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Seasonality of Births and Conceptions in a Pastoral Community of the Province of L'Aquila (Abruzzo, Italy), 1802–1965

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ABSTRACT

Natality rates and seasonality of births and conceptions were analyzed from 6,116 birth records in the pastoral community of Roio (Abruzzo, Italy) from 1802 to 1965. Gross natality rates averaged 25.5 x 1000 in the past, lower than those reported for agricultural groups. Seasonality of births showed a marked pattern: 80%–67% of births occurred in the first six months of the year. The monthly distribution of conceptions was compared to that of marriages. The results show a high correlation in the 19th century and a lower one in the 20th century. These findings suggest that pastoralism acted as a primary regulator of reproduction in this community.

Introduction

As reported by several authors, the main topics of human ecology are intra- and inter-population biological variability and stability and change in population-environment interactions. Adaptability responses are the result of the interaction of the human and environmental components of any specific population-environment system^{1–3}.

Johnston² emphasizes that both populations and environments fluctuate; the fluctuations may be stable or stochastic

and are interactive, not just additive. Among stable fluctuations, environmental seasonality is a basic component of the ecosystem in which populations have evolved. Therefore, seasonality of vital events in historical 'traditional' or contemporary subsistence communities are biocultural indicators of population-environment interactions that may have demographic consequences, affecting the long-term general 'fitness' of the population^{4–10}.

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In human ecology, particular attention has been given to the month of birth, since it is known to depend on several factors: cultural strategies of the couples, climatic factors, and work activities and loads, the latter resulting in temporary impairment of physiological-reproductive functionality^{6,11,14,15}. The month of birth also has important repercussions on the positive 'fitness' and development of newborns, since it is associated with infant survival capability¹⁴ and the intensity and speed of their physical growth^{7,15,16}. Furthermore, the month of birth seems to be associated with later reproductive performance and characteristics such as menarcheal age, fecundity, menstrual disorders, spontaneous abortions and twinning^{9,10,17}.

The present research investigates seasonality of births during two centuries in Roio, a town in the Abruzzo region, where the prevailing subsistence activity has always been pastoralism. The shepherds of Roio were considered the leading shepherds of the Province of L'Aquila and they possessed very large flocks, composed exclusively of the '*gentile di Puglia*' breed, a cross between the ancient native breed and merino sheep introduced by the Aragonese. Their main characteristics were rusticity and ease of breeding; they were raised for meat, milk (and its products) and wool¹⁸.

A previous study of matrimonial seasonality displayed a marked prevalence of summer marriages until the 1940s, with a progressive change toward a 'modern' pattern independent of the traditional subsistence regimen¹⁹. The aim of the present study was to analyze the monthly distribution of births to identify: 1) a pattern of births; 2) if the observed pattern and, more properly, that of conceptions reflect the pattern of marriages; and 3) evidence that marked seasonality of these two vital events has had long-term demographic consequences.

Roio, a '*frazione*' of the Municipality of L'Aquila since 1927, includes four settlements (*villas*) located within a maximum range of 3 km and at an altitude of 700–850 m a.s.l. Although the Province of L'Aquila cannot be defined on the basis of altitude as a high mountain zone, it does have climatic-environmental characteristics typical of mountain environments. Two-thirds of its territory is mountainous, with only a few basins and plains devoted to intensive agriculture. Here more than anywhere else in Abruzzo, these environmental characteristics have been the limiting factors, which have significantly influenced the peopling of the area and the development of subsistence models since the distant past²⁰. These environmental constraints have caused strong reproductive isolation of these communities, which is particularly high in the pastoral ones as well as in the high-altitude ones^{19,21}.

Starting in the 1860s, a strong migratory flow from Abruzzo (and Roio) toward other European and overseas countries occurred on account of the unification of Italy and the beginning of its 'modernization'. Similarly, there was a second flow of emigration towards the northern regions of Italy in the 1950s^{22,23}. The general geographic and demographic parameters^{24,25} are listed in Table 1.

Subjects and Methods

The data were collected from 6116 birth records from Parish Registers of baptisms (1802–1823; 1873–1937) and Civil Registers of births (1824–1872; 1938–1965). To test the reliability of the sources, the sex ratio at birth was calculated. Gross rates of natality in four sample years were obtained by considering the average number of births in 21 years over the population of the sample year. Seasonality of births was analyzed by century. The number of births in each

TABLE 1
GENERAL GEOGRAPHIC AND DEMOGRAPHIC
PARAMETERS IN THE VILLAGE OF ROIO
(ABRUZZO)

Altitude (m.a.s.l.)	700-850
Population	
1841	1292
1881	1636
1921	2092
1951	3282

month was expressed as so many per 1200, corrected according to the number of days of the month so that the average number of expected births per month would be 100.

Results

Results for the sex ratio and natality rates are listed in Table 2. The sex ratio is 108.8 in the 19th century and 105.1 in the 20th century, in agreement with the expected demographic values for a number of births averaging 3000²⁶. Gross natality rates are between 28.7×1000 in the 19th century and 23.4×1000 in 1921, lower than those for other rural populations of the Province of L'Aquila²⁷, Abruzzo^{28,29} and southern Italy^{28,30} with mainly agricultural subsistence regimens. Nevertheless, they still suggest a pre-transitional pattern. The natality rate in the mid-20th century is 8.2×1000 , a 'modern' rate resulting from two main factors acting in synergy on the population: 1) the second

large migratory flow of juveniles and adults towards urban centers, and 2) the availability and rapid diffusion of pharmaceutical products for voluntary birth control. The former must have been more important in those years, while the latter started systematically from the 1960s.

Table 3 shows the number of male and female births and the indices per month, as well as the month of conception, obtained by projecting the births back nine months. The difference between the monthly distribution of males and females in both centuries is not statistically significant: $\chi^2_{[11]} = 16.3$ in the 19th century and $\chi^2_{[11]} = 10.8$ in the 20th century. Therefore, the results refer to males and females combined. In relation to the current debate about possible regulators of the sex ratio in human offspring (particular attention being devoted to seasonality), the absence of a significant difference in the monthly distribution of male and female births in Roio shows that the month of conception has no influence on sex ratio variations^{31,32}.

In the 19th century, almost 80% of births are concentrated in six months: 61.3% from March to June inclusive, and 18.6% in February and July. There is a marked peak in March (index = 202.2) and a weaker one in June (index = 181.4). The trough occurs in October (index = 30.3) and November (index = 27.5).

Although seasonality of births is a general rule in all human populations, the described distribution shows an excep-

TABLE 2
NUMBER OF FEMALE AND MALE BAPTISMS, SEX RATIO AND GROSS NATALITY RATES IN THE
VILLAGE OF ROIO (ABRUZZO) IN THE PERIOD 1802–1965

	Baptisms		Natality ($\times 1000$ inhab.)	
	1802–1899	1900–1965	Years	Rates
Males	1866	1299	1841	24.0
Females	1715	1236	1881	28.7
Total	3581	2535	1921	23.4
Sex ratio	108.8	105.1	1951	8.2

TABLE 3
 NUMBER OF OBSERVED BIRTHS, MONTH INDEX AND ESTIMATED MONTH OF CONCEPTION OF
 MALES AND FEMALES IN THE VILLAGE OF ROIO (ABRUZZO) IN TWO CENTURIES

Month of birth	1802–1899						Month of conception
	Males		Females		Total		
	N	Index	N	Index	N	Index	
January	106	66.9	68	46.7	174	57.2	May
February	172	118.6	151	113.3	323	116.1	June
March	305	192.5	310	212.8	615	202.2	July
April	264	171.8	255	180.5	519	175.9	August
May	298	188.1	227	155.8	525	172.6	September
June	267	173.7	268	189.7	535	181.4	October
July	183	115.5	159	109.1	342	112.5	November
August	78	49.2	65	44.6	143	47.0	December
September	61	39.7	52	36.8	113	38.3	January
October	36	22.7	56	38.4	92	30.3	February
November	35	22.7	46	32.6	81	27.5	March
December	61	38.5	58	39.8	119	39.1	April
Total	1866	1200	1715	1200	3581	1200	

Month of birth	1900–1965						Month of conception
	Males		Females		Total		
	N	Index	N	Index	N	Index	
January	110	99.8	104	99.1	214	99.5	May
February	104	103.1	116	120.8	220	111.8	June
March	138	125.2	128	122.0	266	123.6	July
April	138	129.1	142	139.5	280	134.2	August
May	109	98.9	125	119.1	234	108.8	September
June	122	114.1	111	109.1	233	111.7	October
July	116	105.3	130	123.9	246	114.4	November
August	91	82.6	73	69.6	164	76.2	December
September	95	88.9	82	80.6	177	84.8	January
October	95	86.2	88	83.9	183	85.1	February
November	89	83.3	69	67.8	158	75.7	March
December	92	83.5	68	64.8	160	74.4	April
Total	1299	1200	1236	1200	2535	1200	

tionally strong pattern, with a range of variation of 174.7 index points.

In the 20th century, 67% of births are concentrated in the first seven months, the peak occurring in March (index = 123.6) and April (index = 134.2). August, November and December have the lowest indices: 76.2, 75.7 and 74.4 respectively. The seasonal distribution is still evident but the range of variation is 59.8 index

points, lower than in the previous century. The observed differences between the two centuries are statistically significant ($p < 0.001$). They depend mainly on 1) the decreased percentage of births in the first months of the year, 2) the reduced peak in March and 3) the absence of a marked trough in a particular month.

However, when investigating the relationship between environmental con-

straints, biobehavioral responses and possible repercussions on the general 'fitness' of a community, the timing of conceptions is more informative than that of births. Therefore, the monthly distribution of conceptions reported in Table 3 was correlated with the seasonal distribution of marriages, a biobehavioral indicator, in the same village¹⁹. Marriages were strongly concentrated in the summer months, between June and October: 93.5% in the 19th century and 62.5% in the 20th century. This is the typical pattern in traditional pastoral communities like the one under study, characterized by winter transhumance toward the lowlands of southern Italy. The two distributions in each century are displayed in Figure 2. Despite the fact that conceptions refer to baptisms of all newborns and not only to first births, the correlation between the two parameters is very high in the 19th century ($r = 0.86$). This high correlation fits well with the assumption that seasonality of marriages in this pastoral community is essentially due to the absence of men in the winter

months, thus acting as a regulator of reproduction. In fact, this may partly explain the relatively low natality rates found in this village. In addition, there is a one-month shift between marriages and

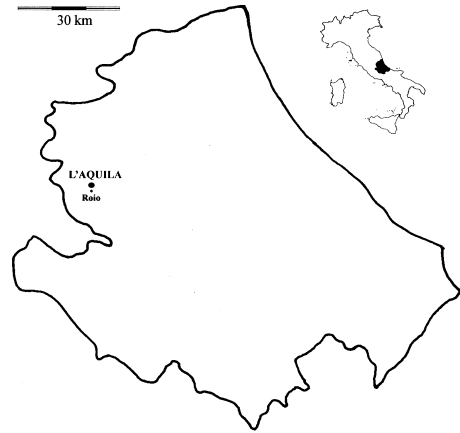


Fig. 1. The Abruzzo Region and the geographical position of the village of Roio in the Province of L'Aquila.

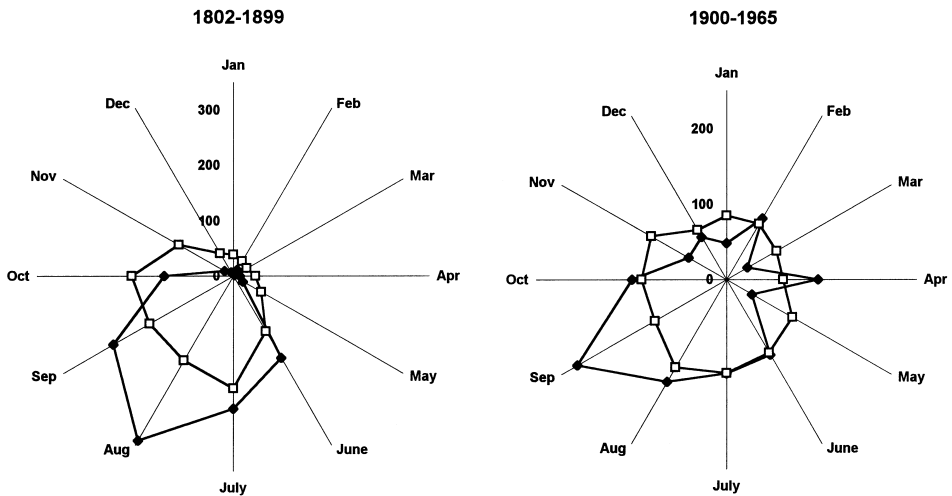


Fig. 2. Monthly distribution of conceptions (-□-) and marriages (-◆-) in two centuries in the village of Roio.

conceptions, suggesting that reproduction occurred almost entirely in 'institutionalized' unions.

The correlation between marriage seasonality and birth seasonality in the 20th century is lower than in the previous period ($r = 0.52$); this depends on the independent variation of both the marriage and conception patterns. In the 20th century, marriages celebrated in the summer months decrease noticeably, with a peak in September (index = 225.8) and a secondary peak in April (index = 120.5). This is in agreement with the consequences of the advent of 'modernization' in Europe, one of which was the reversal from maximum in peculiar periods of the year (in accordance with the subsistence patterns developed by each community) to maximum in specific months: September in autumn, April in spring, and June in summer^{33–36}. The monthly distribution of conceptions shows a tendency to approach the average value of 100 births per month; this can be seen as a temporary effect of the transition from a subsistence regimen to a 'modern' lifestyle, characterized by the release from various constraints acting on the population.

Discussion

Analysis of the monthly distribution of births and conceptions in the pastoral community of Roio showed a marked seasonality in the 19th century, strictly correlated with the pattern of marriages. This strict correlation is due to the absence of men during winter because of transhu-

mance. In fact, a seasonal pattern is also observed when the monthly distribution of births and conceptions in agricultural groups is analyzed³⁷. However, the pattern may vary between different groups and in time within the same group. Moreover, natality rates in agricultural groups are on average 35×1000 and higher²⁷. In addition, the correlation between the month of conception and that of marriage decreases remarkably in the 20th century, when the 'modernization' process occurred.

The present results contribute to our understanding of the relatively low natality rates found in historical times and suggest that pastoralism acted as a primary reproductive regulator. Further detailed study of the demographic structure and evolution in pastoral communities is necessary in order to evaluate the effects on the survival capability of offspring, their patterns of growth and their later reproductive performance and characteristics, as well as for comparisons with agricultural communities.

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**SEZONALNOST ROĐENJA I ZAČEĆA U RURALNIM ZAJEDNICAMA
PROVINCIJE AQUILE (ABRUZZO, ITALIJA) U RAZDOBLJU 1802.–1965.**

S A Ž E T A K

Stopa nataliteta i sezonalnost rođenja i začeca analizirani su iz matičnih knjiga za razdoblje od 1802. do 1965. godine, za 6116 stanovnika ruralne zajednice Roio (Abruzzo, Italy). Ukupna stopa nataliteta iznosila je 25,5 na 1000 stanovnika, što je niže od nalaza u drugim seoskim zajednicama. Sezonalnost rođenja pokazala je izraziti uzorak: 80%–67% sve djece rođeno je tijekom prvih šest mjeseci u godini. Mjesečna raspodjela začeca uspoređena je i s raspodjelom vjenčanja. Rezultati su pokazali visoku korelaciju u XIX. stoljeću a nižu u XX. stoljeću. Ovi nalazi sugeriraju da je pastoralizam primaran regulator reprodukcije u ovoj zajednici.