

Differential Fecundity in Wild Northern Bobwhite Hens under Hatchery Conditions



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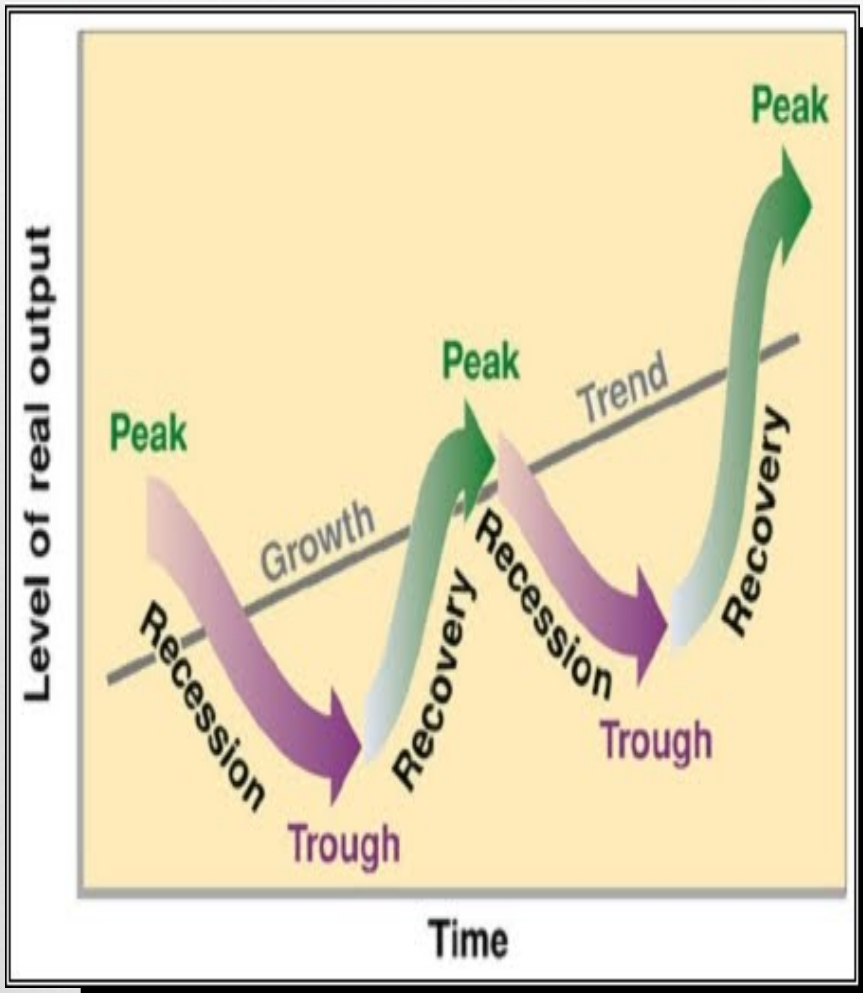
Wildlife Ecology Program

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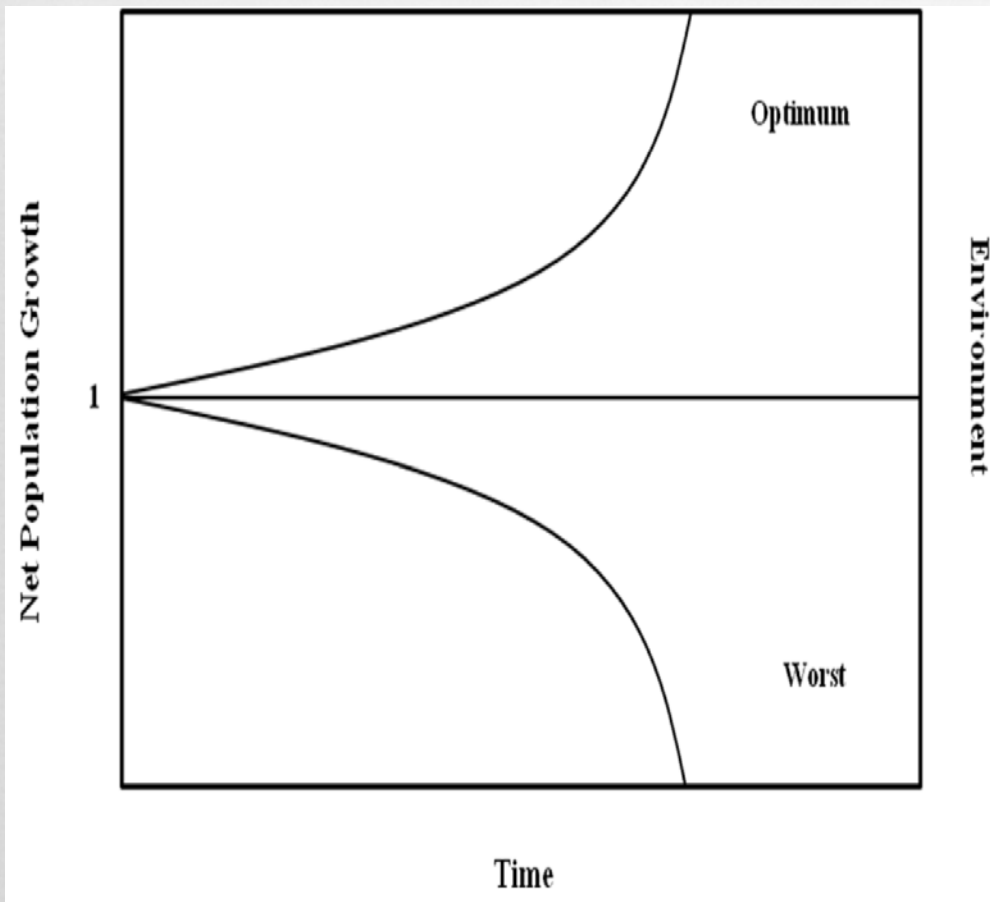
Population Dynamics



- Boom and bust cycles of northern bobwhites (*Colinus virginianus*) have long intrigued and perplexed wildlife biologists and hunters
- This cycle is not well understood in northern bobwhites, especially productivity of hens
- The annual amplitude of productivity and population size depends on reproductive performance by hens buffered by environmental pressures



Biotic Potential



- Under the most optimum environmental conditions, maximum growth rate occurs as evidenced by a geometric growth, and individuals (hens) fulfill their genetic and physiological potential as an intrinsic increase in numbers or biotic potential
- However, through time optimal environmental conditions are not constant and productivity by females is buffered by their physiology
- Most of the time productivity is limited by less than optimum environmental and physiological conditions

Objective



- Questions about multiple clutch production and clutch size after a second clutch or biotic potential of female northern bobwhites and population cyclicity remain unanswered
- The objective of our study was to determine reproductive potential of northern bobwhite hens from southern Texas under controlled environmental conditions by assessing (1) total clutches laid (number of eggs and clutches) by a female, (2) hatchability (proportion of eggs hatched) of eggs, and (3) multi-clutching (probability a female will continue laying clutches) by hens

Capture Acclimation



- We captured wild, adult northern bobwhites in walk-in traps in April 1992 and January 1993 on 2 ranches in Kenedy County, Texas
- All adults received leg-bands, were placed in 3.6 m x 1.2 m x 0.25 m holding pens and transported to the Texas State University Game Bird Alliance facility at the Freeman Ranch
- Birds were acclimated to captivity by slowly changing the diet from milo to Gamebird Layena (Ralston Purina, St. Louis, MO, USA) and replacing water in open poultry water basins to water supplied by modified, automatic drinking cups
- We provided food *ad libitum* and refreshed it daily

Prebreeding



- We transferred 88 cocks from holding pens in mid-February to a 5 m x 5 m breeder room with banks of cages and a dual lighting system (low intensity (60 W) blue light and 13 high intensity (100 W) white incandescent lights)
- Photoperiod was controlled by an electronic timer (Model 1103, Tork Inc., Mount Vernon, NY, USA)
- A single, adult, healthy cock was placed in each compartment and exposed initially to a 15-hr photoperiod to stimulate gonadal development and spermatogenesis
- In early March we paired males with adult hens from the same holding pen
- We then increased the photoperiod 30 min every 5 days until a 17-hr photoperiod was established to mimic the photoperiod during the reproductive season

Egg Production



- Egg collection began 30 March 1993 after acclimation to the 17-hr photoperiod
- We collected eggs daily, marked each egg with sequential and compartment numbers, weighed each egg, wrapped all eggs produced in a day in Saran™ plastic wrap, and stored them in a refrigerator at a constant temperature of 12.8°C
- Eggs remained refrigerated between 7 to 14 days until incubation
- We removed eggs from the refrigerator and allowed them to reach ambient temperature (22°C) before placing them in an incubator
- We assumed eggs placed in the incubator had equal fertility and hatchability
- Eggs were incubated in an inverted position (*i. e.*, small end up) to increase hatching success for 21 days at a temperature of 37.5°C and a relative humidity of 86-88%
- At day 21, we candled eggs with a small pen-light to determine fertility and removed infertile eggs

Chicks



- We transferred fertile eggs to a hatcher and arranged them tightly to synchronize hatching
- Eggs remained in the hatcher about 48 h at a temperature of 36°C and relative humidity of 88-89%
- Hatched chicks were removed to a brood room

Table 1. Total number of sequential clutches and eggs produced collectively and individually by northern bobwhite hens under 17-hour photoperiod in a hatchery.

Egg Production

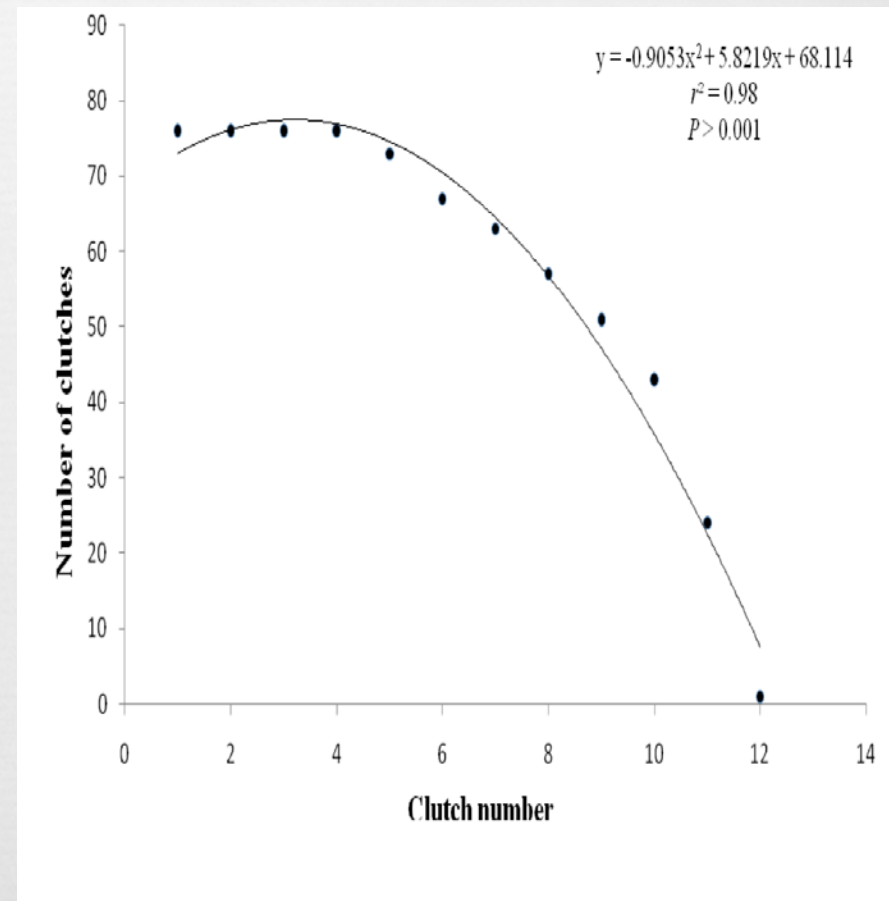
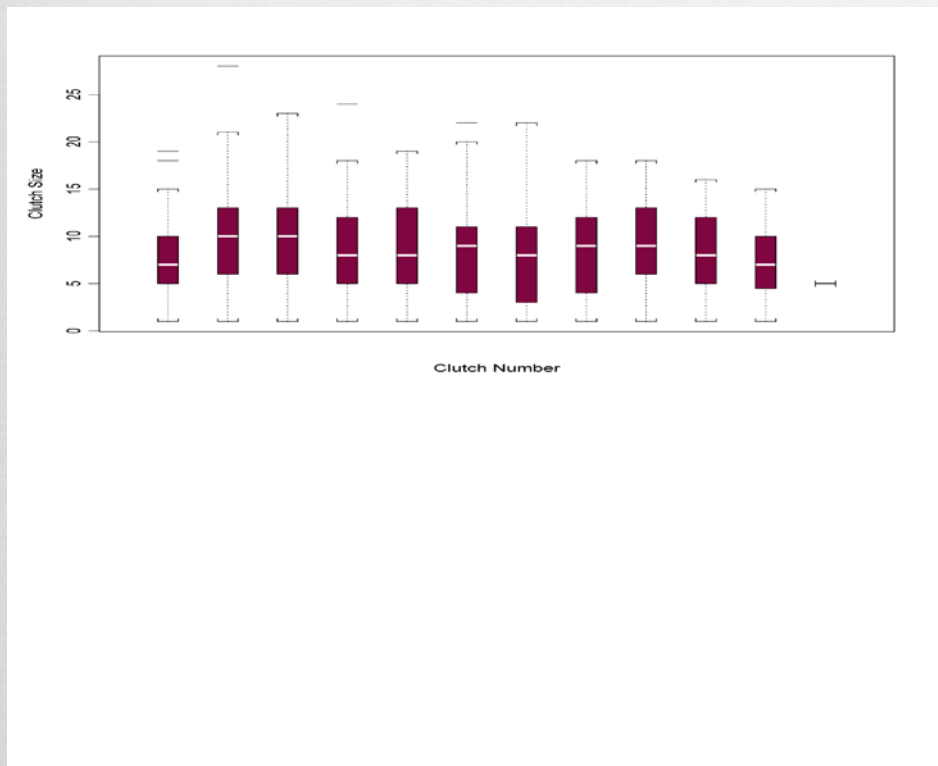
- Eighty-six hens produced 5,888 eggs over a 202-day period (30 March to 19 October 1993)
- 58% of 86 hens produced 9 clutches, 48% 10 clutches, 27% 11 clutches, and only 1 hen produced 12 clutches
- Number of eggs produced by individual hens ranged from 0 to 171
- Eggs laid per day varied from 0 to 0.8
- Mean number of eggs per clutch was 8.57
- Of eggs included for analysis, 3,571 hatched and 2,222 failed (61.6% success)

Category	<i>n</i>	<i>x</i>	standard deviation	min	max
All	687	58.6	4.86	1	28
C1	76	7.03	3.74	1	18
C2	76	9.50	5.06	1	28
C3	76	9.61	4.99	1	23
C4	76	8.18	4.84	1	24
C5	73	9.00	5.21	1	19
C6	67	8.52	5.23	1	22
C7	63	7.84	5.08	1	21
C8	57	8.47	4.93	1	18
C9	51	9.35	4.44	2	18
C10	43	8.26	4.40	1	16
C11	24	7.21	3.92	1	15
C12	1	5.00	NA	5	5

Clutch size by clutch number was normally distributed and consistent across clutch number

Mean eggs per clutch increased from the first to clutch, dropped slightly by the fourth clutch and remained relatively stable through clutch 10 after which there was a substantial reduction in production

This pattern of clutch number affecting clutch size was strongly correlated with a second order polynomial regression



Biotic Potential: A Model for Wild Northern Bobwhite Populations

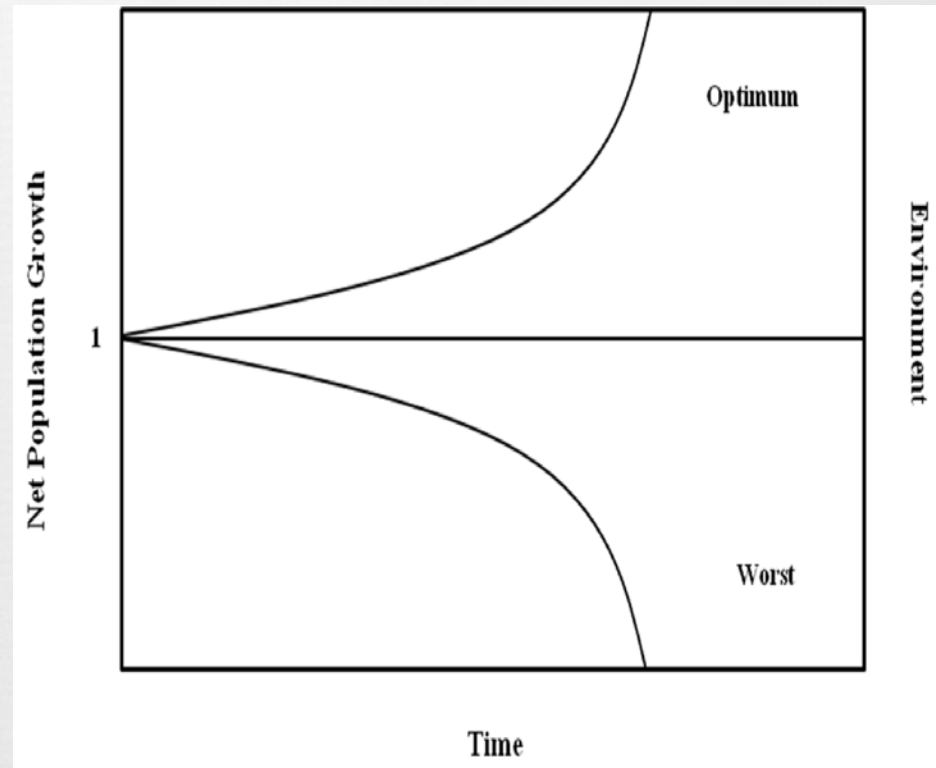


- What is the value of a hatchery study of the biotic potential of northern bobwhite hens?
- It is a model of the potential productive of bobwhites in the wild under optimum environmental conditions and physiological fit hens
- We showed female northern bobwhites can produce multiple clutches and number of eggs per clutch did not appreciably decline as number of clutches increased

Boom and Bust Cycles



- We propose boom and bust cycles evidenced by northern bobwhites relate to complex dynamics in which biotic components (*i.e.*, demographic and habitat parameters) are intricately interrelated with abiotic components (*i.e.*, precipitation, soil, temperature, topography)
- Northern bobwhite hens have the intrinsic, biological potential to produce large numbers of eggs over at least 6 months
- However, realization of the biotic potential of a population depends on periods of optimum conditions interspersed within periods of erratic environmental conditions



Management Implications



- With the current decline in northern bobwhite populations, efforts must be directed toward enhancing productivity
- We have no control over the weather, but we can manage for habitat and other limiting factors
- An optimum environment may occasionally transpire, but good habitat management will hasten the fruition of biotic potential when all variables influencing northern bobwhite productivity occur simultaneously
- We must be in a management position to take advantage of the “right time”

Acknowledgments



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Questions

