WORLD WIDE FUND FOR NATURE AUSTRALIA PROGRESS REPORT

A. Project No and Title

P144: Fire and Invertebrate Conservation in Mallee-Heath Remnants.

B. Report Type

Progress Report No. 5, 31 December, 1991.

C. Authors of Report

Dr Gordon Friend, Mr David Mitchell and Mr Brett Scourse (consultant).

D. Collaborators

Australian National Insect Collection, Canberra.
Western Australian Museum, Perth.

E. Objectives of Project

a) To examine the consequences of instigating deliberate burning for ecological management in remnant semi-arid vegetation by studying components of the fauna which are likely to show a range of responses to fire.

b) Use these data to develop general principles and policies for predictive fire management in such ecosystems.

F. Research Methodology

a) Studies are conducted in the Stirling Range National Park.

b) Three fires were carried out in 1990-1991: a spring burn in November 1990 over 20 ha, and two autumn burns in 1991, one over 20 ha (March) and the other over 200 ha (April).

c) Regular pre-and post-fire sampling using pitfall traps, sweeping and interception traps over 3 years.

d) Field samples are initially sorted to remove sand, plant material and ash, and all invertebrates are identified to ordinal level. Catches of Coleoptera, Arachnida, Hymenoptera, Diptera, Hemiptera and Orthoptera are separated for further detailed identification and analysis. Currently, Coleoptera are being identified to species level and voucher specimens are being lodged with the Australian National Insect Collection in Canberra. Species level identifications and analyses on other invertebrate groups will not be possible with current resources. However our samples are available for work by specialist taxonomists (eg. ants are being examined by Dr Alan Andersen of CSIRO Wildlife and Ecology, Darwin).

G. Summary of Work to Date

a) Permanent trapping grids were selected and established in a range of sites with different fire histories during June 1989. Two additional grids were established in September/October 1991 to sample a large area burnt under high intensity in April 1991. This will provide comparative information on a higher intensity fire which affected a much larger area than the small-scale experimental burns carried out on our areas.

b) Trapping was conducted in June, August, October and December 1989; February, April, June, September and December 1990; February, April, May, October and November 1991.

c) Sorting and identification of all catches up to October 1991 has been completed.

d) Measurement of habitat attributes has been completed on all but two of the 15 study plots; the two yet to be measured are both unburnt (control) grids. Reassessment of the burnt grids will be carried out in the coming autumn.

e) Preliminary analyses of some of the data were carried out during November/December, concentrating on Grid 5A (burnt under low intensity on 24 November 1990), Grid 4A (burnt under low to moderate intensity on 27 March 1991) and Grid 6A (unburnt "control"). Results are shown in Figures 1-11 (attached) and briefly discussed below.

The six orders of invertebrates being separated for more detailed analyses showed very similar abundances and trends on the control and treatment grids before the fires, but a marked short-term increase in abundance occurred on Grid 5A after the spring fire (Fig 1). This change was due to an increase in certain groups of beetles (family Cleridae, Fig 2), flies and wasps (Fig 3) and did not reflect a general increase in a wide range of invertebrates. The abundance of wasps (Fig 3) was lower on both burnt grids than on the unburnt grid in the following autumn. Beetle numbers were similar on all three grids during April/May (Fig 2) and seem to have been little affected by the fires. Both beetle and wasp numbers have increased on the burnt grids as on the control in the recent spring (October 1991) sample, but further samples from autumn 1992 are needed to ascertain trends.

Spider numbers were unaffected in the short term by either the spring or autumn fires (Fig 4), but there may be some longer-term impact as numbers have declined since April, particularly on the grid (5A) burnt in spring. Hemiptera (Fig 5) showed unclear trends which may not reflect any fire impact; Grid 4A diverged from the other two grids prior to it being burnt, while Grids 5A and 6A remained very similar. However, as with spiders, there may be some delayed effect of the fires since Hemipteran abundances on both burnt grids increased markedly in the recent October sample, compared with the control (Fig 5).

All of the above groups show considerable seasonal fluctuations, with abundances generally peaking in spring to early summer and declining in winter. Spiders also showed a distinct decrease in abundance (probably reflecting reduced activity levels) in mid summer 1990 (Fig 4). Furthermore, there is a general tendency for trends to be quite similar on all three grids prior to the fires, but considerable divergence seems to have occurred post-fire.

This divergence was investigated quantitatively by calculating Bray-Curtis dissimilarity measures for Grids 5A and 6A, based on the abundances of the six orders being considered. This produces a single measure, at various points in time, of the difference in ordinal composition of the two grids (see Fig 6). As expected, there is a marked increase in dissimilarity between the two grids immediately after the fire, reflecting the sudden increase in certain taxa of beetles, flies and wasps, as discussed above. Dissimilarity then returned to levels comparable to those before the fire. The overall mean dissimilarity before the fire (0.229) was not significantly different from that after the fire (0.366). Analysis of dissimilarity measures based on beetle abundance (Fig 7) and on presence/absence of beetle species (Fig 8) showed no consistent trends as a result of the fire.

Beetle species richness on grids 5A and 6A also showed no apparent fire-related trends, though there was a marked seasonal trend during 1989/90 (Fig 9). A plot of beetle abundance against time since fire using information from all sites (Fig 10) indicates that mean abundance increases up to about 40 years of age in these mallee-heath habitats, but then declines in older stands. A similar plot of beetle species richness against age (Fig 11) suggests that there is also a decline in the number of species in older stands. However, the lack of replicate grids in the 8 and 50-year-old sites, and the fact that these areas are a considerable distance from the other sites, severely limits this analysis. The low figures for abundance and species richness on these two sites may reflect locality and/or substrate effects rather than any impact attributable to fire. There is scope for considerably more analysis along these lines once all samples are in hand and sorted.

H. Preliminary Recommendations for Management

The preliminary analyses outlined above suggest that the small-scale low to moderate intensity experimental burns carried out on these mallee-heath areas have had only minimal impact on the invertebrate fauna in the short term. However the most recent spring samples suggest that the fires may have some longer-term impacts on certain invertebrate groups such as spiders and bugs, with numbers declining and increasing respectively in the spring following the fires. Information on beetle abundances and species ricnness suggests that peak numbers occur in stands of between 20 to 40 years of age; this offers some guidelines on optimal fire frequencies in these habitat types.

Data from two grids established in similar substrate and (pre-fire) habitat types within the large area burnt under very high intensity in April 1991 will soon be available to compare with that from grids 4, 5 and 6.

Such information will greatly assist in interpreting the results from our smaller scale work, and help place fire management in perspective.

I. Work to be Completed

a) Continue post-fire sampling.

b) On-going sorting and identification of invertebrates from trapping occasions, with detailed work continuing on beetles

c) Carry out further habitat analysis on burnt plots to monitor vegetation recovery.

d) Complete autumn 1992 sampling and sorting to ascertain some longer-term trends, and undertake more detailed analyses of data. Some extension of time will be required for this work (see attached letter).

J. Difficulties Encountered

Some logistic and taxonomic difficulties were outlined in the previous progress report. No further significant problems have arisen recently. The consultant to this project, Mr Graham Hall, resigned in June to complete his Ph.D. studies. Mr Brett Scourse took up the consultancy from July onwards.

K. Budget Report

World Wide Fund for Nature funding for the 30 month period ending 21 December 1991.

	Budget	Expenditure
Salaries	39 050	35 550
Equipment	1 025	360
Plant	2 750	2 460
Administration & Publication	2 325	1 900
Total	$45 150	$40 270

Resources from Department of Conservation and Land Management for the 30 month period ending 21 December 1991.

	Budget	Expenditure
Salaries and Travel	27 500	26 455
Equipment	2 750	3 197
Plant	6 600	4 220
Administration, Computing & Publication	8 250	5 888
Total	$45 100	$39 760

L. Reports or Publications Arising

These were detailed in the previous progress report. No further publications have been prepared to date.

FIGURE 1

STR INVERTEBRATES

ABUNDANCE OF SIX ORDERS

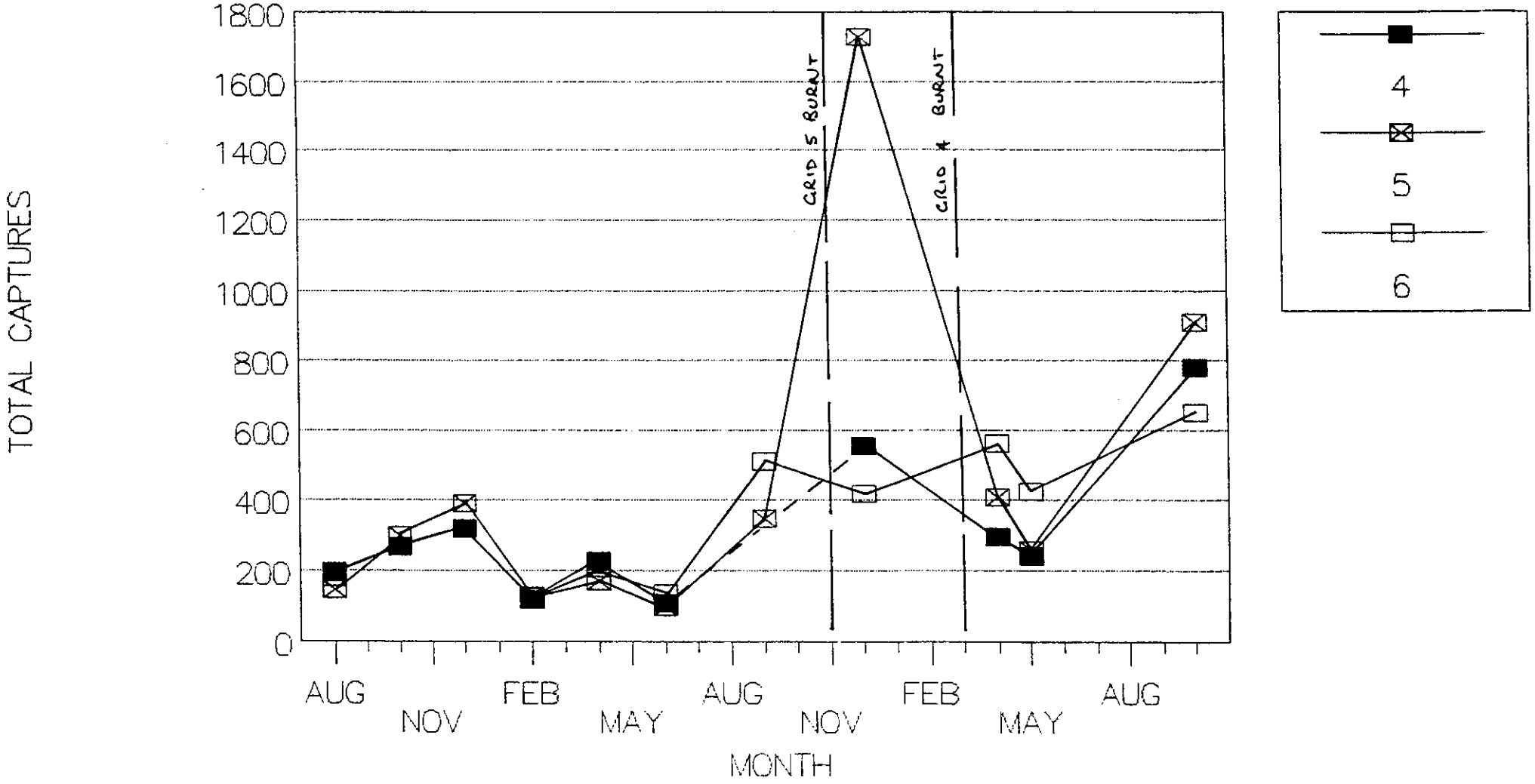

FIGURE 2.

STR – BEETLE ABUNDANCE

1989/1991

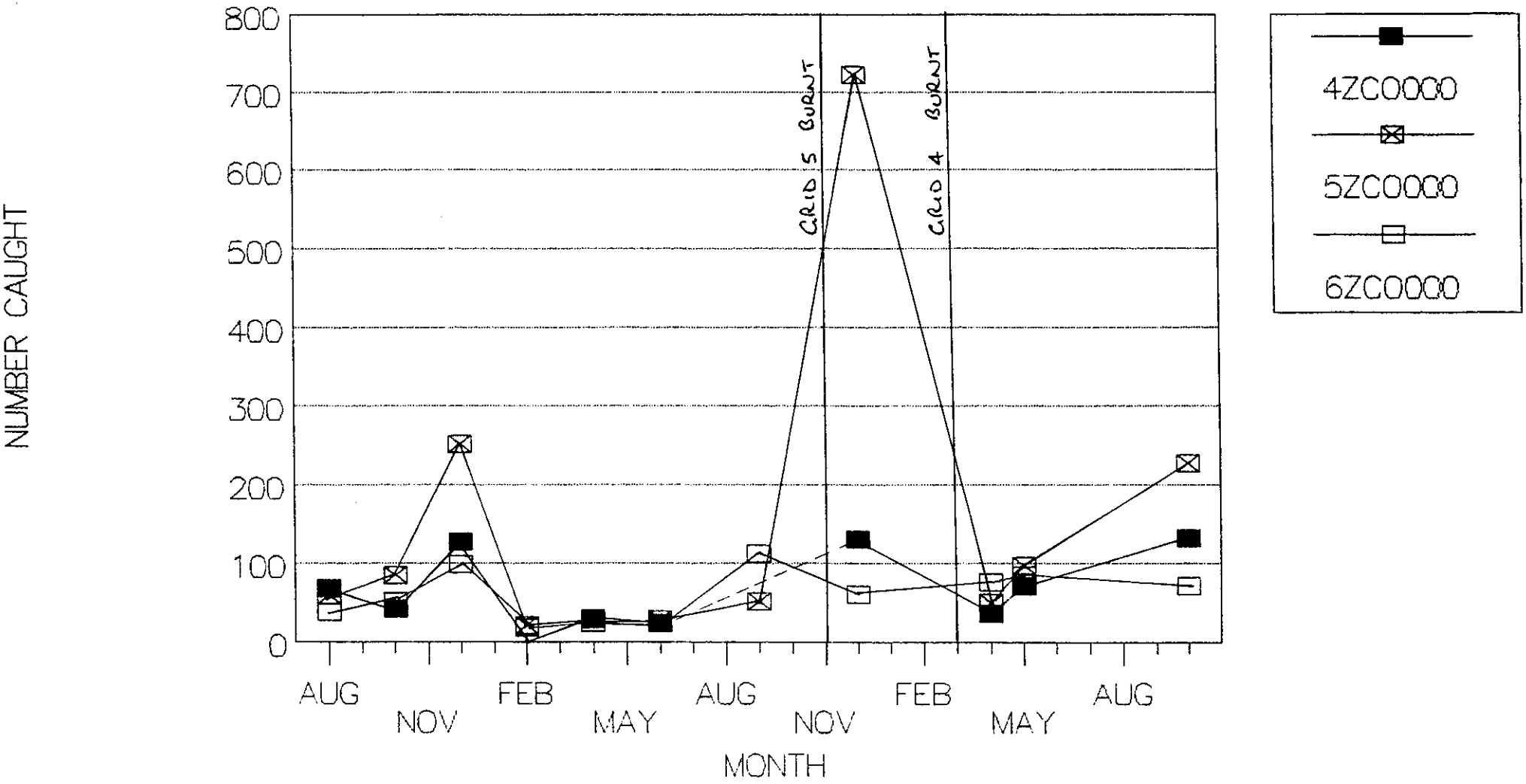

FIGURE 3.

STR – WASP ABUNDANCE

1989/1991

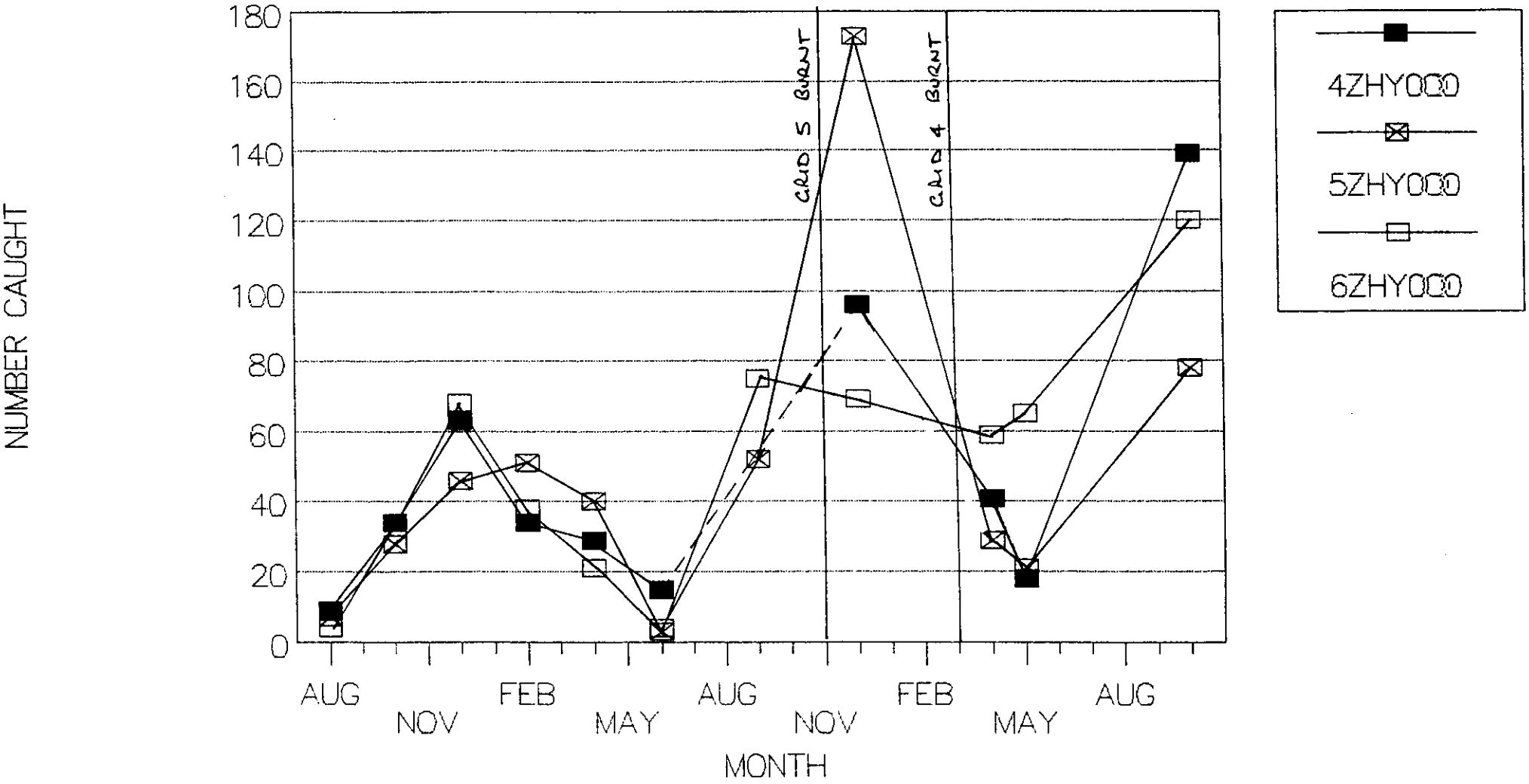

FIGURE 4.

STR – SPIDER ABUNDANCE

1989/1991

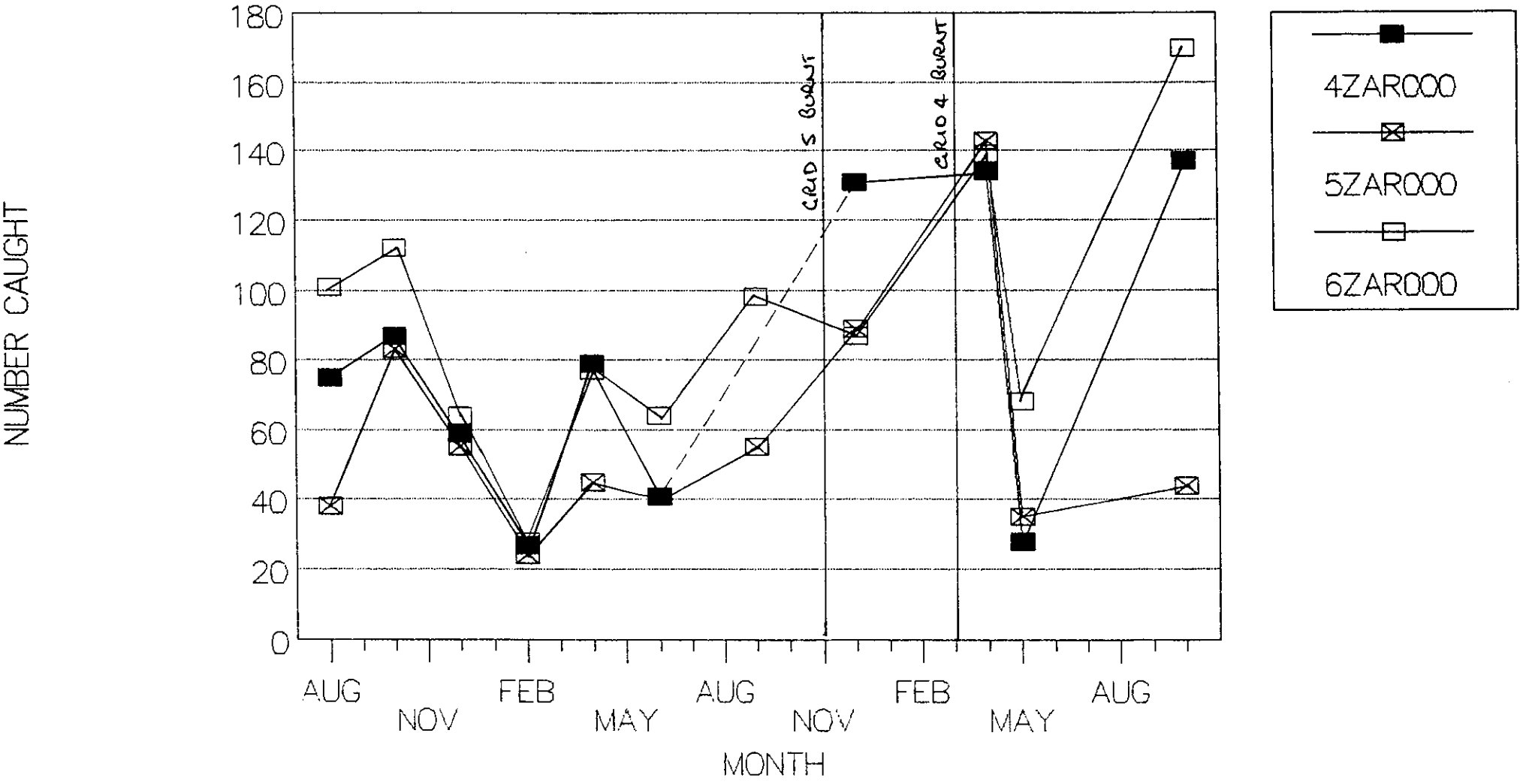

FIGURE 5.

STR – BUG ABUNDANCE

1989/1991

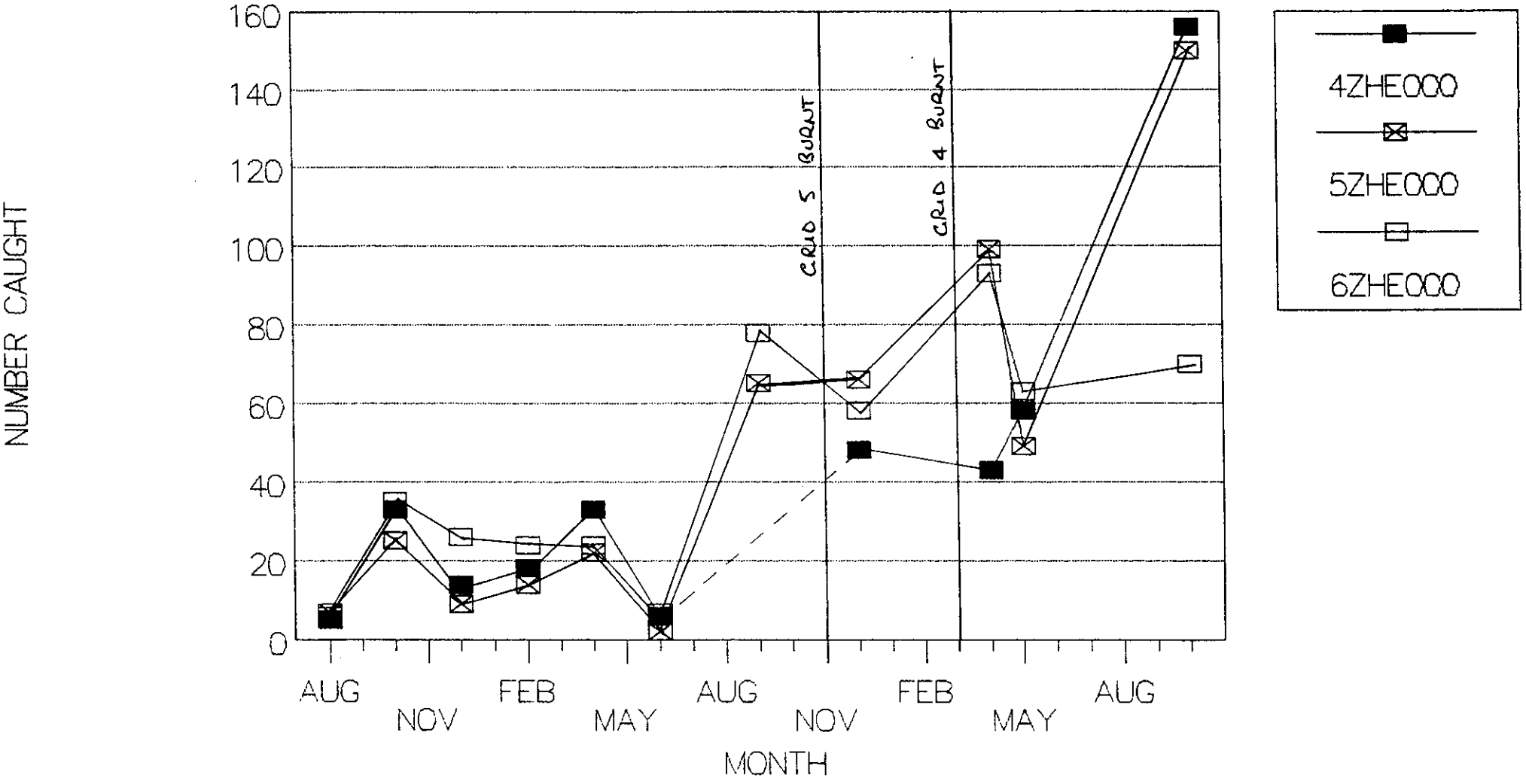

FIGURE 6.

STR ORDER DISSIMILARITY VS TIME

(six orders)

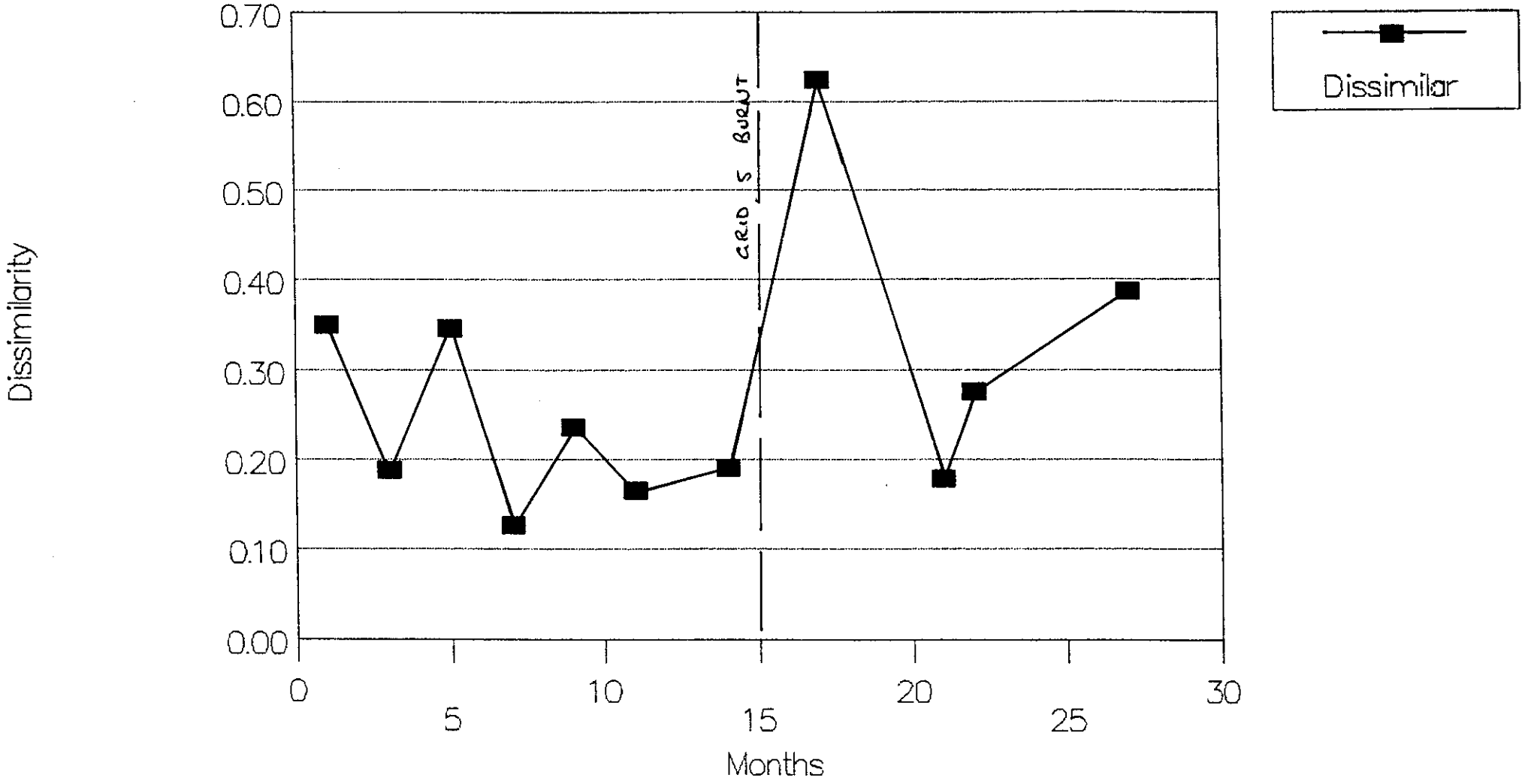

FIGURE 7.

STR DISSIMILARITY VS TIME

(beetle numbers)

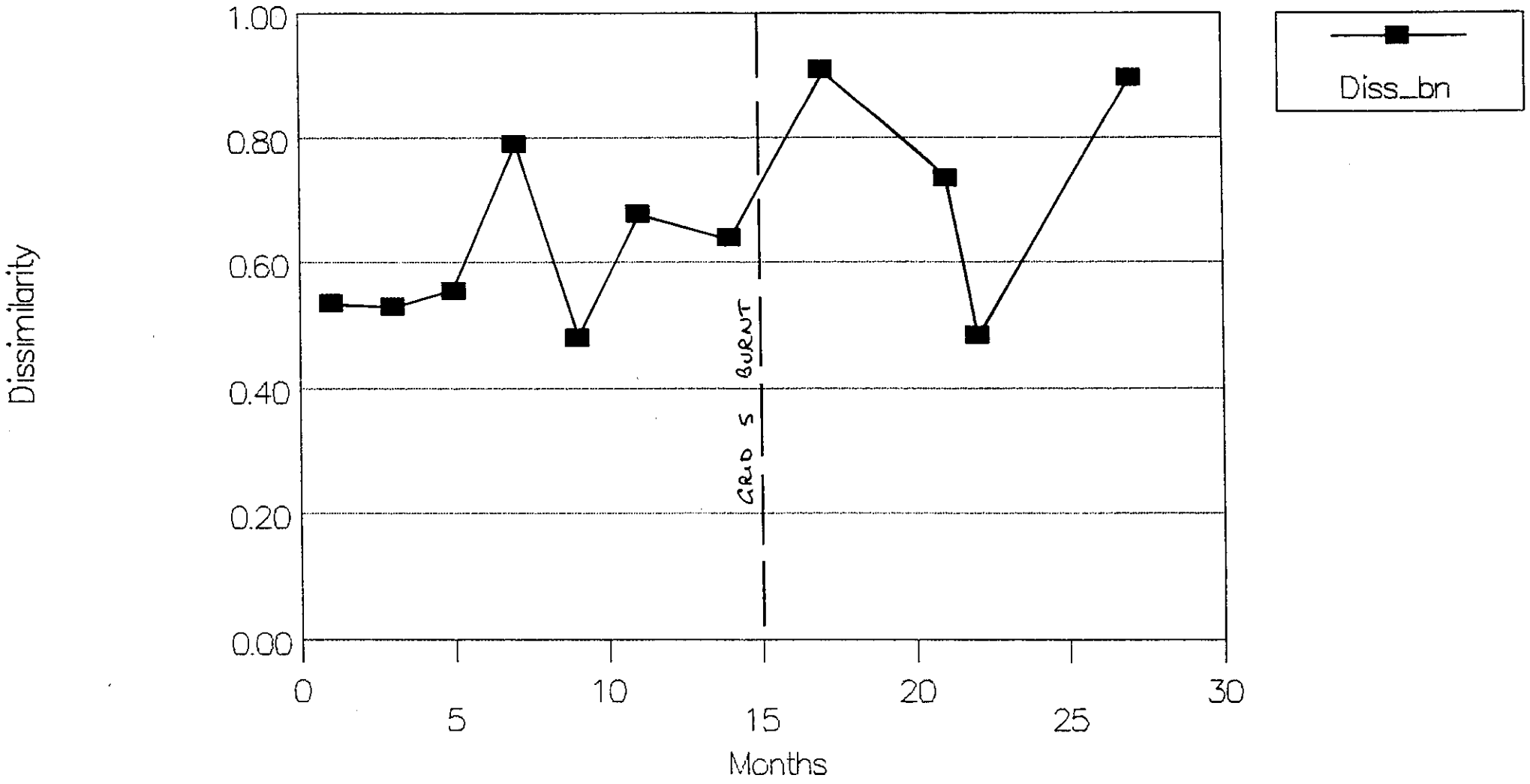

FIGURE 8.

STR DISSIMILARITY VS TIME

(beetle presence/absence

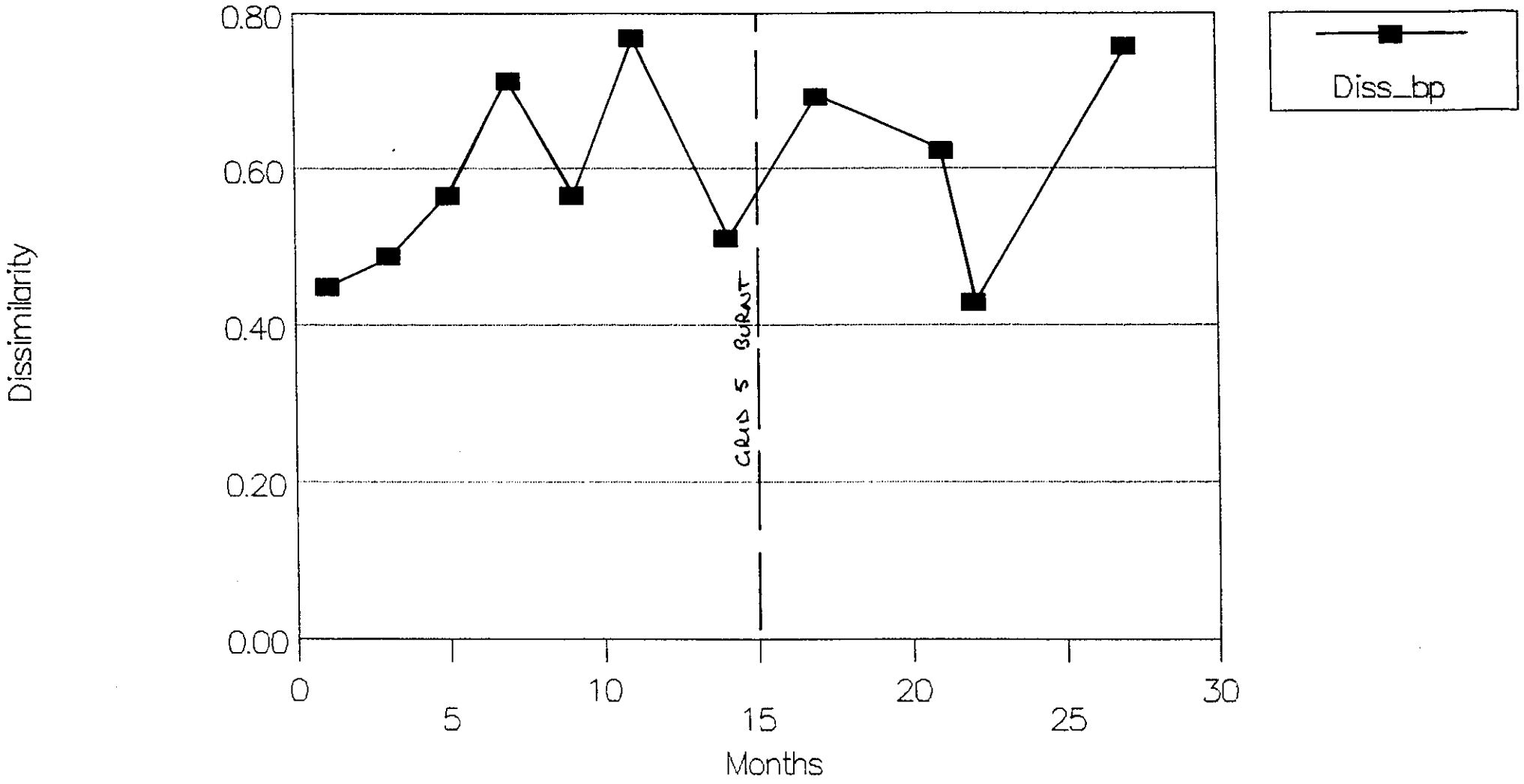

FIGURE 9

STR – BEETLE SPECIES RICHNESS

(number of species)

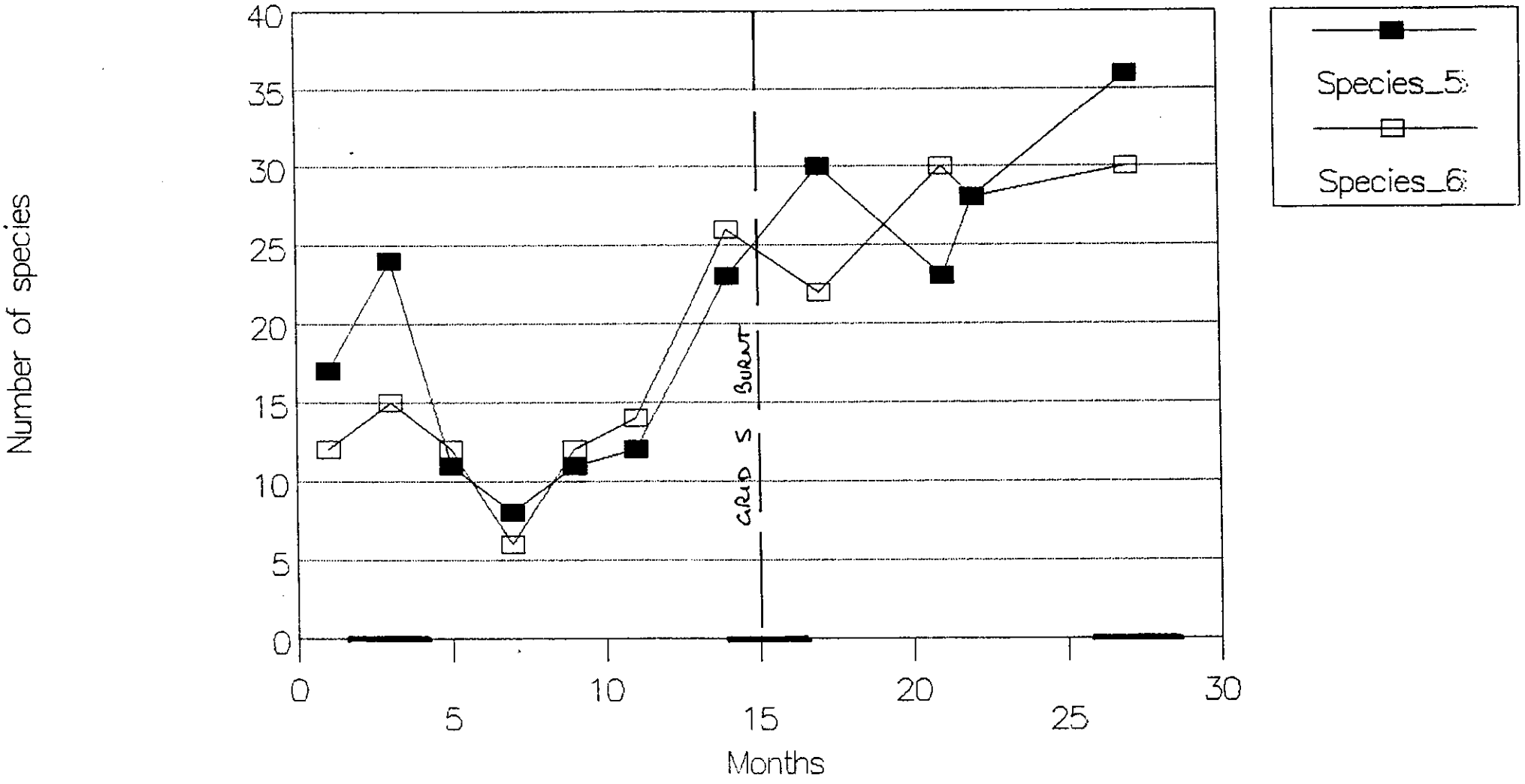

FIGURE 10.

STR – BEETLE ABUNDANCE

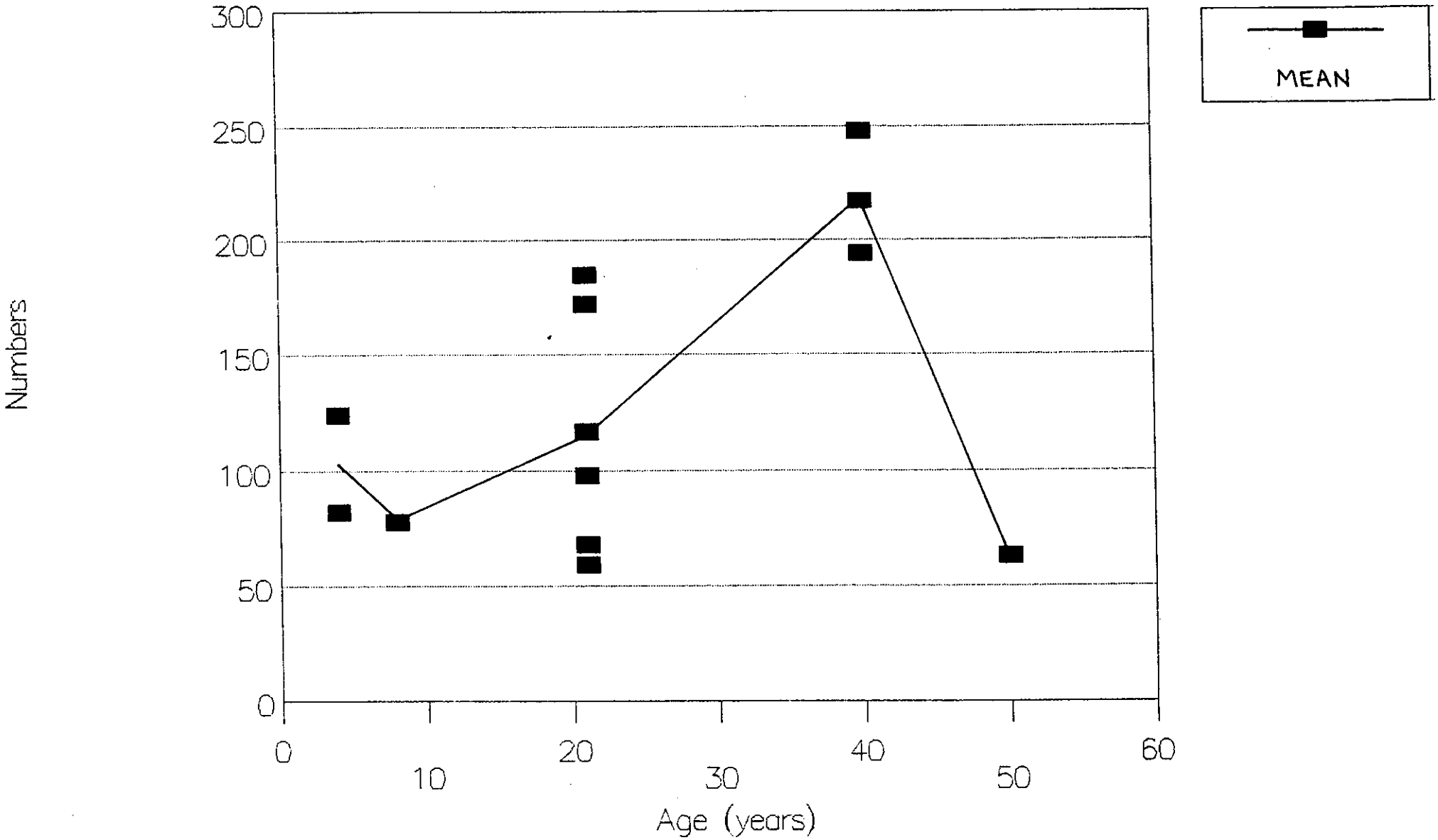

FIGURE 11.

BEETLE SPECIES RICHNESS VS AGE