VIRGINIA COMMONWEALTH UNIVERSITY

FORECASTING METHODS

ASSIGNMENT 3

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SUBMITTED TO-

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Introduction

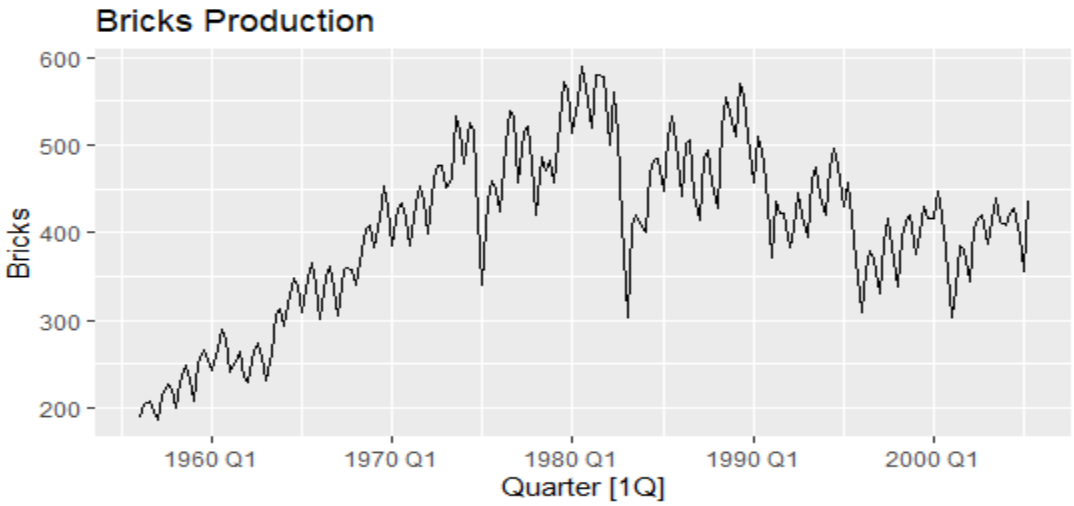
This report presents an analysis of three time series datasets: Bricks Production (quarterly data), Gasoline Barrels (weekly data), and Hare Pelts (annual data). The objective is to explore seasonality, cyclicity, and long-term trends, with a focus on identifying unusual years and understanding underlying patterns.

Time Intervals of Each Series

Dataset	Time Interval	Period Covered
Bricks	Quarterly	1956 Q1 – 2005 Q2
Barrels	Weekly	1991 W06 – 2016 W17
Hare Pelts	Annual	1845 – 1935

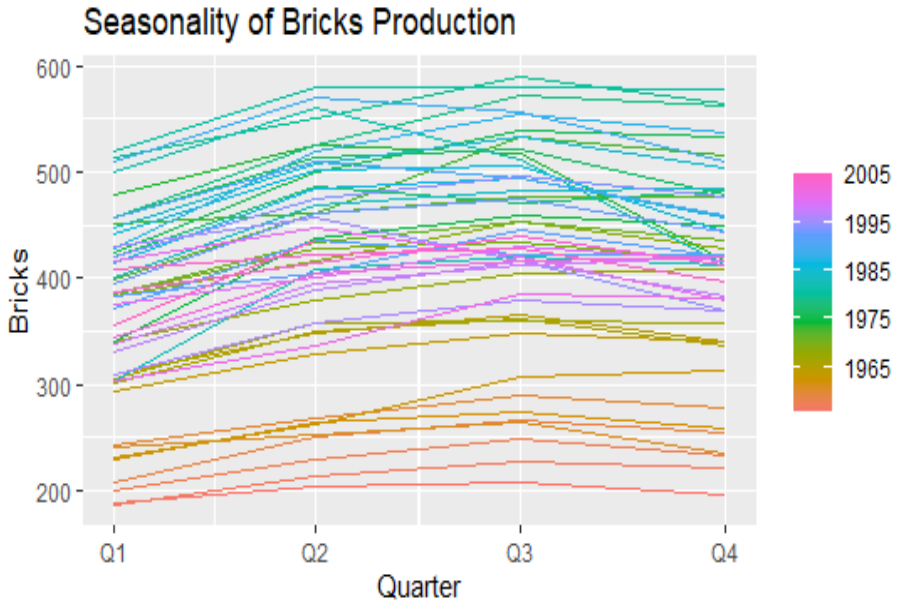
Seasonality, Cyclicity and Trend of each series.

1. Bricks Dataset



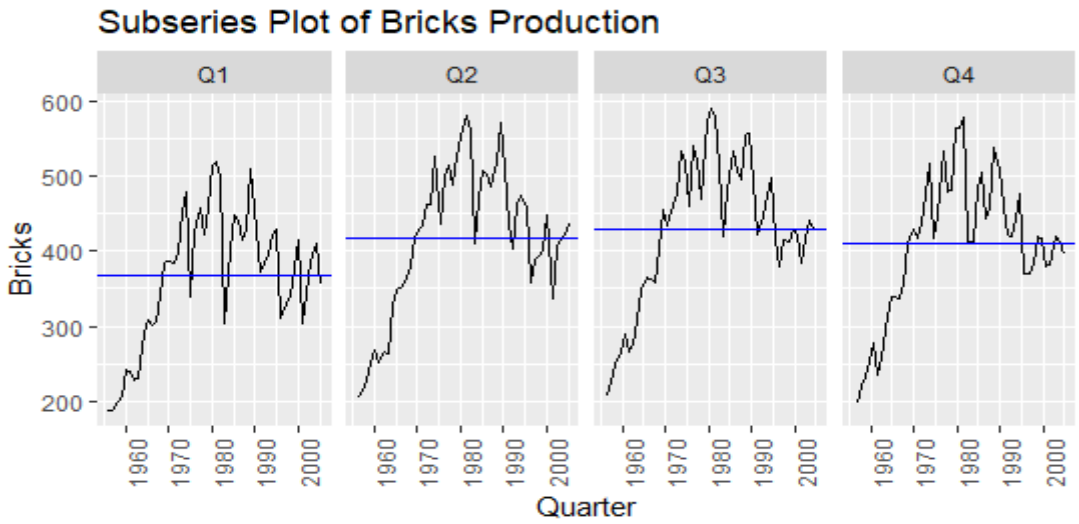
The graph illustrates the quarterly production of bricks from 1956 to 2005. Initially, there is a clear upward trend, with production steadily increasing from the late 1950s through the mid-1970s, likely reflecting a period of growth in construction or industrial activity. The production reaches its peak in the late 1970s to early 1980s. However, following this period, there is a noticeable decline, with a sharp drop in production around the early 1980s, possibly corresponding to an economic downturn or external shocks that affected the construction industry. From the mid-1980s onward, bricks production displays more volatile behavior,

with significant fluctuations but no clear long-term upward or downward trend. This suggests that production was influenced by cyclical factors such as demand variability, economic conditions, or seasonality, although seasonality is not explicitly highlighted in this particular graph. The graph shows that, after the early 1980s, the industry did not fully recover to the peak levels seen earlier in the period.



The graph illustrates the seasonality of bricks production across different years from 1956 to 2005, segmented by quarters (Q1 to Q4). The lines represent the trends within each year, and the color gradient helps differentiate between the years, with warmer colors like orange representing earlier years (e.g., 1965) and cooler colors like blue and purple representing later years (e.g., 2005).

The plot shows a general seasonal pattern, where bricks production tends to peak in the third quarter (Q3) and dips slightly in Q4 before rising again in Q1 and Q2. Over time, production levels rise significantly from the earlier years (lower lines) to the later years, especially between 1965 and 1985, indicating increasing demand or capacity in bricks production. However, the trend begins to flatten and even decline in the later years (1995–2005), suggesting that production stabilizes or slows down towards the end of the time period. This seasonality is likely influenced by construction activities, which tend to peak during warmer months.



The subseries plot of bricks production breaks down the time series into individual quarters (Q1 to Q4) over the period from 1956 to 2005, allowing a clearer view of the trends within each quarter. In **Q1 and Q2**, production rises steadily until the 1980s, where it reaches a peak before experiencing a significant decline. Q2, in particular, shows high volatility after this peak, with sharp fluctuations in production. **Q3** consistently displays the highest levels of production, peaking in the 1970s and early 1980s, but also follows a noticeable decline after the mid-1980s. Meanwhile, **Q4** exhibits more stable production levels compared to other quarters, with fewer sharp rises and drops, though there is still a gradual decline after the 1980s. Overall, the plot highlights that the peak production period across all quarters was in the 1970s and early 1980s, followed by a general decline or stabilization in later years. The blue horizontal lines represent the average production levels in each quarter, showing that Q3 generally had higher production averages, while Q1 and Q4 were lower.

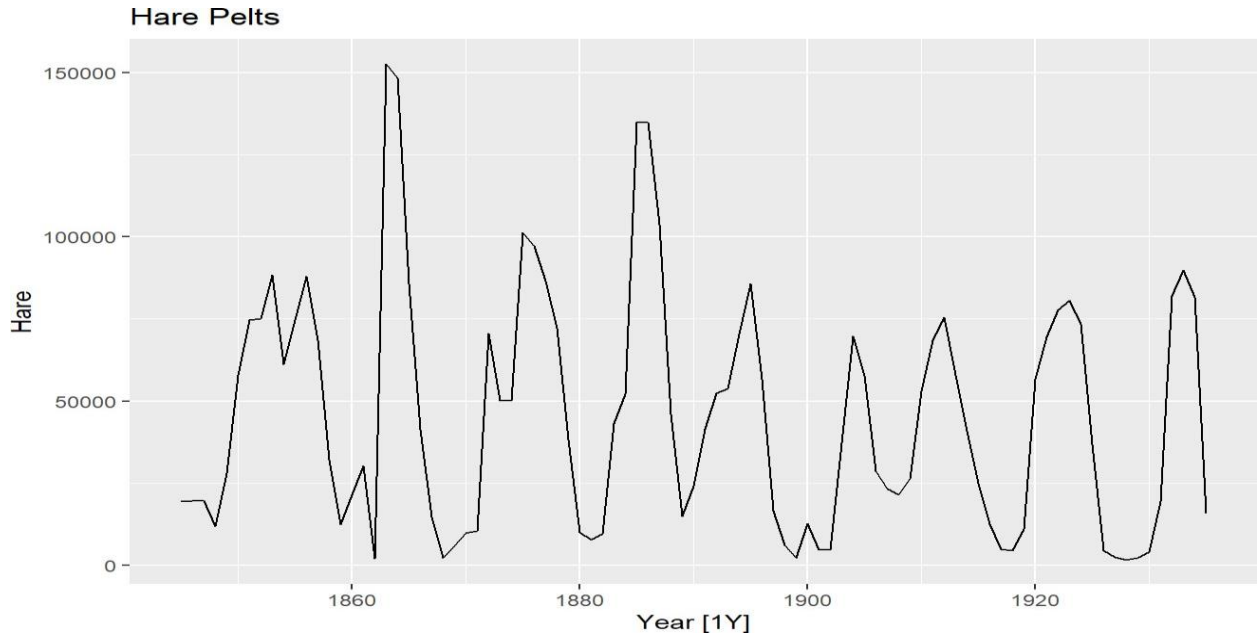
Seasonality: The data shows a strong seasonal pattern with regular fluctuations across quarters. Peaks are often observed in specific quarters, likely tied to construction cycles, which could be influenced by factors like weather conditions or fiscal cycles in the construction industry.

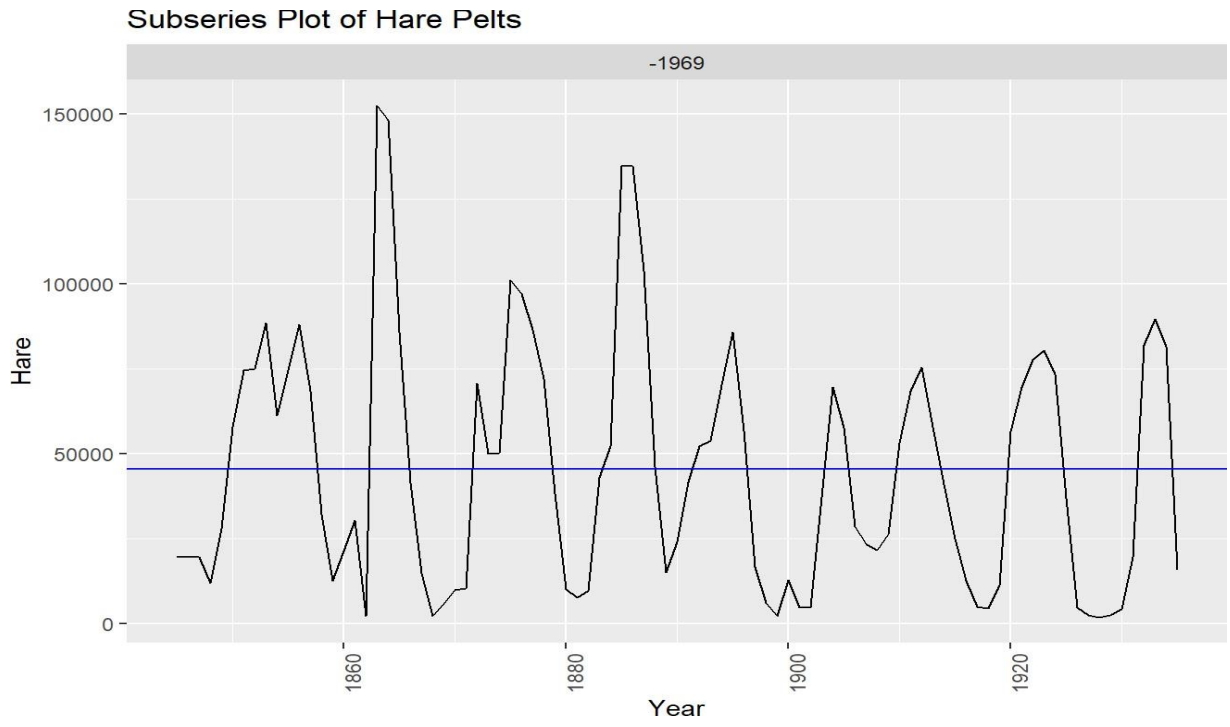
Cyclicity: There are noticeable multi-year cycles in the data, reflecting broader economic cycles affecting construction demand, such as periods of economic growth and recession.

Trend: Over the long term, the trend in brick production fluctuates with significant ups and downs, reflecting broader economic and industry specific trends.

2. Barrels Dataset

. Barrels Dataset





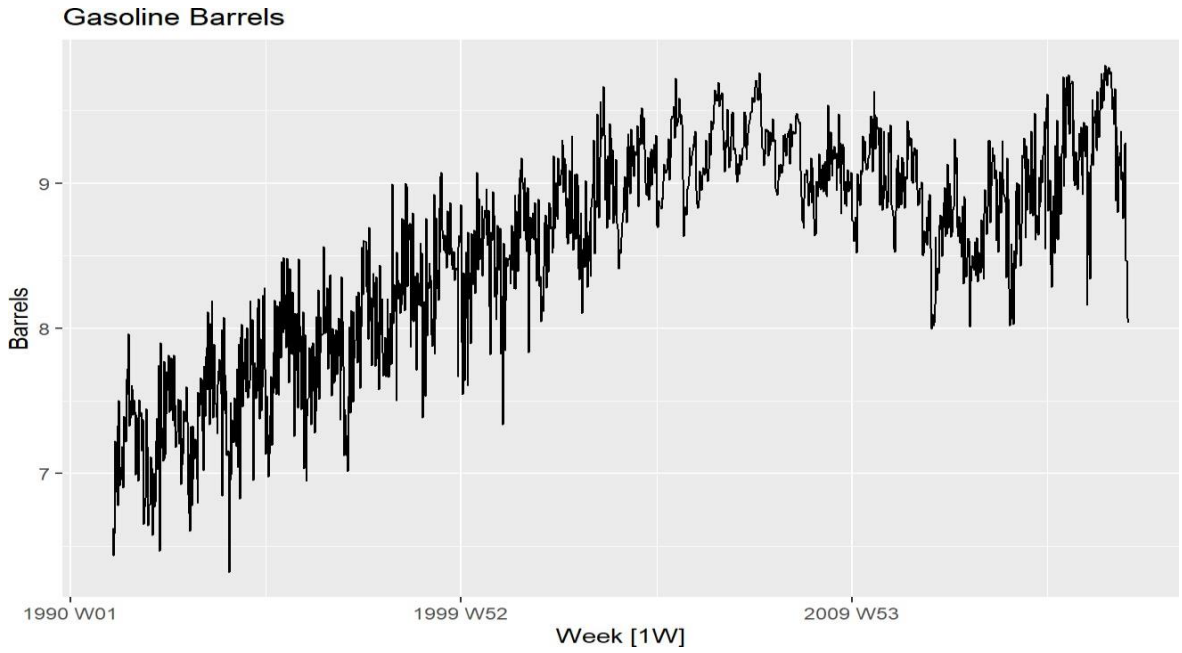
Seasonality: There is a clear weekly seasonality, with production levels showing consistent patterns throughout each year. This regularity suggests a strong influence of

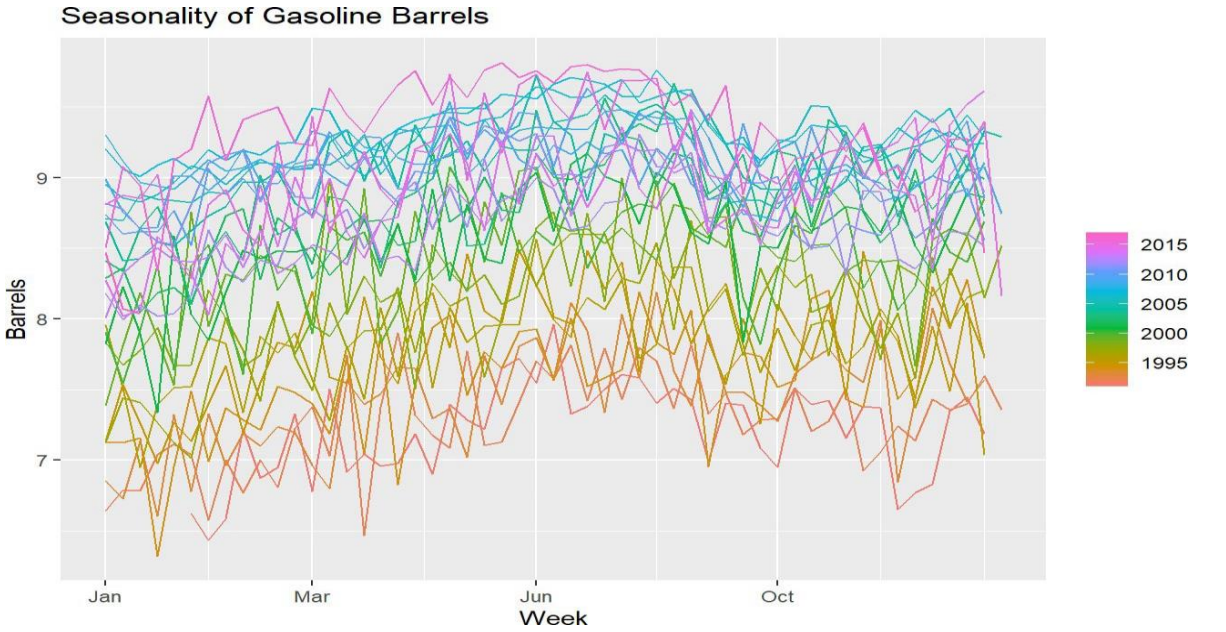
weekly consumption or production cycles, possibly driven by industrial demand, regulatory requirements, or scheduled production runs.

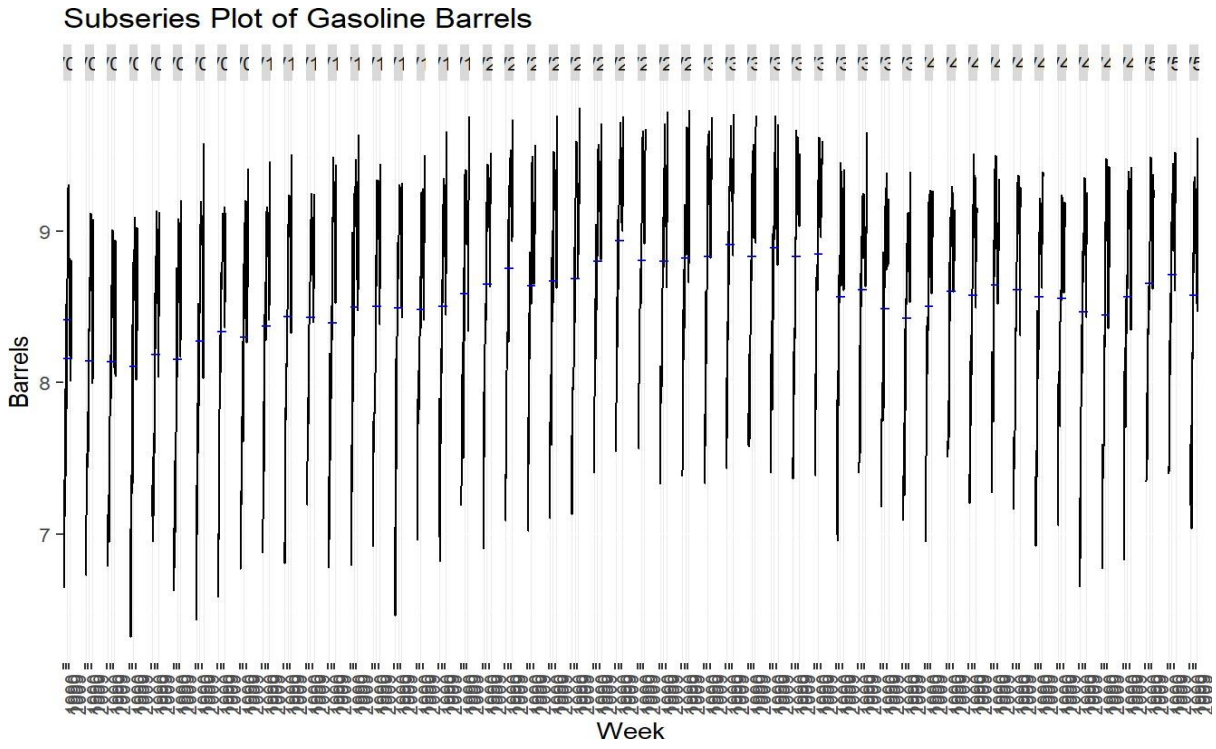
Cyclicity: The dataset does not show long-term cycles as clearly as seasonal patterns but may still reflect broader market cycles tied to changes in global demand, price fluctuations, or technological shifts in production methods.

Trend: Over the years, the trend can reflect gradual increases or decreases in production, influenced by factors such as advancements in production efficiency, changes in resource availability, or shifts in market demand.

3. Hare Pelts Dataset







Seasonality: The dataset shows a longer cyclical pattern rather than a short-term seasonal pattern, with population cycles approximately every ten years. This reflects the natural boom and bust cycles of hare populations, likely influenced by factors such as predator-prey dynamics, availability of resources, and environmental conditions.

Cyclicity: The cyclical pattern is very pronounced, with regular peaks and troughs indicating natural ecological cycles. These cycles are typical of species that have natural population booms followed by crashes.

Trend: The long-term trend in hare populations does not show a strong upward or downward direction but rather fluctuates within the cyclical patterns. However, there are periods where the baseline population level shifts, possibly indicating broader environmental changes or shifts in ecosystem dynamics.

3. Learning from the series

Bricks Dataset: Production appears to have peaks and lows in certain quarters of the year, possibly linked to construction cycles or weather- related influences.

Barrels Dataset: The weekly production shows regular seasonal trends, likely driven by demand cycles or regulatory changes.

Hare Pelts Dataset: The population cycles and trends in this series are highly influenced by environmental conditions, with clear peaks every several years, reflecting natural cyclical patterns.

4. Seasonal Patterns

Bricks Dataset: Seasonality is evident in the quarterly fluctuations, with consistent peaks in certain quarters. This could relate to increased construction activity during specific times of the year.

Barrels Dataset: Weekly seasonality is strong, with regular patterns indicating consistent cycles in production or consumption demand.

Hare Pelts Dataset: Cyclical patterns in the data indicate seasonality, but the cycles are more extended and less frequent compared to the other series, aligning with natural environmental rhythms.

5. Unusual years

Bricks Dataset: Specific years exhibit anomalies, which could be due to economic downturns, policy changes, or significant weather events impacting production.

Barrels Dataset: Unusual production levels in certain years might reflect global events like economic crises, wars, or significant policy shifts in energy regulation.

Hare Pelts Dataset: Some years show dramatic deviations from the cyclical norm, potentially linked to ecological events, disease outbreaks, or other disruptions in hare populations.