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E.A.F.F.R.O.
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A more serious discussion of the economics of new fishing techniques involving large scale production can however, only be engaged into with supporting statistics to argue out real cases.

APPENDIX E

FLUCTUATIONS IN FISH CATCHES AND PRICES AND THEIR CORRELATIONS WITH CLIMATIC FACTORS

By
GERALD G. MARTEN
AND
LEMUEL T. GULUKA

This is a continuation of the programme of time series analysis reported earlier for a number of Kenya landings. As it is a common belief that fish catches are best during the rainy seasons, one object of the analysis was to see for which species this belief is supported by statistical facts. There had also been the speculation that high rainfall, which floods and temporarily expands lake and river margins used by many kinds of fish for spawning, may lead to high recruitment and correspondingly high fish catches a year or two later.

Spectral time series analysis was applied to fifteen years (1959-1973) of monthly records of fish catches, fish prices, rainfall, lake level, and wind at Masese Landing (Jinja). Similar records covering a seven year period (1968-1974) were analysed from two stations (Dunga and Kaloka) near Kisumu in the Kavirondo Gulf.

The time series were detrended by fitting a third order polynomial and using only residuals for subsequent analysis. Fagged autocorrelation and cross correlation coefficients, spectral densities, and coherence as defined by FISHMAN (1969) were calculated for periodicities ranging from two to eighty months. These were then used to identify cycles in fish catches, prices, and climatic factors, as well as associations between the cycles.

Masese

Both rain (Fig. 1) and lake level (Fig. 2) fluctuate with two peaks a year. The march (long rains) peak in rainfall is stronger than the October (short rains) peak. Peaks in lake level lag 2 months behind the short rain's peak and 3 months behind the long rain's peak.

The catches of all fish show two peaks a year and most are highly correlated with both rainfall and lake level. *Tilapia esculenta, T. variabilis* (Fig. 3)

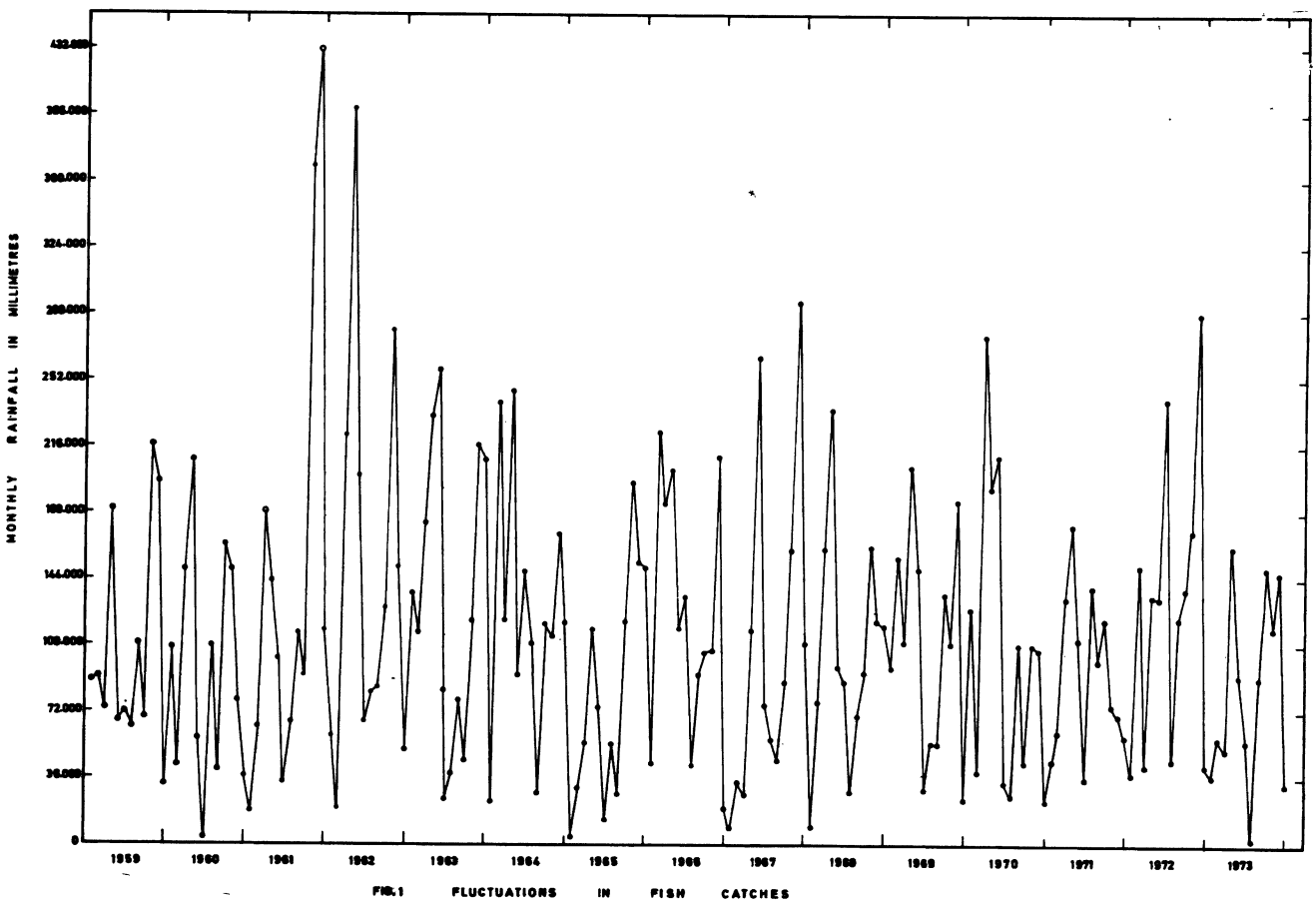


FIG. 1 FLUCTUATIONS IN FISH CATCHES

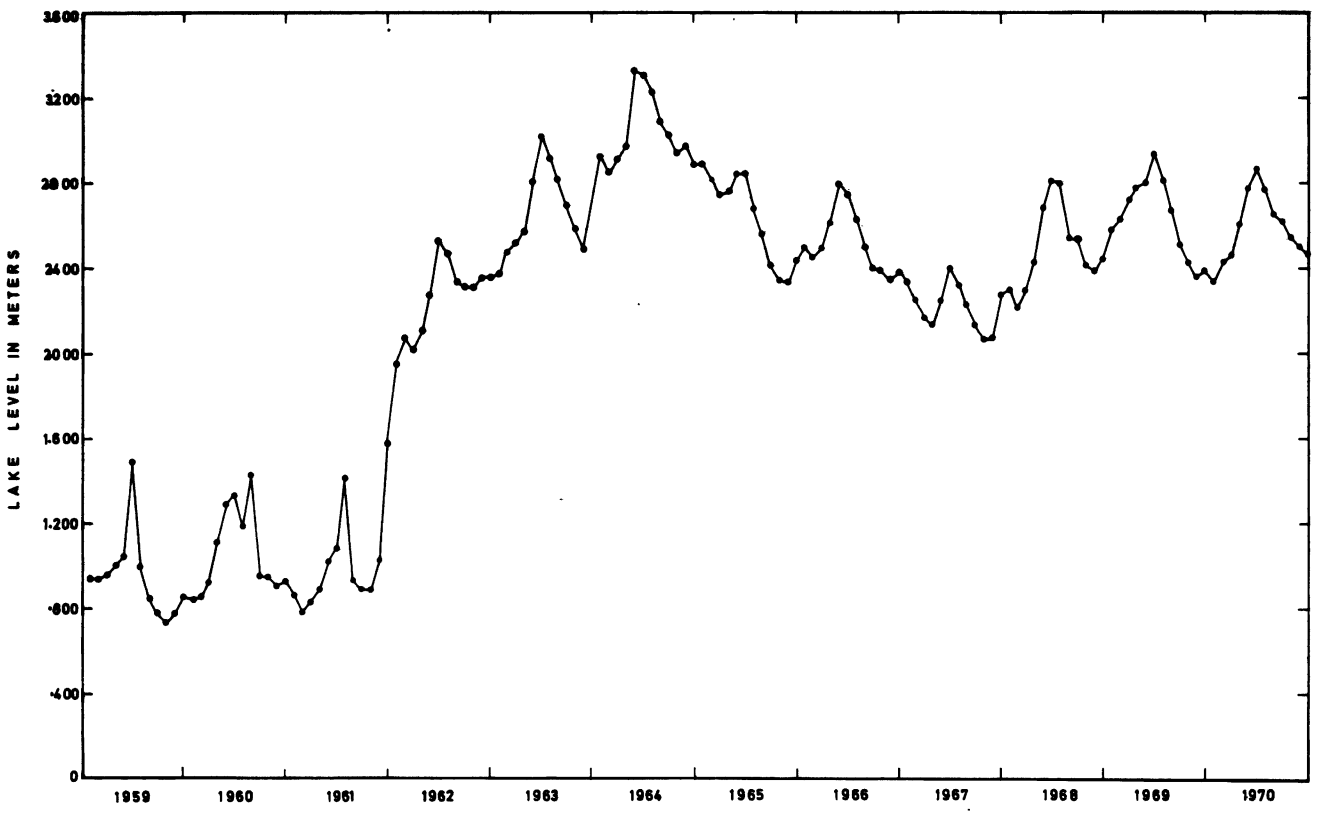


FIG. 2 FLUCTUATIONS IN FISH CATCHES

T. leucosticta, *T. nilotica*, and *Mormyrus* have their peak catches a month before the peak of the short rains (the time of lowest lake level). *Protopterus*, *Bagrus* (Fig. 4) and *T. zillii* have both peaks coincident with those of the rains. Peak catches of *Barbus* and *Clarias* (Which happen to spawn in rivers) are not correlated with rainfall.

Protopterus, *T. zillii* and *Barbus* have cyclic fluctuations with a period of 8 months, which are not associated with rainfall or lake level. Longer-term cycles are found in the catches of *Bagrus* (18 months), *Clarias* (18 months), *Barbus* (2 years) *T. nilotica* (2 years) *T. leucosticta* (4 years), and *Protopterus*

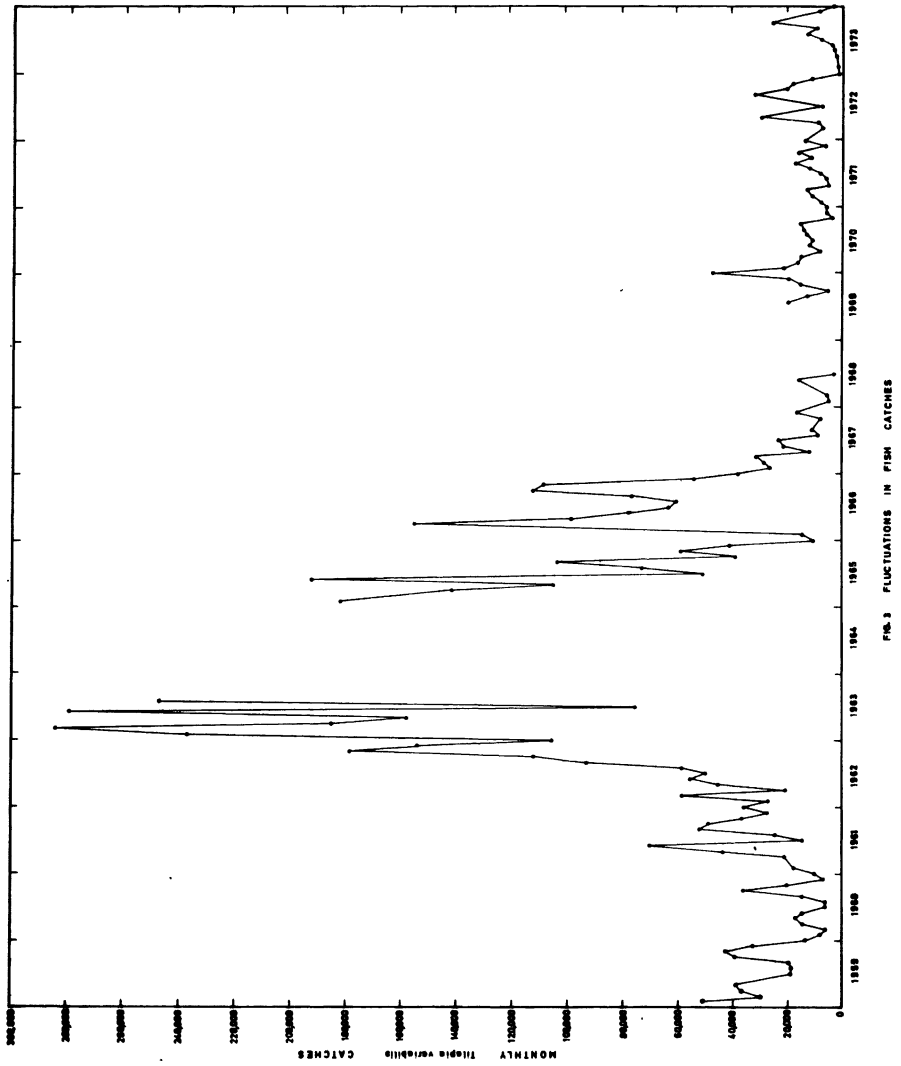
(7 years). Although the peaks of the longer-term cycles in *Bagrus* and *T. nilotica* are independent of rainfall, the peaks in *Clarias*, *Barbus* and *T. leucosticta* are associated with years of low rainfall. This appears to be a consequence of a strong positive correlation with lake level 26 months earlier. In fact, all species show a strong correlation between catch and lake level 2-2½ years earlier.

All fish showed a weak overall negative correlation between catch and price. Most showed a strong negative correlation between month to month changes in price and month to month changes in catch. All fish had a price cycle with a period of 7 to 8 months and another price cycle with a period of 4 years.

Because most of the fishes do not have catch cycles wih 8 month or 4 year periods, the 8 month and 4 year price cycles are not associated with fish fluctuations. Furthermore, the long-term price cycles for the various fishes are highly correlated with one another, even though fluctuations in fish catches at 8 months and 4 years are not at all correlated with one another. It appears long-term price fluctuations must be a consequence of cycles in the economy as a whole.

Nyanza Gulf

Although the results concerning fish catches at the two stations in Nyanza Gulf are very similar to each other, they differ in many respects from those at Masese. As a general rule, the catches of all fish species show two peaks a year like Masese, but often only one of the peaks actually appears each year. Peak catches of *Clarias Synodontis* and *T. variabilis* coincide with peak rains, but peak catches of *Bagrus*, *Haplochromis*, *Protopterus*, and *T. esculenta* do not. *Protopterus* and the *Tilapia* also have a 9 month periodicity, not



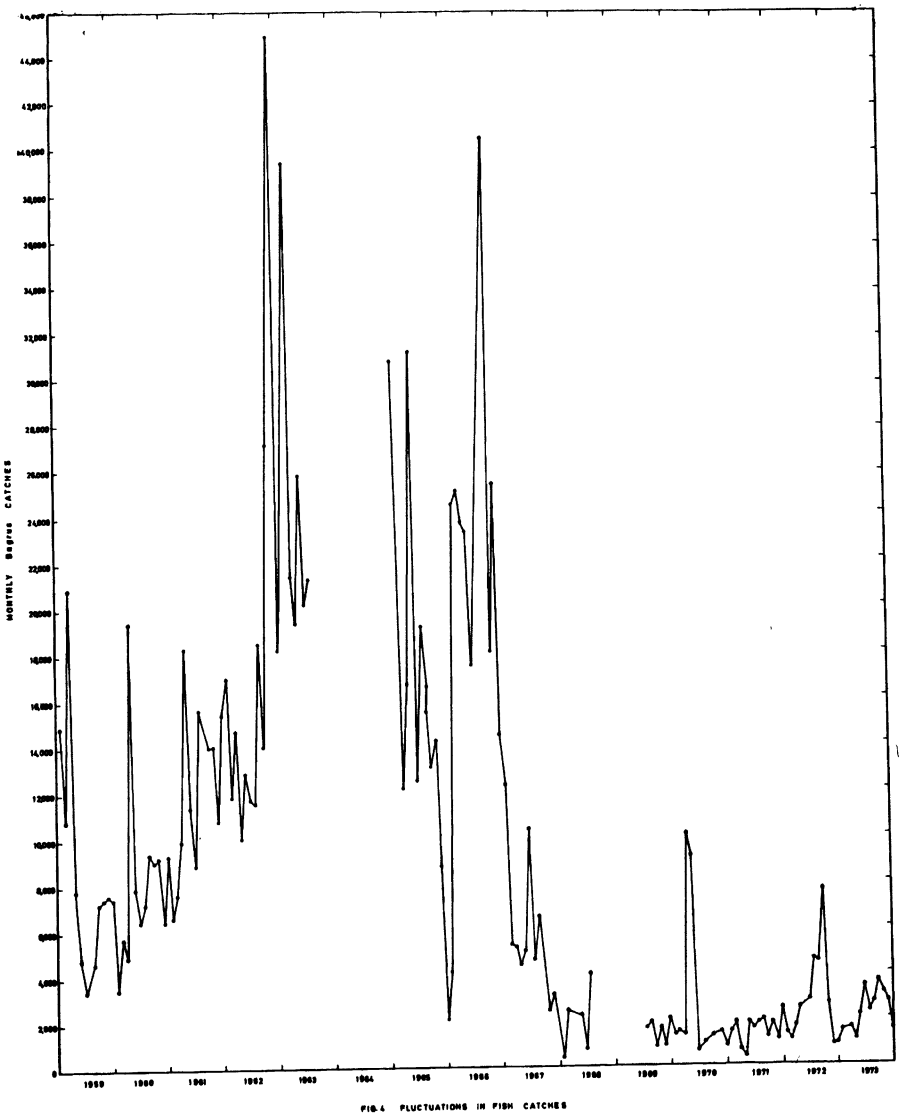


FIG.4 FLUCTUATIONS IN FISH CATCHES

associated with the periodicity in rainfall.

All species have two periodicities in prices, one at 3-4 months and the other at 9 months and peak prices are associated with low catches. The Nyanza Gulf records are not yet long enough to detect whether there is a 4 year price cycle as at Masese.

REFERENCES

FISHMAN, G.S. 1969. Special methods in econometrics. Harvard U. Press. 212p.