated 20,500 cases, only 1,500 are reported. There are approximately 350 *Salmonella* related hospitalizations annually, and between five and ten deaths.

Increases in the rate of *Salmonella* cases observed in the late 1980s occurred among infants, adolescents and older populations. The impression is that these increases are the result of improved reporting, since a similar increase was observed for Shigellosis, a disease with a different epidemiological pattern (Figure 1).

Figure 1: *Salmonella* Cases and Incidence Rates - Louisiana, 1990-2022



Age Distribution

Salmonella isolate submission is most common for cases in infants, newborn to one-year of age, and in children, one to five-years old. The high rate of identification in these young age groups may result from prompt seeking of medical care when symptoms become evident among infants and young children, and more frequent submission of stool cultures from children during investigations of diarrheal illnesses (Figure 2). These practices result in over-sampling of children. Most *Salmonella* infections in children occur outside of child-care environments, with only 1.1% of cases among infants and children being associated with a day care. There are no gender differences in disease occurrence (Figure 3).

Figure 2: *Salmonella* Incidence Rates by Age - Louisiana, 1990-2022

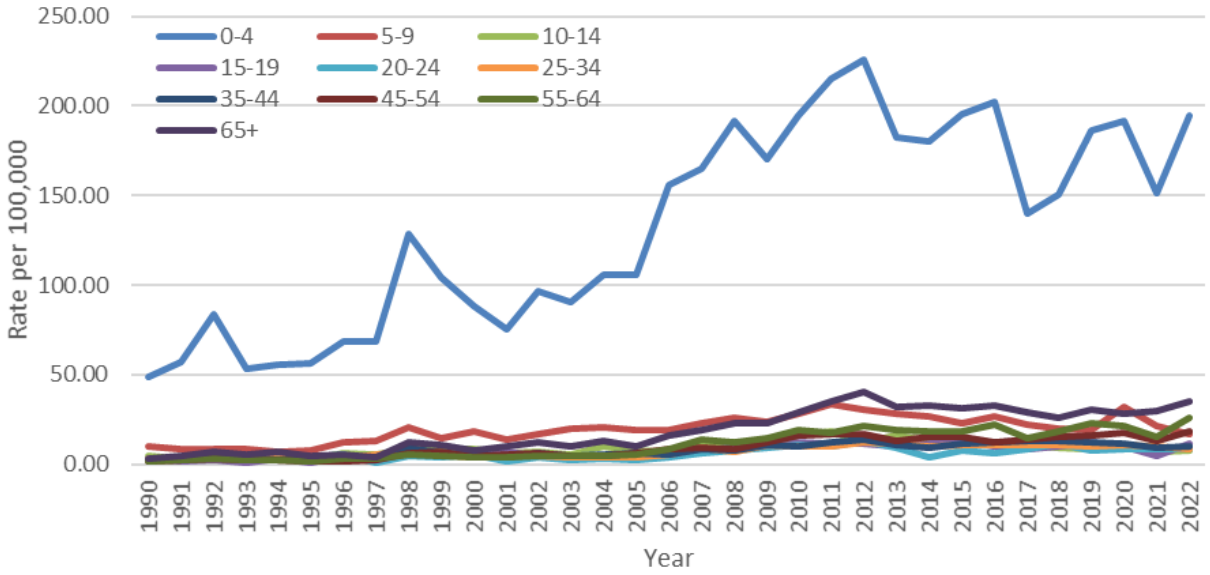
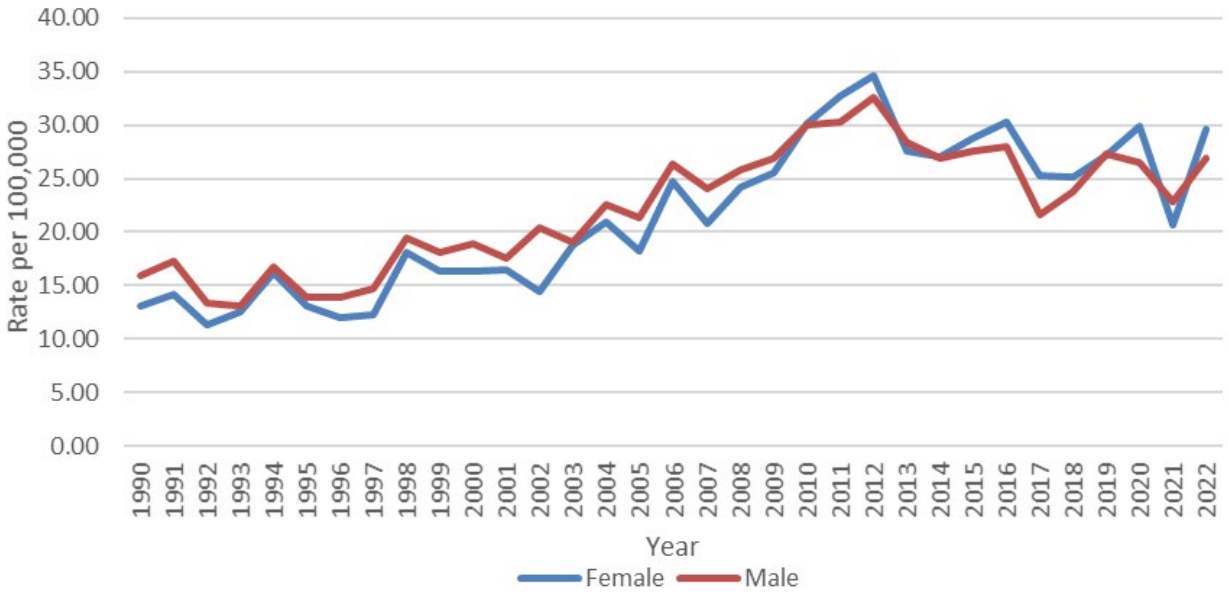


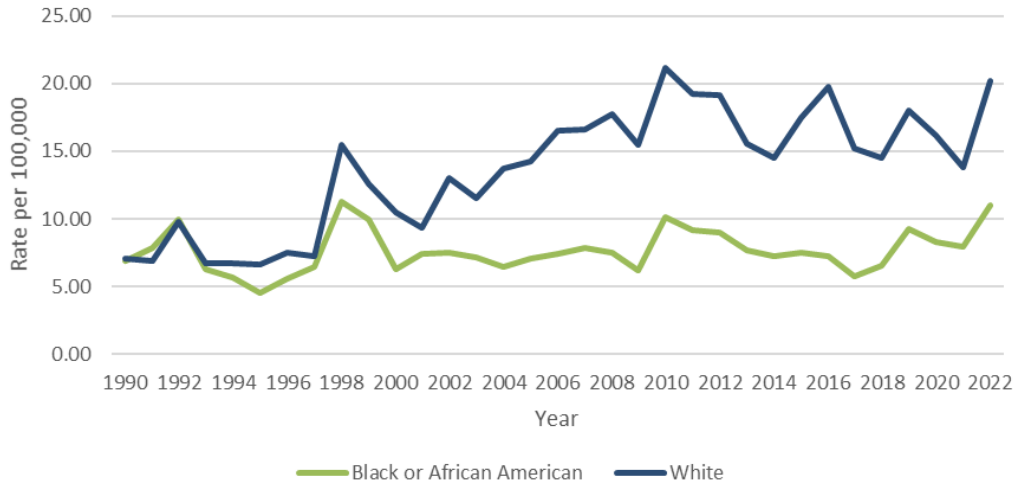
Figure 3: *Salmonella* Average Incidence Rates by Gender - Louisiana, 1990-2022



Race Distribution

White individuals have higher reported rates of *Salmonella* infection than Black or African-American individuals (Figure 4).

Figure 4: *Salmonella* average incidence rates by age and race – Louisiana, 1990-2022



The increases in reported *Salmonella* cases observed throughout the 1990s that have occurred particularly among infants may be explained by greater access to medical care.

Geographical Distribution

The geographic distribution of *Salmonella* reflects reporting practices rather than true differences in incidence. For example, because several parishes are served by medical facilities that are more apt to culture and report *Salmonella*. The rates in these areas are consistently high. (Table 1).

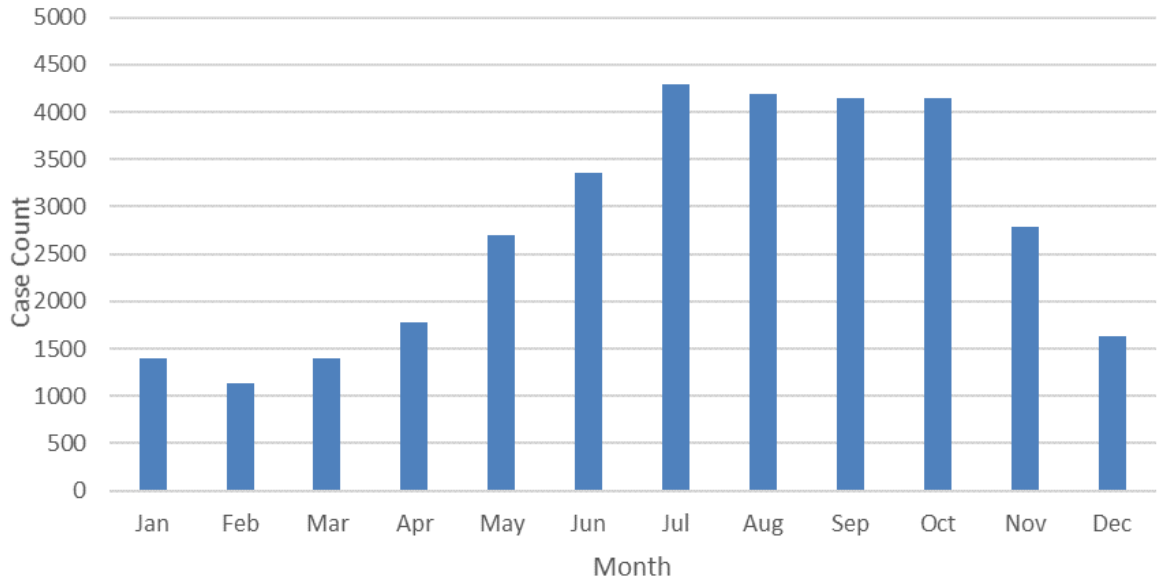
Table 1: *Salmonella* average incidence rates by parish - Louisiana, 2013-2022

Parish	Avg. Inc.	Parish	Avg. Inc.
Acadia	53.54	Madison	9.13
Allen	25.08	Morehouse	37.39
Ascension	30.74	Natchitoches	16.18
Assumption	28.51	Orleans	14.27
Avoyelles	28.76	Ouachita	35.17
Beauregard	29.94	Plaquemines	22.33
Bienville	24.63	Pointe Coupee	29.62
Bossier	21.84	Rapides	25.21
Caddo	20.40	Red river	19.24
Calcasieu	36.94	Richland	37.91
Caldwell	156.09	Sabine	21.31
Cameron	20.41	St Bernard	12.84
Catahoula	59.70	St Charles	26.10
Claiborne	5.81	St Helena	12.33
Concordia	24.10	St James	23.44
De Soto	21.02	St John	54.45
East Baton Rouge	21.06	St Landry	19.41
East Carroll	27.74	St Martin	23.61
East Feliciana	25.75	St Mary	174.12
Evangeline	30.11	St Tammany	3.19
Franklin	44.80	Tangipahoa	24.65
Grant	37.26	Tensas	35.85
Iberia	26.04	Terrebonne	34.25
Iberville	21.55	Union	25.95
Jackson	42.24	Vermilion	42.06
Jefferson	19.94	Vernon	19.28
Jefferson Davis	36.33	Washington	44.73
LaSalle	2.90	Webster	26.17
Lafayette	103.72	West Baton Rouge	28.10
Lafourche	191.62	West Carroll	34.58
Lincoln	30.50	West Feliciana	27.24
Livingston	23.86	Winn	20.47

Seasonal Pattern

There is a clear seasonal pattern in the occurrence of *Salmonella* infection with a peak from summer through fall (Figure 5). Better growth of *Salmonella* at higher temperatures leads to higher concentrations of *Salmonella* in the food supply in the warmer months. Inadequate cooking practices are also more common during these months (picnics, barbecues). This seasonal distribution is observed throughout all age groups.

Figure 5: *Salmonella* Average Rates by Month - Louisiana, 1990-2022



Serotypes

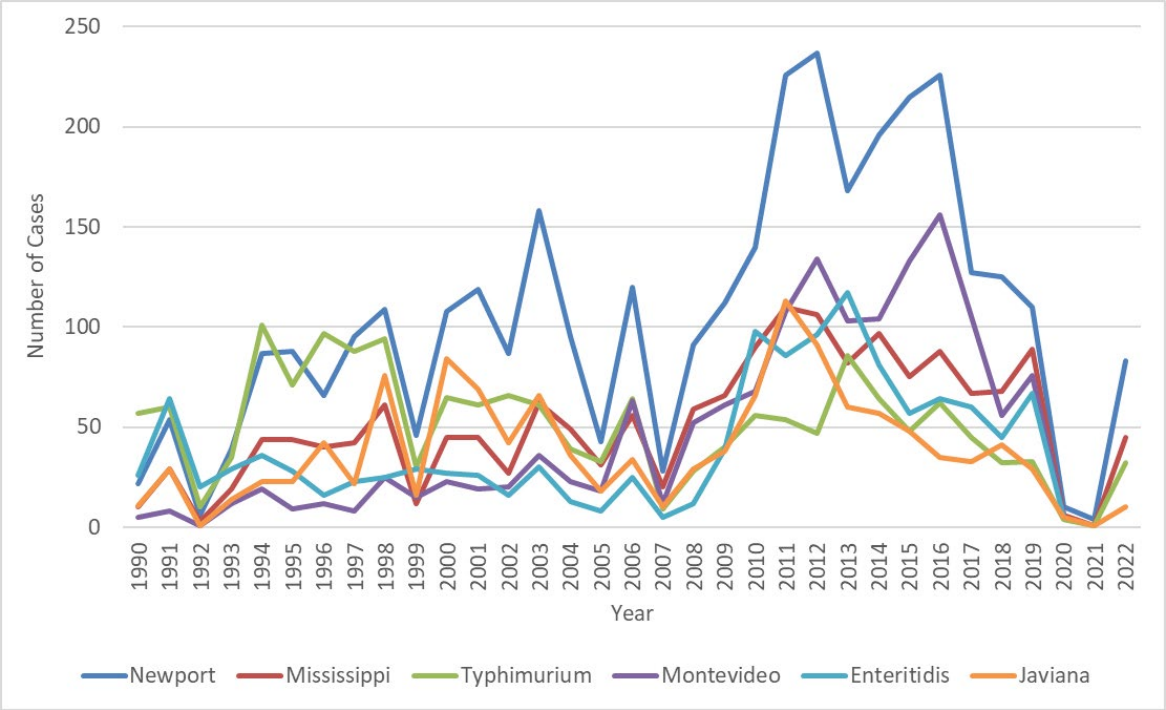
The CDC adopted the Kaufmann-White Scheme for designation of *Salmonella* serotypes on January 1, 2003. The genus *Salmonella* (family – Enterobacteriaceae) is divided into two species, *Salmonella enterica* and *Salmonella bongori*. *Salmonella enterica* is further subdivided into six subspecies that are designated by names or Roman numerals. Under the Kauffmann-White Scheme, subspecies I serotypes are named; subspecies II through VI serotypes are identified by formula. *Salmonella enterica* subspecies I includes the majority of serotypes that can infect humans. Within *S. enterica* there are over 2,500 serotypes based on analysis of the somatic antigen (O) and flagellar antigen (H). Each serotype is given a name, for example, *S. enterica* serotype Typhimurium, is often abbreviated as *S. typhimurium*. Of the more than 2,500 serotypes, some 200 can infect humans. The most common serotypes cultured in Louisiana for the period 1990 to 2023 are presented in Table 2.

Table 2: *Salmonella* Common Serotypes - Louisiana, 1990– 2023

Serotype	Total
Newport	3440
Mississippi	1688
Typhimurium	1673
Montevideo	1532
Enteritidis	1320
Javiana	1272
Muenchen	715
Give	469
Heidelberg	417
Braenderup	390
Infantis	363
Bareilly	354
Rubislaw	350
Gaminara	347
Oranienburg	290
Thompson	246
Anatum	217
Hvittingfoss	163
Saintpaul	158
Lichtfield	127
Agona	116
Hadar	103

Salmonella Newport, *S.* Enteritidis, *S.* Javiana, *S.* Mississippi, and *S.* Montevideo are increasing in numbers. During the COVID-19 outbreak, there has been a decrease in reporting of non-COVID diseases due to individuals being less likely to seek care for non-COVID illnesses, providers testing for fewer diseases, and many individuals not congregating or being exposed to other illnesses in general (Figure 6).

Figure 6: *Salmonella* trends – Serotype Isolates in Reported Cases - Louisiana, 1990-2022



With the exception of *Salmonella* Typhimurium, all serotypes show the same seasonal distribution (higher numbers in the summer and autumn). *S.* Typhimurium, however, remains more constant throughout the year.

There have been clusters among rare serotypes: *Salmonella* Adelaide from 1999 to 2002, *S.* Brandeburg in 1994, and more recently *S.* Hvittingfoss from 2011 to 2015, *S.* Inverness and *S.* Uganda from 2012 to 2014, *S.* Johannesburg, *S.* Urbana, *S.* Poona from 2011 to 2012.

Serotype Uganda Outbreak Investigation

Salmonella enterica serotype Uganda is a rare serotype locally and nationally. Nationwide, the only previously published *Salmonella* Uganda outbreak was in 2001, involving cases associated with consuming pork products. In Louisiana, no cases of *Salmonella* Uganda were reported in the state from 2007 through 2011.

Between the end of October and the beginning of December 2012, six cases of *Salmonella* Uganda were confirmed by the Louisiana Department of Health (LDH) Public Health Laboratory and were found to have matching Pulse Field Gel Electrophoresis (PFGE) patterns. A seventh case was reported at the end of February 2013. The average age of the cases was 73 years with a range of 58 to 87 years; the majority of the cases were male (57%). Illness onset dates ranged from mid-October to mid-January. Seventy-one percent of the cases were hospitalized with no

deaths reported. The cases resided in LDH Regions* 2 (14%), 4 (43%), 5 (29%), and 7 (14%). During the initial investigation, no cases were reported in other states.

All cases were interviewed to assess for exposures using a standardized questionnaire which asked about all food exposures prior to illness onset. No food item was reported being eaten by more than one case. Based on the demographics, location of the cases, and the past outbreak involving pork products, a hypothesis was generated that suggested the source of the *Salmonella* was a regional meat-based food item. All cases were re-interviewed using a questionnaire that focused on meat-based food items popular in Louisiana; all seven cases reported consuming hog head cheese in the seven days prior to illness onset. Five of the seven cases reported consuming Brand A hog head cheese. No other food items were reported being eaten by more than one case.

Four intact packages of Brand A hog head cheese were purchased from a grocery store and were tested for *Salmonella* at the state laboratory. *Salmonella* was not detected in these four packages.

Brand A hog head cheese is produced in an out-of-state facility that is inspected by the United States Department of Agriculture (USDA). USDA was notified of the illnesses possibly associated with consumption of Brand A hog head cheese; as a result, the facility was inspected and their procedures were reviewed. Product testing at an independent laboratory found *Salmonella* in four of nine packages of Brand A hog head cheese. These findings resulted in the recall of 4,700 pounds of hog head cheese.

Figure 7: Louisiana Department of Health Regional Map

2017 Caldwell Parish Outbreak

In October of 2017, the Louisiana Office of Public Health investigated a Salmonella outbreak in Caldwell Parish in Region 8 resulting in 118 cases of salmonellosis. Caldwell is one of the lowest populated parishes in the state, with an estimated 10,600 residents in 2017. The high number of cases related to this outbreak combined with the low population, partially explain the high rate of cases in Caldwell Parish presented in figure 8.

Geography and Reporting

While the overall number of cases and rates by parish have increased, this is likely just an increase in detection of disease and reporting statewide. The geographic distribution of cases has remained relatively consistent over time (Figure 8).

Figure 8: *Salmonella* Average Incidence Rate (Cases per 100,000 Population)
Louisiana, 2013-2022