UK crime statistics and bike crime: compound line graphs

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Overview

This resource is designed to give you an overview of crime in the UK. Table 1 in Appendix C shows the UK crime statistics from January 2011 to December 2020.

In general, recorded crime has declined, year on year, since 2011, but within the data this assertion may hide some individual crimes which may not have changed. Therefore, a greater level of scrutiny is required. Additionally, it is valuable to identify geographical patterns to a particular crime (such as bike crime) i.e., if some Police Forces are seeing a greater level of bike theft than others.

One way to visualise, compare and analyse this amount of data is to create a compound line graph. This type of graph is very useful to see change in one or more quantities over time.

The Thames Valley Police resource pack

In partnership with Thames Valley Police (TVP), the Royal Geographical Society (with IBG) has created a resource pack for you to go out and collect your own bike crime data. Please only do so in a safe manner. The following resources are available for download to help:

- A resource to help prepare a sophisticated crime investigation, designed by Raphael Heath
- 1 UK crime statistics and bike crime: compound line graphs
- 2 Who is vulnerable to bike theft?
- 3 Chi-squared and bike theft patterns
- 4 Spearman's Rank Correlation Coefficient and bike theft
- A selection of worksheets from the RGS-IBG to help you with FSC statistical methods
- 5 A focus on Iffley in Oxford by Thames Valley Police
- An online student bike theft quiz form (for students to answer)
- An online Survey123 observation form (for fieldwork data collection)

Specification links

AQA
GCSE 3.2.1. Urban Issues and Challenges *Urban change in cities in the UK leads to a variety of social, economic, and environmental opportunities and challenges.*

Edexcel
GCSE 4.5 Globalisation and economic change create challenges for the chosen UK city that require long-term solutions. *How economic change is increasing inequality in the city and the differences in quality of life.*

OCR
GCSE 1.2.3. There are different causes and consequences of development within the UK. *The causes of uneven development within the UK, including geographical location, economic change, infrastructure, and government policy.*

Eduqas
GCSE 2.2.2 What are some of the contemporary challenges facing UK towns and cities?

Different data

This resource will utilise data on bike crime from three different sources: the 2017 An Overview of bike theft: England and Wales and the 2020 Nature of Crime: bike theft both based on the Crime in England and Wales survey (CSEW), official Police recorded crime (specifically for Iffley, Oxford) and the BikeRegister database on bike registration and bike theft nationwide.

The CSEW refers to an annual victimisation survey in which a large representative sample of England and Wales are asked about their experiences of crime (amongst other things) in the past twelve months.

Official Police recorded crime only refers to all those incidents of bike theft which are reported to the Police.

You will need to pay close attention to which dataset is used, and when.

1. In the year ending March 2020, there were 84,545 police recorded bike thefts in England and Wales (excluding Greater Manchester Police) whilst according to the CSEW, there were 271,000 incidents of bike theft over the same period. This is clearly over three times greater than the number of cycle thefts recorded to the police.

   Why do you think some statistics for the same metrics appear to have different values depending on whether the data was collected by the CSEW, the national Police Service or BikeRegister?

Compound line graphs

A compound graph is an extension of a simple line graph but with each value stacked on top of one another. This graph shows layered data allowing you to see what proportion one data layer is of the total. When you sum up all the data layers of the graph, this represents total data.

A stacked line graph looks like a cross-section of a layered cake, with each layer representing one part of the whole. The total height is the absolute value, the total figure.

The differences between the points on the adjacent lines give the actual values for each data layer. To emphasise the data layers, areas between the lines are usually coloured.

Three things to remember before you chose to draw a compound line graph:

- Time is always plotted along the horizontal axis
- The scale must be high enough to enable you to plot the full range of data for each variable
- The data is continuous

What is continuous data?

Continuous data is data which can take any value within a set range — on a graph it is data from all the points *and the points* in between. It can be measured as finely as possible i.e., including fractions and decimals.

Graph 1 in Appendix A shows the total crime across the UK from January 2011 to December 2020 in a compound line graph.

2. Explain how this is continuous data.

3. Think critically: what is the problem with displaying the data as a compound line graph? List 3 issues you can spot.

4. Identify 3 benefits of displaying data in a stacked line graph.

5. Which two crimes have consistently been the largest from 2011 to 2020?

6. Describe the trend in bike theft over this period (use Appendix B for greater clarity).

7. Access the excel spreadsheet titled *UK crime statistics breakdown*. This is the same data as Table 1 in Appendix C. Once the spreadsheet is open highlight the columns for anti-social behaviour and bike theft and create a stacked line graph.

What we know about bike crime

Bike theft is a relatively low-volume offence accounting for around 2% of all Police recorded crime. Across the different Police Forces in England and Wales there is significant variation in the rate of bike thefts per 1,000 members of population. For example, in Dyfed-Powys (Wales) there are only 0.2 bike thefts per 1,000 population (the lowest) whereas in Cambridgeshire it is 5.1 bike thefts per 1,000 population (the highest). In Thames Valley the rate is 2.3 bike thefts per 1,000 population.

Glance at the Overview of bike theft: England and Wales ONS report from 2017, in particular study *Figure 1: Trends in Crime Survey for England and Wales (CSEW) and Police recorded bike theft, year ending December 1981 to year ending March 2017*.

8. Describe the line depicting data from the CSEW on bike crime in Figure 1 (of the ONS report).

Further work

- Compound graphs in geography https://www.internetgeography.net/compound-line-graphs-in-geography/

- With bike thefts rife, cyclists reveal the true cost of crime https://inews.co.uk/inews-lifestyle/money/bike-thefts-rife-cyclists-reveal-true-cost-crime-885103

- Why the crime drop? From the University of Chicago Press Journals https://www.journals.uchicago.edu/doi/pdfplus/10.1086/678081?casa_token=OXiqpVNI4WsAAAAA%3AVCj8T2cy62hYWgqB_WRbNXugZsg_zYPCYGLM3-jXzlvW49s0BITTFtqw1e9aZgoPRXJR4haLbvs&

- Five tests for a theory of the crime drop https://link.springer.com/article/10.1186/2193-7680-2-5

- The Arizona State University guide for police officers summarising what is known about bike theft and bike theft prevention https://popcenter.asu.edu/content/bike-theft-0

- An additional student activity as part of this project could be the following. Ask students to visit the police.uk data website, and:
  - Assign each student a Police Force
  - Ask students to download crime data for their allocated police force for the past 2 years
  - Ask students to extract/filter only bicycle theft data from these data
  - Ask students to produce a line graph showing the number of recorded bike thefts in their allocated force over this period?
  - Answer: does bike theft in this police force area show an overall upward/downward trend, or have numbers stayed the same? Are there any seasonal patterns?

Answers

1. There are discrepancies between different data sets because not all crime is reported to the Police. A common reason for not reporting bicycle thefts to the police is due to victims' belief that the police are unlikely to locate the stolen bicycle and/or catch the bicycle thief. Traditionally, there are higher crime figures (and some think more accurate) associated with the CSEW.

   A major strength of a crime victims survey is that they overcome the problem of underreporting. Survey respondents are asked to report their experience of crime in the past 12 months regardless of whether they reported their victimisation to the police. For this reason, estimates produced by crime surveys are generally considered to be a more reliable estimate of the true extent of crime. By comparing survey estimates to police recorded crime figures, we can also determine the extent of the so-called 'dark figure' of crime; that crime which occurs but which is not reported to the police.

2. The data is continuous because it is possible to measure fine points between the different Police Forces for, say, anti-social crime.

3. The Metropolitan Police Service covers 620 miles² with close to 9 million people within its boundaries. Both the population and the amount of crime is much higher than other data layers. Therefore, the compound line graph is warped making it difficult to read data from the other Police services. Other problems are a lack of detail for low value data layers, such as Robbery, and general difficulty in calculating individual data layer values.

4. Compound line graphs are clear, colourful and catch the eye. They give an overview of a large amount of data. It is possible to analyse trends over time.

5. The two crimes which have consistently ranked in the top two crimes nationwide, across all Police Forces, are: anti-social behaviour and violent crime.

6. Appendix C shows that bike theft, like all crime, has declined between 2011 and 2020.

7. Graph drawing task.

8. Two main findings are apparent. First, levels of bike theft rose considerably during the 1980s and peaked in the 1990s. In 1996, for example, there were an estimated 660,000 incidents of bike theft according to the Crime Survey of England and Wales. Since then, bike thefts have shown a general downward trend. This overall pattern is seen in both sources of data. The second finding relates to the underreporting of cycle theft: for each year the number of cycle thefts as measured by the crime survey of England of Wales is at least double that recorded by the police.

Appendix A
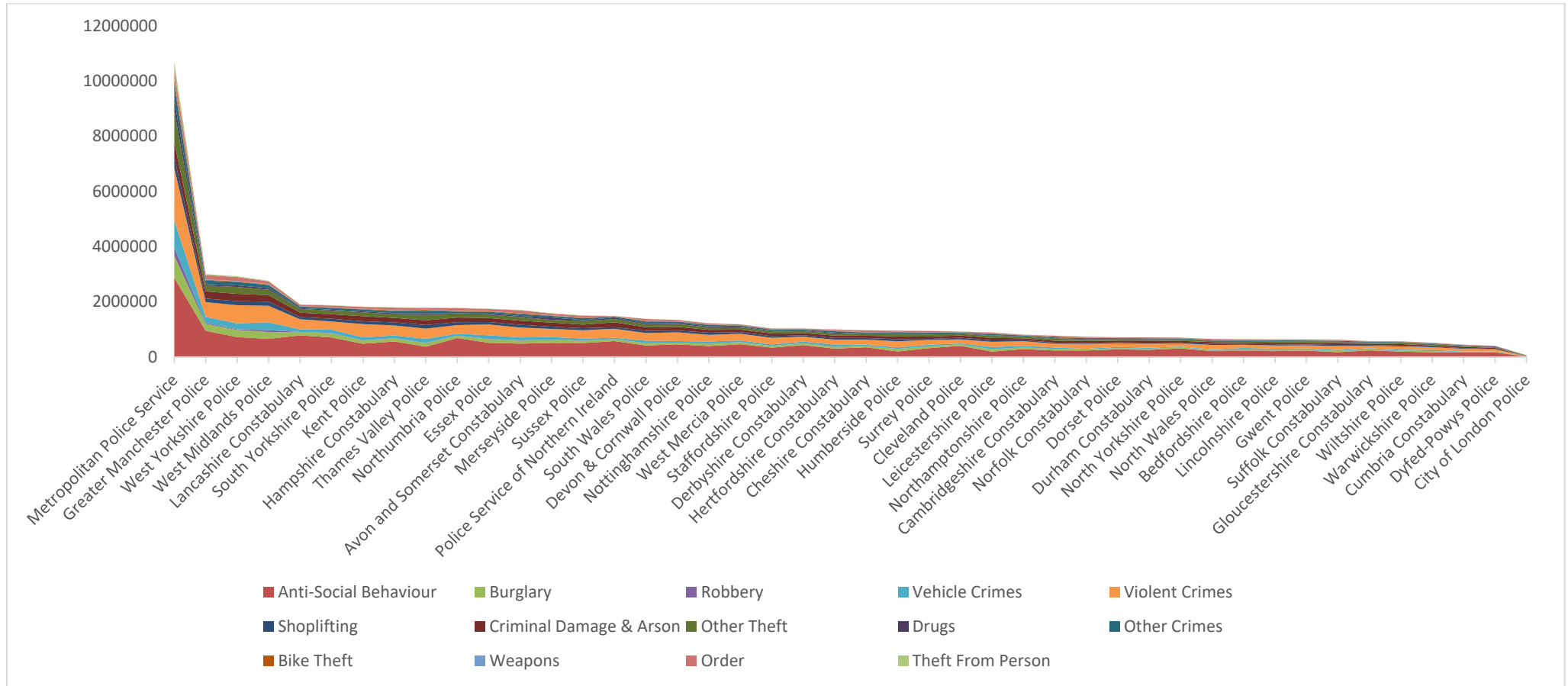
Graph 1 a 2D compound line graph of UK crime from January 2011 to December 2020 for all Police Forces in England and Wales

Appendix B
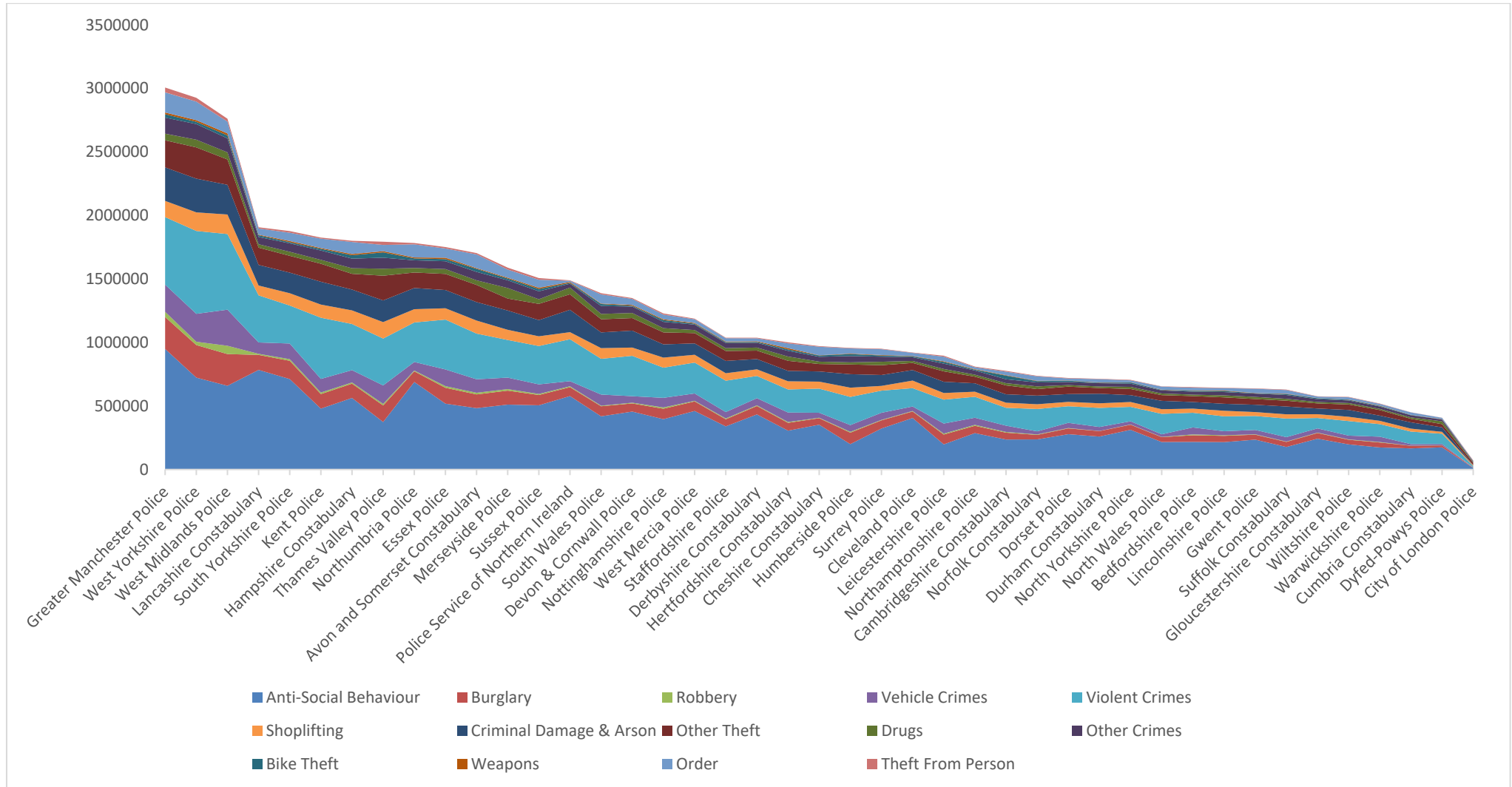
Graph 2 a compound 2D stacked area chart of UK crime from January 2011 to December 2020 excluding Metropolitan Police Force data

Appendix C

Police Constabulary	Anti-Social Behaviour	Burglary	Robbery	Vehicle Crimes	Violent Crimes	Shoplifting	Criminal Damage & Arson	Other Theft	Drugs	Other Crimes	Bike Theft	Weapons	Order	Theft from Person
Greater Manchester Police	948631	251705	41295	213271	531800	127610	263843	212965	52051	126558	27065	13259	158246	38357
West Yorkshire Police	723115	256634	25720	219616	652322	146526	265391	246433	60297	123105	17672	12731	146338	30227
West Midlands Police	659024	249200	65825	284011	595283	154030	233441	199663	55416	110518	23385	15246	93500	22544
Lancashire Constabulary	783921	118426	7697	89941	371055	77367	161596	136392	27325	56368	13577	4804	49016	9137
South Yorkshire Police	711968	143799	12747	122797	299281	96464	162546	132710	31512	66122	9506	8752	65632	13208
Kent Police	478938	114584	12558	107288	481082	103158	180045	141562	31284	73561	12727	7098	73400	8006
Hampshire Constabulary	563314	112337	9274	96659	363879	106829	164505	123420	43752	75232	27003	9366	95459	9627
Thames Valley Police	373418	130333	12838	144791	369387	129324	170270	195349	54832	86078	41965	9880	49184	25236
Northumbria Police	688781	84028	5868	67912	310828	103869	167595	121443	35375	60565	15012	8085	102706	10264
Essex Police	517890	125460	12787	131725	391545	89980	142920	126888	38635	60988	17277	10587	72848	11294
Avon and Somerset Constabulary	483093	107686	12949	106171	359699	102696	145223	135236	35950	66711	24313	5000	108649	10254
Merseyside Police	510601	110148	12297	89959	296069	80457	151572	94111	83716	59806	13991	6888	64674	14049
Sussex Police	505233	80608	8448	75987	301524	76493	127845	127512	36726	62171	18290	9381	63699	12627
Police Service of Northern Ireland	577939	70133	6932	40094	329647	56562	175580	121932	53636	29864	6388	7323	9355	3487
South Wales Police	418328	79670	4507	87028	282126	83227	124549	103432	41982	62214	15344	4323	71266	9374
Devon & Cornwall Police	456208	64281	4695	52039	317069	65193	133724	99074	39690	50127	6858	6232	47829	6190

Nottinghamshire Police	396367	81849	10365	75112	237397	79829	103717	94479	33460	49208	14033	6619	36658	9521
West Mercia Police	460594	75102	5073	58008	242869	61262	89782	81284	24013	42291	8212	4916	28689	4871
Staffordshire Police	339658	55897	6428	49783	247432	58000	97127	78808	21696	40616	7630	4384	25778	3715
Derbyshire Constabulary	433802	65541	6028	55732	174864	52218	81280	66459	23617	37911	7577	4094	23002	4828
Hertfordshire Constabulary	305595	61967	6550	74267	181389	64311	81802	79137	33771	45021	11080	10607	36510	9212
Cheshire Constabulary	352280	51582	2990	39224	190774	54787	79937	58479	18550	38386	9963	2561	66956	4872
Humberside Police	199689	90177	6428	52965	221642	72795	106426	76779	16163	50121	15709	3168	41294	4126
Surrey Police	322624	64403	3429	56010	173751	37849	85346	77592	26671	40242	9370	3601	45738	3529
Cleveland Police	405207	51128	4193	35174	144889	59106	83516	55498	16174	28299	7275	2855	24315	3297
Leicestershire Police	197724	77164	7698	78950	188494	52290	88412	81871	18847	41493	14581	4257	36245	7127
Northamptonshire Police	286338	57572	7576	55523	164776	40546	66544	51938	15566	32496	6761	3706	16270	4416
Cambridgeshire Constabulary	235922	54087	5275	49442	141180	39594	66298	69535	18197	30701	29233	3373	27328	6429
Norfolk Constabulary	236575	36028	3130	24619	175536	37463	68042	51585	21536	30612	9657	3311	35092	3667
Dorset Police	277728	45742	2659	40651	130652	35070	61457	58528	12121	24470	9663	2002	15483	4145
Durham Constabulary	259276	42306	1590	31072	150581	35812	75807	44613	12271	25768	4043	2022	26234	2100
North Yorkshire Police	312571	40174	1740	24712	114017	37842	54310	48253	16728	25207	9563	2058	14947	3487
North Wales Police	215877	38563	1639	20679	161033	36225	66844	44437	13092	24294	3833	1972	23786	1592
Bedfordshire Police	217390	51595	6913	54654	116273	32083	52143	46582	11428	23024	7620	2628	21860	4119
Lincolnshire Police	215661	49514	4620	30929	118113	43679	55161	49930	15774	26207	8702	3210	19054	2189
Gwent Police	234573	39819	2077	34964	109611	31354	57577	44707	17066	25795	2999	1444	33882	2175

Suffolk Constabulary	177431	39858	3118	33877	146264	33952	61002	46092	14688	29470	8317	2798	28773	3308
Gloucestershire Constabulary	242718	44282	2887	33325	82228	30215	43966	40516	11376	21915	7177	1576	11485	2461
Wiltshire Police	197373	36998	2297	29971	114773	33476	53849	43111	11287	19748	6089	2051	17589	2691
Warwickshire Police	172987	40036	3150	41877	98663	26608	40430	43992	9687	18310	5139	2366	12980	2661
Cumbria Constabulary	165885	20713	867	12400	98404	23327	49400	27873	11134	17080	2380	1589	18114	1128
Dyfed-Powys Police	174740	14917	469	9948	81840	14877	35146	25114	22448	13573	1275	1344	11056	611
City of London Police	12051	2706	669	1847	8804	6628	2213	17475	4364	5743	2994	366	2221	4150
Metropolitan Police Service	2875056	790442	301894	987378	1894475	385229	543163	1150928	387717	526690	149929	39482	342749	308958

Table 1 UK crime statistics breakdown from January 2011 to December 2020