Exploratory Data Analysis

In [285]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
```

In [286]:
```
#download the GVA data
file_path1 ="\\Users\\eggfr\\Flatiron\\Flatiron_phase4_project\\Gun-Image-Classification\\HC Folder\\data\\Gu
```

Gun Violence Archive (GVA) is a not for profit corporation formed in 2013 to provide free online public access to accurate information about gun-related violence in the United States. GVA will collect and check for accuracy, comprehensive information about gun-related violence in the U.S. and then post and disseminate it online. We have around 448402 gun incidents in American between 2013 to 2022.

In [287]:
```
gun_data_raw_df = pd.read_csv(file_path1, encoding= 'unicode_escape')
gun_data_raw_df.shape
```

Out[287]:
```
(448402, 8)
```

Let's check and see if there is any missing data.

In [288]:
```
gun_data_raw_df.isna().sum()
```

Out[288]:
```
Incident ID            0
Incident Date          0
state                  0
City Or County         0
Address            15443
n_killed               0
n_injured              0
Operations        448277
dtype: int64
```

Address will not be used in this analysis, and there is too many data missing in the operation column. Let's drop those two columns and also rename some of of the columns as well.

In [289]:
```
gun_data_raw_df.rename(columns={'Incident Date':'Date','state': 'State','n_killed': 'People Killed','n_injur
gun_data_df = gun_data_raw_df.drop(['Address','Operations','Incident ID'], axis=1)
```

Death by gun incidents in location in 2014-2022

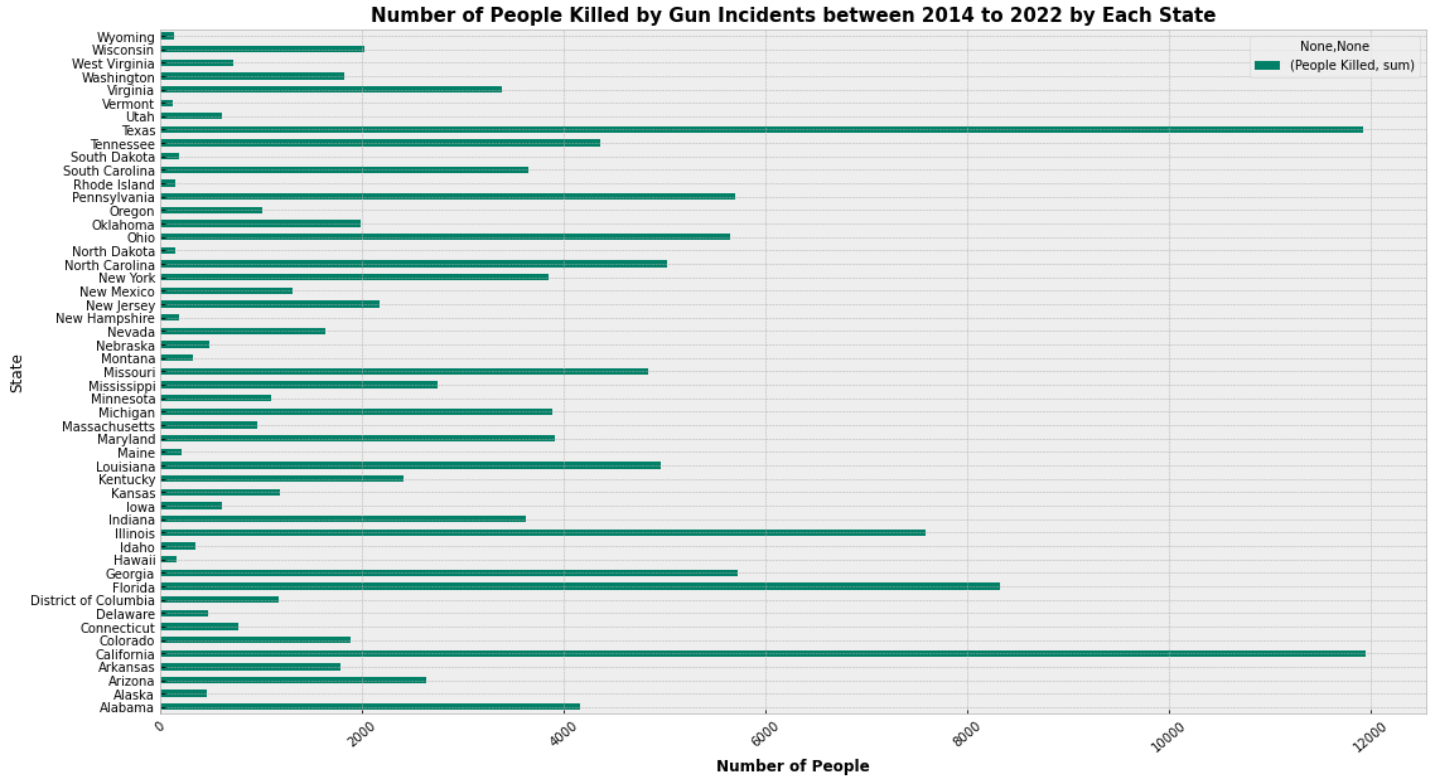
In [290]:
```
gun_data_df.head()
```

Out[290]:

	Date	State	City Or County	People Killed	People Injured
0	2014-01-01	Florida	Orlando	1	1
1	2014-01-01	Ohio	Cincinnati	1	0
2	2014-01-01	California	Glendale	0	1
3	2014-01-01	Texas	Hebbronville	0	1
4	2014-01-01	New York	Rochester	1	1

In [291]:
```
# plot number of people Killed by gun incidents between 2014 to 2022 by each state
plt.style.use('bmh')
order_df = gun_data_df.groupby('State').agg({'People Killed':['sum']}).plot.barh(figsize=(18,10), colormap='
plt.title('Number of People Killed by Gun Incidents between 2014 to 2022 by Each State', weight = "bold", fo
plt.xticks(rotation=40)
plt.xlabel('Number of People', weight = "bold", fontsize = 12)
```

Out[291]:
```
Text(0.5, 0, 'Number of People')
```



Californa, Texas, Florida and Illionis are the top 4 states with the most people killed with gun incidents. Let's investigate this a little bit further with popoulation density and income.

Death by gun incidents by location and average income in 2017

Let investigate the population data in 2018 https://www.kaggle.com/datasets/lucasvictor/us-state-populations-2018 (https://www.kaggle.com/datasets/lucasvictor/us-state-populations-2018) . Also, poverty data data and annual income data for each state are gathered from this obesity study. https://www.kaggle.com/datasets/annedunn/obesity-and-gdp-rates-from-50-states-in-20142017 (https://www.kaggle.com/datasets/annedunn/obesity-and-gdp-rates-from-50-states-in-20142017)

In [292]:
```
gun_data_df.Date = pd.DatetimeIndex(gun_data_df.Date)
state_df = gun_data_df.set_index("Date").groupby([pd.Grouper(freq="Y"), "State"]).sum().reset_index()
state_df
```

Out[292]:

	Date	State	People Killed	People Injured
0	2014-12-31	Alabama	314	560
1	2014-12-31	Alaska	29	48
2	2014-12-31	Arizona	219	215
3	2014-12-31	Arkansas	165	222
4	2014-12-31	California	1303	1565
...	...	...	...	...
454	2022-12-31	Virginia	248	527
455	2022-12-31	Washington	149	247
456	2022-12-31	West Virginia	37	54
457	2022-12-31	Wisconsin	171	433
458	2022-12-31	Wyoming	7	4

459 rows × 4 columns

Population data for each state for 2018, and the first 5 row is shown.

In [293]:
```
file_path2 ="\\Users\\eggfr\\Flatiron\\Flatiron_phase4_project\\Gun-Image-Classification\\HC Folder\\data\\2
```

In [294]:
```
file_path3 = "\\Users\\eggfr\\Flatiron\\Flatiron_phase4_project\\Gun-Image-Classification\\HC Folder\\data\\
```

In [295]:
```
population2018_raw_df = pd.read_csv(file_path2, encoding= 'unicode_escape')
population2018_raw_df.rename(columns={
'STATE':'State','POPESTIMATE2019':'Population'}, inplace=True)
population2018_df = population2018_raw_df.drop(['lat','long'], axis=1)
population2018_df.head()
```

Out[295]:

	State	Population
0	Alabama	4903185
1	Alaska	731545
2	Arizona	7278717
3	Arkansas	3017804
4	California	39512223

Average Income and poverty rate for each state for 2017, and the first 5 row is shown.

In [296]:
```
obesity_df = pd.read_csv(file_path3, encoding= 'unicode_escape')
abcd=obesity_df.query('Year == 2017')
gdp_df = abcd[['State','Poverty.Rate*100','Average.Income']]
gdp_df.head()
```

Out[296]:

	State	Poverty.Rate*100	Average.Income
3	Alabama	16.89	26471.72046
7	Alaska	11.11	34438.53759
11	Arizona	14.86	29420.61094
15	Arkansas	16.40	25272.81432
19	California	13.30	35128.22756

People that are killed and injured in 2017 from the GVA dataset.

In [297]:
```
state_2017_raw_df = state_df[(state_df['Date'] > '2017-12-01') & (state_df['Date'] < '2018-5-31')]
state_2017_raw_df['Total Incident'] = state_2017_raw_df['People Killed']+state_2017_raw_df['People Injured']
state_2017_raw_df.head()
```

```
C:\Users\eggfr\AppData\Local\Temp\ipykernel_26020\1819508499.py:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  state_2017_raw_df['Total Incident'] = state_2017_raw_df['People Killed']+state_2017_raw_df['People Injured']
```

Out[297]:

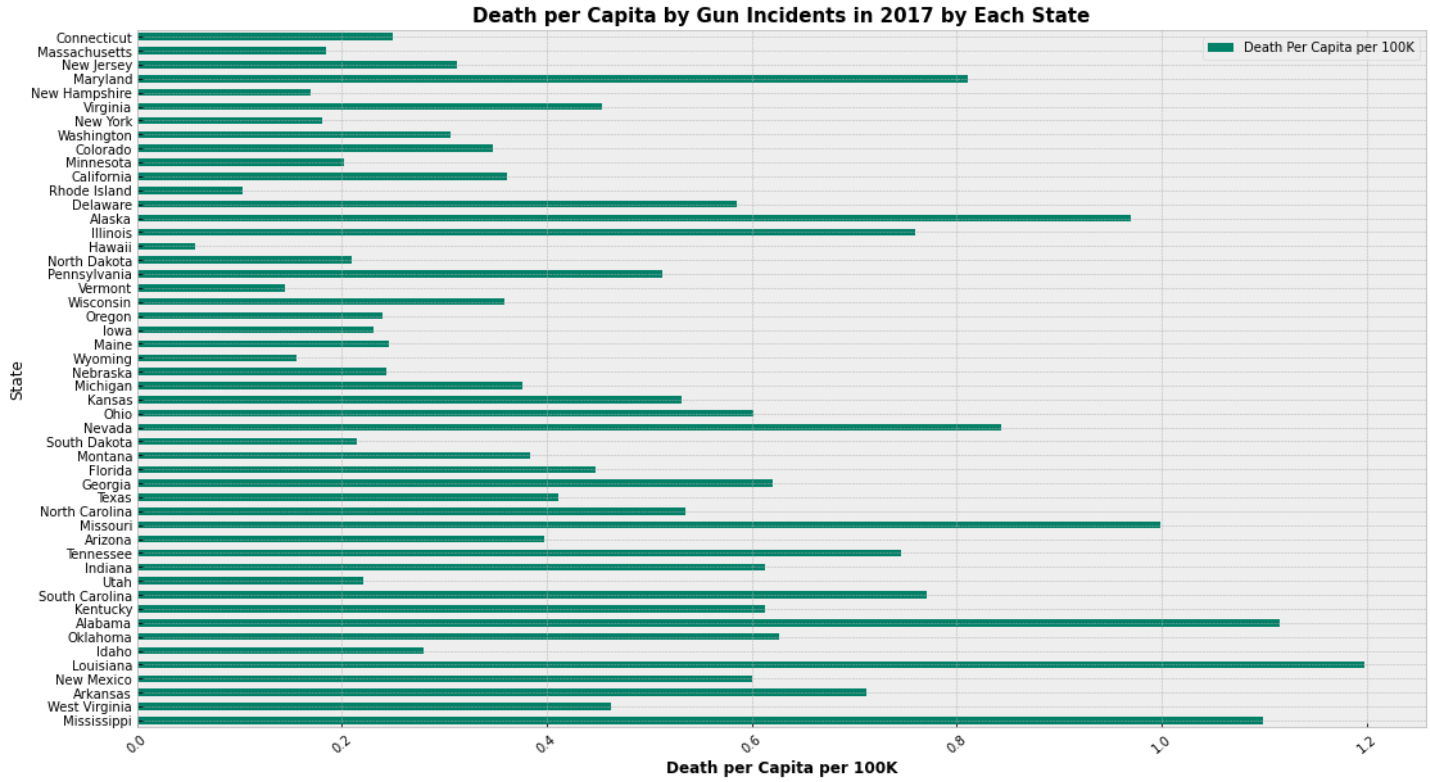
	Date	State	People Killed	People Injured	Total Incident
153	2017-12-31	Alabama	547	859	1406
154	2017-12-31	Alaska	71	68	139
155	2017-12-31	Arizona	289	300	589
156	2017-12-31	Arkansas	215	444	659
157	2017-12-31	California	1427	1951	3378

We will combine all 3 tables into 1 tables, and people killed per population and total incident per population for each state is also calculated. Death per Captia by Gun Inicdentsin 2017 by each state is plotted.

In [298]:
```
combine_df = pd.merge(population2018_df,gdp_df, left_on ='State',right_on ='State')
```

In [299]:
```
state_2017_df = pd.merge(state_2017_raw_df,combine_df, left_on ='State',right_on ='State')
state_2017_df ['Death Per Capita'] = state_2017_df ['People Killed']/state_2017_df ['Population']
state_2017_df ['Incidents Per Capita'] = state_2017_df ['Total Incident']/state_2017_df ['Population']
state_2017_df['Date'] = pd.DatetimeIndex(state_2017_df['Date']).year
state_2017_df.rename(columns={'Date':'Year'},inplace = True)
state_2017_df['Average.Income']=state_2017_df['Average.Income'].apply(np.ceil)
state_2017_df.sort_values(by='Average.Income', ascending=True, inplace = True)
state_2017_df.head()
state_2017_df ['Death Per Capita per 100K'] = state_2017_df ['Death Per Capita'] *10000
state_2017_df.to_csv('table_Kill_Per_capita.csv')
state_2017_df.head()
state_2017_df.plot.barh(x='State',y='Death Per Capita per 100K',figsize=(18,10), colormap='summer')
plt.title('Death per Capita by Gun Incidents in 2017 by Each State', weight = "bold", fontsize = 15)
plt.xticks(rotation=40)
plt.xlabel('Death per Capita per 100K', weight = "bold", fontsize = 12)
```

Out[299]:
```
Text(0.5, 0, 'Death per Capita per 100K')
```



States with lower average income such as Mississippi, Louisiana have a higher Death per Capita while higher average income state such as connecticut, massachusetts have a lower Death per Capita,

Death by gun incidents vs Age group

Let's study study the relationship between death relate to gun incidents and age group with CDC dataset. The following data set is obtained from CDC https://wonder.cdc.gov/controller/datarequest/D76 (https://wonder.cdc.gov/controller/datarequest/D76). The deaths from self harm and gun assault incidents from 1999 to 2022. The deaths is then classified into 3 different age groups, <35, 35 to 65 and 65+ for both datas.

In [300]:
```
file_path3 = "\\Users\\eggfr\\Flatiron\\Flatiron_phase4_project\\Gun-Image-Classification\\HC Folder\\data\\
```

Let's study the relationship between death by assault vs age group.

In [301]:
```
assault_raw_df = pd.read_csv(file_path3, encoding= 'unicode_escape')
assault_df = assault_raw_df.drop(['Notes','Year Code','Ten-Year Age Groups','State Code'], axis=1)
assault_df['Max_Age'] = assault_df['Ten-Year Age Groups Code'].str.split('-').str.get(1)
assault_df['Max_Age'] = assault_df['Max_Age'].str.replace('May','15')
assault_df[assault_df['Max_Age'] ==""] = np.NaN
assault_df['Max_Age'].fillna(method='ffill',inplace = True)
assault_df.to_csv('asssault_gun_2014_2022.csv')
```

In [302]:
```
file_path4 = "\\Users\\eggfr\\Flatiron\\Flatiron_phase4_project\\Gun-Image-Classification\\HC Folder\\data\\
```

In [303]:
```
assault_clear_raw_df = pd.read_csv(file_path4, encoding= 'unicode_escape')
assault_clear_raw_df.head()
```

Out[303]:

	Unnamed: 0	Year	Ten-Year Age Groups Code	State	Deaths	Population	Crude Rate	Max_Age
0	0	1999	14-May	California	36	5246778	0.7	15
1	1	1999	14-May	Florida	18	2069242	Unreliable	15
2	2	1999	14-May	Illinois	17	1823415	Unreliable	15
3	3	1999	14-May	Indiana	12	879493	Unreliable	15
4	4	1999	14-May	Louisiana	12	689702	Unreliable	15

Let's study the relationship between self harm and different age group.

In [304]:
```
file_path5 = "\\Users\\eggfr\\Flatiron\\Flatiron_phase4_project\\Gun-Image-Classification\\HC Folder\\data\\
```

In [305]:
```
self_harm_raw_df = pd.read_csv(file_path5, encoding= 'unicode_escape')
self_harm_df = self_harm_raw_df.drop(['Notes','Year Code','Ten-Year Age Groups','State Code'], axis=1)
self_harm_df['Max_Age'] = self_harm_df['Ten-Year Age Groups Code'].str.split('-').str.get(1)
self_harm_df['Max_Age'] = self_harm_df['Max_Age'].str.replace('May','15')
self_harm_df[self_harm_df['Max_Age'] ==""] = np.NaN
self_harm_df['Max_Age'].fillna(method='ffill',inplace = True)
self_harm_df.head()
```

Out[305]:

	Year	Ten-Year Age Groups Code	State	Deaths	Population	Crude Rate	Max_Age
0	1999.0	14-May	Texas	14.0	3251565.0	Unreliable	15
1	1999.0	15-24	Alabama	72.0	633971.0	11.4	24
2	1999.0	15-24	Alaska	17.0	89183.0	Unreliable	24
3	1999.0	15-24	Arizona	55.0	710747.0	7.7	24
4	1999.0	15-24	Arkansas	39.0	379744.0	10.3	24

In [306]:
```
file_path6 = "\\Users\\eggfr\\Flatiron\\Flatiron_phase4_project\\Gun-Image-Classification\\HC Folder\\data\\
```

In [307]:
```
self_harm_clear_df = pd.read_csv(file_path6, encoding= 'unicode_escape')
self_harm_clear_df
bins= [0,35,65,85]
labels =['<35','35 to 65','65+']
self_harm_clear_df['Age_Group'] = pd.cut(self_harm_clear_df['Max_Age'], bins=bins, labels=labels, right=Fals
self_harm_clear_df.drop(['Unnamed: 0','Max_Age'], axis=1,inplace = True)
self_harm_clear_df.rename(columns={'Deaths':'Self Harm Deaths'},inplace = True)
self_harm_clear_df.head()
self_harm_clear_df.to_csv('self_harm_clean_2014_2022.csv')
```

In [308]:
```
self_harm_clear_df.head()
```

Out[308]:

	Year	Ten-Year Age Groups Code	State	Self Harm Deaths	Population	Crude Rate	Age_Group
0	1999	14-May	Texas	14	3251565	Unreliable	<35
1	1999	15-24	Alabama	72	633971	11.4	<35
2	1999	15-24	Alaska	17	89183	Unreliable	<35
3	1999	15-24	Arizona	55	710747	7.7	<35
4	1999	15-24	Arkansas	39	379744	10.3	<35

See the presentation slide for visualization. When we look at deaths realte to gun incidents, we classified the gun death cause in two different groups, by self harm, and by assault. Self harm deaths contributed more deaths than assault deaths, and both groups exhibit an upward trend since year 1998, and both death counts also spiked recently. We also further investigate these incidents into 3 different age groups. Age group between 35-64 is the majority group that contribute for self harm deaths, and all 3 age groups also exhibit upward trends since 1998. Age group < 34 is the majority group for assault gun deaths, and age group between 35-64 also exhibits similar pattern.

Twitter usage since 2010

Let's take a look at twitter usage since 2010 from the following dataset
https://www.kaggle.com/datasets/margarethamartinez/socialmedia2021?select=Social+Media+Users.csv
(https://www.kaggle.com/datasets/margarethamartinez/socialmedia2021?select=Social+Media+Users.csv)

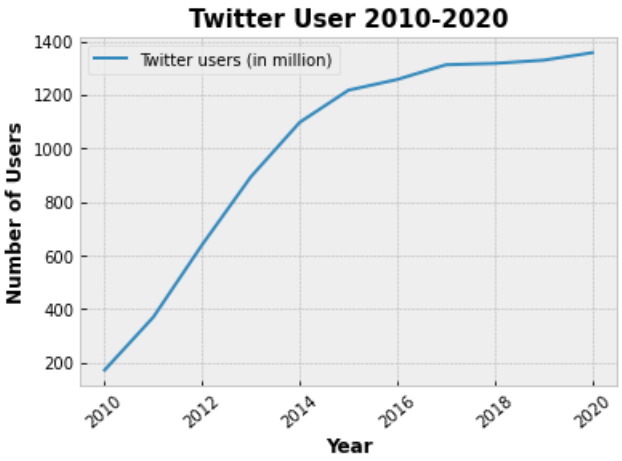
In [309]:
```
file_path7 = "\\Users\\eggfr\\Flatiron\\Flatiron_phase4_project\\Gun-Image-Classification\\HC Folder\\data\\
```

In [310]:
```
social_media_raw_df = pd.read_csv(file_path7, encoding= 'unicode_escape')
social_media_raw_df.head()
social_media_raw_df['Year'] = (social_media_raw_df['ï»¿'].str.split(' ').str.get(1))

social_media_raw_df.drop(columns=['ï»¿'])
#social_media_raw_df
social_media_df = social_media_raw_df.groupby(by=["Year"], dropna=True).sum()
#social_media_df
social_media_df.plot()

plt.title('Twitter User 2010-2020', weight = "bold", fontsize = 15)
plt.xticks(rotation=40)
plt.xlabel('Year', weight = "bold", fontsize = 12)
plt.ylabel('Number of Users', weight = "bold", fontsize = 12)
#social_media_raw_df.plot(figsize=(18,10), colormap='summer')
```

Out[310]:
```
Text(0, 0.5, 'Number of Users')
```



Twitter users increase significantly since 2010 and the death counts by gun incidents also has a significant uptrend since 2010.

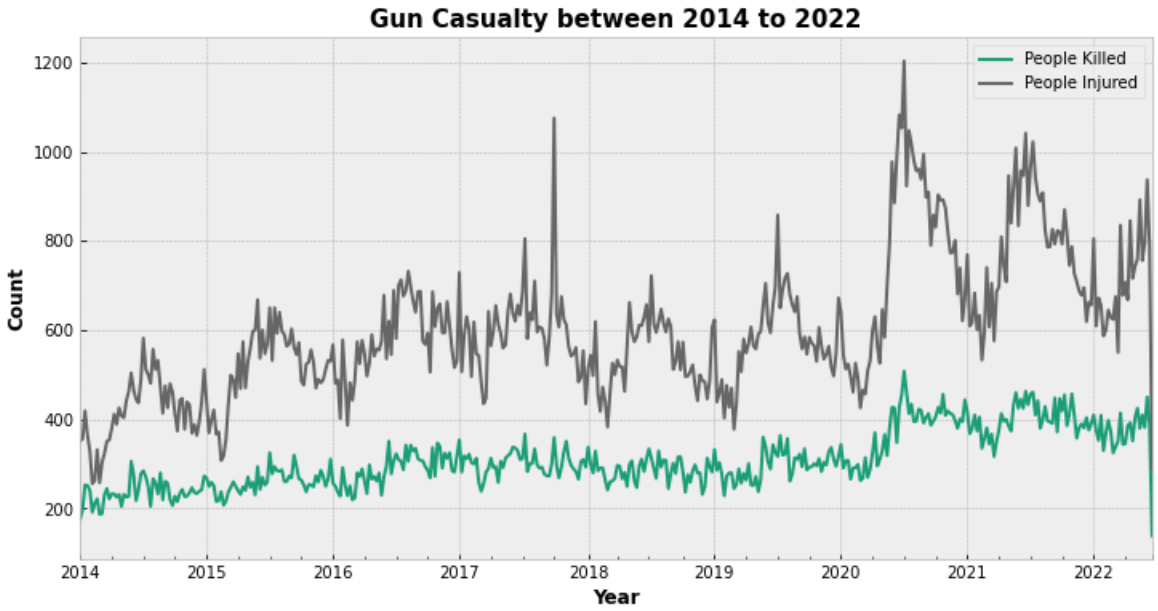
Time series plot for people killed and injured relate to gun incidents between 2014 to 2022

Let's prepare a time series to see if there is a trend for people killed and injured relate to gun incidents in america between 2014 to 2022

In [311]:
```
gun_data_time_series_df = gun_data_raw_df.drop(['Address','Operations','Incident ID'], axis=1)
gun_data_time_series_df['Date'] = pd.to_datetime(gun_data_time_series_df['Date'])
gun_data_time_series_df.set_index('Date', inplace=True)
gun_data_time_series_df.rename(columns={'state': 'State','n_killed': 'People Killed','n_injured': 'People In
gun_data_time_series_df = gun_data_time_series_df.resample('W').sum()

plt.style.use('bmh')
gun_data_time_series_df.plot(figsize=(12,6), colormap='Dark2')
plt.title('Gun Casualty between 2014 to 2022', weight = "bold", fontsize = 15)
plt.xlabel('Year', weight = "bold", fontsize = 12)
plt.ylabel('Count', weight = "bold", fontsize = 12)
```

Out[311]:
```
Text(0, 0.5, 'Count')
```



There is an upward trend for people killed, people injurded relate to gun incidents in america between 2014-2022 from the time series plot.