Vibrios

Cholera is a Class A Disease and must be reported to the state within 24 hours by calling the phone number listed on the web page.

Non-cholera Vibrio infections are Class C Diseases and must be reported to the state within five business days. All Vibrio cultures should be sent to the State Public Health Laboratory for confirmation.

Epidemiology

All *Vibrio* species infections were added to the list of nationally notifiable diseases in January, 2007. *Vibrios* are Gram-negative, curved, rod-shaped bacteria that are natural inhabitants of the marine environment. In the United States, the transmission of *Vibrio* infection is primarily through the consumption of raw or under-cooked shellfish or by exposure of wounds to warm seawater or seafood drippings.

The most common clinical presentation of *Vibrio* infection is self-limited gastroenteritis. Historically, many cases of *Vibrio*-associated gastroenteritis have been under-recognized. This is because most clinical laboratories do not routinely use the selective medium, thiosulfate-citrate-bile-salts-sucrose (TCBS) agar, for processing of stool specimens unless they are specifically requested to do so. However, the recent increase in the use of culture-independent diagnostic tests (CIDT) has led to an increase in diagnosed and reported cases.

Wound infections and primary septicemia also occur, particularly for *Vibrio vulnificus*. Patients with liver disease and those who are immunocompromised are at a particularly high risk for significant morbidity and mortality associated with these infections. Early detection and initiation of treatment is very important, particularly for cholera and invasive *Vibrio* infections, because these infections may rapidly progress to death. According to the Centers for Disease Control and Prevention (CDC), about one in four people with serious *V. vulnificus* infections die, as quickly as within a day or two of illness onset. Each year there is an average of 50 culture-confirmed *V. vulnificus* cases, 45 hospitalizations, and 16 deaths reported from the Gulf Coast states (Alabama, Florida, Louisiana, Mississippi and Texas). There are as many as 95 cases nationwide (only half are culture-confirmed), 85 hospitalizations and 35 deaths.

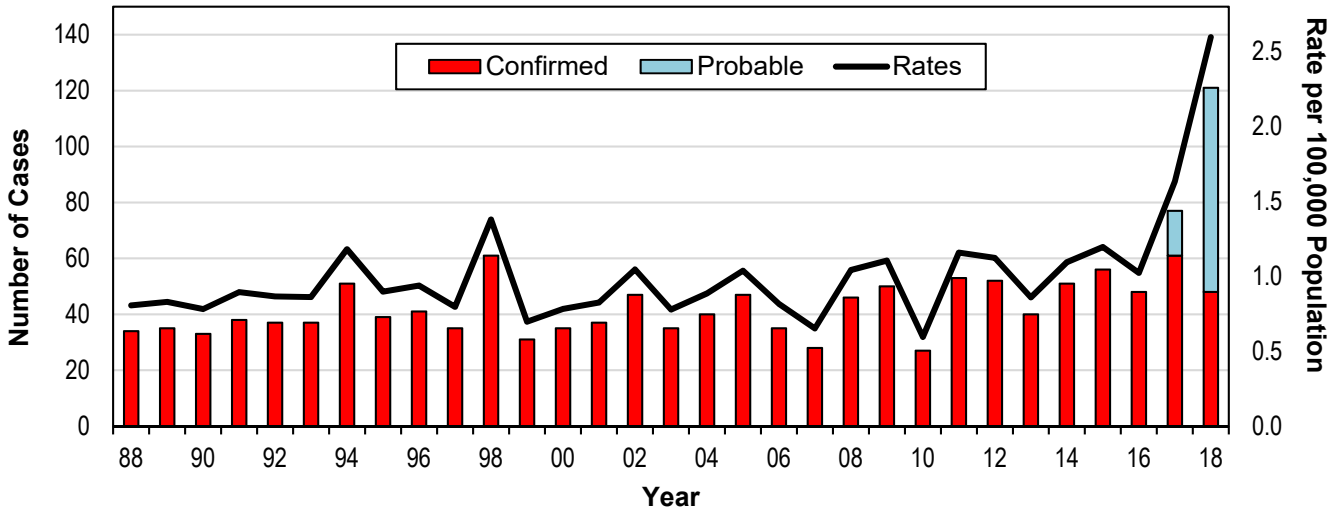
The most commonly reported species is *Vibrio parahaemolyticus.* According to the CDC, there is an average of 215 culture-confirmed *V. parahaemolyticus* cases, 30 hospitalizations, and one to two deaths reported each year nationwide. They estimate the true number of cases a year to be 45,000.

According to the CDC's FoodNet, in 2017 there were 240 culture-confirmed cases of *Vibrio* in 2017 nationwide, and 100 cases of non-culture-confirmed cases, which is 0.69 cases per 100,000 population. Of the culture-confirmed cases, 45% were *V. parahaemolyticus*, 28% were hospitalized, 4% died, 3% were associated with an outbreak, and 8% were associated with international travel.

Incidence

Until 2017, the number of reported *Vibrio* infections remained fairly stable over 20 years, ranging from 20 to 60 cases per year (Figure 1). However, due to an increase in the use of non-culture tests (culture independent diagnostic tests, or CIDTs), which are much more sensitive than culture tests and provide rapid results, there has been a marked increase in reported cases. These CIDT cases are classified as "probable" cases, as opposed to culture "confirmed" cases.

Figure 1: Cases and incidence rates - Louisiana, 1988-2018



There are several species of Vibrios, some increasing in reported numbers over time and others decreasing in numbers. The most common *Vibrio* species observed in reported cases in Louisiana is *V. vulnificus* (25%), followed by *V. parahaemolyticus* (22%), *V. cholerae non O1* (16%), and all other *Vibrios*. (All other *Vibrios* include *V. alginolyticus*, *V. damsela*, *V. fluvialis*, *V. hollisae* and *V. mimicus*). *Vibrio cholerae 01* accounts for approximately 3% of total *Vibrio* cases (Table 1).

Table 1: *Vibrio* species distribution - Louisiana, 1988-2018

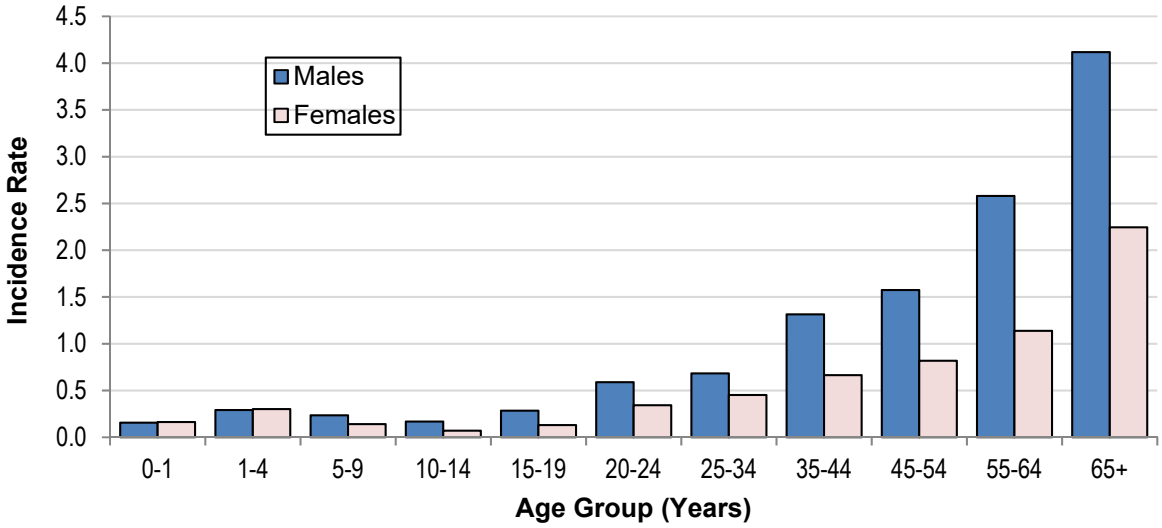
Species	Total 1988-1997	Total 1998-2007	Total 2008-2017	2018	Total
Vibrio cholerae	**8**	**20**	**14**	**3**	**45**
• *cholerae* O1	8	19	6	3	36
• *cholerae* O139	0	0	1	0	1
• *cholerae* O141	0	1	2	0	3
• *cholerae* O75	0	0	5	0	5
***Vibrio* Other**	**215**	**132**	**258**	**95**	**700**
• *alginolyticus*	14	10	12	0	36
• *cholerae* Non-O1 Non-O139	71	58	87	7	223
• *damsela*	4	2	1	0	7
• *fluvialis*	22	20	63	8	113
• *furnisii*	0	0	2	1	3
• *hollisae*	10	9	12	0	31
• *metschinikovii*	0	0	1	0	1
• *mimicus*	34	25	56	3	118
• Multiple	10	0	0	1	11
• Species Not Identified	50	8	24	22	104
• *cholerae* unspecified (CIDT *Vc*)				52	52
Vibrio parahaemolyticus	**80**	**109**	**100**	**12**	**301**
Vibrio vulnificus	**77**	**135**	**128**	**11**	**351**

Age, Gender, and Race Distribution

Since the distribution is similar for all *Vibrio* cases, the following discussion describes all *Vibrio* species combined.

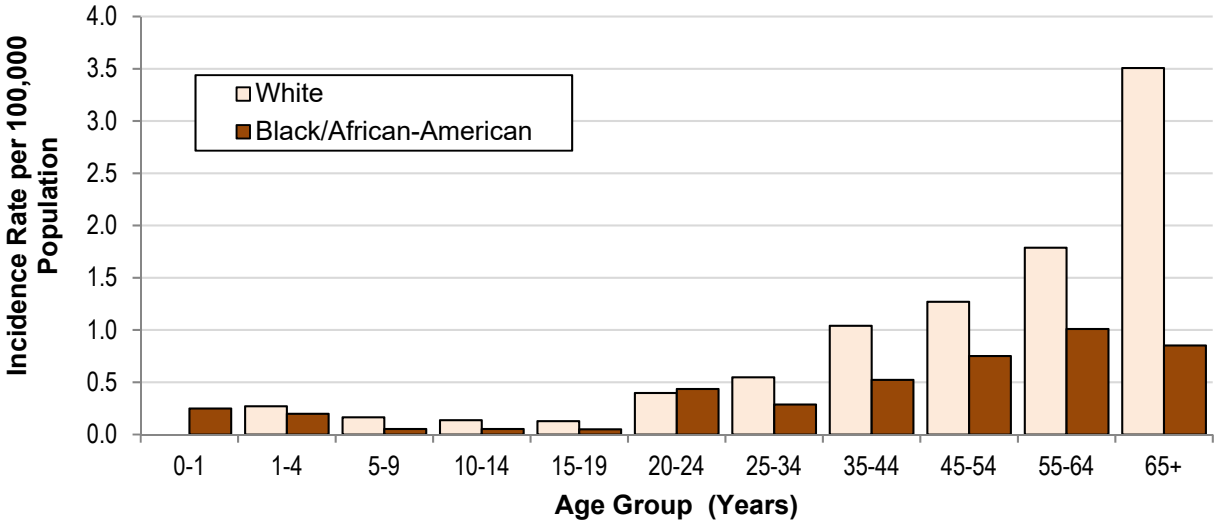
The age group distribution shows an increase in *Vibrio* cases in older age groups. This is an expected finding since adults and older people are more often in contact with seawater, and are the most common consumers of raw seafood (Figure 2).

Figure 2: *Vibrio* annual incidence rates by gender and age - Louisiana, 2000-2018



The race distribution shows a predominance of *Vibrio* infection among whites in the oldest age group (Figure 3).

Figure 3: *Vibrio* annual incidence rates by race and age - Louisiana, 2000-2018



Geographical Distribution

The geographical distribution of *Vibrio* cases shows the highest concentrations in southern Louisiana and the large cities. This is possibly due to easy access to fresh seafood, proximity to beaches, and water activity. This distribution reflects the cultural patterns of raw seafood consumption. The parishes with the five highest rates are highlighted below (Table 2).

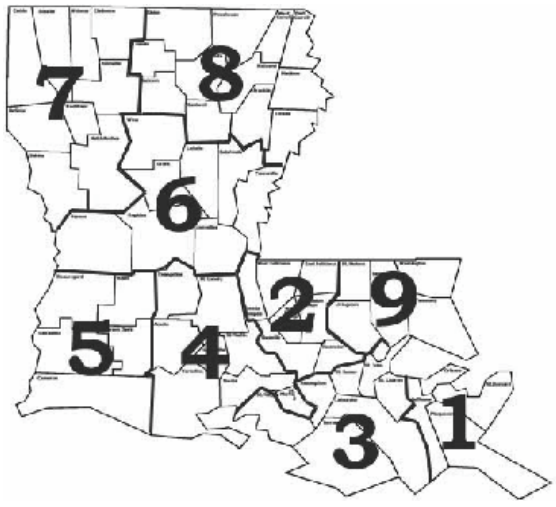
Table 2: *Vibrio* cases per Region (Figure 4) and Parish - Louisiana, 1988-2018

Region	Parish	Cases 1988-1997	Cases 1998-2007	Cases 2008-2017	Cases 2018*	Incidence 1988-2018
4	Acadia	3	4	4	<5	0.70
5	Allen	1	0	1	0	0.26
2	Ascension	4	2	10	<5	0.69
3	Assumption	1	2	3	<5	0.96
6	Avoyelles	1	1	1	0	0.23
5	Beauregard	0	0	3	<5	0.38
7	Bienville	0	1	0	0	0.21
7	Bossier	0	2	4	0	0.19
7	Caddo	3	4	2	0	0.11
5	Calcasieu	9	10	22	13	0.94
8	Caldwell	0	0	1	0	0.31
5	Cameron	2	2	0	<5	1.93
6	Catahoula	0	0	0	0	0.00
7	Claiborne	0	0	0	0	0.00
6	Concordia	0	0	1	0	0.15
7	De Soto	0	0	1	0	0.12
2	East Baton Rouge	15	16	31	29	0.70
8	East Carroll	0	0	0	0	0.00
2	East Feliciana	1	0	3	8	1.87
4	Evangeline	0	0	0	0	0.00
8	Franklin	1	0	0	0	0.15
6	Grant	0	1	0	0	0.16
4	Iberia	10	7	10	<5	1.23
2	Iberville	1	1	5	<5	0.89
8	Jackson	0	2	0	0	0.40
1	Jefferson	88	55	50	6	1.42
5	Jefferson Davis	0	0	3	0	0.30
6	La Salle	0	0	0	0	0.00
4	Lafayette	8	27	37	0	1.20
3	La Fourche	15	37	22	<5	2.66
8	Lincoln	2	0	0	0	0.15
9	Livingston	0	7	14	6	0.87
8	Madison	0	0	1	0	0.25
8	Morehouse	0	1	0	0	0.10
7	Natchitoches	0	0	1	0	0.08
1	Orleans	83	64	44	<5	1.51
8	Ouachita	1	3	5	0	0.19

1	Plaquemines	8	4	10	0	2.87
2	Pointe Coupee	0	0	2	<5	0.69
6	Rapides	1	2	3	<5	0.20
7	Red River	0	0	0	0	0.00
8	Richland	0	0	0	<5	0.15
7	Sabine	0	0	0	<5	0.13
1	St. Bernard	15	22	10	0	2.90
3	St. Charles	5	5	9	0	1.23
9	St. Helena	0	0	0	0	0.00
3	St. James	1	8	5	0	2.08
3	St. John the Baptist	3	2	5	0	0.73
4	St. Landry	5	1	7	0	0.49
4	St. Martin	4	3	8	<5	1.05
3	St. Mary	3	1	2	<5	0.45
9	St. Tammany	33	29	73	17	2.44
9	Tangipahoa	9	6	11	<5	0.92
8	Tensas	0	0	0	0	0.00
3	Terrebonne	33	41	52	6	3.97
8	Union	0	0	0	0	0.00
4	Vermilion	5	4	7	<5	1.06
6	Vernon	1	0	0	0	0.06
2	Washington	3	3	9	<5	1.16
8	Webster	0	0	3	0	0.23
2	West Baton Rouge	1	2	5	<5	1.49
9	West Carroll	0	0	0	0	0.00
7	West Feliciana	1	2	0	<5	1.07
6	Winn	0	0	0	0	0.00

*For single years with small numbers of cases in a given parish, the number is only listed as <5 in order to protect patient confidentiality. Exact case counts can be listed when years are aggregated or the count is five or more.

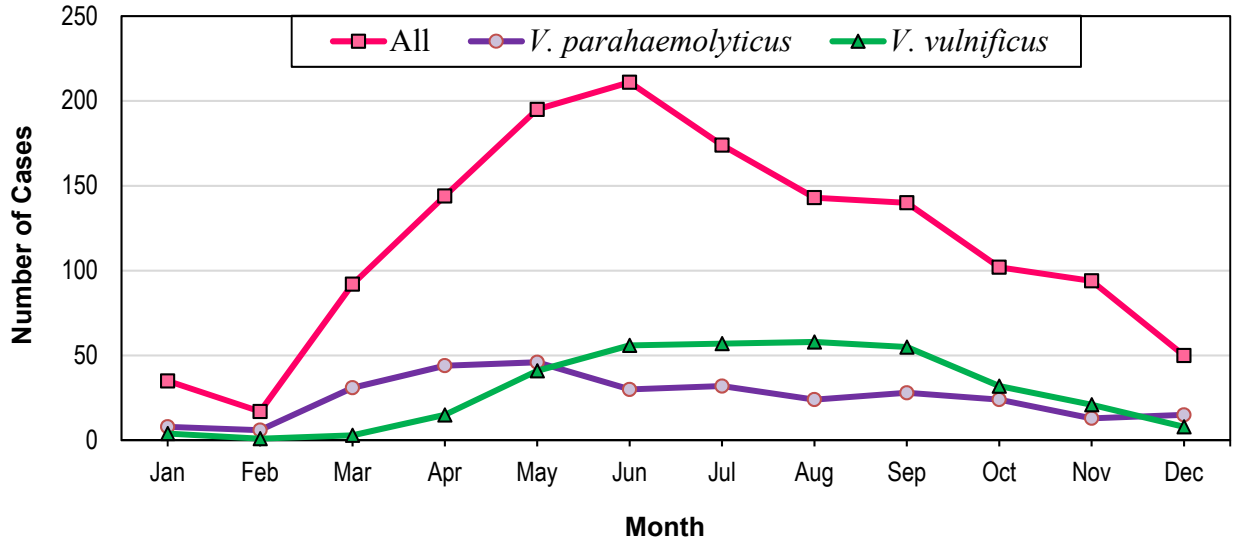
Figure 4: Louisiana Department of Health regional map



Seasonal Distribution

Cases reported by month of illness onset show a definite seasonal pattern (Figure 5).

Figure 5: *Vibrio* cases by month of occurrence - Louisiana, 1988-2018



For all *Vibrio* species, there are few cases from December to February; the numbers increase progressively to reach a peak in June. There is a slight difference in seasonality by species. *V. parahaemolyticus* transmission starts earlier than *V. vulnificus* transmission.

Clinical Presentation

The clinical presentation is highly dependent on the *Vibrio* species. Gastroenteritis is the most common clinical presentation, followed by wound infection and septicemia. *Vibrio cholerae* O1 causes almost exclusively gastroenteritis; *Vibrio parahaemolyticus* and the other *Vibrios* cause mostly gastroenteritis, and some wound infections; *Vibrio vulnificus* causes mostly wound infections followed by septicemia and very few gastroenteritis cases (Table 3).

Table 3: Clinical presentation by *Vibrio* group - Louisiana, 1988-2018

Clinical Presentation	Total	*V. parahaemolyticus*	*V. vulnificus*	*V. cholerae* O1	*Vibrio* Other
Gastroenteritis	693	178	20	33	462
Septicemia	155	9	112	3	31
Wound Infection	254	49	154	0	51
Undetermined / Other	295	65	65	9	156
Total	1397	301	351	45	700
Death	82	6	60	0	16
Percent Mortality	5.9%	2.0%	17.1%	0.0%	2.3%

Most *Vibrio* infections have a good prognosis with the exception of *Vibrio vulnificus.*

Exposure

Seafood consumption is reported in 65% of cases; exposure of the skin to surface waters, particularly seawater, is reported in 36% of cases. Exposure is dependent on the *Vibrio* species. Most *Vibrio* infections are foodborne

with the exception of *Vibrio vulnificus* for which exposure to seawater is a major exposure factor (Table 4).

Table 4: Exposure Type by *Vibrio* Group - Louisiana, 1988-2018
Total Number and Percentage of Known Exposures*

Exposure Type	Grand Total		*V. para-haemolyticus*		*V. vulnificus*		*V. cholerae* O1		*Vibrio* Other	
Seafood Exposure	**501**	**65.1%**	**123**	**74.5%**	**56**	**22.8%**	**25**	**92.6%**	**297**	**89.7%**
Oyster-Raw	127	16.5%	29	17.6%	23	9.3%	4	14.8%	71	21.5%
Oyster-Raw and Other Seafood	98	12.7%	22	13.3%	12	4.9%	3	11.1%	61	18.4%
Oyster-Cooked	13	1.7%	8	4.8%	3	1.2%	0	0.0%	2	0.6%
Oyster-Cooked and Other Seafood	14	1.8%	4	2.4%	1	0.4%	0	0.0%	9	2.7%
Shellfish-Cooked	171	22.2%	47	28.5%	12	4.9%	11	40.7%	101	30.5%
Other Seafood	71	9.2%	13	7.9%	3	1.2%	7	25.9%	48	14.5%
Skin Exposure	**275**	**35.8%**	**42**	**25.5%**	**192**	**78.0%**	**2**	**7.4%**	**39**	**11.8%**
Seawater/Wound	156	20.3%	28	17.0%	117	47.6%	0	0.0%	11	3.3%
Dripping/Wound	59	7.7%	10	6.1%	34	13.8%	1	3.7%	14	4.2%
Floodwater or Freshwater	21	2.7%	0	0.0%	15	6.1%	0	0.0%	6	1.8%
Seawater	32	4.2%	4	2.4%	24	9.8%	1	3.7%	3	0.9%
Seawater and Seafood*	7	0.9%	0	0.0%	2	0.8%	0	0.0%	5	1.5%
Other / Unknown	**628**	**-------**	**136**	**-------**	**105**	**------**	**17**	**-------**	**369**	**-------**

**Percentages add up to more than 100% when individuals report both Seawater and Seafood Exposure*

When looking at all confirmed and probable *Vibrio* cases with known exposures and clinical presentations, it is evident that certain types of exposures are more likely to lead to certain types of illnesses. Seawater/wound exposure accounted for 36% of all septicemia cases and 58% of all wound infection cases, while some form of raw oyster consumption accounted for 45% of gastroenteritis cases (Table 5).

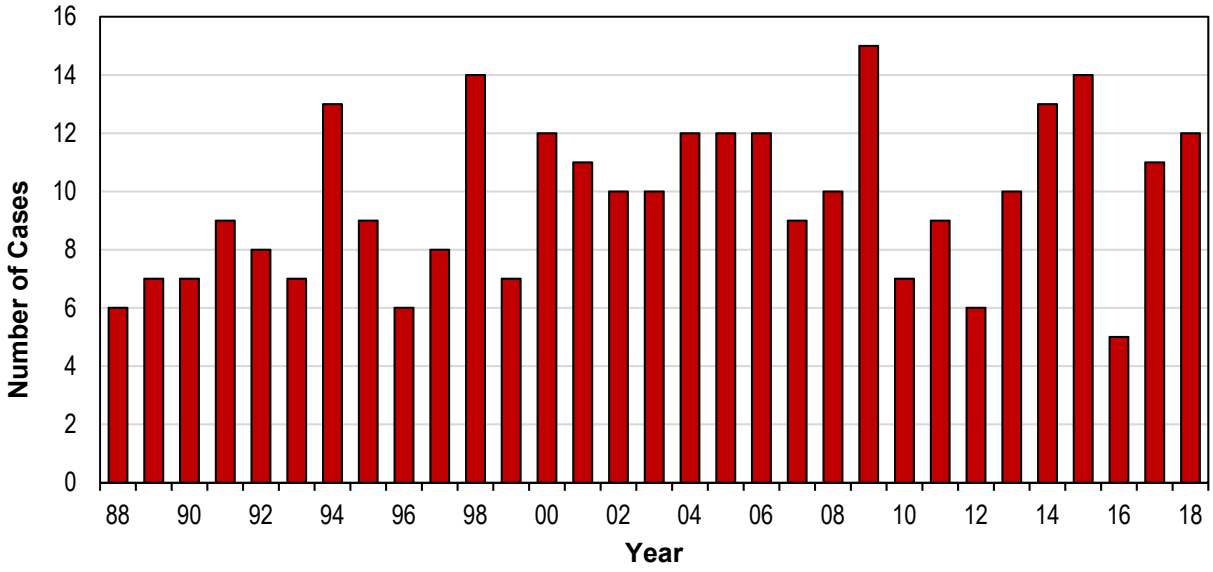
Table 5: Known Exposure Type by Clinical Presentation – Louisiana, 2000-2018

Exposure Type	Gastroenteritis	Septicemia	Wound	Other	Total
Oyster-Raw	24.3%	16.8%	0.6%	7.7%	**17.4%**
Oyster-Raw and Other Seafood	20.4%	9.3%	0.6%	0.0%	**13.7%**
Oyster-Cooked	2.7%	1.9%	0.0%	0.0%	**1.9%**
Oyster-Cooked and Other	2.4%	0.0%	0.0%	0.0%	**1.4%**
Shellfish-Cooked	30.3%	10.3%	1.3%	15.4%	**20.3%**
Other Shellfish	15.3%	2.8%	0.0%	23.1%	**10.0%**
Seawater/Seafood	1.2%	0.9%	0.0%	7.7%	**1.0%**
Seawater/Wound	0.0%	36.4%	65.4%	0.0%	**20.7%**
Dripping/Wound	1.2%	11.2%	17.6%	7.7%	**6.7%**
Floodwater or Freshwater	1.2%	0.9%	8.8%	7.7%	**3.0%**
Seawater	1.0%	9.3%	5.7%	30.8%	**3.9%**
Total	**61.7%**	**13.2%**	**19.1%**	**5.9%**	

Vibrio parahaemolyticus

Vibrio parahaemolyticus represents about 22% of *Vibrio* infections. The number of reported cases of *V. parahemolyticus* has varied over the last several years (Figure 6).

Figure 6*: Vibrio parahaemolyticus* Cases – Louisiana: 1988-2018



Cases of *Vibrio parahaemolyticus* with known clinical information present as simple gastroenteritis (75%), wound infections (21%), or rarely septicemia (4%), (Table 3). Hospitalizations and deaths are rare. Everyone is susceptible to gastroenteritis due to a *Vibrio parahaemolyticus* infection.

Consumption of crustacean and molluscan shellfish is commonly implicated in the transmission of *V. parahaemolyticus.* Raw oysters are another source of foodborne *V. parahaemolyticus* infection.

- About 41% of patients with *V. parahaemolyticus* and known food exposures reported eating raw oysters alone or with other seafood. Studies indicate that the infectious dose of *V. parahaemolyticus* is greater than one million viable cells ingested. This dose may be lowered in case of consumption of antacids or food with buffering capacity, at the same time as ingestion of the infectious dose.

- 59% of the cases with food exposures reported eating cooked seafood. Of those reporting cooked seafood consumption, the most common items reported were:
    - shrimp
    - crawfish
    - crabs
    - cooked oysters

  Note: some cases reported eating more than one cooked seafood item.

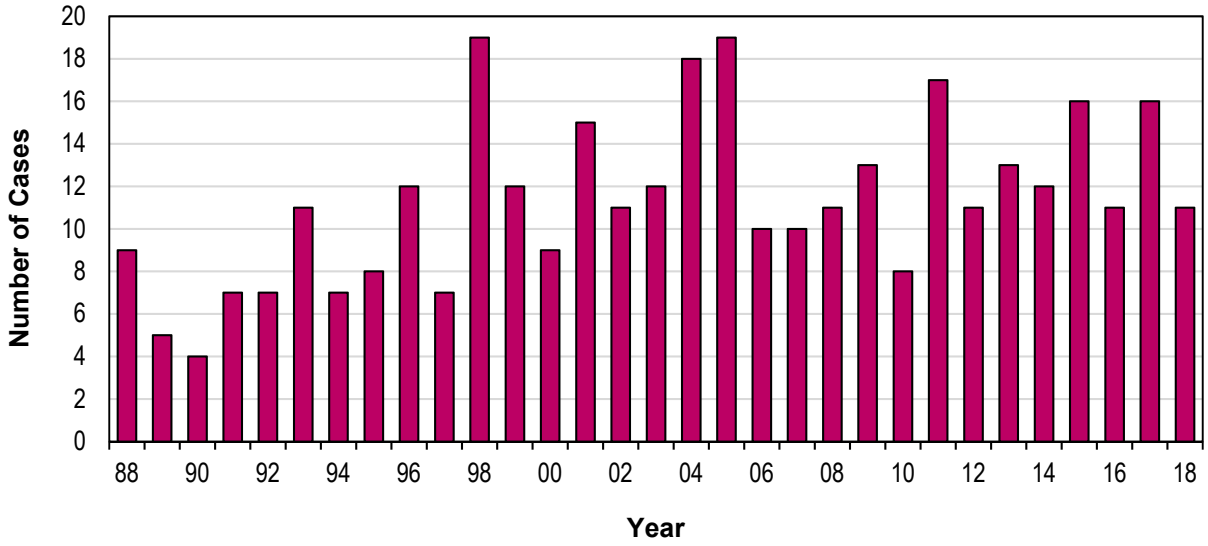
- Finally, 26% of all *Vibrio parahaemolyticus* cases did not consume seafood but had skin exposure to seawater or drippings from seafood.

Vibrio vulnificus

V. vulnificus is the most important pathogenic *Vibrio* in the U.S. because of its invasiveness and the high fatality rates associated with infection. It was first identified and described by the CDC in 1976 and has become a cause of seafood-associated deaths in the United States.

Over the last ten years, the number of reported *V. vulnificus* cases has ranged from eight to 19 cases (Figure 7).

Figure 7*: Vibrio vulnificus*, annual cases - Louisiana, 1988-2018



The most common clinical presentation is a wound infection (54%) followed by septicemia (39%) with the least common being gastroenteritis (7%), (Table 3).

About 81% of patients infected by *Vibrio vulnificus* with known medical histories had one or more medical risk factors. *Vibrio vulnificus* occurs almost exclusively among immunocompromised patients or patients with end-stage liver failure. With increasing survival rates of this susceptible population, it is expected that the number of infections will also continue to increase.

High-risk conditions are: chronic liver disease, hemochromatosis, diabetes, cancers (particularly those on chemo or radio-therapy), leukemia, lymphoma, Hodgkin's, immune suppression (such as HIV), long term steroid use, alcoholism, chronic kidney disease and being elderly. The virulence of *V. vulnificus* in humans is associated with the availability of iron. Patients with increased iron stores, such as is seen in hemochromatosis, alcoholic liver disease, or hemolytic anemia, are susceptible to septicemia (mostly fatal) with *V. vulnificus*. The organism is unable to use transferrin-bound iron for growth; however, in patients with iron overload and transferrin saturation of 75% or higher, free iron is available for use by the organism. Other studies have shown that invasive disease caused by *V. vulnificus* could also be due to resistance to host phagocytic defense mechanisms. Disorders such as diabetes and HIV have been shown to be associated with defects in phagocytosis.

Among individuals with *V. vulnificus* infections and known medical histories, medical risk factors observed were:

- Severe chronic liver disease 27 %
- Diabetes 24 %
- Chronic alcoholism 18 %
- Kidney failure 17 %
- Malignancy 11 %
- Antacid use 10 %

The clinical presentation of *Vibrio vulnificus* infection is dependent on the type of exposure to the bacteria (Table 6).

Table 6: Exposure and Clinical Presentation for *Vibrio vulnificus* – Louisiana: 1988-2018
Total Numbers and Percentages of Known Exposures

Exposure	Gastroenteritis		Septicemia		Wound Infection		Other		Grand Total	
Seawater, Floodwater, Freshwater	2	14%	11	11%	21	17%	5	50%	39	16%
Seawater in Wound	0	0%	36	38%	81	64%	0	0%	117	48%
Seafood Dripping in Wound	1	7%	12	13%	19	15%	2	20%	34	14%
Seawater and Seafood Exposures	1	7%	1	1%	0	0%	0	0%	2	1%
Oyster-Raw	1	7%	19	20%	1	1%	2	20%	23	9%
Oyster-Raw and Other Seafood	3	21%	8	8%	1	1%	0	0%	12	5%
Other Seafood	6	43%	9	9%	3	2%	1	10%	19	8%
Other / Unknown	6		16		28		55		105	
Grand Total	20		112		154		65		351	

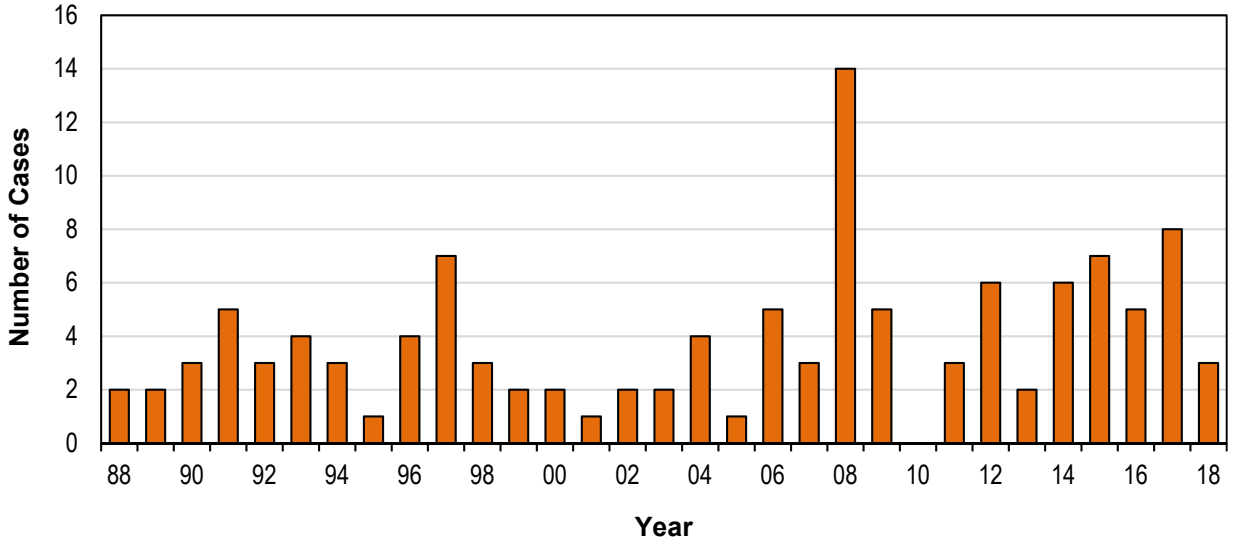
Other Non-Cholerae Vibrios

The increase in reported numbers of other non-cholerae *Vibrios* is attributed to increased awareness among medical providers and laboratory testing.

V. alginolyticus is a halophilic *Vibrio*, first recognized as being pathogenic in humans in 1973. Wound infections account for most of *V. alginolyticus* infections; ear infections are also seen with this organism. Gastroenteritis is thought to be a rare presentation of *V. alginolyticus* infection. Other clinical syndromes reported in association with *V. alginolyticus* infection include chronic diarrhea in a patient with AIDS, conjunctivitis and post-traumatic intracranial infection. Resistance to tetracycline and chloramphenicol has been reported in a few isolates of *V. alginolyticus*, but all strains appear to be sensitive to ciprofloxacin. There is on average, one case reported in Louisiana each year.

V. mimicus is a non-halophilic *Vibrio* named according to its similarity to *V. cholerae*. *V. mimicus,* and as human pathogen, can cause sporadic episodes of acute gastroenteritis and ear infections. It was the most frequently reported *Vibrio* serotype in 2008 with 14 cases (30%), (Figure 8).

Figure 8: *Vibrio mimicus* cases – Louisiana, 1988-2018

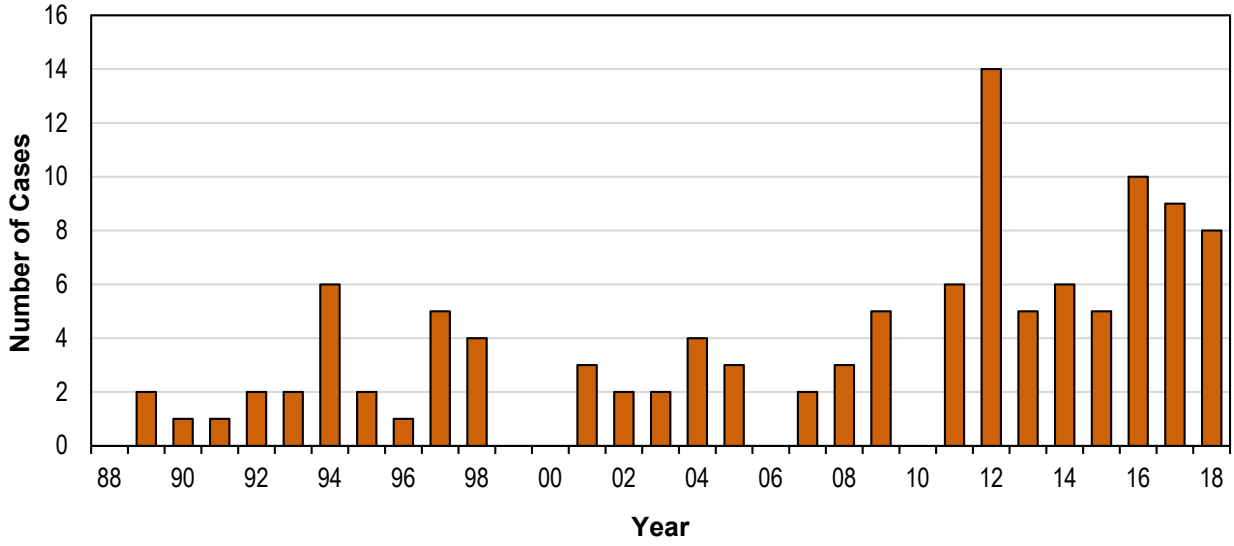


V. mimicus is an etiological agent of sporadic watery diarrhea and food poisoning after the consumption of raw or cooked fish or shellfish. Eighty-five percent of *V. mimicus* cases reported in 2008 were related to the consumption of cooked fish or cooked shellfish.

V. mimicus can produce enterotoxins which are virtually identical to the Cholera toxin (CT), produced by *V. cholerae*. In 2008, 71% (ten) of the isolates were tested at the CDC; six isolates showed the presence of CT using Polymerase chain reaction (PCR). Pulse-field gel electrophoresis (PFGE) was performed on all ten isolates to determine molecular subtype of the bacteria. All ten *V. mimicus* isolates differed in their PFGE pattern. The six patients whose isolates were positive for CT, volunteered to have their blood tested for the presence of antibodies to CT. Serum collected from three of the patients tested positive for the presence of antibodies to the CT toxin. Antibodies to Cholera toxin (CT) do not seem to be sufficient to protect against further infections. The presence of CT has been shown in literature several times, but a patient infected with *V. mimicus* CT-like toxin and developing anti-CT antibodies has not been documented in literature.

V. fluvialis is a halophilic Vibrio, first identified in Bahrain in 1975, in a patient with diarrhea. It is biochemically similar to *Aeromonas hydrophila* but can be differentiated from this organism by its ability to grow well on media containing 6% to 7% sodium chloride. The largest series of *V. fluvialis* infections involved 500 patients in Bangladesh, half of whom were young children. In that series, patients presented with diarrhea (100% with 75% bloody diarrhea), vomiting (97%), abdominal pain (75%), dehydration (67%), and fever (35%). *V. fluvialis* rarely causes wound infections or primary septicemia. On average, about two cases of *Vibrio fluvialis* are reported each year in Louisiana. In 2012, 14 cases were reported in Louisiana, 12 of which were confirmed by the State Public Health Lab (Figure 9).

Figure 9: *Vibrio fluvialis* cases – Louisiana, 1988-2018



Spike in cases of *Vibrio fluvialis* in 2012: Of the *V. fluvialis* cases reported in 2012, over half were male (57%). The median age for cases was 60 years of age with a range of six to 84 years. Fifty percent of the cases were from Region 3, the remaining cases were from Regions: 1, 4, 7 and 9. Over half of the cases were hospitalized (57%). Two cases were wound infections; the remaining 12 were gastroenteritis cases. Symptoms reported by gastroenteritis cases were diarrhea (92%), nausea (75%), abdominal cramps (75%), vomiting (58%), bloody stools (33%), and fever (33%). Over half (57%) of cases had at least one more pathogen isolated from the same source as the *V. fluvialis.* Other pathogens isolated were *Plesiomonas shigelloides* (two), *Aeromonas* (two), MRSA, Group B Streptococcus, *Proteus mirabilis, Edwardsiella, Clostridium difficile* and algae. Exposure information was obtained on nine of the 14 cases. Of the gastroenteritis cases with known exposure, 70% reported consuming raw oysters either alone or with other seafood prior to onset and 30% reported consuming seafood other than oysters.

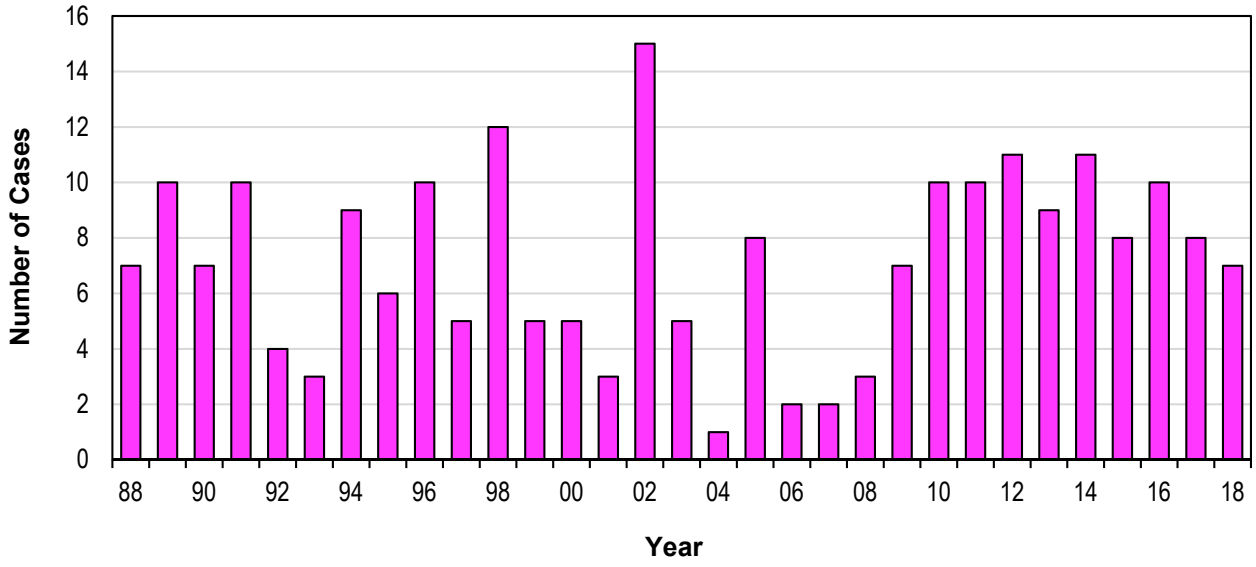
Photobacterium damsela (formerly *Vibrio damsela*), is a halophilic, Gram-negative bacillus similar to *V. vulnificus*. It strictly causes soft-tissue infections following exposure of wounds to brackish water or injury by saltwater animals. *P. damsela* infections can be fulminant and frequently are fatal even in immunocompetent hosts. Between 1988 and 2018, seven cases were reported in Louisiana.

Grimontia hollisae (formerly *V. hollisae)* is a halophilic *Vibrio,* first described in 1982. It most commonly causes gastroenteritis. *G. hollisae* is difficult to isolate, since it grows poorly on selective TCBS media and it needs to be isolated from colonies on a blood agar plate. *G. hollisae* septicemia and wound infections have been reported, but are rare. On average, one case of *G. hollisae* is reported each year in Louisiana.

Vibrio cholerae Non-O1

*Vibrio cholerae Non-O1*is classified in groups according to its somatic antigen O. Non-O1s are found in surface waters (freshwater rivers, ocean) throughout the world. The infection is acquired by ingesting heavily contaminated water or food (raw or poorly cooked seafood, especially oysters, clams, shrimp or crabs). Small outbreaks are sometimes reported (Figure 10).

Figure 10*: Vibrio cholerae* non-O1, annual cases - Louisiana, 1988-2018



These infections usually occur in individuals with increased susceptibility to infections: immunocompromised individuals with gastric disease (low gastric acidity) or liver disease.

V. cholerae non-01 can produce a wide range of symptoms: asymptomatic infections, simple diarrhea, or severe diarrheal disease. Some isolates are capable of producing a toxin indistinguishable from *V. cholerae O1*. Diarrhea and simple enteritis is the most common clinical picture. Approximately a quarter of infected patients have bloody stools. Illness usually is self-limiting and requires no treatment.

Vibrio cholera O75

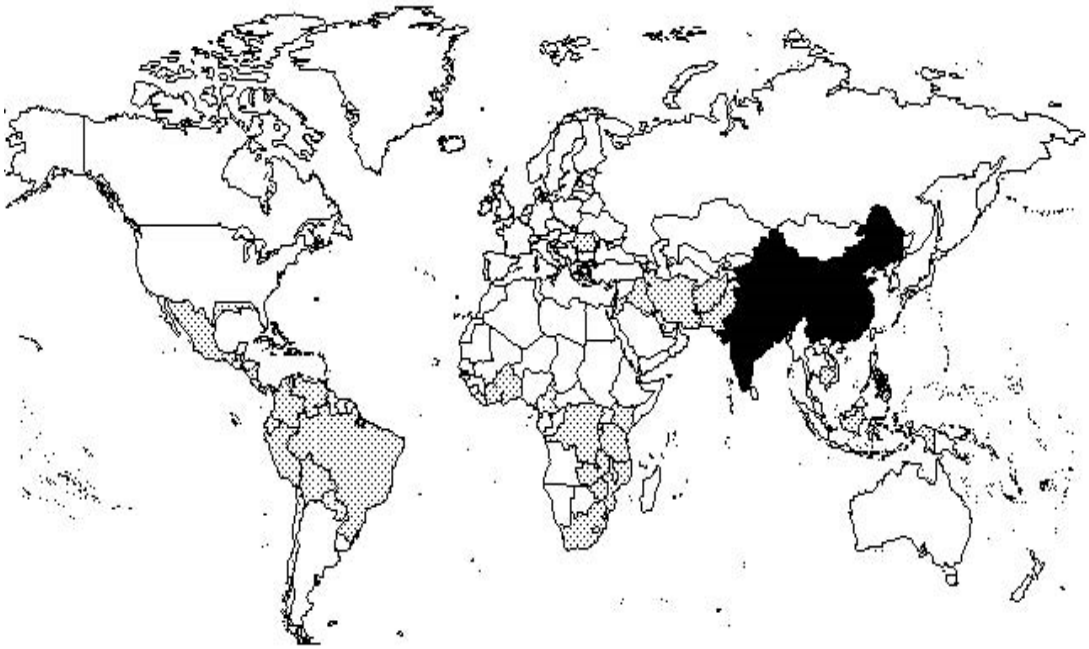
In Louisiana, there have been five reported cases of *Vibrio cholerae* O75 since 1988. One case was part of a multistate outbreak (LA, GA, IN, TN, AL) associated with consumption of raw or lightly cooked oysters from Apalachicola Bay in Florida. All PFGE patterns of the *V. cholerae* O75 isolates in this outbreak were similar. The main illness was gastroenteritis with no hospitalizations and no deaths.

Vibrio cholerae O1

V. cholerae O1 and *V. cholerae O139* are the main causes of pandemic cholera. The world now is experiencing a seventh cholera pandemic, with the El Tor variant of *V. cholerae O1* being the infectious agent. The pandemic started in Indonesia in 1961, spread through the Middle East in the late 1960s and into Africa in the 1970s, where it remains endemic. In 1991, the pandemic reached South America through Peru and spread rapidly.

From 62 cases reported world-wide in 1961, the number reached a peak of 595,000 in 1991. The classical biotype has not disappeared and has caused major epidemics (1982 in Bangladesh). By 1993 the number had decreased somewhat to 300,000. Cholera is now well implanted in Southeast Asia, Africa and South America, with sporadic cases throughout the world (Figure 11).

Figure 11*:* Seventh cholera pandemic, 1961-1991



The O1 group includes the serotypes Ogawa, Inaba and Hikojima, the classical bio-types and El Tor. El Tor, a variant of the classical cholera, was isolated from a patient in the Sinai Peninsula in 1903. At that time it was considered to be non–pathogenic, but it now has become the agent responsible for the seventh pandemic. El Tor differs from classical *V. cholerae* in its ability to agglutinate chicken erythrocytes, its sensitivity to polymyxin B and its resistance to cholera phage group 4. Cholera O1 also is classified by toxin production: toxigenic or nontoxigenic.

In 1992, toxigenic *V. cholerae O139* (the Bengal strain) was recognized as another cause of cholera. *V. cholerae O139*, first discovered on the Indian subcontinent, has been reported in the United States as an imported infection. Although the primary organism that causes cholera globally is *V. cholerae O1*, continued laboratory surveillance of *V. cholerae O139* is recommended because it has similar epidemic potential.

Vibrio cholerae O1 represents about 3% of all Vibrio cases reported in Louisiana over the past 29 years (Figure 12).

Figure 12*: Vibrio cholerae O1* cases - Louisiana, 1988-2018