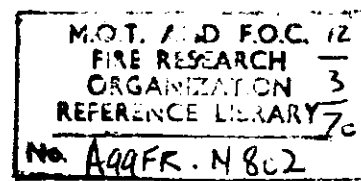


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## Fire Research Note

No. 802

MAKE LEICESTER FIRE-SAFE CAMPAIGN:  
STATISTICS OF FIRES IN DWELLINGS

by

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February 1970

FIRE  
RESEARCH  
STATION

F.R. NOTE NO. 802.  
FEBRUARY, 1970.

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STATISTICS OF FIRES IN DWELLINGS**

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**SUMMARY**

Dwelling fire statistics were examined for a period before and after an intensive generalised fire prevention campaign. Both frequency and average size appeared to have been reduced for a few months afterwards.

**KEY WORDS:** Cost-benefit, fire prevention, fire statistics, publicity, correlation, time series.

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**MINISTRY OF TECHNOLOGY AND FIRE OFFICES' COMMITTEE  
JOINT FIRE RESEARCH ORGANIZATION**

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**INTRODUCTION**

The "Make Leicester Fire-safe" campaign, undertaken on the initiative of the Home Office, ran for four weeks, beginning on 25th September 1967. During this time a great variety of organizations attempted to get fire prevention messages of various kinds across to the citizens of Leicester, using most of the possible media with the exception of television.

Activities were coordinated by a committee, on which the City of Leicester Fire Department was represented. Assistance, particularly in the form of printed publicity material, was provided by the Fire Protection Association and by the Home Office.

The campaign was intended to provide experience for the planning of proposed national campaigns, and surveys were therefore commissioned into the knowledge, attitudes and behaviour of a sample of the population of Leicester before and after the campaign. These were carried out by Sales Research Services Ltd. on the joint behalf of the Home Office, the Fire Protection Association and the Fire Service Research and Training Trust.

Three surveys took place: immediately before the campaign, immediately after, and about a year after. Small but statistically significant changes were observed immediately after the campaign, mostly in the direction hoped for, some being by as much as 20 per cent of the population sample. Although these short term effects were quite large, there was a fairly rapid decay evident by the time of the third survey, and most of the examples of changes from the pre-campaign state were considerably less than in the second survey. The greatest was still however 20 per cent; this was the increase in the percentage of people agreeing completely with the statement that fires can break out so suddenly and spread so quickly that people can be trapped even if they behave sensibly.

The Information Sub-Committee of the Joint Fire Prevention Committee of the Central Fire Brigades Advisory Councils for England and Wales and for Scotland felt that these measurable changes in knowledge, attitudes and behaviour might have brought about an observable (if not a measurable) change in the fire loss situation. Fire statistics were therefore examined for the period before and after the campaign.

#### METHOD

##### Principle of comparison

There is no way of knowing what fires would have occurred in Leicester if the campaign had not taken place.

An estimate can be made however by studying the fire record of a similar city. Nottingham, a city with a similar population (about 300 000) and located in the same part of the country was chosen.

Over the period studied changes in the total population of the two cities can be neglected (Appendix 1). Other demographic changes have also been neglected.

Any change in the fire experience of Leicester apparently due to the Leicester campaign would really arise because of the difference in fire prevention activity between Leicester and Nottingham. Although Nottingham is probably at least as fire conscious as most cities, the effort put into fire prevention over the period concerned can almost certainly be neglected in comparison with the much larger effort resulting from the campaign at Leicester.

##### Source of fire statistics

Local authority fire brigades, among them those of Leicester and Nottingham, return reports on the fires they attend to the Joint Fire Research Organization, and these form the basis of the statistics analysed.

There is a minor technical complication, in that Leicester City fire brigade attends fires in parts of the administrative county of Leicestershire, and by a long standing arrangement returns reports on these for statistical analysis included together with those for fires occurring within the city boundary. There was a change in the area of Leicestershire served by the city fire brigade during February 1967, which means that only fires occurring after this change can conveniently be compared with those for Nottingham for the purpose of this investigation.

The statistics for Nottingham are for fires within the city boundary only.

The campaign included a certain amount of publicity directed at industry. However, since the main emphasis was undoubtedly on influencing the private householder, only fires occurring in domestic premises were examined in any detail for a measurable campaign effect. Accordingly the fires chosen were basically those classified by the coding system of the Joint Fire Research Organization as occurring "in dwellings", with the minor exception of those which the fire brigades attended after extinction for investigation only ("late calls"), which were excluded from this analysis.

Fires occurring in caravans, and chimney fires confined to the chimney, are excluded.

#### Sizes of fires

The fire reports from Leicester and Nottingham do not include an estimate of the financial loss caused by the fire. Since a reduction in average fire size could be as useful an effect of the fire prevention campaign as a reduction in fire frequency, an arbitrary division into large and small fires was made from the reports.

Those where the coded punched card derived from the report indicated some fire fighting action by the fire brigade were classified as large. Those where none was indicated - i.e. where the fire was "out on arrival" - were classified as small.

It is convenient to assume a fixed ratio between the sizes of the average large fire and the average small fire. This was taken to be 5. This ratio is used merely as a device to weight the "large fire" more than the "small" ones and is not to be regarded as an accurate relationship. Calculation of the true ratio would require information, not at present available, on both direct and consequential losses, injury and fire-fighting costs. However, the ratio selected would be correct for average losses of £100 and £500 in the small and large fires respectively and would appear to be of the right order of magnitude.

#### Deseasonalisation and smoothing

Fires in dwellings have a seasonal variation in frequency (being most frequent in the winter). This cycle was eliminated so far as possible by expressing all fire statistics for Leicester as a ratio, those for Nottingham being the standard for comparison. The cities are near enough to each other (40 Km) to be affected by much the same weather conditions.

The number of fires occurring in dwellings in either city within one month is sometimes less than ten, so proportionately large random variations are to be expected. All statistics were, therefore expressed as 3-month moving totals. This introduces about the right amount of smoothing for our purpose. That is to say it appears to be high enough to eliminate random frequency and low enough not to eliminate campaign effect on frequency. Trending.

Because of the February 1967 change in Leicester "over-the-border" arrangements, usable statistics for the period before the campaign were only available for the six whole calendar months March to August.

Preliminary graphical examination suggested that the short term effect of the campaign on both fire frequency and size declined within a few months. It was therefore convenient to take the statistics for the same six months in 1968 (March to August) as at least an approximation to the long term situation, and to disregard such complications as the possibility of an "overshoot". Taking the same six months also helps to reduce the error in estimating the trend because of differences in the seasonal variation in Leicester and Nottingham.

The two points used to estimate the trend are therefore based on fires for March to August inclusive in the two years 1967 and 1968.

#### DISCUSSION

##### Interpretation of graphs

Figure 1 suggests that the average size of fires of the type considered was smaller in Leicester than in Nottingham before the campaign. Immediately after the campaign there was an apparent short term decrease (i.e. the average size in Leicester became even smaller in relation to that in Nottingham). After a few months however there was an increase which continued beyond the size relationship which existed before the campaign and the average sizes of the fires in the two towns became about equal.

Figure 2 illustrates the apparent short term reduction in size and suggests that the effect was at its greatest (i.e. the average fire size was at its minimum) about one month after the campaign. The fire frequency also appears to have been reduced, although in this case the apparent minimum was not attained until about 4 months afterwards.

The combination of frequency and size is illustrated in Fig 3 (in which frequency x size is equated to fire loss) and has much the same form of variation as its components.

Although the reductions in size, frequency and loss referred to above all followed the campaign and there were changes in the direction hoped for, it is not possible to say with certainty that they were a direct result of the campaign and did not happen by chance. If the effects were real, contributory factors could be:

- (a) a change in the types of fire occurring,
- (b) a change in the behaviour of people encountering them  
(among other possibilities a change in the tendency to call the brigade to small fires).

There is also an element of uncertainty in the definition adopted for a "small" fire (that it is one which is out upon the arrival of the brigade). Certain actions taken by the fire brigade, for example removal of burnt material out of doors, may or may not be regarded, or recorded, as fire-fighting. Hence other factors that might contribute to an apparent change in fire size could include:

- (a) a change in the action taken by the brigade at the fire,
- (b) a change in the method of recording the fire brigade action.

It is not possible to attach any statistical significance to the changes described (see Appendix 2).

Similar arguments and reservations are applicable to the unexplained apparent increase in fire size in Leicester which took place during the 12 month period in the middle of which the campaign was run.

#### Profit and loss

There are insuperable difficulties in calculating the rate of return on the money spent on the campaign.

The cost of all fires prevented by the campaign in the infinite future, together with the reduction in size of those smaller than they would otherwise have been, brought to their present value at the time of the campaign, cannot be estimated because of the random and other variations in the statistics available.

It can be shown that approximations for the short term saving suggested by Fig. 3 would be taken as one tenth of the annual fire loss, the cost of 20 average fires, or £10 000, but the statistical uncertainties associated with the graph have to be borne in mind.

Difficulties, conceptual as well as statistical, also arise in deciding the amount of money spent on a campaign of this kind. Money provided by the central government (in this case, about £4000) is a cost to the United Kingdom but not to Leicester. Money (or the equivalent in time) provided from voluntary sources is stimulated by official action, and without it no fire prevention campaign could achieve much, but its cost to the larger community is nil. It may have a negative "cost" if, as seems quite plausible, the people involved enjoy their voluntary efforts.

Because of these uncertainties, it seems likely that measurable decreases in fire losses could only be associated with measurable government expenditure on propaganda, education or legislation for a much more specialised (and possibly much larger) campaign. Indirect measures, such as changes in knowledge, attitudes and behaviour, provide a more precise indication of the success or otherwise of a particular fire prevention activity.

#### CONCLUSIONS

An intensive but generalised fire prevention campaign in a medium-sized city appears to have had the short term effect, lasting for a few months, of reducing the fire loss in dwellings by about a third, by reducing both the frequency and average size of fires. This short term effect may not be statistically significant. It is not possible to deduce what may have been the long term effect, which would be better measured by indirect methods.

#### ACKNOWLEDGMENTS

Thanks are due to Mrs. I. C. Day and Mrs. R. Dolan for extracting the relevant punched cards.

The work described in this paper forms part of the programme of the Joint Fire Research Organization of the Ministry of Technology and the Fire Offices' Committee; the paper is published by permission of the Director of Fire Research.



APPENDIX 1

Table 1

Population estimates (mid-year)

	* Leicester	Nottingham
1965	267 030	310 990
	(boundary change)	( - 0.2% )
1966	283 540	310 280
	( - 0.3% )	( - 0.2% )
1967	282 800	309 740
	( - 0.9% )	( - 1.5% )
1968	280 340	305 050

\* The fire statistics in the body of the report and in Appendix 2 do not refer to this population.

Source: Registrar General for England and Wales.

## APPENDIX 2

### Magnitude of random variations

The published annual statistics for "fires in dwellings" in Leicester and Nottingham can be used to estimate the expected magnitude of the random variations in the ratio of the fire frequencies in the two cities. The statistics are not consistent in their definition with those used in the body of the report, because of

- (a) the change in "over-the border" arrangements near Leicester in February 1967
- (b) the inclusion of "late calls" in the published statistics.

Table 2

Fires in dwellings (published statistics)  
Leicester and Nottingham

	<u>Leicester</u>	<u>Nottingham</u>	<u>Ratio</u>
1962	188	258	0.73
1963	246	270	0.91
1964	178	252	0.71
1965	192	245	0.78
1966	204	262	0.78

The mean ratio is 0.78 (with a standard error of 0.03). This is fairly similar to the ratios illustrated in the graphs, confirming that the adjustments to allow for (a) and (b) would not, for this purpose, be worth making.

The standard deviation of the ratio is 0.07. This is for the ratio of annual totals, so for 3-month totals, such as are plotted on the graphs, the standard deviation must be at least twice as much, say 0.14. Because of factors such as the differences in weather between the two cities, it would in fact be expected to be greater.

From inspection of the graphs, the possibility that all the variations recorded are due to chance ~~cannot~~ therefore be ruled out.

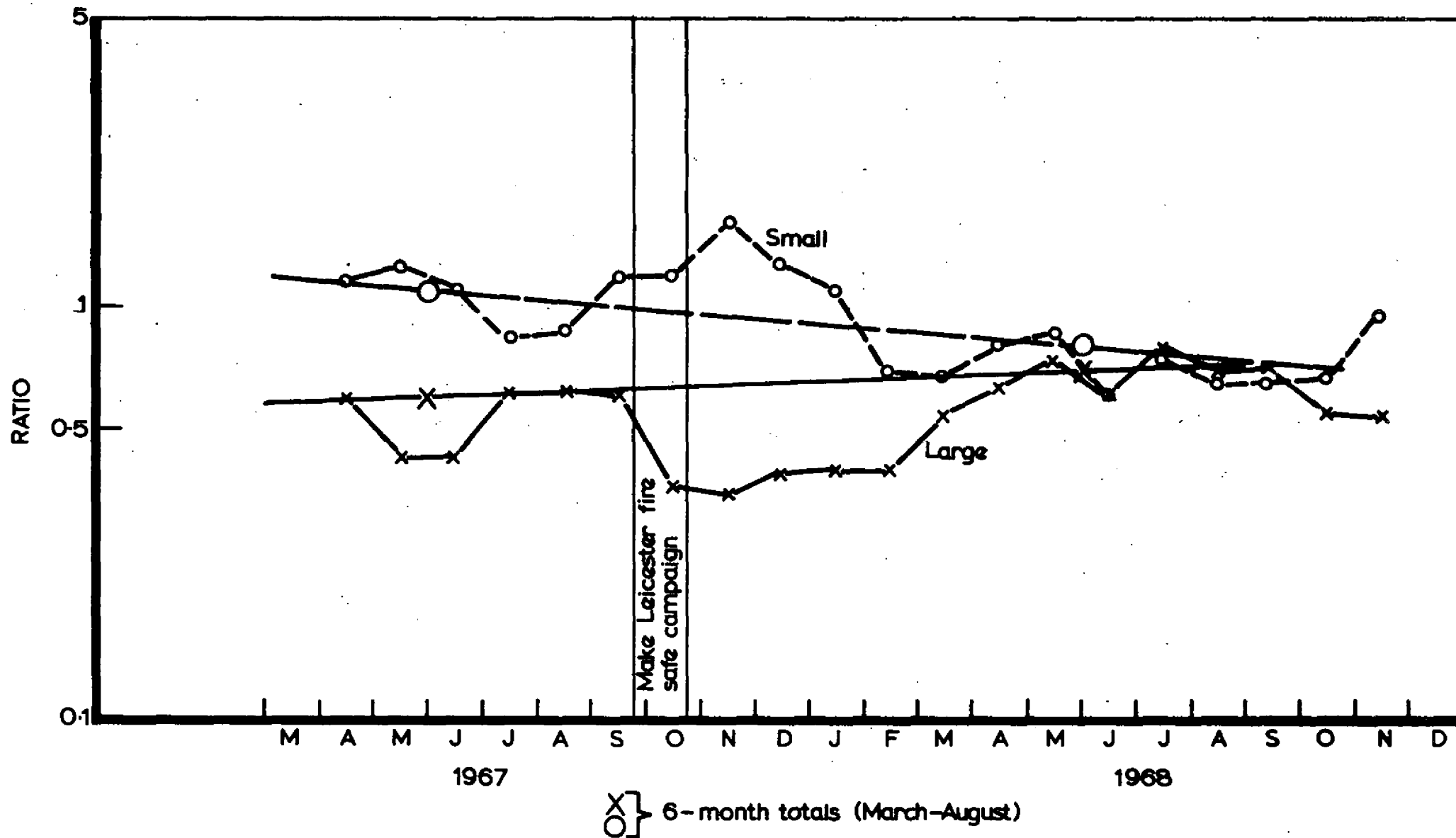
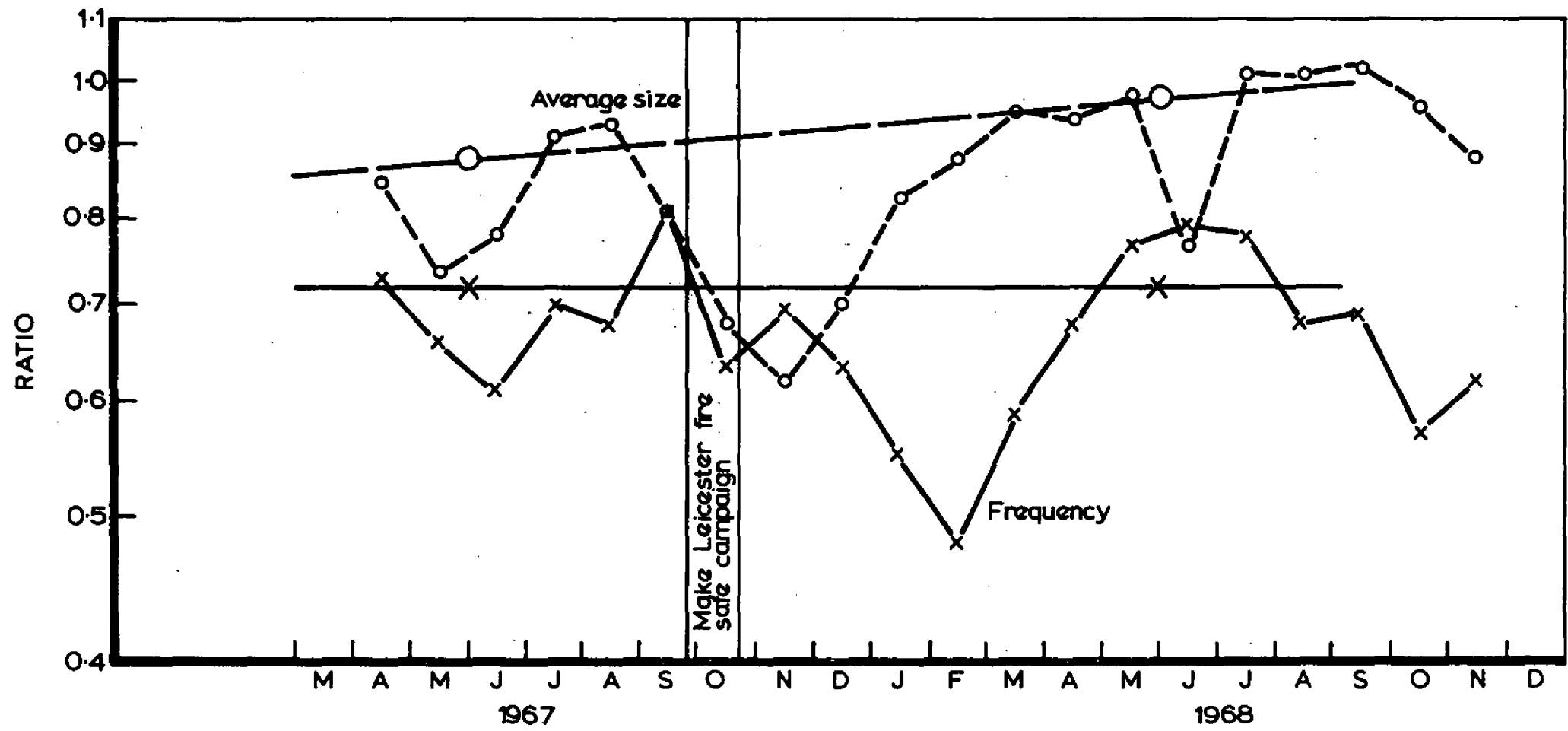


FIG.1. FREQUENCIES OF LARGE AND SMALL FIRES IN DWELLINGS ATTENDED BY FIRE BRIGADES (3-MONTH TOTALS) RATIO: LEICESTER/NOTTINGHAM



X } 6-month totals (March-August)  
O }

FIG. 2. FREQUENCIES AND ESTIMATED AVERAGE SIZES OF FIRES IN DWELLINGS ATTENDED BY FIRE BRIGADES (3-MONTH TOTALS) RATIO: LEICESTER/NOTTINGHAM

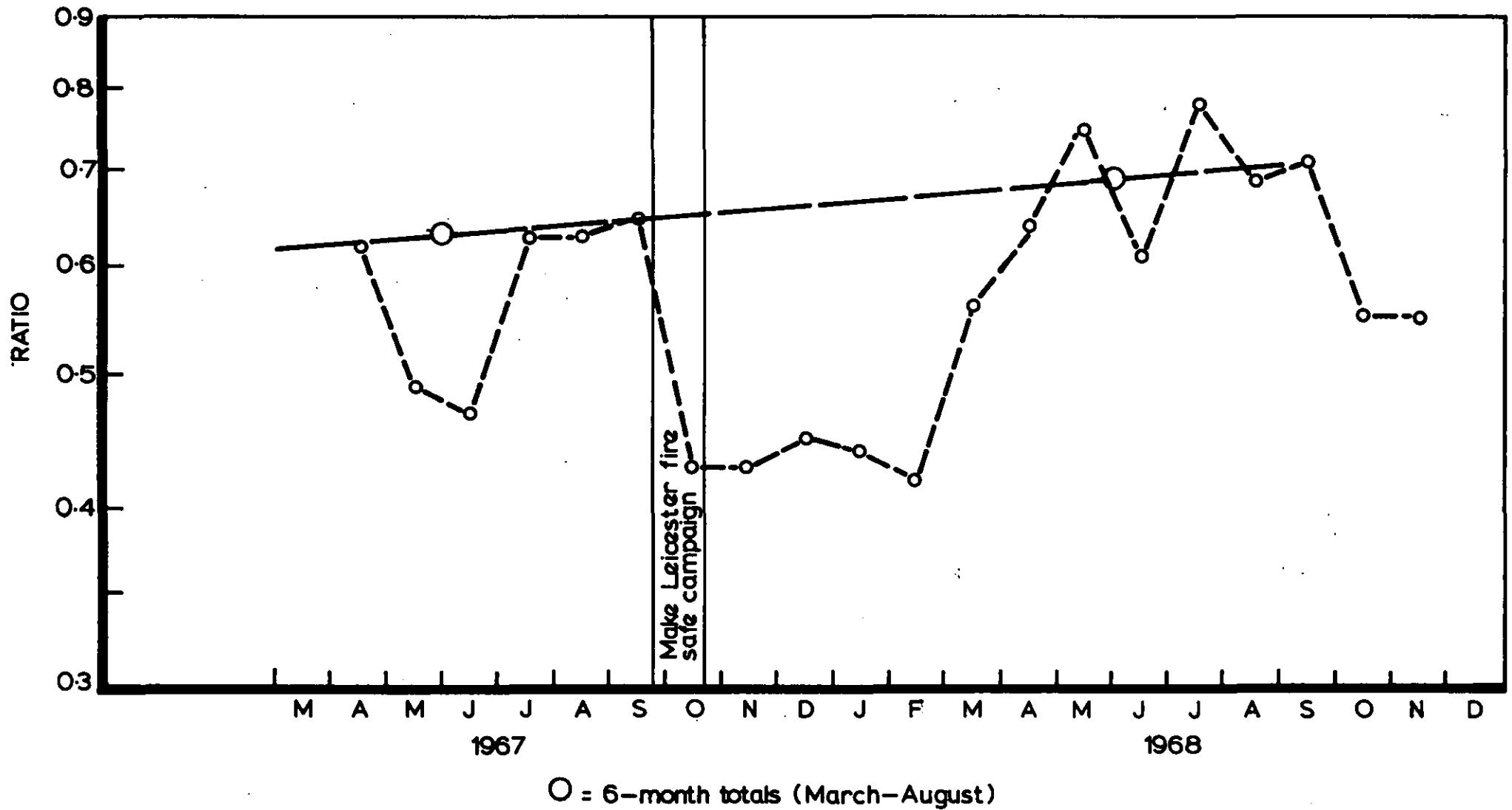


FIG. 3. ESTIMATED LOSSES IN FIRES IN DWELLINGS (3-MONTH TOTALS) RATIO, LEICESTER / NOTTINGHAM

