

**THE PRODUCTION OF NON-TRADITIONAL POULTRY IN BRITISH  
COLUMBIA AND THE INTRODUCTION OF A NEW POULTRY SPECIES:  
PARTRIDGE TINAMOU**

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## ABSTRACT

The purpose of this thesis was to examine and evaluate the potential for the domestication and commercialization of the partridge tinamou (*Nothoprocta perdicaria*) as a new poultry species. The development of non-traditional animals and crops and their products are becoming an integral component of agriculture. Competition for an international market is changing the dynamics of food production in British Columbia. Diversification and niche marketing are requiring producers to re-evaluate the types of crops and animal products produced.

The tinamou are birds native to Central and South America and are prized by hunters as one of the finest game birds because of their tasty, all white meat carcass. The exploitation of several species of tinamou was once of enormous proportions and as a result many species of tinamou are now becoming rare in the wild. Until recently, the domestication for commercial production of the tinamou has not been successful.

The research was inter-disciplinary in nature and consisted of two experiments (feed trial and housing studies) as well as two surveys (industry and market studies).

The research has demonstrated that the partridge tinamou can be successfully reproduced and reared under indoor conditions. At the onset of the study in 1993, the University of British Columbia (U.B.C.) tinamou breeding flock consisted of 8 females and a total of 52 chicks were hatched. At the conclusion of the study (1995) the breeding flock consisted of 213 females and a total of 2,314 chicks were hatched. The study showed that the partridge tinamou does not require specialized equipment, facilities or feeds to reproduce and

thrive. Modified nest boxes along with traditional poultry equipment and management techniques are used, thereby lessening capital expenditures.

The objective of the feed trial was to compare the performance of young tinamou fed a 21% protein turkey grower diet with those fed a 17% protein turkey finisher diet. The results of the study indicated that although the asymptotic weight of the birds fed the two diets were not significantly different, the growth pattern of the birds was dissimilar. Birds fed the 21% protein grower diet grew faster before week 8 and were significantly heavier at week 8 than the birds fed the 17% protein finisher diet. The study concluded that the 21% protein turkey grower diet was suitable for tinamou growth.

The surveys have indicated that the B.C. game bird industry has good growth potential. Increased consumer, restaurant and retail demand for game birds (squab, silkies, quail, partridge and pheasants) has been fueled by the growing ethnic and Asian populations. The popularity in the ethnic community for non-traditional (as far as North America is concerned) poultry may provide a niche market for the partridge tinamou. The uniqueness of the all white meat carcass caters to the exotic tastes of the Asian restaurant and retail markets. The low fat content of the carcass provides a healthy low fat poultry alternative for the North American and European markets.

The successful production and commercialization of the partridge tinamou is dependent on technical advances in tinamou nutrition and management. An effective marketing strategy will ensure a competitive edge for the partridge tinamou in the B.C. game bird industry.



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## **DEDICATION**

This thesis is dedicated to the memory of Mr. Wayne Bohls,  
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has enabled this project to become a reality

## Chapter 1 INTRODUCTION

In 1994, the Canadian Agricultural Research Council (C.A.R.C) recognized that one of the major areas deserving top priority was the research and development of alternative crop and livestock species and non-traditional agricultural products. Such development would enable Canadian agriculture to remain competitive.

The consumption of "game birds" such as squab, quail, pheasants, silkies and partridges have steadily increased in B.C. (Paulson et al., 1989). The commercial production of game meat has become an important part of the poultry industry. In addition, attention is focused on the commercialization of new species such as Ostriches, Emus, and Rheas (Thornberry, 1989).

This thesis deals with the development of a new poultry species, the partridge tinamou (*Nothoprota perdicaria*) for commercial production. The tinamou are birds native to Central and South America (Burton and Burton, 1970). These birds have been prized by hunters as one of the finest game birds because of their tasty meat (Harrison, 1978). Trapped tinamou have also been processed and exported to North America and Europe as "South American Quail" (Burton and Burton, 1970). The commercial exploitation of several species of tinamou, such as the spotted tinamou, the crested tinamou, and the red-winged tinamou, was once of enormous proportions. Lahille (1921) reported that 9,013,256 tinamou were exported from Argentina to Europe and North America from 1890 to 1899. Bump (1969) reported that 18,000 pairs of spotted tinamou were received in New York in 1923. However, because of heavy exploitation, many tinamou species are now becoming rare in the wild.



Domestication for commercial production of the tinamou has not been tried anywhere in the world. The partridge tinamou is a white meat bird, and the carcass has a noticeable absence of fat. The nature of the bird and the characteristics of its carcass suggest potential for commercial meat production.

The potential success of the introduction of the partridge tinamou to the market place is dependent on an in-depth knowledge of the existing B.C. game bird industry. I first conducted a survey of the B.C. non-traditional poultry (game bird) industry and examined its strengths, weaknesses and future growth potential (Chapter 2). The commodity strategy suggests that there exists a “niche” market for game birds in both the European and Asian restaurant and retail trade. The partridge tinamou has the potential to carve a niche in the existing market.

In Chapter 3, I reviewed the biology of the partridge tinamou, research conducted up to date, and the potential for commercial production of this species.

The prerequisites to commercial production of the partridge tinamou involved developing appropriate housing and diets. In Chapter 4, I compared 3 types of nest structures in association with egg production, feed consumption, and egg fertility. In Chapter 5, I compared two commercially available poultry feeds for growth and development of young tinamou.

In Chapter 6, A squab market survey of European and Asian poultry specialty wholesalers, restaurants and meat/poultry retailers is used as a model to provide insight for the marketing strategy for the partridge tinamou.

It will not be feasible within the time frame of a M.Sc. thesis to fully develop the partridge tinamou for production on a commercial scale. The studies conducted are exploratory in nature and cannot be considered as conclusive. I hope my research will provide the groundwork for further development and the success of a commercial endeavor.

## **Chapter 2      A COMMODITY DEVELOPMENT STRATEGY FOR THE B.C. GAME BIRD INDUSTRY**

### **INTRODUCTION**

Game birds (squabs, silkies, pheasants, partridges and quails) are a high value, specialized food product, considered a luxury in both the Chinese, European and North American retail and restaurant markets. Increase in consumer, retail and restaurant demand for game birds has been motivated by the growing Asian and ethnic population. In 1995, approximately 44,000 people immigrated from the Pacific Rim to Vancouver (Statistics Canada, 1995). This immigration trend is expected to continue. Game bird consumption has been a traditional part of the Asian and South Asian food cultures, and the consumption of game birds has been reflected in Vancouver ethnic cuisine. The present “niche” market potential for game birds has not been fully utilized by the existing game bird industry, and the potential for growth in this industry is continues to be optimistic.

The B.C. game bird industry is composed of the squab, silkie, pheasant (flight -- birds raised for hunting or release and meat), partridge (flight and meat) and quail (egg and meat) producers. A study in 1989 (Paulson et al.,) indicated potential growth for the B.C. game bird industry. The study revealed inherent strengths in the technology and knowledge of the producers and weaknesses in marketing and industry structure. The 1989 study concluded that a unified organization of producers and technical support from government and university agencies were necessary to promote and develop the growth of the game bird industry in B.C.

The current growth experienced by the game bird industry has necessitated an up-to-date detailed study of the B.C. game bird industry. The present study would examine commercial and semi-commercial game bird production in B.C. to determine who the producers were, where they produced, what they produced, and how they marketed their products. In addition it is essential to examine the costs associated with production and the value of the industry to the B.C. economy. Finally, an examination of the outside factors (imports, exports, and tariff structure) is needed to determine the extent of their influences on the B.C. game bird industry. These results would provide the framework for recommendations that would enable the industry to proceed with strategic production and marketing plans.

### **SPECIFIC OBJECTIVES**

The objective of the game bird producers' survey was to examine in detail the B.C. game bird industry. Specifically the objectives of the study were to:

1. Determine the structure of the B.C. game bird industry
2. Ascertain the marketing structure of game birds
3. Evaluate the production quantities and value of game bird production to the B.C. economy
4. Examine the quantity of game birds entering the B.C. market place

## **METHODOLOGY**

### **DATA COLLECTION**

Data collection methods for the study included:

1. Personal interviews and surveys of game bird producers, processors and retailers.
2. Telephone interviews and surveys of game bird producers, processors and retailers.
3. Statistics were obtained from Statistics Canada and Agriculture and Agri-Food Canada

The survey forms used are presented in Appendix 2.1.

### **Industry Samples**

A judgment sampling method (Zikmund, 1994) was used to target game bird producers, processors, and retailers. This sampling method involved the identification of “experts” for the purpose of in-depth interviews and surveys.

B.C. game bird producers and processors were located from producer lists obtained from B.C. Ministry of Agriculture, Fisheries and Food, poultry processors and the North American Game Bird Association.

Samples targeted in the survey were:

## **1. B.C. Game Bird Producers**

Game bird producers were selected if one or more of the following criteria applied:

1. Produced squabs, silkies, pheasants, partridges or quails for meat, flight/release or eggs
2. Production facilities were located in the Lower mainland (Vancouver, Pemberton and Fraser Valley), Vancouver Island or Okanagan Valley.
3. Production was on a commercial basis, utilizing licensed processing facilities

## **2. Game Bird Processor and Chinese Specialty Poultry and Meat Retailers**

In addition, personal interviews/surveys were conducted with the game bird processor located in the Lower Mainland. Personal interviews/surveys were also conducted with Chinese poultry and specialty meat retailers in the Vancouver area.

## **LIMITATIONS OF THE STUDY**

The “judgment sampling method” (Zikmund, 1994) used in this study results in detailed information obtained from those determined to be “game bird production” experts. Therefore, the data presented in this report is not statistical and should be viewed only as directional in nature.

## RESULTS

### RESPONSE RATE

The response rate for the producer survey was 89%. The response rate and sample size for sample are detailed in Table 2.1.

**Table 2.1 Sample Size and Response Rate**

Sample Type	Sample Size	Response*	No response**	Response Rate
Game Bird Producers	24	22	2	92%
Game Bird Processor	1	1	0	100%
Chinese Meat/Poultry Retailers	8	6	2	75%

\*Surveys were obtained from those who had interest and/or experience in the production of game birds

\*\*No responses included those in the sample who did not wish to respond to the survey or could not speak English

### THE PRODUCERS

The results of the survey indicated that the B.C. game bird industry is composed of a small group of producers (Table 2.2). These producers produced mainly squab, quail meat and quail eggs for the Chinese retail and restaurant market. Pheasants for the North American and European restaurant markets and flight birds for the hunt/release sectors were also produced. The producers indicated that average farm size was small ranging from 5 to 10 acres and the quantity of birds produced was limited. The number of breeding pairs for squab production varied from 300 to 3500 pairs, average squab production size was 1200 breeding

pairs. For pheasants, the number of breeding birds varied from 50 for flight production to 660 breeding pheasants for meat. Other products include chicks incubated for sale to other producers and the production of quail eggs. The quail egg industry, consists of two producers, produced approximately 451,250 quail eggs for domestic sale in 1994. A detailed synopsis of the local industry is presented in Appendix 2.2.

**Table 2.2 Types of Game Birds Produced and Number of Producers**

Type of Game Birds	# of Producers
Squabs	10
Chukar Partridge (Meat)	3
Chukar Partridge (Flight)	2
Meat Pheasant	2
Flight Pheasant	3
Quail Egg	2
Quail Meat	1
Silkie	1

## **COMMERCIAL AND SEMI-COMMERCIAL GAME BIRD PRODUCTION**

The survey indicated that the B.C. game bird commercial and semi-commercial industry produced a total of 297,863 birds in 1993 and 295,838 birds in 1994 (Table 2.3). Commercial production alone totaled 252,910 bird in 1994, this figure includes all birds processed at a federal or provincial inspected processing plant. Semi-commercial production includes all birds sold live for hunting, falconry and those birds slaughtered on farm. In 1994 it was estimated that in 42,928 birds were produced by this sector. Semi-commercial production has been estimated at 6% of commercial production.



**Table 2.3 Game Bird Production in B.C. - 1993 and 1994.**

Bird Type	Commercial*		Semi-Commercial**		Other Products		Total	
	1993	1994	1993	1994	1993	1994	1993	1994
Squab	70,860	67,860	7,086	6,786	-	-	77,946	74,646
Pheasants								
a) Meat Birds	27,700	23,100	2,770	2,310	-	-	30,470	25,410
b) Flight Birds	-	-	9,517	13,587	-	-	9,517	13,587
Quail	125,000	125,000	12,500	12,500	-	-	137,000	137,500
Partridge								
a) Meat Birds	6,300	6,950	630	695	-	-	6,930	7,645
b) Flight Birds	-	-	2,500	4,050	-	-	2,500	4,050
Silkie***	30,000	30,000	3,000	3,000	-	-	33,000	33,000
Quail Eggs	-	-	-	-	336,050	451,250	336,050	451,250
Total	259,860	252,910	38,003	42,928				

1993 Total Production - Commercial + Semi-Commercial 297,863

1994 Total Production - Commercial + Semi-Commercial 295,838

\* includes birds slaughtered by licensed processing facilities

\*\*includes bird sold live for hunting, falconry and birds slaughtered on farm (estimate)

\*\*\*processor estimate - a significant portion of the total B.C. silkie production may be exported live. Total silkie production is estimated as high as 100,000 bird/year

There has been slow and limited growth in some sectors of the industry. Sectors traditionally dependant on export markets (pheasants) have shown a decline in production numbers, whereas, those sectors dependant on domestic markets (silkie and squab) have shown steady and continued growth. This growth is due primarily to the increasing ethnic populations in the greater Vancouver area, and the demand for these products for medicinal and festive usage.

Producers cite the lack of domestic and export markets for pheasant and partridge as the main reason for the slow growth of this sector. Traditionally, pheasants and partridges are consumed in European and Middle Eastern regions. However, this transference of food culture has not taken place in the North American market. Producers who choose to produce meat pheasants indicated that their markets consist of sales to hotels and restaurants (95%) and to retail outlets, airlines and cruise lines (5%). Export markets for the B.C. meat pheasant industry are non existent.

### **Unit costs and prices**

The price paid to the producer, wholesale values, retail values, processing costs and feed and chick costs on a per pound and per bird basis are shown in Table 2.4. The survey indicated the prices paid to the producer in 1994 ranged from \$5.40/lb. for partridge, \$6.10/lb. for squab to \$6.50/lb. for pheasant. Prices paid to the producers for silkie and quail were unavailable. Processing charges varied with the size of bird, from \$1.55/bird for squab (average weight 12. Ounces) to \$2.55/bird (average weight 2 lbs.) for pheasant. Wholesale and retail prices (Table 2.4) were obtained as a result of a survey of the game bird processor and Chinese speciality meat and poultry retailers in Vancouver, B.C. Retail prices for game birds were similar in

each of the speciality shops surveyed. Unit feed and chick costs/bird were obtained from the BCMAFF Planning for Profit publications.

**Table 2.4 Unit Costs and Prices - 1994 (\$Cdn.)**

	Price Paid to Producer*	Processing Cost /Bird	Chick & Feed Costs/Bird	Wholesale Value per lb.**	Retail Value per lb***	Dressed Weight Lb.	Wholesale Value per bird	Retail Value per Bird
Squab								
a) Import	N/A	N/A	N/A	6.95	7.50	1.13	7.85	8.48
b) Domestic	6.10	1.55	1.60	7.35	8.35	0.94	6.91	7.85
Pheasant								
a) Meat	6.50	2.55	2.49	3.50	5.50	2.50	8.75	13.75
b) Flight	10.50	N/A	2.49	N/A	5.00	2.10	8.75	10.50
Partridge								
a) Meat	5.40	1.55	2.30	7.25	8.85	1.00	7.25	8.85
b) Flight	5.00	N/A	2.30	N/A	6.00	1.00	5.00	6.00
Silkie	unavailable	2.00	0.96	4.40	5.99	2.00	8.80	11.98
Quail	unavailable	0.65	0.43	4.10	4.95	0.22	0.90	1.09
Quail Eggs	0.07	N/A	0.11	0.07	0.104	N/A	N/A	N/A

\* Price Paid to the Producer by the Wholesaler. Prices obtained from the producer

\*\* Wholesale Value - Price of product charged by the wholesaler to retailer. Price obtained from wholesaler

\*\*\* Retail Value - Price of product charged by retailer to the consumer. Prices obtained from a survey of Chinese Poultry Retailers, Vancouver, B.C.

Processing charges obtained from process

Unit feed costs obtained from BCMAFF Planning for Profit

The producers indicated that the major obstacle to production was not the technical production of the birds but the difficulties associated with having a single processor. The number of bird processed, the cost of processing and price paid to the producer are set by the processor. The survey indicated that there was no negotiation on either processing charges or producer prices from processor. The survey also indicated that producers who chose to market their own products were also charged a premium price for processing. The results for the producers were increased production costs and uncertainty in determining potential revenue.

#### **Value of game bird slaughter in B.C.**

The value of game bird production (including imports of squab) is shown in Table 2.5. The total value of the feed and chicks (Feed and chick costs/bird x number of birds) sold to the industry is estimated to be \$383,877. The total value of processing (Processing cost x number of birds) is estimated to be \$388,646. Total wholesale value (Wholesale value/bird x number of birds) is estimated at \$2,151,331. Total retail value (Retail value/bird x number of birds) of game birds to the B.C. economy is estimated to be \$2,588,816.

**Table 2.5 Value of Game Bird Production in B.C. - 1994**

Bird or Product	Market	Process	No. of Birds	Value of Product	Value of Processing	Wholesale Value	Retail Value
Squab	Import	Commercial	98,631	N/A	N/A	774,253	836,391
	Domestic	Commercial	67,860	108,576	105,183	468,845	523,633
	Domestic	On Farm/Live	6,786	10,858	10,518	46,884	53,263
		Total	173,277	119,434	115,701	1,289,983	1,422,287
Pheasant	Domestic	Commercial	23,100	57,519	58,905	202,125	317,625
	Domestic	Flight	13,587	33,832	34,647	118,886	142,664
	Domestic	On Farm/Live	2,310	5,752	5,891	20,213	24,255
		Total	38,997	97,103	99,442	341,224	484,544
Partridge	Domestic	Commercial	6,950	15,985	10,773	50,388	61,508
	Domestic	Flight	4,050	9,315	6,278	20,250	24,300
	Domestic	On Farm/Live	695	1,598	1,077	3,475	4,170
		Total	11,695	26,898	18,127	74,113	89,978
Silkies	Domestic	Commercial	30,000	28,800	60,000	264,000	359,400
	Domestic	On Farm/Live	3,000	2,880	6,000	26,400	35,940
		Total	33,000	31,680	66,000	290,400	395,340
Quail	Domestic	Commercial	125,000	53,750	81,250	112,750	136,125
	Domestic	On Farm/Live	12,500	5,375	8,125	11,275	13,613
		Total	137,500	59,125	89,375	124,025	149,738
Quail Eggs	Domestic	N/A	451,250	49,638	0	31,588	46,930
		Total Value		383,877	388,646	2,151,331	2,588,816

\* Value of Feed - obtained from B.C.M.A.F.F. Planning for Profit (Squabs, Silkies, Quail and Pheasants)

\*\*Value of Processing - Figures obtained from Wingtat game bird processors and packers, Surrey, B.C.

\*\*\*Wholesale Value - Figures obtained from wholesaler - Wingtat game bird processors and packers, Surrey, B.C.

\*\*\*\*Retail Value - Figures obtained from a survey of Chinese specialty meat and poultry retailers.

Compared to the value of the B.C. broiler industry (\$200 million/year) (B.C.M.A.F.F., Poultry Statistics, 1994), the B.C. game bird industry (\$2.5 million/year) comprises only 1% of the total retail broiler value. It should be noted that the retail value of imported squab (\$836,391) is greater than the retail value of domestically produced squab (\$523,633). The demand for squab from the Asian and ethnic communities far out strips B.C. squab production capabilities. High production costs and low production numbers in B.C. enabled the lower cost imported product to take a large share of the B.C. squab market. In 1994 the wholesale value of imported squab was \$6.96 per pound while the wholesale value of domestic squab was \$7.35 per pound (Table 2.4).

### **Historical Trends**

The production trends of B.C. game birds have been variable. Squab, silkie and quail production remains strong, but pheasant and partridge production have not shown significant growth. The survey of producers suggested that squab, silkies and quail meat and eggs are in demand in the Chinese retail and restaurant sectors. However, pheasants and partridges have not shown the same consumer demand in the North American or European retail and restaurant markets. The survey indicated that producer production projections for 1995 and 1996 show strong growth for squab, and silkies, quail meat and quail eggs. However, a softening of production for meat pheasants and meat partridges is expected (Table 2.6).

**Table 2.6 Historical Trends - B.C. Game Bird Commercial Slaughter**

Bird	Actual Production					Producer Projection** *	
	1986*	1987*	1988*	1993*	1994**	1995	1996
Squab	31,463	28,011	50,015	70,860	67,860	101,100	131,300
Pheasants	31,238	41,326	57,081	27,700	23,100	13,000	20,500
Quail	25,447	33,409	80,588	125,000	125,000	125,000	125,000
Partridge	5,361	24,804	15,125	6,300	6,950	25,000	15,000
Silkies	3,585	3,671	4,052	30,000	30,000	35,000	40,000

\*Agriculture and Agri-Food Canada (1994)

\*\*Producer survey

\*\*\*Producer estimates from survey

The results of the survey indicated that producers estimate a projected increase of 49%, or a total production of 101,010 squabs for 1995 and an increase of 32% to 131,300 squabs for 1996. Quail and silkie production numbers are expected to remain consistent for the next several years. Pheasant and Chukar partridge production are anticipated to be variable.

Production trends exhibit short seasonal production cycles as well as long term cyclical production fluctuations. More game birds are produced in summer when production is most efficient; less production is evident during the winter months due to the short day length and cold climatic conditions. Demand for squab/silkies/partridges is greatest during the fall months (September to October) and during the Chinese festive season (January & February).

Long term (3 to 5 years) cyclical fluctuations are due to structural changes within the game bird industry and are a result of the entrance and exit of producers. When prices for the



product are high there are new entrants to the industry. When prices are low, production is reduced and marginal producers leave the industry.

### **Projected supply of game birds in B.C**

The producers surveyed were asked to provide their actual 1994 and anticipated 1995 production levels. Growth rates were then forecasted for 1996 and 1997 using production level criteria provided by the producers and an estimate of growth provided the B.C. Ministry of Agriculture, Fisheries and Food (Table 2.7). The projected number of birds for 1996 was calculated by (number of birds in 1995) x (anticipated annual growth rate). B.C. Ministry of Agriculture (1994) anticipates an annual growth rate of 2.33%. Incorporated into the retail and wholesale value is a 1% per year increase in price to account for inflation for 1996 and 1997. The predicted retail value of production for 1996 was calculated by (retail value for 1995) x (anticipated annual growth rate) x (inflation rate). The projection forecasts an overall increase in supply of 10% compounded yearly for squabs/silkies and partridges.

The number of imported, frozen U.S. squab entering the B.C. market place during 1994 is estimated at 98,631 birds. B.C. game bird producers intend to expand production in the belief that a high quality, domestically produced, fresh product will be able to displace U.S. imports. This displacement of imports may be achievable if there is sufficient and consistent year round domestic supply of squab for the wholesale, retail and restaurant markets.

Silkie and quail production are also expected to grow steadily. The increasing Asian population and the accompanying consumer demand have indicated a strong domestic market. Export markets may be available in the U.S. for B.C. produced silkies.

Little growth in local supply is indicated for meat pheasants, due to the fact that a continuing tariff on Canadian game bird exports to the U.S. market has reduced the competitiveness of B.C. pheasants. Domestic demand for pheasant is minimal and is not expected to increase.

Slow but steady growth is indicated for the production of pheasants and partridge flight birds. The demand for these products is increasing due mainly to the anticipated anti-gun legislation and the increasing encroachment of urban areas on traditional hunting areas. Many rural hunting areas have now fallen under the jurisdiction of municipal governments. The discharge of fire arms is now prohibited in many areas. As a result of this legislation, hunters are now looking for organised "game preserve" hunting areas.

**Table 2.7 Projected Supply Of Game Birds In B.C.**

Bird/Product Type	1994		1995		1996		1997		Annual Compounded Growth**
	# of Birds	Retail Value	# of Birds	Retail Value	# of Birds	Retail Value	# of Birds	Retail Value	
Squab (domestic)	74,646	585,896	82,111	650,931	90,322	716,675	99,354	789,059	10%
Squab (imported)*	95,631	836,391	103,583	886,993	106,741	931,786	114,178	978,841	5%
Pheasants - Meat	25,410	341,880	25,664	348,752	25,921	352,274	26,180	355,832	1%
Pheasants - Flight	13,587	142,664	14,266	151,295	14,960	158,935	15,729	166,961	5%
Quail	137,500	149,738	151,250	166,358	186,375	183,161	183,013	201,660	10%
Partridge - Meat	7,645	65,678	8,410	72,968	9,250	80,337	10,175	88,452	10%
Partridge - Flight	4,050	24,300	4,253	25,770	4,465	27,072	4,688	28,439	5%
Silkies	33,000	395,340	36,300	439,223	39,930	483,584	49,923	532,426	10%
Quail Eggs	451,250	46,930	473,813	49,769	497,503	52,283	522,378	54,923	5%

Total Retail Value

2,588,816

2,792,058

2,986,106

3,196,592

\*Imported Squab: Agriculture and Agri-Food Canada (1994)

## Exports

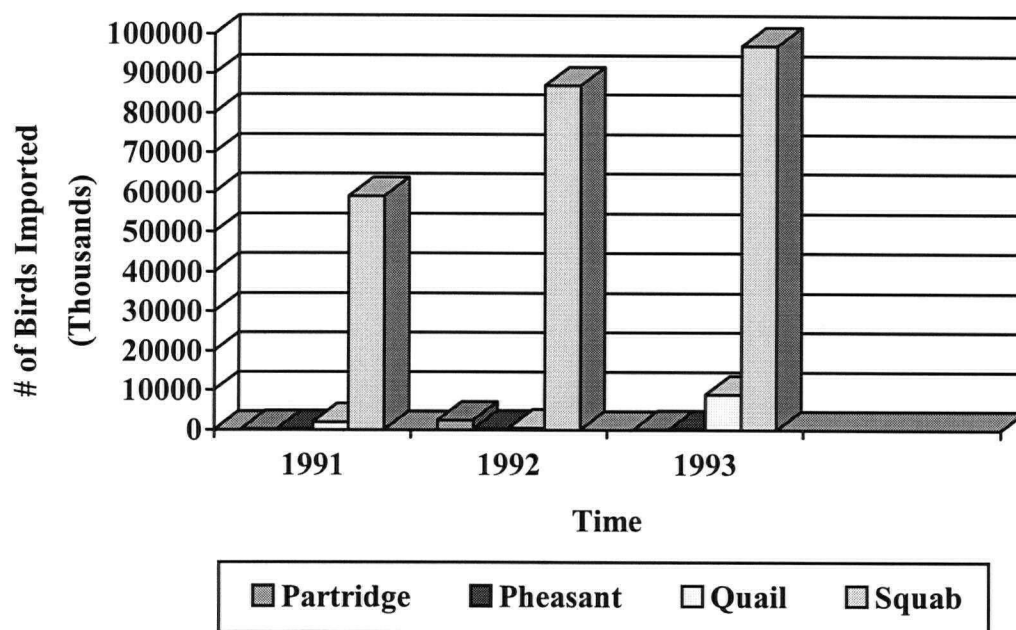
There is a tariff on game birds entering the U.S. from Canada. This tariff significantly reduces the competitive position of the B.C. pheasant producers in their traditional U.S. markets. The tariffs on B.C. game birds are as follows (Agriculture and Agri-Food Canada, 1994):

Quail	fresh or frozen	free of tariff
Silkies	fresh/frozen	3.3 cents/kg.
Pheasants	fresh or frozen	3% of wholesale value
Partridge	fresh or frozen	3% of wholesale value

## Imports

**Foreign:** Figure 2.1 (derived from statistics obtained from Agriculture and Agri-Food Canada, 1994) illustrates the number of squab, quail and partridges imported from the U.S. into Canada for the period 1991 to 1993. It is noteworthy that Canada is largely self sufficient in the production of pheasants, quail, silkies and partridge. However, in 1993, approximately 98,631 frozen squabs were imported to Canada, with the majority of the imports destined for the B.C. market.

**Figure 2.1 Imports of Game Birds into Canada - 1991 to 1993**



Source: Agriculture and Agri-Food Canada (1994)

**Imports - Domestic:** The total game bird population in Canada (commercial plus semi-commercial production) as reported by Statistics Canada (1991 Census) is shown in Table 2.8. Quebec is by far the largest producer of quail with 659,860 birds; Ontario produced 157,987 quail in 1991. It is difficult to assess the number of game birds processed in Ontario and Quebec that reach the B.C. wholesale and retail markets. The 1989 estimates indicated that 350,000 quail were imported from Quebec into B.C. (Paulson et al., 1989).

**Table 2.8 Canadian Game Bird Production By Province -- Total On Farm Production in 1991**

Poultry Product	B.C.	Sask.	Quebec	Ontario	Canada
Pigeons & Doves	26,597	405	307	3,822	32,789
Pheasants	48,817	23,290	35,753	170,793	345,829
Quail	7,266	-	659,860	159,989	829,784
Partridge	202	4,961	3,030	11,682	20,048

The total number of game birds and the total dressed weight of the birds produced in Quebec, Ontario, and B.C/Manitoba are shown in Table 2.9. Manitoba was included in B.C. slaughter figures in the figures provided by Statistics Canada (1991). These numbers represent the total number of game birds slaughtered at federally inspected processing plants. Total Canadian commercial production is reported at 10,461,424 birds with a dressed weight of 1,882,901 kg.

**Table 2.9 Canadian Commercial Slaughter - Game Birds 1990 to 1993**

	1990		1991		1992		1993	
	# Birds	Dressed Wt.	# Birds	Dressed Wt.	# Birds	Dressed Wt.	# Birds	Dressed Wt.
Quebec	5,126,601	700,206	4,537,913	548,390	6,358,080	639,742	5,154,972	610,515
Ontario	1,333,713	292,207	1,282,853	264,457	1,603,144	328,975	4,751,290	1,005,912
B.C. & Man.	396,702	198,829	396,438	217,917	570,186	299,875	555,162	2,664,744
Total Canada	6,827,016	1,191,242	6,217,204	1,030,764	7,420,400	1,268,592	10,461,424	1,882,901

\* Commercial slaughter does not include chickens, turkeys, ducks and geese  
Total bird numbers are aggregated for all game birds  
Source: Agriculture and Agri-Food Canada

## **DISCUSSION**

The potential growth for the B.C. game bird industry is favorable. The strengths of the industry lie in the growing demand for squabs (domestic market) and silkies (export market). The game bird industry faces many challenges, currently the lack of industry structure, high production costs, non competitive processing market and a lack of central marketing agency contribute to low producer margins and revenues.

### **Industry Structure**

Currently there are no formal Game Bird Producers Associations or centralized distribution facilities in B.C. However, the squab producers have formed a loose association that is limited in the scope of its activities. Generally, attempts by the industry to form producer co-operatives have met with resistance. This is due in large part to the independent and entrepreneurial nature of the individual producer. A strong industry infrastructure would provide a solid producer position for the advancement of the industry, and foster a co-operative trade of information on health, management, and marketing of products. Currently, the lack of sophisticated management techniques and market information reduces the stability, and impairs the growth and development of the B.C. game bird industry.

### **High Production Costs**

High input costs are a reality for the B.C. game bird producer. Most game bird producers are located in the Fraser Valley, the high land values are reflected in the small farm size. Attempts to purchase land to increase farm size is costly, often discouraging new

producers from entering the market and preventing expansion of facilities by existing producers

Financial institutions are reluctant to finance game bird operations because of the lack of industry stability. Game bird producers do not have a supply management system, producer cash flows and revenues are often unstable and difficult to predict. Most producers finance their operations by use of personal assets and the use of higher cost consumer credit.

There is only one game bird processor in the lower mainland. Producers from other regions (Okanagan, Vancouver Island) face high transportation costs, higher bird mortality and grade reduction of birds due to injury during transit.

B.C. is known for its high feed costs because ingredients are shipped in from other provinces and processed in the Fraser Valley. The larger game bird producers purchase feed in bulk, however many of the smaller producers purchase feed in sacks. This practice is generally more expensive than bulk feeding. In order to reduce feed costs, producers will feed a commercial poultry formulation to their game birds. Poultry feeds may not be the most efficient form of feed for maximizing game bird growth, but is often the most economical.

### **Non competitive processing market**

Traditionally, the B.C. game bird processing sector has been in a position to determine the quantity of birds to be processed and the price paid to the producer. This “monopoly” has restricted the processing options for producers and has resulted in increased costs.. The total output from commercial production operations is processed by the only



game bird processor in the Lower Mainland. This processor is a federally registered processing plant that is able to process for both the domestic and export markets.

The survey indicated that producers from the Kamloops and Okanagan Valley area are facing a difficult financial position. The added transportation costs, stress on the birds and added producer time in transporting the birds resulted in a higher cost of production. One producer had chosen for the 1995 year to leave the pheasant meat industry. The producer cited the lack of domestic markets, and the increased cost of production as the main areas of difficulty. The producers suggested that competition such as another processor may reduce the overall cost of production.

The processor, in turn, is faced with seasonal variation in supply, and unpredictable short term increases in supply from uncontrolled import markets. The processor has been confronted with the problem of handling a large number of small batches of birds that increases processing costs.

### **Marketing of game birds**

The processor's function is not only processing but also marketing. This "monopoly" on the processing and marketing function allows the processor to set the price of processing, the price paid to the producer, the wholesale price to the retailer and the marketing of the product. The producers indicated a frustration at the lack of competition at the processor and marketing level.

The product marketing channels are from the processor to wholesalers, specialty meat distributors and retailers and restaurants. Those producers who choose to market their own

products via the traditional marketing channels (wholesalers, distributors or retailers/ restaurants), may be able to elicit a higher price for their product. However, the draw back to the do-it-yourself marketing is the difficulty in establishing initial distribution contacts and the time necessary to service these contacts.

B.C. producers have been unable to establish strong brand names and customer loyalty. There is little or no advertising budget for the promotion of B.C. produced game birds. The B.C. game bird markets are price sensitive, often cheaper imports have dominated sales.

There is also a lack of long-term contracts with major food chain stores/ restaurants/airlines. The difficulty has been in the inconsistent quality and supply of the game birds. Long term contracts could provide some stability to the industry by guaranteeing a consistent supply to the consumer and would result in stable cash flows to the producer.

The production of squab dominates the B.C. game bird industry. Squabs are subjected to both long term and short term economic cycles. Short term seasonal demand cycles indicate that there is more consumer demand during the summer months with peaks in demand occurring in September to October. Long term structural cycles refer to the changes within the industry. These cycles are most evident when the price for squab increases, production also increases. Also when prices for squab decrease, marginal producers leave the industry and production levels decrease.

Imported squab pose problems to the B.C. producers. U.S. frozen squabs are often imported in large quantities and sold at a considerably lower price than the comparable B.C.

product. These squabs can be sold at lower prices because of the large economies of scale evident with the large co-operative California operations. Squabs are also regarded as price sensitive. Often the cheaper frozen U.S. product displaces the better quality fresh B.C. product on market shelves. Distributors and importers of squabs are most active when consumer demand peaks (Christmas and New Year) and do very little to support the market between seasons. Distributor prices are usually increased during high demand periods without benefit to the producer profit margins.

The commercial squab market is also subject to the inconsistent and unexpected supply from back yard squab hobbyists. These pigeon fanciers sell squab at low prices to defray their own feed costs. It is estimated that between 8% and 20% of the total squab industry can be attributed to the hobbyists.

The result of these economic forces on the B.C. squab industry has been a variable and unstable profit margins for the producers. The effects of this instability of revenue projection have resulted in the slow growth and development of the domestic squab industry. The potential of growth is evident by the increased request for information from foreign investors (S. Paulson, pers. comm.). However, the scarcity of capital for building and breeding stock, combined with a lack of competitive, structured marketing and a non-competitive processing sector has created serious obstacles for the domestic squab producer.

The producers remain optimistic about the future, domestic demand for squab has been steadily increasing since 1989. This is due to the large influx of immigration from the

Pacific Rim. It is anticipated that this domestic demand for squab will continue to grow at a steady rate in the next few years

A promising market in the semi-commercial sector is the increasing "niche" market for pheasants and partridges for hunting/release game programs. These producers have contributed a total of 13,587 flight pheasants and 4,050 chucker partridge to the 1994 game bird industry output. This market has grown due to the anticipated anti-gun legislation and the necessity to move the traditional hunting areas out of the way of the encroaching urban sprawl. These enterprises provide a "packaged" service to the hunter by ensuring a safe hunting area, hardy lean birds that flush well and the dressing and packaging of birds.

There are two major pheasant enterprises in B.C. one enterprise is located on Vancouver Island, the other is located near Kamloops, B.C. Both operations cater to the traditional hunter who prefers hunting in a rural/wilderness environment. Both operations incubate eggs from their own breeding stock, raise their birds to maturity (22 weeks for pheasants) and releases the birds on large tracts of private land. Approximately 50% of all birds released to the hunters escape unharmed and are left to breed in the wild. Both operations provide their released birds with vegetative cover and food source (wheat and corn crops) for winter survival. This niche market is expected to continue to grow in the future.

The B.C. game bird industry has excellent growth potential. The continuing requests for information from foreign investors indicate an optimistic future for the B.C. game bird industry (S.Paulson, pers. comm). The industry's potentials far outweigh the difficulties. The future challenges to the industry will have to be met with determination and vigour from the producers.

Imports of game birds from the U.S. combined with the continuing tariffs on Canadian game bird exports will provide one of the largest challenges to the B.C. industry. To remain competitive in the domestic and export markets, producers should place their emphasis on efficient production management systems to reduce the cost of production and establish new domestic and export markets. Based on the results of the survey, a list of recommendations is presented in Appendix 2.3.

### **Chapter 3      PARTRIDGE TINAMOU -- AN INTRODUCTION**

There are a total of 9 genera and 47 species of tinamou (Appendix 3.1) that inhabit the area from Central Mexico to Southern Chile (Proctor et al., 1993). Currently, 14 species of tinamou inhabit the South American Continent (Hellmayr, 1942). The tinamou are classed in their own order, Tinamiformes (family Tinamidae), and is an ancient or primitive group of birds (Welty, 1975).

Tinamou are most closely related to the rhea family that also includes other ratites (ostriches, emus and cassowaries). The breeding habits of the tinamou are like those of the rhea, with polygamy being the dominant form of mating (Bruning 1974). The males take the major role with nest building, egg incubation and care of the young.. The physical similarities between the rhea and tinamou are found in the structure of the palate and in the shape of the rhamphotheca -- the horny covering of the bill (Chikilian et al., 1996). There are also chemical similarities in the composition of the eggs (Campbell et al., 1985). This relationship between the rhea and tinamou suggest that the Tinamou is a very primitive bird originating from the early ancestors of modern birds (Pearson et al., 1955).

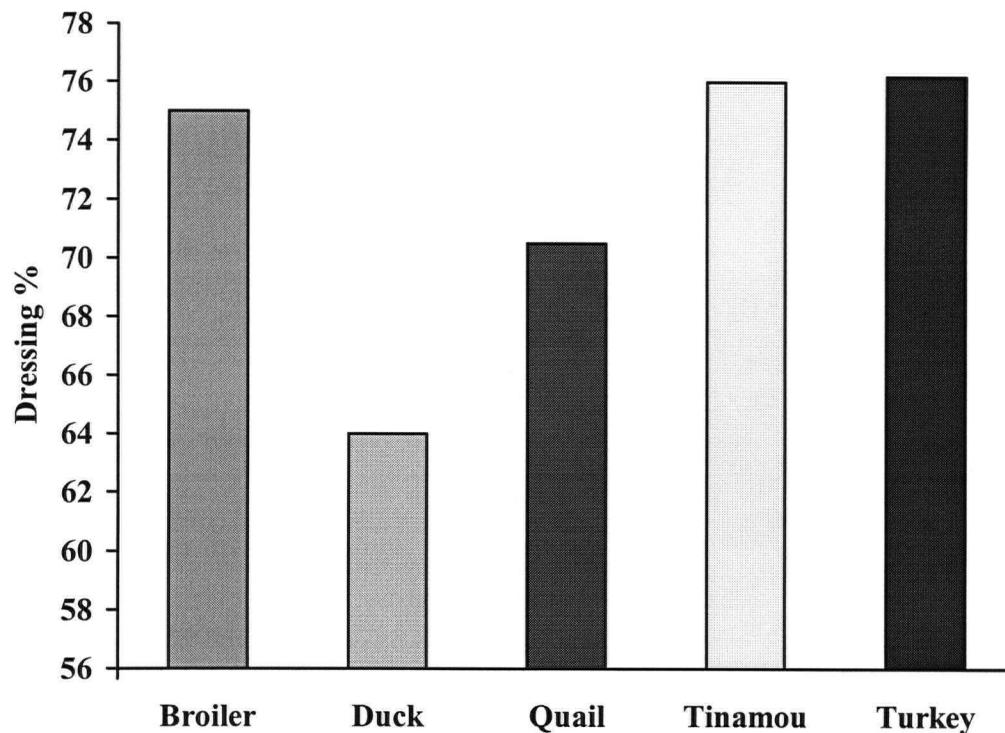
Tinamou species can be as large as a domestic chicken to smaller than a bobwhite quail. Tinamou are compact birds with slender, curved bills, small head and thin neck, their legs are built for running; there are three short front toes. These birds are ground dwelling creatures that escape the attention of their enemies by standing motionless, heads erect and listing for the sounds of their predators. The wings of the tinamou are short and rounded,

flight is clumsy. When flushed, tinamou will exert a short, sharp burst of energy, fly straight up and land hard (Thomson, 1964).

The coloration of the plumage of the tinamou is highly protective. They are generally gray, brown or cinnamon in color with soft bars or spots across the plumage. Male and female tinamou are similar in color and body conformation, adult female Tinamou tend to be slightly heavier than male tinamou (Thomson, 1964).

The partridge tinamou (*Nothoprocta pedicularia*), also known as the Chilean tinamou is one of the smaller varieties (adult weight approx. 450 g.) of tinamou successfully captive-bred by aviculturists (Smith, 1908; Shore-Bailey, 1929). There are two sub species of the Chilean Tinamou; the Northern Chilean Tinamou *Nothoprocta pedicularia pedicularia* and the Southern Chilean Tinamou *Nothoprocta pedicularia sanborni*. The unique feature of the partridge tinamou is a carcass that is composed mainly of translucent white meat with a noticeable absence of fat. In contrast, ostrich meat is red in color, similar to the color of beef. In a study conducted by Cheng et al., (manuscript in preparation) the mean slaughter weight of the 12 birds was  $455.8 \pm 67.1$  g. The oven dressed weight (without skin) was  $350.0 \pm 25.8$ g. and was 76.8% of slaughter weight. The breast meat averaged  $138.1 \pm 15.1$  g and was 40.7% of dressed weight. In comparison with other poultry and game bird species (broiler, turkey, duck and quail), the dressing percentage of the tinamou ranked high and was comparable to that of commercial broiler and turkey (Dressed weight = (whole carcass weight - weight of intestine - weight of feathers); Dressing % = (Dressed weight/whole carcass weight ) x 100) (Figure 3.1).

**Figure 3.1 A Comparison of Carcass Yield Of the Tinamou At Market Age With Broiler, Duck, Quail and Turkey (Cheng et al., 1992 in prep).**



Externally, male and female partridge tinamou appear alike. However, females are often heavier than the males (Bohl, 1972; Cheng et al., in prep). Unfortunately, the difference in the size is not big enough to lend itself to visibly separating the sexes. Calls and whistles are used to distinguish the sexes during the breeding season. Males calling from their nesting areas are more vocal and distinctive as compared to the females (Bohl, 1972; McLarty, 1992). Rottman (1968) observed that males were more nervous than females and walked with the body and neck more erect. When excited, the males would raise their crown feathers, females rarely raised the feathers on their head (Rottman, 1968). Similar to the ratites and *Anseriformes* (waterfowl), the male Tinamou possesses a large phallus (Bump, 1969; Bohl, 1969; Bohl, 1972; King 1981). The adult partridge tinamou can be sexed by



cloacal examination. The males have a coiled whitish colored phallus that when extruded during the breeding season can measure 1/2" to 1" in length. Females tend to have a small phalloid organ (Bohl, 1972).

## **Chapter 4     NESTING SYSTEMS, BREEDING AND MANAGEMENT**

### **INTRODUCTION**

Tinamou are very shy, secretive birds that would prefer to run and hide and are careful not to expose themselves to humans (Bohl, 1972). There have not been any attempts to rear and propagate partridge tinamou in high density, production oriented facilities. This chapter will review the native habitat and breeding behavior of the partridge tinamou and survey the research on captive breeding and rearing programs. The chapter concludes with a detailed study of housing conditions for rearing and breeding tinamou in indoor facilities.

### **NATIVE HABITAT AND BREEDING BEHAVIOR**

An understanding of the nesting habits and breeding behavior of the partridge tinamou would provide an indication of the housing needs of the birds. In the wild, the partridge tinamou inhabits the semi-arid grasslands of southern Chile. Summers are generally dry and sunny while winters are frequently rainy (Bohl, 1972). The partridge tinamou are ground nesters and nest during the summer dry season, however drought conditions occurring during the summer will delay the breeding season (Bohl, 1972). Nests for the partridge tinamou are found in a variety of setting and wild vegetation is preferred to cultivated agricultural crops. Nests can be found on hill sides, in valleys, along fence rows, in ditches and permanent pastures (Bump 1968; Rottman 1968; Bohl, 1972), anywhere there is protection from predators.

Generally, the male tinamou is territorial in nature and will establish a territory from which he uses calls or whistles to attract the attention of the females (Bump, 1969; Bohl, 1972).

Bohl (1972) suggests that a variation of polygyny and polyandry describe the breeding behavior of the partridge tinamou. Polyandry because the female forms mating bonds sequentially with several males during the breeding season, and polygyny because the male forms mating bonds simultaneously or sequentially with two or more females.

Polyandry is common breeding behavior of ratites such as ostrich (Sauer et al., 1964) and rhea (*Rhea americana*) (Thompson, 1964; Bruning, 1974), but otherwise uncommon among birds (Oring, 1982).

Partridge tinamou clutch size varies from 6 to 18 eggs depending on the number of females laying in the nest. One of the most interesting aspects of partridge tinamou breeding behavior is the paternal incubation of the eggs and care of the chicks. Exclusive incubation and care by the male is rare among bird species. Generally in gallinaceous birds, it is the female who incubates the eggs and cares for the young. Tinamou females will lay an average of 15 to 25 eggs per year, the male starts incubation once the clutch is completed (Bohl, 1972; Rottman, 1968). Incubation in the wild is 18 to 20 days (Bohl, 1972).

The females cease to lay once incubation begins and will start laying again in a different nest if stimulated by another male. This type of breeding behavior suggests that the female could lay more clutches than if she concerned herself with incubating and guarding the eggs (Thompson, 1964). The absence of "broodiness" pre-adaptes the females to laying a

large number of eggs in captivity when the appropriate conditions are provided (Cheng, pers. comm.).

Partridge tinamou eggs are relative large (40 grams) in proportion of the adult body weight (450 grams) (Cheng et al., 1992 unpublished data). The shells of the eggs are glazed like porcelain with chocolate to chocolate -- purple tinged coloration (Bohl, 1972).

Generally, the fertility of wild tinamou eggs is high (Bohl, 1969). The fertility rate for 114 spotted tinamou eggs collected from wild nests was reported at 94.5 % (Bump, 1969). Bump also noted that of the 48 eggs produced by captive pale spotted tinamou the fertility rate was 85.5%. Captive crested tinamou eggs were found to have a fertility rate of 85% (Bohl, 1969). Bohl did not report on the sample size, whether incubation was by natural or artificial incubation, or the percentage hatchability.

## **CAPTIVE REARING**

There is limited information pertaining to the rearing of the partridge tinamou in captivity. Smith (1908) obtained a pair of partridge tinamou and placed them in an outdoor aviary in England. The aviary consisted of a roomy shelter shed that faced south, with a glass verandah in the front and a large open pen. The pen (approximately 30 square yards in size) had a dry gravel soil base and was covered with rough grass. The report indicated that the birds were extremely nervous and spent a great deal of time hiding under grass tufts. Early in June 1908, Smith found 5 eggs in a nest under a large tuft of grass. The nest was a shallow, grass lined indentation in the soil. The partridge tinamou male was found sitting near the nest. Four chicks hatched on July 5, 1908, however only 2 chicks survived the summer.

Shore-Bailey (1929) attempted to rear 5 wild caught partridge tinamou in an outdoor aviary. Only two of the adult birds survived to breed the next year. The pair laid 5 eggs and were able to rear 2 chicks to fledgling. The two chicks survived in captivity and nested in the outdoor aviary the next year. The literature did not discuss or describe the details of the outdoor aviary facility.

Bohl (1969) found that the crested tinamou, a close relative of the partridge tinamou, was easily raised in outdoor pens with minimal amount of vegetation for cover. When crested tinamou were confined in a pen with a large quantity of brush cover, the birds would become very shy of human (Bohl, 1969). Bump (1969) found that another two species of tinamou, the spotted tinamou and pale spotted tinamou, could be raised in out door aviaries as long as there is enough vegetation. However, Bump commented that due to the very nervous disposition of these birds, they were not easy to raise in captivity. To rear the spotted tinamou Bump used an adaptation of the common rearing system used for quail. During 3 breeding seasons in the late 1960's, 312 chicks were hatched and 258 birds were raised near Buenos Aires, Argentina. Pen size varied from 4' x 8' x 6' to larger pens of 20' x 40 x 6'. Pen cover varied from bare sand with 10-25% grass cover to complete coverage with grass, native plants and alfalfa.

### **CAPTIVE BREEDING**

In a study conducted by Bohl (1972) in Chile, 15 adult partridge tinamou (7 females, 8 males) were mated using a ratio of one male to two females. Holding pens measured 9' x 12', plentiful grasses and brush cover was provided. Eggs were collected and removed from

the pen each morning to encourage laying. A total of 208 eggs were laid. Bohl reported that partridge tinamou eggs did not hatch well under the same incubation conditions set for other species of tinamou (100.2° F. to 100.5° F. with a relative humidity of 63%).

Bohl (1969) found that Crested tinamou could also be bred in captivity with very little brush cover for nesting. For this study Bohl used pens that measured 9' x 10' x 6' high, brush, forbs and grass clumps were provided for nest cover. Breeding ratio of 1:1 or 1:2 (male:female) was found to be satisfactory, eggs were collected and incubated for 18-19 days at 101° degrees F. to 102° degrees F. with a relative humidity reading of 60 to 65% (Bohl, 1969).

Bump (1969) reported that the spotted tinamou and pale spotted tinamou were not difficult to breed in captivity. To breed pale spotted tinamou a breeding ratio of 1:1, 1:2, 2:3 or 3:5 (males:females) were used. The study found that smaller pens (9' x 12' x 6') with a ratio of 1:2 or 1:3 adults were satisfactory. More eggs were collected if the back half of the pen had tall grass for cover and forbs (small legume type plants) in the front half.

#### **CAPTIVE BREEDING AND REARING AT THE UNIVERSITY OF BRITISH COLUMBIA**

In 1989, a flock of 30 partridge tinamou (four or five generations removed from the wild) was established at the University of British Columbia for evaluation. The birds were housed in an out door pen. The limited number of birds did not allow for detailed scientific studies to be conducted. However, the experience gained from the outdoor and indoor aviary rearing provided valuable insight into the captive propagation of the partridge tinamou.

A study was conducted by McLarty (1992) to observe the breeding behavior of partridge tinamou in an outdoor aviary. Eight birds were separated into two identical, side by side 12' x 12' outdoor "flight pens". The pens were constructed with plywood walls and a roof of chicken wire. Each pen had a gravel base with 3 diagonal rows of long grass for cover. Two pieces of plywood leaned up against the center wall provided additional cover for the birds. The study was conducted over a four month period from April to August 1991. The study found that the weather and temperature had a direct effect on breeding behavior. The breeding activity of the partridge tinamou was severely reduced or stopped during rainy periods in the summer. Only one clutch of eggs was completed and the nest was abandoned by the male half way through incubation because of heavy rain. It was concluded that the cool and wet spring and early summer climatic condition in British Columbia was not conducive to outdoor breeding of the partridge tinamou.

In 1992, pedigree matings using 6 female and 10 male tinamou were attempted in indoor pens. Six identical floor pens (8' x 8') were set up, four of these pens housed one male and one female tinamou each. The remaining two pens each housed 3 males and one female. A total of 49 eggs were collected during a trial period. The eggs were artificially incubated and hatchability was only 22%.

Because of the poor reproductive performance of the birds during the summer, birds were then exposed to long light in the fall and put in a group breeding situation. Two identical pens were constructed (9 meters x 15 meters), each pen housed 5 females and 23 males. The birds started breeding again in December 1993 and lasted until the first week of March 1994. During this breeding attempt 112 eggs were set, fertility was 91% and

hatchability was 67%. It was concluded that group breeding situation would facilitate egg production because it provided more stimulation for the females to lay more eggs.

Initial artificial incubation and hatching at U.B.C. showed that the temperatures and humidity used for chicken incubation (99.5° F., 86° F. wet bulb) resulted in poor hatchability for partridge tinamou eggs. High embryonic mortality was evident during the very late stages of incubation. The chicks hatched under these conditions were wet and weak. In a small trial using 18 eggs humidity was adjusted to 99.5 °F., and 83 °F. wet bulb (50% relative humidity), hatchability was increased to 83% (Cheng et al., unpublished data).

## **NESTING SYSTEM EXPERIMENT**

### **OBJECTIVES**

The commercial production of the partridge tinamou has not previously been attempted. Preliminary studies (Cheng et al., in prep.) suggested that tinamou could be stimulated to lay under indoor conditions. The objective of this experiment was to compare three different types of nest systems and study their effect on partridge tinamou egg production, fertility and hatchability.

### **METHODS AND MATERIALS**



Seventy-eight females and 36 males (ages ranged from 8 months to 4 years old) were available for the experiment. Thirteen females and 6 males were randomly assigned to each of 6 identical 3.8 m x 3.8 m indoor floor pens (Figure 4.1). The experimental design consisted of 3 treatments x 2 replicates. Three nest types, "Lean-To's", "A-Frames" and "Enclosed Cubicles" were compared. The Lean-To type of "nest" consisted of a piece of 240 cm by 45 cm plywood leaning against the wall at a 45 degree angle to provide some cover (Figure 4.2). This has been the type of shelter used for the previous breeding attempts at UBC and was simple and inexpensive to make. A-Frame housing is a form of shelter and nest structure commonly used when ranging chickens and turkeys outdoors (Poultry World, 1948). The A-frame structure used in this experiment consisted of 5 open A-frames stacked in 2 levels (Figure 4.3) as a unit, and 3 units per pen. Enclosed Cubical nest system was selected as the third treatment as it would provide the most secure and protective environment for the birds (Figure 4.4).

The birds were placed in the experimental pens in early April and were exposed to natural day light. They were fed a 26% Turkey starter fortified with 1.25% calcium. Feed and water was provided *ad libitum*. Weekly feed consumption was measured for each pen during a three week period in July. Egg laying commenced in mid April and eggs were collected and set for incubation in a forced-air incubator (Humidaire, Model HIA) weekly from May 1 to July 31, 1995.

Data were analyzed by Least Squares ANOVA for repeated measures with the help of JMP<sup>™</sup>, a statistics software designed by SAS (1995). The following statistical model was used:

For weekly egg production per female, percentage fertility, and percentage hatchability:

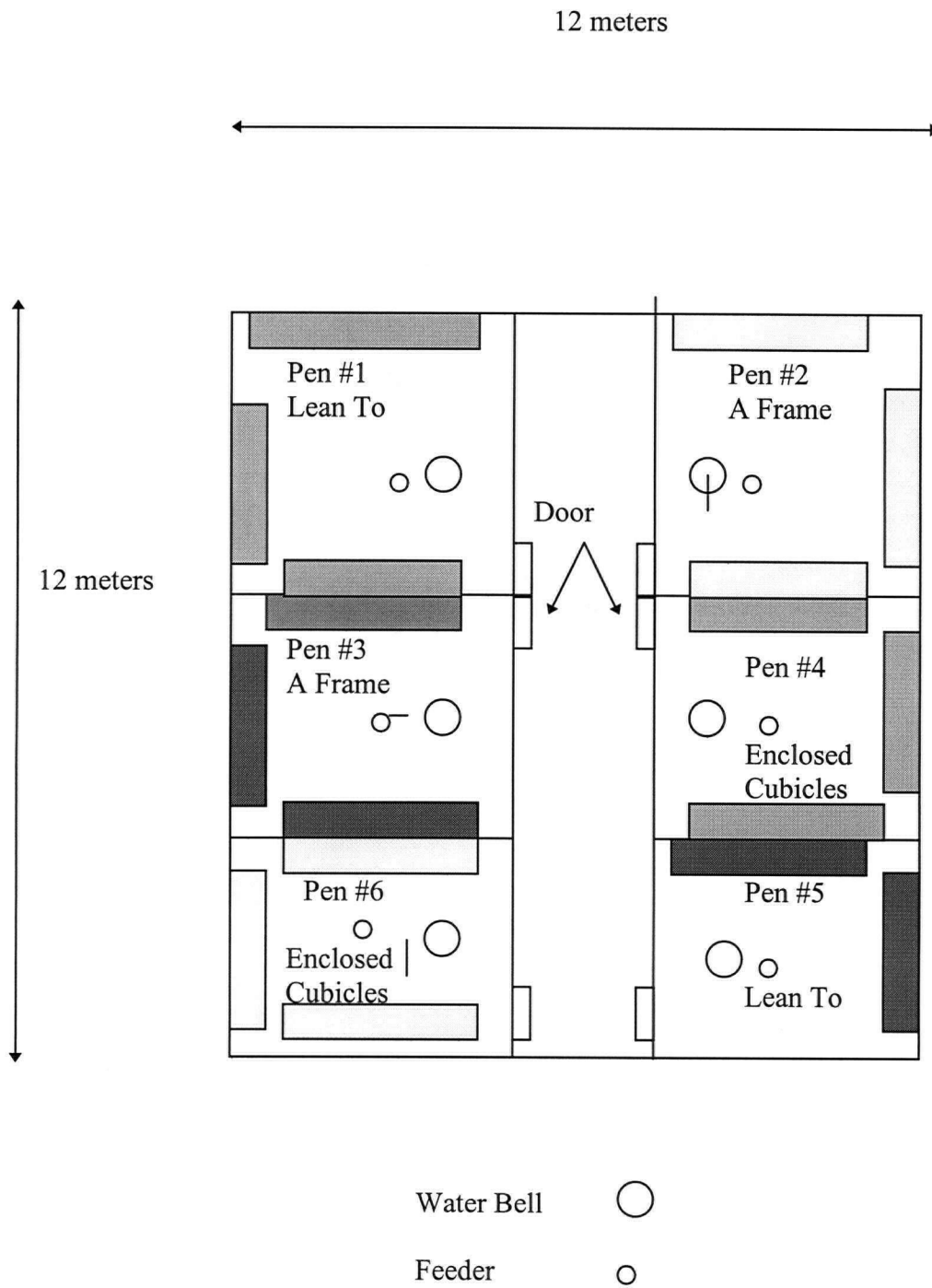
$$Y_{ijkl} = \mu + R_i + N_j + E1_{jk} + H_k + (NH)_{jk} + E2_{ijkl}$$

Where Y = the parameter measured, R = the effect of replication, N = the effect of nest type, E1 = the error term for sub-plot, H = the effect of a particular hatch, (NH) = the 2-way interaction between Nest type and Hatch, and E2 = error term for the model.

Percentages were arc-sine transformed before analysis.

For weekly feed consumption, the number of eggs collected for that week was added to the model as a co-variate.

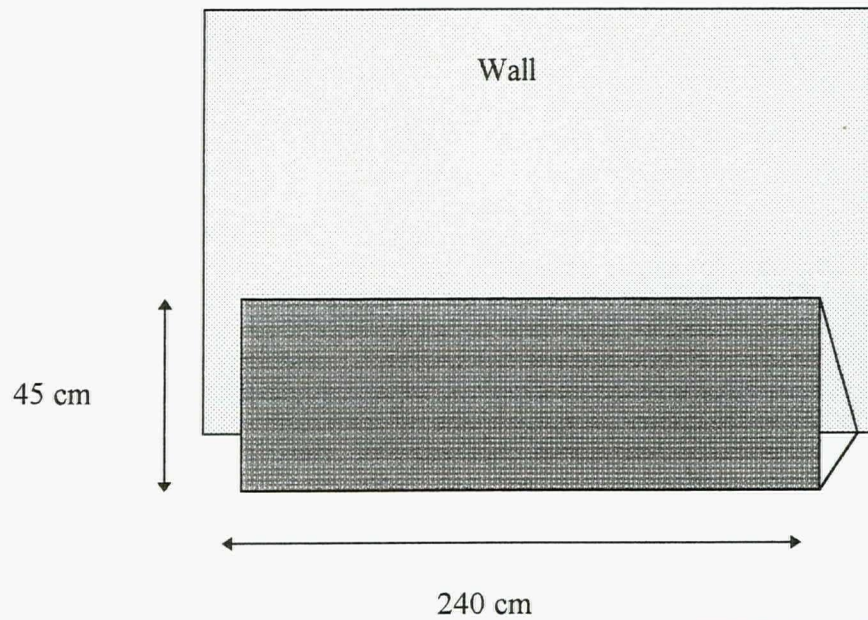
**Figure 4.1 Barn and Nesting System Layout**



**Figure 4.2. Lean To Nest System**

**Figure 4.2. Lean To Nest System**

The Lean To nest unit was constructed using 1/2" plywood measuring 45 cm x 240 cm. One unit was placed along each of the three sides of the pen.

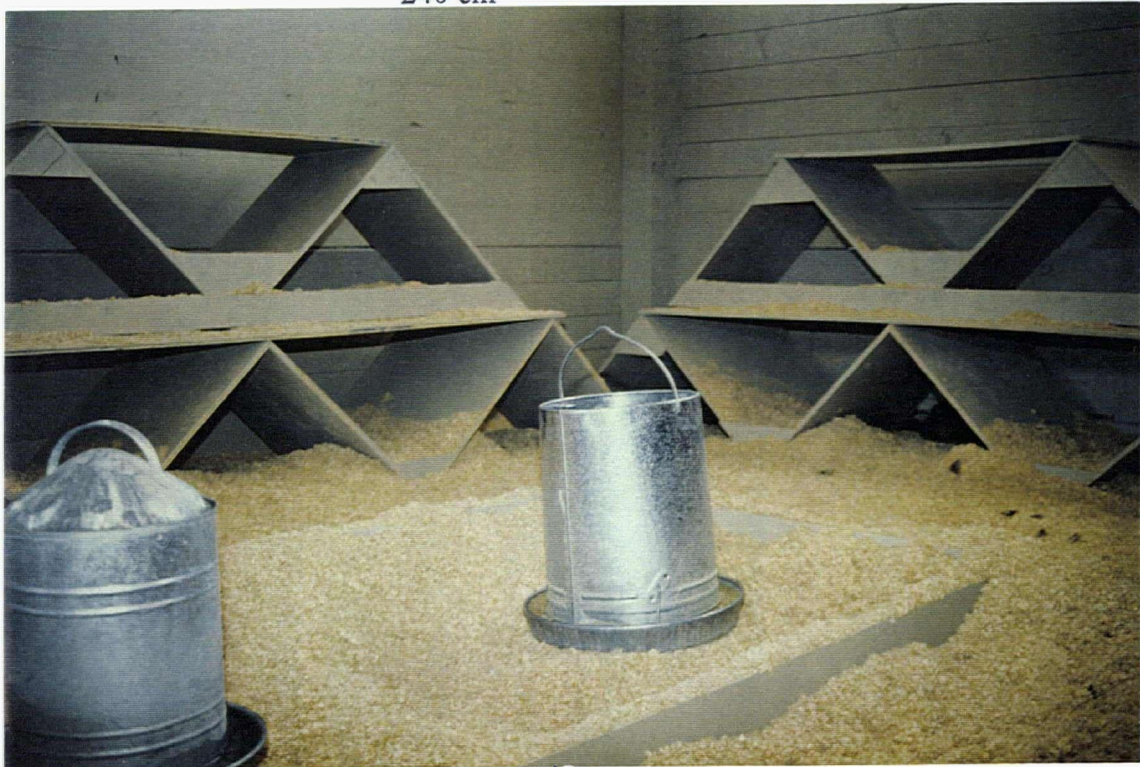
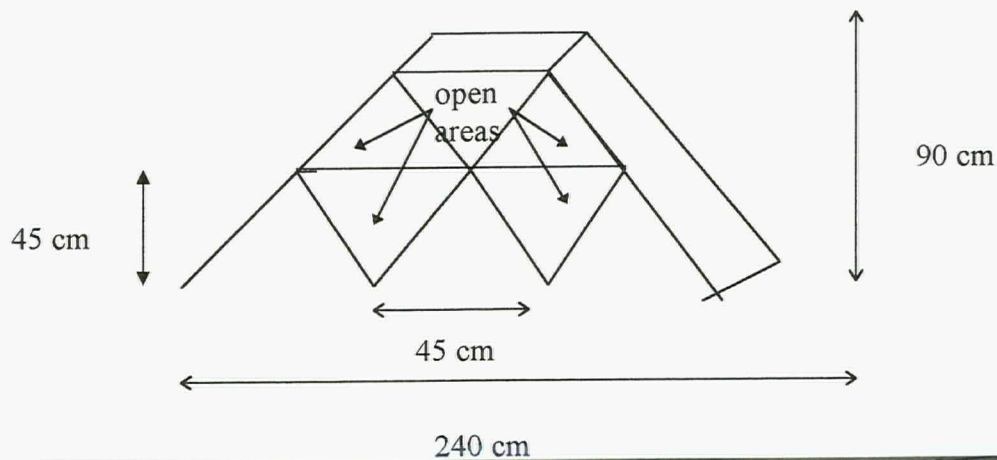


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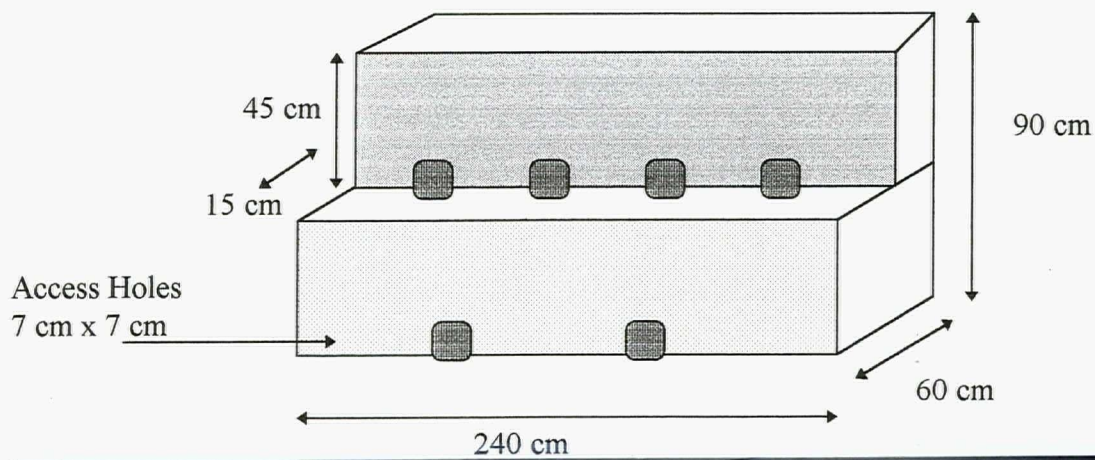
**Figure 4.3 A Frame Nest System**

Each 2-level A-frame nest unit was constructed using 1/2" plywood. Each A-frame measured 45 cm wide x 45 cm deep x 45 cm high at the apex. Both the back and the front were open. Fifteen cm wide plywood gangways were constructed for bird access to the upper level. One unit was placed along each of the three sides of the pen.



**Figure 4.4 Enclosed Cubicles Nest System**

Each unit, consisted of a 2-story battery of 8 Enclosed Cubical, was constructed of 1/2" plywood. Each cubicle measured 60 cm x 60 cm x 45 cm high. The cubicles were completely open at the back with 7 cm x 7 cm openings at the front. The top section at the front has a hinged door to facilitate egg collection. Fifteen cm wide plywood gangways were constructed for bird access to the upper level. One unit was placed along each of three sides of the pen.



## **RESULTS**

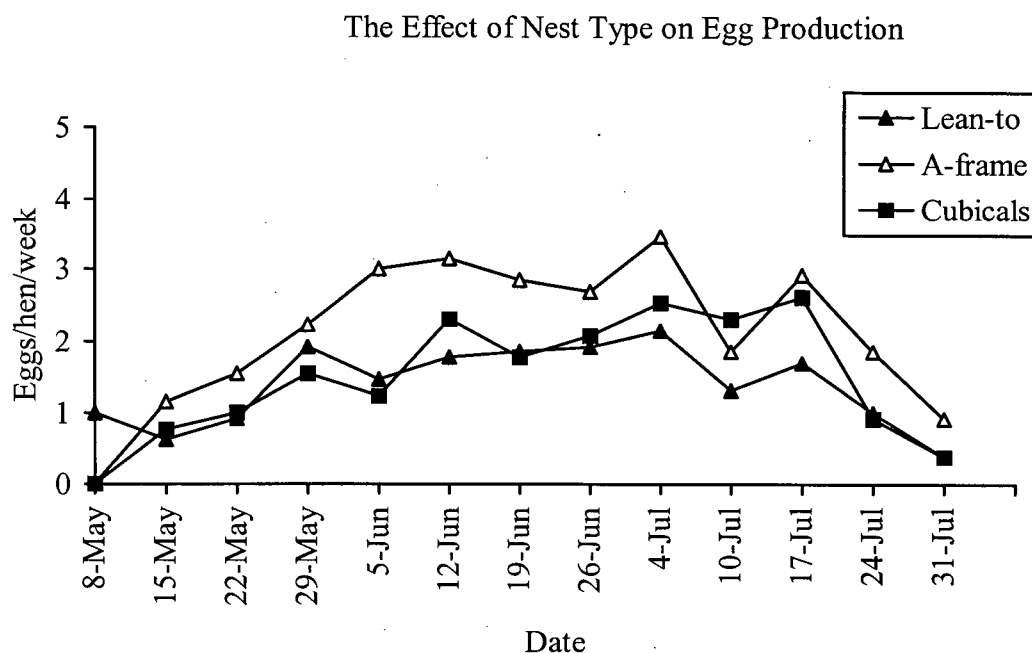
### **Date of First Egg**

Females in Pens 2, 3, and 4 started laying in May 1, females in pens 1, 5 and 6 did not lay their first eggs until May 8. It was noted that Pens 5 and 6 were closest to the barn door and may be exposed to more traffic and disturbance.

### **Egg Production**

Weekly egg production was recorded from May 1 to July 31, when egg production in most pens dropped to zero. There was no significant difference in egg production from the 2 replicates. Nest type, however, significantly ( $P < 0.01$ ) affected egg production. Females in A-frame nests laid significantly more eggs (0.98 egg per female per week) than those in the cubicles (0.69) and lean-to's (0.67) and as expected, hatch effect was highly significant ( $P < 0.0001$ ). Weekly egg production per female increased from May 8 (0.12) to July 4 and peaked at 1.4 eggs per female, maintained at a similar level for 2 more weeks, and quickly declined to 0.29 by July 31 (Figure 4.5).

**Figure 4.5 The Effect Of Nest Type On Egg Production**

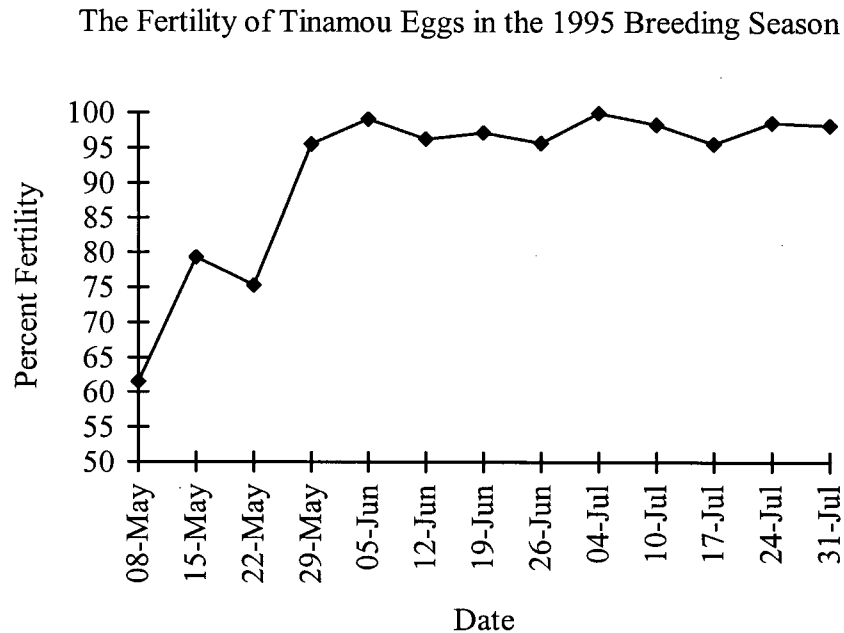


### **Fertility and Hatchability**

Percent fertility was not affected by the type of nest the females were in. Fertility was low (61.5%) when the females first started laying, but quickly increased to 95% by May 29 and was maintained above 95% until the end. None of the factors examined affected hatchability (mean = 72%).



**Figure 4.6 The Fertility Of Tinamou Eggs In The 1995 Breeding Season**



### **Feed Consumption**

Neither Nest type nor hatch affected feed consumption (mean = 0.15 Kg per bird per week). Weekly feed consumption regressed significantly ( $r^2 = 0.76$ ,  $P < 0.006$ ) on the number of eggs produced in that week.

### **DISCUSSION**

Many species that normally establish breeding territories become organized into dominance social orders or despotism when forced together in small spaces (Wilson, 1975). The partridge tinamou may be an exception. McLarty (1992) found that males exhibited territorial behaviour when they were put in large outdoor flight pens. Nevertheless, no such

behaviour or aggressive interactions related to establishing dominance hierarchies was observed in the high density floor pens. Instead, one large communal nest was found in each pen (except for the Lean-to's, see below) with several males incubating side-by-side, seemingly peacefully. Such breeding behaviour has not been reported in the literature. Given the same amount of space, less pronounced territoriality or aggressive behaviour would certainly be conducive to reproduction in captivity (Nichols et al., 1992).

Birds housed in the A-frame nesting system produced significantly more eggs (0.98 eggs/female/week) than those in the cubicles (0.69) and lean to's (0.67). Bohl (1972) indicated that in the wild, the female tinamou is attracted to the nest site by hearing the calls of the male. The female was then stimulated to lay by observing the courtship ritual that included the motion of digging the nest in front of the females. The A-frames are constructed so that the entire front and back portions are open. Both males and females can easily hear and observe each other. This may facilitate egg laying compared to the other two structures that formed more visual barriers. Furthermore, the openness of the A-frames also allowed birds to see intruding human and allowed them to get away before the intruder got close. Birds could move from one A-frame to another easily to avoid the intruder while still being sheltered. The nests were usually found at the rear of the A-frames so that incubating birds could retreat through the passage way behind the A-frames with the approach of human.

In squab production systems where floor pens are used, nests facing the entrance of the pen are usually less productive than nests facing perpendicular to the entrance (Paul Marini, pers. comm). Birds in the former were "cornered" when the caretaker entered because there was no escape route. As a result, they sat tight and flushed out of the nest at the last

second and caused egg breakage and injuries to the squabs. Birds in the latter could get away from the side of the nest further from the intruder before the intruder got too close. Birds that are less stressed in this manner produced better.

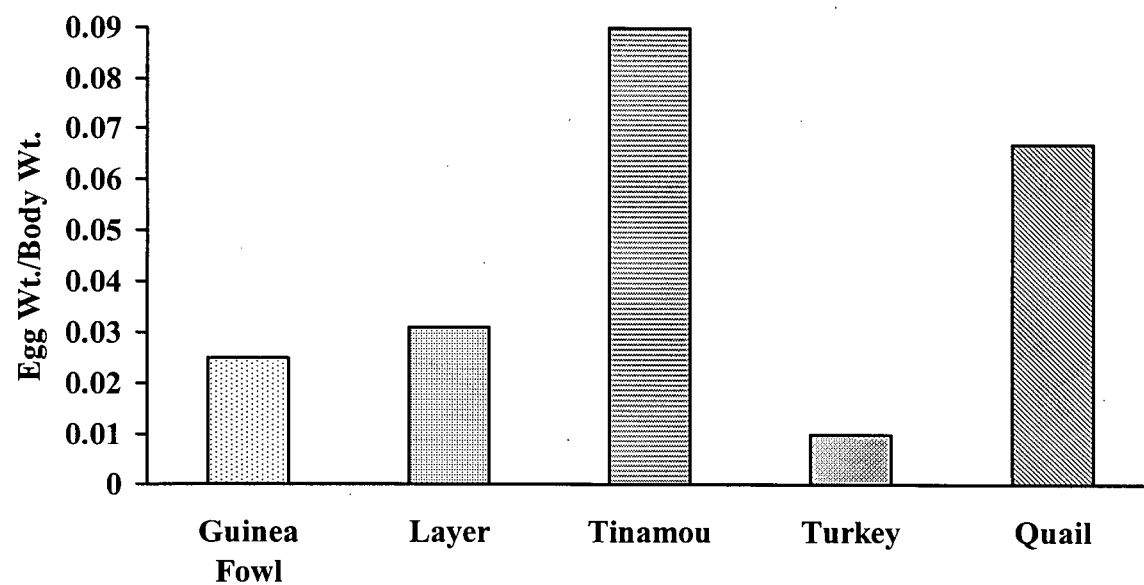
The Lean-to system produced the fewest numbers of eggs. The Lean-to system was essentially closed on the front side (plywood) and back side (wall), and was only open at the ends. The area behind the Lean-to was long, narrow, dark, and afforded little opportunity for the males and females to proceed with the courtship ritual. While eggs were found under the shelter of the Lean-to's, they were scattered. Occasionally, shallow nests were found with only a few eggs. During egg collection and maintenance, the birds in the Lean-to pens proved to be extremely flighty and excitable. Entering the pens resulted in a massive, excited, short burst of flight for the birds. While the sheltered areas were similar in the 3 types of nest systems, birds' accessibility to the sheltered area was perhaps least with the Lean-to's.

The enclosed cubicles are closed at the front but open at the back. While males and females could interact along the passage ways behind the cubicals, there was a lot more visual barriers. Birds inside the cubicals could not see approaching human until the lid at the top of the cubical was open. Nests were also found at the back of the cubical allowing easy escape for the incubating males. Further research will be necessary to determine if the visual barriers of this system would minimize the over-reaction of the birds in a higher density situation. The outcome may be a more efficient nesting structure than those provided by the A-frame system.

Bump (1969) and Bohl (1969) (1972) indicated that the fertility rate for wild tinamou ranged from 85% to 90%. In this study, the partridge tinamou showed an overall fertility rate of 94% with hatchability of 72%. The egg number and the fertility rate are high, indicating that the density of birds in the pen, and the diet provided did not adversely affect reproduction. On one hand, it will be interesting to see if the male to female sex ratio can be increased from 1:2 to 1:3 or 1:4 without lowering fertility. On the other, the results indicated that with the present sex ratio, fertility may not be affected even if the females could increase their egg production. Hatchability rate was satisfactory, but required improvements by fine tuning incubation conditions.

The eggs of the partridge tinamou are similar in size to medium chicken eggs (40 g) and are large considering the hen's body weight (500 g) (Fig. 4.7). It is therefore logical to assume that egg production in tinamou would be more affected by feed consumption than other species like chickens. In the present study, weekly feed consumption regressed significantly ( $r^2 = 0.76$ ;  $P < 0.006$ ) on the number of eggs produced. Egg production in tinamous may be improved by improving feed intake. Feed intake may be improved by improving the birds' accessibility to the feed and water.

**Figure 4.7 Comparison Of Egg Weight/Body Weight for Guinea Fowl, chicken (layer), Tinamou, Turkey And Quail (Cheng et al., 1992 in prep.)**



## **Chapter 5      THE EVALUATION OF TWO COMMERCIALY AVAILABLE FEEDS FOR PARTRIDGE TINAMOU MEAT PRODUCTION**

### **INTRODUCTION**

The main difficulties in the successful commercial production of a new domesticate are associated with feeding, housing and management. Satisfying the nutritional requirements for the species is the underlying concern in any rearing program. Feed formulation for newly domesticated species poses unique challenges. With little published information available, the feeding program involves two aspects: the feed must be acceptable to the birds and the feed must at least be adequate to sustain the health, well being and growth of the bird. Only after these two conditions are satisfied can one start to refine the feeding program to promote efficient conversion and fast growth.

### **NATURAL FOOD HABITS OF THE PARTRIDGE TINAMOU**

An understanding of the native habitat, nutritional value of native feeds, and the digestive tract of the bird will provide information for feed formulation designed to fulfill the nutritional needs of the bird.

In the wild, the partridge tinamou thrives in open grassland, pastures, orchards and vineyards. Unlike gallinaceous birds which dig and scratch with their feet, tinamou dig with their bill for bulbs or tubers. Tinamou are not a threat to agricultural crops, only fallen seeds are picked up from the ground (Bohl, 1972). Housse (1945), Rottmann (1969), and Bohl (1972) examined crops of the partridge tinamou and found that seeds and fruits of Leguminosae and Gramineae plants made up of more than 34% of the feed taken. Their diet

also included beetles, flies, grasshoppers, sowbugs and snails, with Orthoptera (beetles and flies) and Coleoptera (grasshoppers) being most important (Bohl, 1972) (Appendix 5.1).

## **THE DIGESTIVE TRACT OF THE TINAMOU**

The anatomy of the digestive tract of the tinamou is not well documented. A recent study conducted by Chikilian et al., (1996) examined the anatomy of three species of tinamou (I. *Crypturellus tataupa*, *Nothoprocta cinerascens* and *Nothura maculosa*). The study found that the general morphology of the digestive system the tinamou followed the basic anatomy of the avian alimentary canal. The digestive system of the tinamou consisted of an esophagus, crop, proventriculus, ventriculus, small intestine, well developed caeca and rectum. Chikilian et al., (1996) suggested that the well developed crop provided a storage chamber for food. . The study also found that the tinamou had a relatively long proventriculus. Ziswiler (1967) indicated that insectivorous birds have a short proventriculus because they ingest foods high in protein. However, grain and seed eating birds tend to have longer proventriculus that allow for more efficient digestion of low protein foods. The native diet of most tinamou species consists of fruits, leaves, buds, seed and some small insects (Chikilian et al., 1996).

An interesting aspect of the digestive tract of tinamou and ratites are their caeca. Clench and Mathias, (1995) reported that some tinamou have the most elaborate caeca found in birds. The caeca of the tinamou, in general, are paired, long (6-24 cm), simple and finger like (intestinal type) as found in the Bushland (*Nothoprocta cinerascens*) (Chikilian et al., 1996). The caeca of the Red Billed Tinamou (*Rhynchotus*) are long and spiral like, similar to

those of the ratite family (Clench and Mathias, 1995). Crested tinamou (*Eudromia elegans*) have exceptionally unusual caeca, which are long and wide with the external surface divided into many lobular projections or outpockets. These outpockets are prominent at the base but diminish in size and organization at the tip. The internal organization of the caeca are spiral in form similar to those of the ostrich family (Clench and Mathias, 1995). Bohl (1972) suggests that the possession of large, lobular caeca has enabled the Crested Tinamou to survive in the deserts of Argentina on grasses and desert plants and without direct access to water with only succulent vegetation to supplement its water needs. The study conducted by Chikilian et al., (1996) found that the columnar epithelium lining the villi in the caeca and the presence of mucous crypts and goblet cells suggested that the caeca have both absorptive and secretory functions. Clench and Mathias (1995) suggest that the caeca of ratites and tinamou may have several functions; they may be the site for fermentation and further digestion of feed, for the utilization and absorption of water and nitrogenous compounds, and as a site for microbial action (Swart et al., 1993).

### **FEEDING TINAMOU IN CAPTIVITY**

There is limited information concerning the rearing of the partridge tinamou in captivity. Smith (1908) and Shore-Bailey (1929) attempted to breed wild-caught partridge tinamou that were shipped to England. The pair that Smith reared laid 5 eggs and was able to raise 2 chicks to fledging. Two of the 5 tinamou that Shore-Bailey raised survived and nested the next year in captivity. A few chicks were hatched by the males, and were fed



mealworms and small seeds. Unfortunately, these chicks did not survive for more than a few weeks after hatching.

Bohl (1972) kept 15 wild, caught partridge tinamou in an outdoor aviary in Chile. For one breeding season Bohl was able to collect 208 eggs of which 68 hatched with artificial incubation. The breeding birds were fed a commercial poultry diet supplemented with methionine, white fish meal, cooked ground liver or alfalfa leaf meal (Bohl, 1972). However, Bohl recommended that when available, the breeding birds should be fed a game bird breeding feed with a minimum of 26% protein. The newly hatched chicks were fed a "protein mash" (unknown composition) supplemented with cooked liver and chopped egg yolk. Live meal worms were also used to stimulate the penned chicks to eat (Bohl, 1972). After the first few weeks, the young tinamou were fed a game bird starter mash with hard boiled egg, finely chopped alfalfa, clover or lettuce several times a day. For non-breeding birds, Bohl recommended a maintenance diet consisting of a game bird maintenance feed with protein level of at least 19%. Desirable supplements included wheat, barley, sorghum, millet, cracked corn and green feed such as alfalfa, lettuce or chard (Bohl, 1969).

### **COMMERCIAL FEED FOR GAME BIRDS**

Nutrient requirements for most game birds have not been well established (Leeson, 1994). Most of the commercially available game bird feeds are formulated based on the nutritional requirements of the turkey, and have been fed to game birds with reasonably good results (Leeson 1994, Homer 1980, Teitge, pers. comm.). The increased popularity of commercial game bird production in North America has prompted the formulation of feeds

better suited the nutritional needs of these birds. The high economic value of ratites for example, has promoted a series of feed trials to determine the specific nutritional requirements of the bird (Swart et al., 1994). In most cases, however, the small volume of sales and the lack of nutritional information have deterred the feed companies from formulating feed specifically for a particular species.

The formulation of diets for game birds is complicated as they are often produced for various types of markets, quail are produced for meat and egg, while pheasants may be produced for both release and meat. Birds raised for meat and egg production (quail) require adequate diet formulation promote growth and production, however, birds raised for release (pheasants and partridges) do not require maximum body weight (Leeson, 1994).

In general, growing pheasants require a feed formulation with a protein content of 18 to 20% (Streib et al., 1991). Leeson (1994) suggests a two phase grower diet for pheasants, the first stage from 6 weeks of age to 12 weeks consists of a diet with a protein content of 20.%, and a second stage from 12 weeks to market age of 15% protein.

Guinea fowl have become a well established industry in Europe. In France, the rearing of guinea fowl does not differ significantly from that of commercial poultry and commercial poultry diets have been used in rearing of guinea fowl (Leeson, 1994). Leeson suggests a diet formulation and feeding regimen similar to that of pheasants, stage 1 of the grower diet should contain a protein level of 20% and fed to guineas from 4 to 10 weeks of age. Stage 2, fed from 10 weeks of age to market age, should contain at least 18% protein.

Belshaw (1985) and Wiseman (1984) suggest a protein level of 17.3% to 19.1% protein for growing guinea fowl.

The nutritional requirements of the Japanese quail (*Coturnix coturnix japonica*) are well documented. In the wild the quail prefer diet high in protein in order to thrive and reproduce efficiently (Shim and Vohra, 1984). Quail producers in Japan have long been aware that domesticated quail require a higher level of protein in their diets than domesticated fowl (Howes, 1964). Early investigators raised their quail flocks successfully on turkey starter diets containing 25% to 28% protein (N.A.S., 1969). Vohra and Roudybush (1971) suggests a diet containing 25% protein for growing quail. Leeson (1994) and Ernst (1975) suggests that a grower ration for meat type quail should contain a minimum of 20% protein. Shim and Vohra (1984) suggested a diet containing 20% protein for maximum egg production.

The Bobwhite quail (*Colinus virginianus*), a new world quail is native to the south eastern U.S. Skewes, P., and H. R. Wilson, (1983) suggest a game bird grower diet from 5 weeks of age to 10 weeks of age with protein level of 20.8%.

In general, the literature reviewed suggests that the diet formulation for game birds should contain 20% to 25% protein.

The partridge tinamou is within a family of birds that is not well studied even in the wild. The California Quail (*Lophortyx californica*) has been introduced into Chile and co-habits with the Chilean tinamou (Bohl, 1972). The partridge tinamou and California quail share the same habitat but may differ in food habits and feeding behavior. Published

literature on the nutritional requirements of California quail does not exist, generalizations or comparison of the nutritional requirements of the partridge tinamou to gallinaceous birds may not be applicable.

Based on the recommendations of Bohl (1969, 1972), and Cheng et al., ( in prep.) a pilot feed trial was conducted with a small number of partridge tinamou. A commercially available 26% protein Turkey Starter and a 18% protein "Hen Scratch" were compared for promoting the growth of young partridge tinamou from 3 weeks of age to 13 weeks. Birds fed the higher protein diet grew faster and bigger, but because of the small number of birds involved, no statistical analysis was conducted.

Traditionally, turkey feeds have been used as a basis for feed formulation for quails and pheasants (Leeson 1994, Homer, 1980). It is therefore, appropriate to explore further, the suitability of turkey feeds for growing tinamou. The objective of this study was to compare the performance of young tinamou fed a 21% protein Turkey Grower Diet with those fed a 17% protein Turkey Finisher Diet.

## **MATERIALS AND METHODS**

Eggs were collected weekly from December 1993 to May 10, 1994, and set for incubation in a forced-air incubator (Robins model HIA) (83° F. Wet Bulb). From a breeding flock of 59 adults which were housed in two indoor pens and stimulated to breed with artificial lighting, a total of 56 tinamou chicks were hatched for the feed trial.

### **Brooding - Hatch To 3 Weeks Of Age**

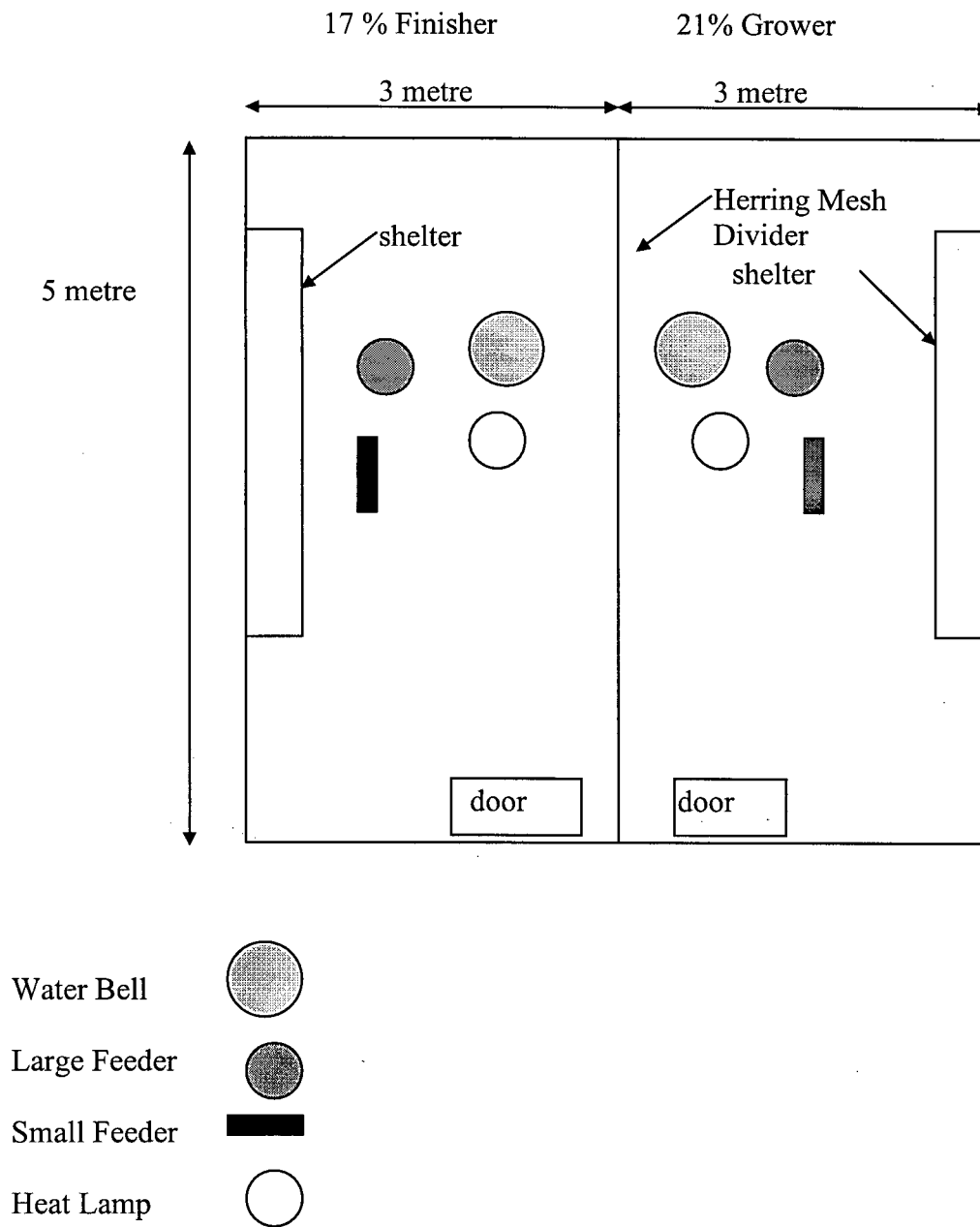
Newly hatched tinamou chicks were weighed and banded on both wings with numbered #5 fingerling tags (National Band and Tag Company, Kentucky, U.S.A.) Two identical brooders were set up in the same room for the chicks, each brooder measured 93 x 124 x 75 cm high. The concrete floor was covered with wood shavings to a depth of 7 cm. Each brooder was equipped with an automatic waterer and a small 10 cm x 30 cm rectangular feeder. An infra-red heat lamp was placed above a corner of the brooder to maintain a warm area of 23<sup>0</sup> C (99<sup>0</sup> F). To reduce bird density, brooder 1 held chicks from hatch to 2 weeks of age, after which time they were transferred to brooder 2 and held for another week before being placed in the pens for the feed trial. For the first 3 weeks, the chicks were fed a 26% protein non-medicated Turkey Starter crumble and were exposed to a 24L-0D light cycle.

#### **Feed Trial - 4 weeks to 13 weeks of age**

A light controlled room was divided into halves to form two indoor pens for the feed trial. Each pen measured 3m x 5m and shared a common wall of black nylon herring netting (2 cm x 2 cm mesh) (Figure 5.1). The concrete floor was topped with 7 cm deep wood shavings. Each pen was provided with an automatic waterer and a 12 kg capacity round feeder. An infra-red heat lamp was placed in one corner to provide extra heat for the younger birds that needed brooding. A three sided wood shelter (30 cm x 93 cm x 30 cm high) was placed along one wall to provide shelter for the birds. The shelter was completely open on the back side, and 12 cm x 12 cm holes were also cut in several places along the front enclosed sides to allow for bird access. Feed and water were provided *ad libitum*. During

the trial the birds were exposed to a 17L-7D light cycle. Temperature of the room was maintained at 22 °C.

**Figure 5.1. Diagram of Juvenile Pens**



With the small number of breeding stock available, less than 10 eggs were usually collected and 5 or 6 chicks were hatched each week. After spending 3 weeks in the brooders, the chicks were randomly assigned to one of the two trial pens. The number of chicks in the pens were adjusted for mortality occurring in that particular pen. The adjustment was to minimize difference in density between the two pens (Table 5.1). The chicks were individually weighed before being placed in the trial pens and weekly thereafter until 13 weeks of age when they were taken out of the trial pens and transferred to a holding pen. A measure of tarsus length was also taken at the same time the birds were weighed. Over the 6 month period, a total of 26 chicks was assigned to pen 1 (17% protein grower diet) and 29 chicks were placed in Pen 2 (21% protein finisher diet) (Table 5.1).

**Table 5.1 Time Table For Hatch and Mortality During the Feed Trial Indicating Weekly Density of Birds in Each Trial Pen.**

17% Protein Turkey Finisher					21% Protein Turkey Grower			
Week	Add	Subtract	Mortality	Net	Add	Subtract	Mortality	Net
1	2	0	1	1	2	0	1	1
2	3	0	0	4	3	0	1	4
3	2	0	1	5	2	0	0	6
4	3	0	0	8	4	0	0	10
5	3	0	0	11	2	0	1	11
6	2	0	1	12	3	0	0	14
7	1	0	0	13	2	0	0	16
8	2	0	2	13	3	0	0	19
9	2	0	0	15	0	0	0	19
10	2	0	0	17	2	0	0	21
11	2	0	0	19	2	0	1	20
12	1	2	1	17	2	1	0	19
13	0	2	0	15	2	2	0	19
14	0	3	0	12	0	3	1	15
15	0	1	0	11	0	1	0	14
16	0	3	0	8	0	3	0	11
17	0	0	0	8	0	2	0	9
18	0	2	0	6	0	3	0	7
Total	26		6		29		5	

(add = new 3-week olds added; subtract = 12-week old taken out)



Commercial turkey feeds were purchased from a local feed manufacturer. The calculated feed analysis is found in Table 5.2.

**Table 5.2 Feed Analysis Of The Two Trial Diets**

<b>21% Protein Turkey Grower</b>		<b>17% Protein Turkey Finisher</b>	
Nutrient	Content	Nutrient	Content
Metabolizable Energy (kcal/kg)	2800	Metabolizable Energy (kcal/kg)	2925
Crude Protein (%)	21.0	Crude Protein (%)	17.0
Lysine (%)	0.92	Lysine (%)	0.70
Methionine (%)	0.40	Methionine (%)	0.34
Methionine + Cystine (%)	0.65	Methionine + Cystine (%)	0.58
Threonine (%)	0.74	Threonine (%)	0.59
Crude Fat (%)	4.3	Crude Fat (%)	5.2
Crude Fiber (%)	4.2	Crude Fiber (%)	3.4
Calcium (%)	1.05	Calcium (%)	0.95
Total Phosphorus (%)	0.92	Total Phosphorus (%)	0.78
Available Phosphorus (%)	0.51	Available Phosphorus (%)	0.45
Sodium (%)	0.21	Sodium (%)	0.20
<b>Vitamin Pre-Mix (same for both diets)</b>			
Vitamin A (IU/kg)	8500		
Vitamin D3 (IU/kg)	2500		
Vitamin E (IU/kg)	35		
Vitamin K (IU/kg)	1.5		
Thiamin (mg/kg)	4.0		
Riboflavin	6.0		
Pantothenic Acid (mb/kg)	20.0		
Pyridoxine (mg/kg)	5.0		
Cobalamin (mcg/kg)	15.0		
Folacin (mg/kg)	1.0		
Niacin (mg/kg)	70.0		
Biotin (mcg/kg)	225.0		
Ascorbic Acid (mg/kg)	2200.0		

## DATA PROCESSING

All uneaten feed remaining at the start of the weekly session was weighed, any feed added to the feeders was also weighed and recorded. Weekly feed consumption was calculated for each pen.

A Condition Index was derived by using the formula:  $[(\text{Body weight} \div (\text{Tarsus length})^2)]$  (O'Connor, 1984). Weeks 3, 8, and 13 body weights and condition indices were analyzed by t test procedure (TTEST PROC., S.A.S., 1985).

All birds were weighed weekly, feed conversion ratio for each experimental pen was calculated by:  $(\text{Total Weight of Feed Eaten} \div \text{Total Weight Gain})$ . Daily feed intake was calculated by:  $[\text{Total Amount of Feed Eaten (by all birds in trial pen during the past week)} \div \text{Total number of birds in the trial pen}]$ . Asymptotic points (point of inflection where weight gains change) were then compared.

## RESULTS

There was no difference in week 3 body weight and condition index for birds to be assigned to the two diets. At week 8, birds fed the 17% protein diet were significantly ( $P < 0.001$ ) lighter (250 g.) and showed significantly ( $P < 0.003$ ) more variation in their body weight than those fed the 21% protein diet (282 g) (Figure 5.2). However, at week 13 body weights were not significantly different (17%; 350 grams vs 21%; 364 grams,  $P < 0.06$ ) between the two treatments.

Birds fed the 21% protein diet had a significantly longer tarsus at week 8 and week 13 than birds fed the 17% protein diet. However, their condition index was significantly ( $P<0.05$ ) higher (0.19 mm vs 0.13 mm) at week 8 only and was not different at week 13 (0.16 mm) (Figure 5.3).

Birds fed the 17% protein diet suffered higher mortality between week 4 and week 13 (6/26) than those fed the 21% diet (5/29).

Average weekly feed consumption for birds fed the 21% protein diet was 120 g/bird/week. Birds fed the 17% protein diet had an average weekly feed consumption of 130 g/bird/week. Feed conversion ratio was 5.6 for the 21% protein diet and was 6.1 for the 17% protein diet.

Figure 5.2 Body Weight Of Juvenile Tinamou From Hatch to 13 Weeks of Age

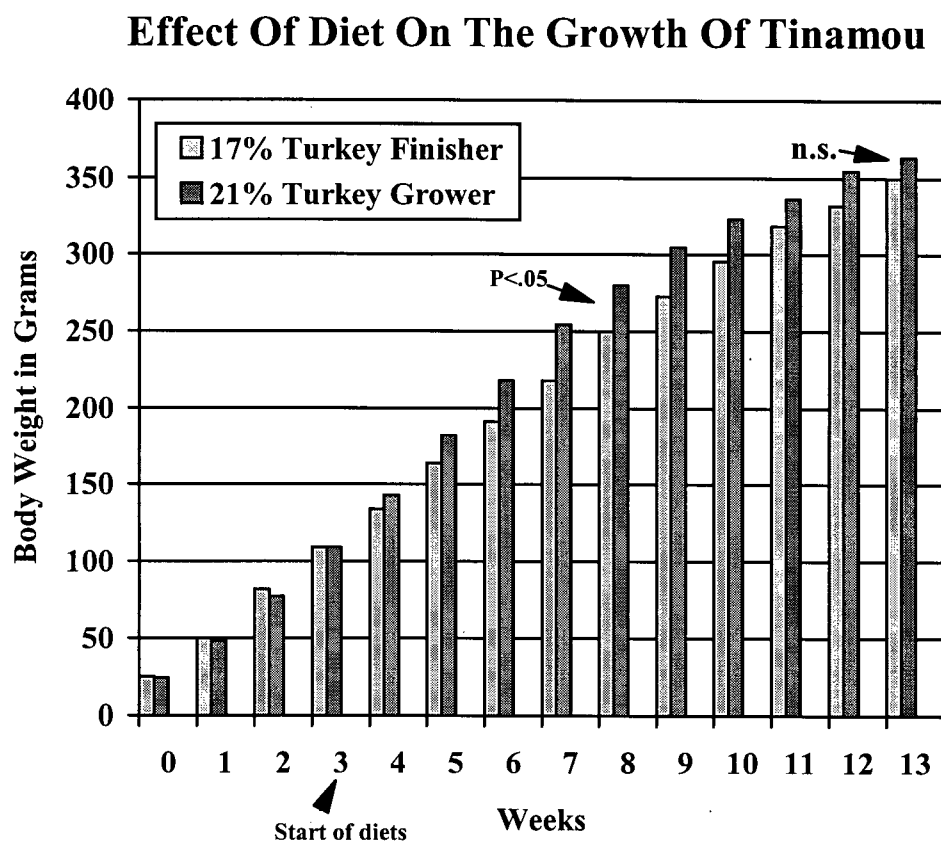
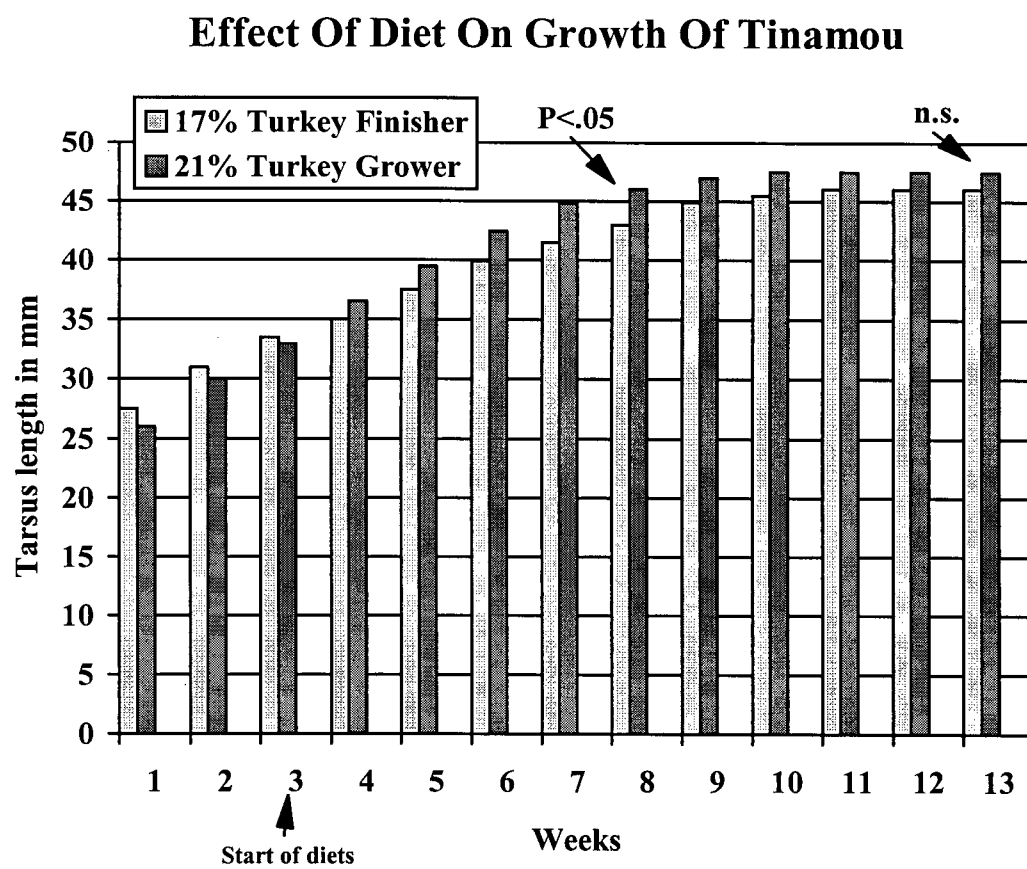


Figure 5.3 Tarsus Length of Juvenile Tinamou From Hatch To 13 Weeks of Age



## DISCUSSION

The objectives of the study were to examine the differences in growth and body weight attributed to the two types of commercially available turkey feed. The differing feeds were similar in energy concentration but differed in the protein, crude fat, fiber, mineral and vitamin content of the feed.

Although the asymptotic weight of the birds fed the two diets was not significantly different, the growth pattern of the birds was different. Birds on the 21% protein grower diet grew faster before week 8 and were significantly heavier at week 8 than birds fed the 17% protein finisher diet. They reached asymptotic weight 2 weeks ahead of the birds fed the finisher diet. There were also other indications that the 17% protein finisher diet would not be a satisfactory diet to be used for the whole growth period. The weights of the birds fed this diet were significantly more variable than the birds fed the grower diet. Mortality of birds fed the finisher diet was also higher.

*Post mortem* (conducted by Cathleen Nichols) examination of dead birds from this group indicated the main cause of death (4 out of 6) was starvation, because the crops of these birds were packed with shavings. Most of the mortality occurred during the early part of the study, some week 3 birds transferred to the trial pens did not recognize the larger feeder and did not find the feed. The problem was solved when a small feeder similar to the type used in the brooder was placed side by side with the large feeder and no more mortality

due to starvation occurred since then. However, it is most interesting to note that no starvation occurred with the birds fed the grower diet.

Birds fed the 17% protein finisher diet also had problems with feather pecking. Bohl (1969) reported serious problems of feather pecking when rearing spotted tinamou (*Nothura maculosa*) and the pale spotted tinamou (*Nothura darwini*) in outdoor aviaries using an unspecified "poultry diet". The feather pecking problem was solved when methionine was added (1%) to the diet. It is possible that the finisher diet that we used also did not meet the methionine requirements of these birds.

For this study, feed intake by the birds for a particular week was calculated by measuring total feed disappearance per week divided by the total number of bird-days (to take into account the mortality during the week) in each pen. The low number of birds available for the trial necessitated the staggering of birds into the trial pens, the result being that there were birds of varying ages in the pens. However, bird number were balanced between the pens. The weekly feed intake/bird is therefore only a rough estimate. Birds fed the 17% protein finisher diet consumed 130 g/bird/week, while the 21% protein grower group consumed 120 g/bird/week. Birds consume feed first to meet energy requirements and secondly to meet the protein requirements (Larbier and Leclercq, 1994). In this trial, the 17% protein finisher diet may not have met the protein requirements for growth, resulting in birds having to eat more to fulfill that requirement. During the 13 week period, the birds fed the finisher diet had a feed:gain ratio of 6.13, while the birds fed the grower diet had a feed:gain ratio of 5.60. Feed:gain ratio reported for pheasant marketed at 14 weeks of age was 3.15 and that for Guinea fowl (marketed at 12 weeks of age) was 3.28 (Leeson and Summers,

1994). Given that the partridge tinamou is still a semi-wild bird, the feed:gain ratio estimated in this study appears to be reasonable.

The feeds used in these trials represent an approximate estimation of the diet requirements for the tinamou. Further research and study is necessary to develop a feeding program with refined diets to promote better feed conversion and fast growth.



## **Chapter 6      SQUAB MARKET STUDY OF WHOLESALERS AND RESTAURANTS**

### **INTRODUCTION**

Squab is a high value, specialized product purchased by the wholesale and restaurant sectors. Considered a luxury food product in both the Chinese, European and North American restaurant and retail markets, squab has established a successful “niche” market. The B.C. squab industry has excellent growth potential, demand for squab has increased steadily since 1989 (Paulson et al., 1989). During 1994, B.C. squab production reached 74,646 birds while imports of frozen U.S. squab totaled 96,631 (Kermode, 1994; also see Chapter 2). For 1996, the consumption of squab in B.C. is anticipated to reach 400,000 birds (B.C. Ministry of Agriculture, Fisheries and Food, 1996). The demand for domestic and imported squab is expected to grow spurred on by the growing Asian and ethnic population.

The large number of U.S. imported squab indicates a potential demand for B.C. produced squab. During the summer and fall of 1995, a market study of Lower Mainland poultry wholesalers and restaurants was carried out to explore the market potential for B.C. squab. The purpose of the study was to use squab as a model to provide information that can be used to guide the production and marketing efforts of the partridge tinamou.

In attempting to construct a model for the partridge tinamou, the market segment thought most likely to provide a successful market was the Asian, European and North American restaurant and retail sectors. The partridge tinamou’s physical attributes are unique to game bird species, the white meat and small size (10 oz. dressed weight) are difficult compare to the dark meat game birds quail (4 oz. to 6 oz. dressed weight) and squab (16 oz.

dressed weight) or pheasants (2.0 kg. dressed weight). Quail was not used as a model due mainly to the limited amount of production, sales and marketing data available. The Chukar partridge appeared to be similar in size to the tinamou, however the chukar partridge market has collapsed in the last few years (E. Eng., L. Stobbe, pers. comm.), production, sales and marketing data was not available. Duck and pheasants were considered as models however, the end usage of the majority of duck produced in B.C. is the Asian "barbecued duck" market and pheasants are not consumed in large quantities in the Asian, European or North American restaurant and retail markets.

The rationale for using squab as a model has been the successful production and marketing of squab to the Asian, North American and European restaurant and retail sectors in B.C. The advantages of using squab as a model:

1. Squab is a familiar and recognized poultry product in both the Asian and European wholesale, retail and restaurant sectors,
2. Sales for squab have increased steadily since 1989
3. Historic production, sales and marketing data were available.

## **RESEARCH OBJECTIVES**

The purpose of the study was to determine the market potential for B.C. produced squab and to provide information that can be used to guide the production and marketing efforts of the partridge tinamou.

The objectives of the squab market study was to determine the types of restaurant/retailers that purchased squab, if they purchased domestic or imported product and the motivation for their purchases. Further it was prerequisite to examine the physical and marketing attributes that affected squab purchasing behavior. It was also necessary to examine the factors that affected the demand of squab including price sensitivity and temporal effects. This knowledge could then be utilized to direct the production and marketing strategy of the partridge tinamou. Specifically, the objectives of the study were:

1. To determine the major purchasing factors for squab
2. To identify the customers for squab (within the lower mainland area of B.C.)
3. To determine the factors affecting the demand for squab
4. To estimate the price sensitivity for squab

Other topics discussed include:

1. Usage ( fresh or frozen, whole or cut up)
2. Temporal demand (seasonal trends)
3. Physical preferences ( color, size, freshness)
4. Marketing attributes (price, quality, packaging)

## **METHODOLOGY**

### **Data Collection**

Data collection methods for the market research study included:

1. Mail surveys
2. Telephone interviews/surveys
3. Personal interviews/surveys

### **Market Samples**

A judgment sampling method (see Chapter 2) was used to target the niche of wholesale and restaurant squab buyers. The sampling method involved the identification of "experts" for the purpose of in-depth interviews and surveys.

Selecting 100 Asian and 100 European and North American type restaurants involved a review of all of the Lower Mainland restaurants (B.C. Restaurant Association 1993, B.C. Business Listing, 1993). All family type restaurants (A & W, McDonalds etc.) and restaurants that would not serve squab were removed from the listing. This resulted in a large number of Asian, North American and European restaurants, a random sample of 100 Asian and 100 European and North American type restaurants were then selected for the survey.

In order to obtain a good response, surveys were mailed with a letter of introduction and a self addressed, stamped envelope for return. Surveys for the Chinese restaurants were translated from English into Cantonese. Chinese responses were then translated back to English. (see Appendix 6.1 for restaurant surveys)

Poultry wholesalers were located from poultry producers and processors. All poultry wholesalers were personally contacted and interviewed (see Appendix 6.3 for wholesaler survey).

Restaurants were classified as European (French, Italian, Greek or Hungarian), North American (West Coast type of menu with a European or Continental flavor) and South East Asian (Vietnamese, Japanese, Thai, Philippine or Indonesian) and Asian (Chinese Restaurants - Cantonese and Mandarin style Chinese restaurants).

Three market samples were targeted in the survey:

### **Poultry Wholesalers**

Lower Mainland wholesalers were selected if one or more of the following factors applied:

1. The wholesaler was a poultry specialty wholesaler
2. The wholesaler was a European poultry specialty wholesaler
3. The wholesaler was an Asian or South East Asian poultry specialty wholesaler

The wholesalers in this sample were surveyed via personal and telephone interview/survey.

### **Select European, North American and South East Asian Restaurants**

Lower Mainland and Whistler restaurants were selected if one or more of the following factors applied:

1. The restaurant was a European, North American or South East Asian restaurant.

2. The restaurant had a traditional culture that included squab on the menu
3. The restaurant was known to serve non-traditional poultry products
4. The restaurant was a three or four star establishment

The restaurant personnel in this sample were surveyed by personal, mail and telephone interview/survey.

### **Select Chinese Restaurants**

Lower Mainland and Whistler restaurants were selected if one or more of the following factors applied:

1. The restaurant specialized in Mandarin/Cantonese menus
2. The restaurant was known to serve non-traditional poultry products
3. The restaurant was a three or four star establishment

The restaurant personnel in this sample were surveyed by personal, mail and telephone interview/survey.

### **LIMITATIONS OF THE STUDY**

The "Judgment Sampling Method" used in this study results in detailed information obtained from those determined to be squab "experts". Therefore, the data presented in this report is not statistical and should be viewed as only directional in nature.

## RESULT AND DISCUSSION

### RESPONSE RATE

The combined response rate for all three samples was 35.7%. The response rate and sample size for each of the three samples are detailed in Table 6.1.

**Table 6.1. Sample Type, Size and Response Rate**

Sample Type	Sample Size	Response*	No Response**	Response Rate (%)
Poultry Wholesalers	24	23	1	95.8 %
Restaurants - European/North American and South East Asian	96	41	55	42.7
Restaurants - Chinese	104	16	88	15.4
TOTAL	224	80	144	35.7%

\* Surveys were obtained from those who had interest and/or experience in the purchasing of squab

\*\* No responses includes those in the sample that either:

1. could not be contacted
2. did not reply to survey

#### A. POULTRY WHOLESALERS

A total of 24 poultry wholesalers were personally surveyed/interviewed. This group was composed to wholesalers that served the following markets:

1. European restaurants
2. European poultry retailers
3. Chinese restaurants
4. Chinese poultry retailers
5. South East Asian restaurants
6. South East Asian poultry retailers

A. Wholesalers that served the European and North American restaurant and retail trade sold squab into the following markets:

1. European restaurants
2. North American restaurants

European and North American type poultry wholesalers also sold a limited quantity of other game birds; partridge, quail, pheasant and ostrich into these markets.

B. Wholesalers that served the Chinese restaurant and retail trade sold squab into the following markets:

1. Chinese restaurants
2. Chinese poultry retailers
3. South East Asian restaurants
4. South East Asian poultry retailers

Wholesalers serving the Chinese and south east Asian restaurant and retail sectors also sold quantities of partridge, quail, and pheasant into these markets.

### **Familiarity Of Wholesalers To Squab**

A total of 24 wholesalers were interviewed, all wholesalers were familiar with squab as a food product. Of the wholesalers interviewed, 17 wholesalers did not purchase squab, 1 wholesaler specialized in exotic non traditional poultry and game products (purchased only small quantities of squab) and 6 wholesalers purchased large quantities of squab. These six



wholesalers provided squab for the Chinese and South East Asian restaurant and retail markets.

### **Origin Of Squab Purchased By Wholesalers**

Wholesaler buyers indicated that the form of squab purchased for the lower mainland restaurant/retail market was divided among:

1. Fresh/frozen B. C. produced squab
2. Frozen, imported squab

Wholesalers reported that U.S. imports accounted for 55% of their total squab purchases. Wholesalers indicated that, in general, imported squab originated from California. The major reasons for purchasing imported squab were:

1. The competitive price of the imported squab product
2. Consistent supply of imported squab through out the year
3. The availability of the U.S. product.

Wholesale price ranges for squab in 1995:

B. C produced fresh/frozen squab	\$8.40 to \$8.70/lb (\$Cdn.)
Imported squab	\$7.40 to \$7.70/lb (\$Cdn.)

### **Size Of Wholesale Market**

Wholesalers indicated that the majority of squab (98%) is sold into the Chinese, South East Asian restaurant and poultry retail markets. The North American and European restaurant and poultry retail sectors consist of only a very small portion of the total wholesale squab sales.

## **Forms Of Squab Purchased By The Wholesalers**

Squab wholesalers purchase squab in two forms

1. Fresh, whole squab
2. Frozen, whole squab

Survey results indicated that frozen whole squab was the most common form purchased by poultry wholesalers.

The reasons given for the use of the frozen form of squab include:

1. Storage life of fresh birds is short (4 days)
2. Storage life of frozen birds (3 months)
3. Ease of handling
4. Bulk purchasing
5. Ease of storage

## **Factors Influencing The Purchase Decision**

### **Squab Physical Attributes**

The top five squab physical attributes (in order of importance) that influences the wholesaler buyers' purchasing decision are:

1. Size of bird
2. Freshness
3. Color of meat
4. Skin color
5. Well bled bird

**Size of Bird** - Wholesalers indicated that a 16 ounce bird was preferred over the smaller 10 to 14 ounce B.C. produced squab. The wholesalers serving the Chinese restaurant and retail sectors indicated that the U.S. imported squab was consistently 16 ounces in size.

**Freshness** - The wholesalers surveyed reported that freshness was an important factor in the buying decision. Fresh squab was preferred over the frozen product, wholesalers indicated that a premium price could be obtained for a fresh squab product.

**Color of Meat and Color of Skin** - Wholesalers indicated that the color of the meat and skin was important in the purchasing decision. Pigmented squabs have pigmented skin, and are not regarded as high of quality as a light skinned bird.

**Well Bled Bird** - Wholesalers suggested that high quality processing was important in the marketability of squab. Squab that was over scalded, not properly eviscerated or bruised was not considered high quality.

### **Marketing Attributes**

The top five squab marketing attributes (in order of importance) that influences the wholesaler buyers' purchasing decision are:

1. Availability of Squab
2. Supply of Squab
3. Price
4. Delivery
5. Packaging

**Availability of Squab** - Wholesalers are faced with the difficulty with the availability of squab. Often with the limited supply of squab, wholesalers are unable to obtain the product. This may be due to an informal "quota" from the processor or broker to the wholesaler or preferential sales from processor or broker directly to a restaurant or retail establishment. Often a wholesaler would be left with the inability to purchase the squab product.

**Supply of Squab** - The supply of squab was one of the single most important factors in the wholesaler buyers' purchasing decision. Wholesalers indicate that it is long term supply and not weekly or monthly supply that was of concern. Short term supply deficiencies are met by menu substitution of seafood or other specialty products. The inability to meet order placings results in slow development of the squab market . To compensate for supply inconsistencies, wholesalers attempted to purchase large quantities of squab from the B.C. processor or American poultry brokers in anticipation of a future shortages.

**Price** - Price was of concern to the squab wholesale buyer. Chinese wholesalers, in general, were willing to pay a slightly higher price for squab. However, European and North American type poultry wholesalers found that price was a consideration in the purchasing of squab. North American and European wholesalers were more price sensitive in squab purchases. The pricing problem for the wholesaler is that too high a price results in a decline of client demand.

**Delivery** - Delivery of the B.C. product from the processor was not of concern, however, the added costs of brokerage fees, transportation costs and time were of concern when obtaining the imported product.

**Packaging** - Packaging was of moderate concern to the squab wholesaler. Fresh, B.C. produced squab was purchased by the case with 30 birds per case. The packaging for imported squab is individual cryovac packaging and purchased at 30 birds per case.

### **Price Sensitivity**

The high price for squab is reported as:

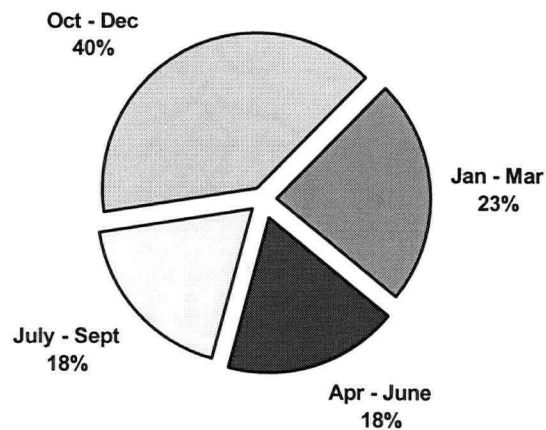
1. The factor that most affects demand
2. Common reason not purchase squab
3. A concern when making the decision to purchase squab

The survey results imply that Chinese, European, and North American poultry wholesalers are price sensitive. The results indicated that when the prices of fresh or frozen squab are increased by 30 percent, the wholesalers' estimate of weekly volume demand declines by more than 30 percent.

### **Seasonal Trends**

The survey indicated that wholesale squab sales did not exhibit extreme seasonal variations. Chinese wholesalers reported that demand was slightly higher during the fall and winter months. North American and European type poultry wholesalers reported that squab sales were even through out the year. Figure 6.1. indicate the seasonal trends in wholesale squab sales.

**Figure 6.1 Seasonal Trends in Wholesale Squab Sales**



### **Sales Trends And Inquiries**

European and North American type poultry wholesalers indicated that customer inquiries for squab were limited during 1995. Most European or North American poultry wholesalers do not purchase large quantities of squab and the purchase of squab is usually a “special request” from a restaurant or poultry retailer. However, Chinese poultry wholesalers reported a continued strong demand for squab from restaurants and retailers. This demand is expect to continue in 1996 and 1997.

### **Factors To Increase Demand**

Poultry wholesalers indicated that the major factors that would increase demand were:

1. Consistent supply
2. Lower price
3. Increased customer demand
4. Suitable bird size
5. Quality assurance

Consistent supply and lower price would allow the wholesaler to develop the market for squab. Increased customer demand would follow as an extension of the market development.

Suitable bird size and promotional material (recipes, tent cards, cooking tips) were considered important factors in positively affecting a developing wholesale demand.

### **Persons Responsible For The Decision To Purchase Squab**

The person responsible for squab purchases within the wholesale establishment tends to be the manager or wholesale specialty buyer. Wholesalers purchase squab from import brokers or direct from the processor.

### **Who Do The Wholesalers Sell To?**

#### **Distribution of Wholesaler Clientele**

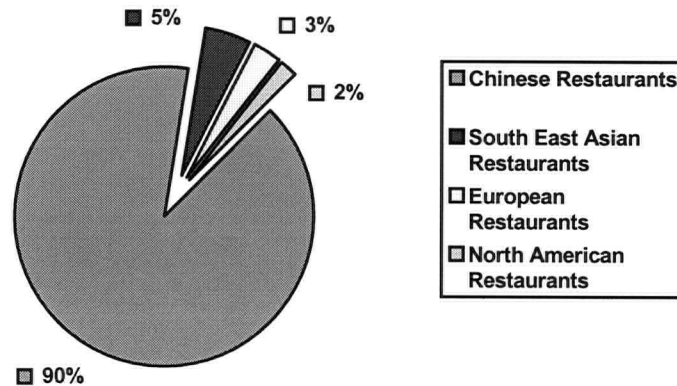
Restaurants represented 85% and poultry retailers accounted for 15% of the wholesales' clientele. European and North American type poultry wholesalers indicated that the majority of their squab products are sold to European/North American type restaurants. Chinese wholesalers reported that the majority of their squab products are sold into the Chinese and South East Asian restaurant and retail markets.

### **Wholesale Squab Restaurant Distribution**

Wholesalers surveyed indicated that 90% of their total squab sales were mainly to three and four star Chinese restaurants. South East Asian restaurants (Thai and Philippine) restaurants and North American and European style restaurants accounted for only 10% of

the total wholesale squab sold to restaurants in the Lower Mainland area. Figure 6.3. shows the distribution of squab sales to restaurants.

**Figure 6.2 Wholesale Squab Restaurant Distribution**

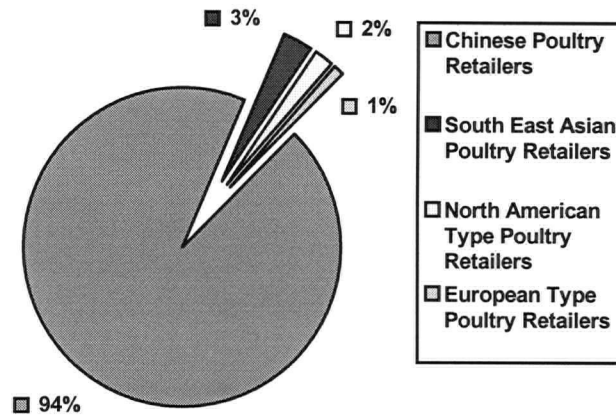


### **Wholesale Squab Distribution to Poultry Retailers**

Wholesalers indicated that the majority (94%) of squab sold to retailers are sold to Chinese Poultry/Meat retailers. Squab sales to S.E. Asian, European and North American type poultry retailers accounted for only 6% of total wholesale squab sales. Figure 6.4. indicates the distribution of wholesale squab sales to poultry/meat retailers.



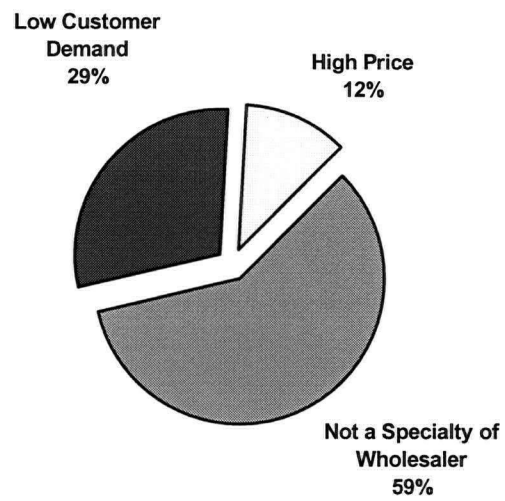
**Figure 6.3 Wholesale Squab Distribution to Poultry Retailers**



### **Reasons Why Wholesalers Do Not Purchase Squab**

Wholesalers reported that the most common reason for not purchasing squab was because squab was not a specialty of the wholesalers. Wholesalers indicated that the majority of squab purchases were made by a few large Chinese wholesalers that service the Chinese restaurant and retail markets. Other factors including high price, and low customer demand contributed to the purchasing decision. Figure 6.4 indicates the reasons why wholesalers do not purchase squab.

**Figure 6.4 Why Wholesalers Do Not Purchase Squab**



## **B. RESTAURANTS**

A Total of 200 restaurants were surveyed by mail/telephone. The restaurants surveyed served distinctive squab markets:

1. European and North American restaurant trade
2. Chinese and South East Asian restaurant trade

The types of restaurants that serve squab tend to be:

3. Chinese (Cantonese)
4. European (French)
5. North American (Bistro)

Restaurants that serve squab has a price per dinner serving which falls within the following ranges:

European and North American	\$14.00 to \$26.00
Chinese	\$12.00 to \$20.00

### **Forms Of Squab Used By Restaurants**

Survey results indicated that 54% of restaurants preferred fresh squab, frozen squab was considered acceptable by 46% of the restaurants. Fresh whole squab was preferred by the European and North American type restaurants. Chinese restaurants also favored fresh whole squab, however, frozen squab was an acceptable substitute when fresh squab was not available.

The reasons given for the use of frozen squab by the restaurants include:

1. Bulk purchasing
2. Ease of storage
3. Ease of shipping
4. Distance from U.S. suppliers to B.C. restaurants discourages fresh squab shipment
5. Competitive price of frozen, imported product
6. Inconsistent or low customer demand

### **Factors Influencing The Purchase Decision**

#### **Physical Attributes**

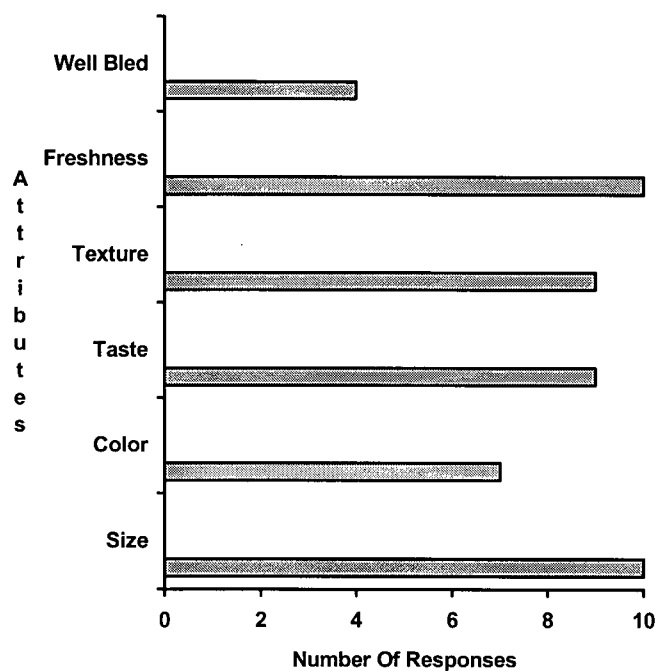
The top five squab physical attributes (in order of importance) which influences the restaurant buyers' purchasing decision are:

1. Freshness
2. Size
3. Taste
4. Texture
5. Color

Restaurant buyers commented that freshness and size are primary concerns when purchasing squab. Preference for fresh squab was rated higher over frozen squab, the restaurant buyers indicated that they would be willing to pay a premium price of \$0.25/lb for fresh squab. However, frozen B.C. produced squab or U.S. imported squab rated high in quality.

Restaurants preferred squab that would provide one serving per person, the ideal weight for squab was suggested to be 12 ounces and 15 ounces per bird. Taste, texture and color of meat were not considered flexible features as they are inherent to the species of squab. Figure 6.5 indicates the major physical squab attributes that are important to the restaurant buyer.

**Figure 6.5 Major Physical Attributes of Squab**



### **Marketing Attributes**

The top five squab marketing attributes (in order of importance) which influences the restaurant buyers' purchasing decision are:

1. Availability
2. Price

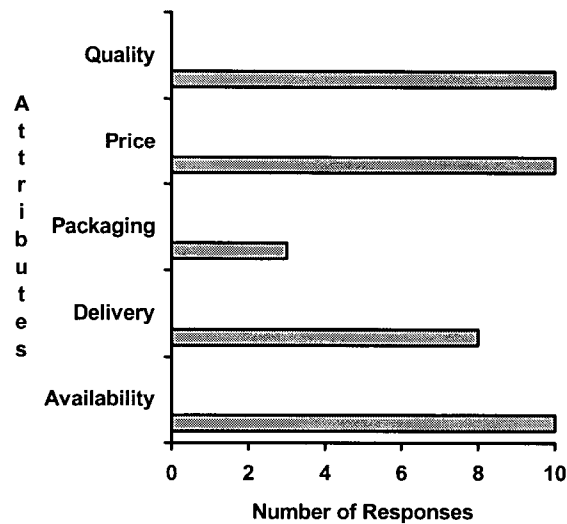
3. Quality
4. Delivery
5. Packaging

**Availability and Supply** - Restaurant buyers reported that the supply and availability of squab was their greatest concern. For larger restaurants (>150 person capacity), long term supply and not weekly supply was a concern in the purchasing decision. Inconsistent short term supply could be handled by offering squab as a menu specialty, however, during the peak summer months and Chinese New Year Festive season, adequate supply was critical to the restaurant buyer.

**Price** - Price of squab was a major factor in the marketing of squab. European restaurant buyers indicated that food costs are approximately 35% of total menu price. The high cost of squab restricted the market for squab.

**Quality, Delivery and Packaging** - Delivery, packaging and quality issues were regarded as part of the expected service to be provided by the wholesaler or processor.

**Figure 6.6 Marketing Attributes of Squab**



### **Motivation For Purchasing Squab**

Restaurant buyers purchase squab for the following reasons

1. Client draw to restaurant
2. Image associated with serving squab
3. Direct customer request (European/North American restaurants)
4. Special occasion request (weddings, banquets)
5. Chinese New Year

### **Problems With The Purchase Of Squab**

Restaurants have identified two major problems with purchasing squab

1. Lack of consistent supply
2. Size of bird

The inability to obtain long term supply for B.C. produced or U.S. imported squab is one of the greatest difficulties for the restaurant buyers. Short term supply inconsistency during the peak summer months and Chinese New Year also pose great difficulty. Size of bird is of concern to the restaurant buyer, squabs less than 12 ounces are unacceptable.

### **Substitution Of Squab**

Restaurant buyers indicated that there are no substitutes for squab. Squab is a specific food product and quail, partridge or pheasant were not acceptable substitutes for squab.

### **Demand For Squab**

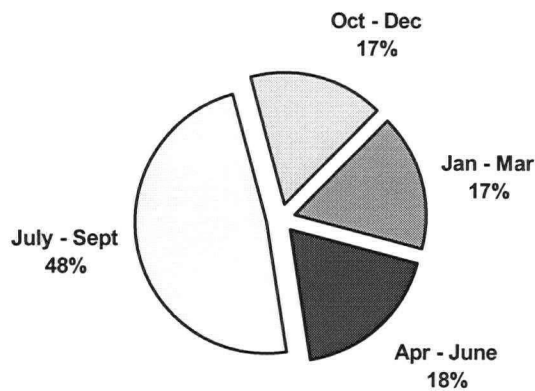
#### **Seasonal trends**

European and North American type restaurants indicated that the greatest demand for squab was during the July to September and October to December time periods. Restaurant buyers suggested that the increase may be due to the popularity of Bistro menu items during the summer and fall months.

Past history assumed that the majority of squab sales in Chinese restaurants occurred during the Chinese festive season. However, Chinese restaurant buyers indicated that 45% of their total squab volume was served during the summer months. The Chinese festive season accounted for only 17% of total volume served. The restaurant buyers suggested that the increasing number of Asian visitors to the Vancouver area during July, August and September was responsible for the increase in squab sales. Figure 6.7 shows the seasonal trends for squab sales.



**Figure 6.7 Seasonal Trends for Restaurant Squab Sales**



### **Price Sensitivity**

The high price level for squab is reported as:

1. The factor that most affects the demand for squab
2. A major concern when making the purchasing decision for squab
3. The most common reason for not purchasing squab

Survey results indicated that restaurants are price sensitive. When the prices of fresh or frozen squab are increased by 30 percent, the restaurant's estimated of weekly volume demand declines by more than 30 percent.

The restaurant buyers also indicated that the customer is moderately to very sensitive to menu price increases. Increases in wholesale price of squab are difficult to pass along to the customer. Menu prices for squab will often be kept stable in order to maintain customer loyalty and increase potential clientele.

## **Sales Trends and Inquiries**

European and North American type restaurant buyers indicated that there is a very limited market for squab. The present squab market for these types of restaurants is not expected to grow in the future.

Chinese restaurant buyers reported that customer inquiries for squab remains strong. The growing Asian population and large number of Asian visitors will ensure consistent, strong growth in the Chinese restaurant market for squab.

## **Person responsible for the decision to purchase squab**

The person responsible for the purchase of squab in the restaurant establishment tends to be the manager or chef. Restaurants purchase their squab from import brokers or full service meat and poultry wholesalers.

## **Factors To Increase Demand**

Restaurant buyers indicate that the major factors that would increase demand are:

1. Lower price
2. Consistent supply
3. Consistent quality

Price, supply and quality factors are suggested as the primary factors that would increase customer demand. Promotional materials, quality assurance, and minimum order size are considered secondary factors. Restaurant buyers suggest that once price, supply and quality concerns are addressed customer demand would increase.

## **Reasons Why Restaurants Do Not Have Squab On Their Menu**

The major reason why restaurants do not have squab on their menu are:

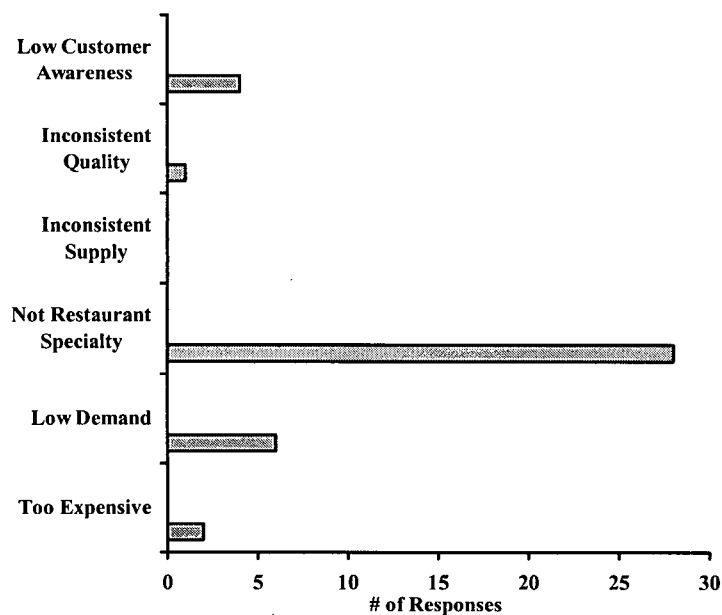
1. Not a specialty of the restaurant
2. Low customer demand
3. Customer is not aware of squab as a food product
4. Squab is too expensive

European and North American type restaurant buyers suggested that squab was not a traditional food item in the North American diet. The transference of squab consumption from European cultures to North American cultures has not taken place. In general, North American consumers are not familiar with squab as a food product.

Chinese restaurants that served squab had “Cantonese” type of menu. These restaurants were large with seating capacity of 100 to 400 people. Smaller restaurants < 80 (seating capacity) and Dim Sum restaurants do not serve squab because it is too expensive or not a specialty of the restaurant.

South East Asian restaurants (Indonesian, Philippine, Vietnamese) responded that squab was not a food product in their diets. The one exception was a Thai restaurant that served very limited amounts of squab. Figure 6.8 indicates the reasons why restaurant buyers do not purchase squab.

**Figure 6.8 Reasons Why Restaurants Do Not Purchase Squab**



### **SUMMARY OF SQUAB SURVEY**

It must be emphasized that there are two very distinct, separate markets for squab in particular and game birds in general; the Chinese and South East Asian wholesale, restaurant and retail markets and the North American and European wholesale, restaurant and retail markets

The wholesale market for squab and game birds are composed of several large Chinese wholesalers that provide the majority of game bird products for the Asian restaurant

and retail markets and a small number of wholesalers that provide game bird products to the North American and European restaurant and retail markets. The Chinese restaurant and retail markets are extremely loyal to their wholesalers and it is difficult for a European or North American type wholesaler to enter the Chinese wholesale market.

The supply of squab and to a limited extent other game birds (Chukar Partridge) are of major concern to both wholesale and restaurant buyers. The inconsistent supply and availability of squab has resulted in some restaurants to import large quantities directly from American processors or producers. The squab imports reported in this study are statistics gathered from Agriculture and Agri-Food Canada. The reported 1994 import data of 96,631 squabs, is a very conservative estimate. It is speculated that approximately 400,000 squabs are entering the domestic market directly from U.S. processors or producers (B.C.M.A.F.F. 1996). These statistics infer that demand is far greater than domestic production. Increased production capacity, high quality standards, competitive pricing and good marketing strategy may increase the market share of B.C. game bird producers.

The squab market study furnishes a compass, not a road map for the potential success of the partridge tinamou in the present game bird market. The squab market study provides insight as to the potential markets for the partridge tinamou, who the potential purchasers would be, the quality standards required, temporal demand and a price that would be considered competitive for the partridge tinamou.

The squab market study suggests a potential market for the partridge tinamou in the European and North American restaurant and to a lesser extent in the Asian restaurant and retail trade. Unlike the Asian market, the cultural transference of squab or game bird

consumption from Europe was not evident in the North American/European restaurant and retail market sectors. Squab by nature is a very dark colored meat, and higher in fat content than chicken (1.6%), or duck (2.3%). Partridge tinamou carcass meat is translucent white in color and contains only 1.3% fat (Yuen, T., manuscript in preparation). These characteristics may appeal to the “white meat” and “low fat” consumer found in the European and North American restaurant and retail markets.

The potential for the partridge tinamou in the Asian restaurant/retail markets lie with the decline of the B.C chukar partridge industry (E.Ng., L. Stobbe pers. comm.). The partridge tinamou has the potential of substituting for or replacing the chukar partridge on Asian restaurant menus. Game bird consumption has been a traditional feature of the Asian community, pheasants, peacocks, and quail are consumed on a regular basis in Asia. The introduction of a new species of game bird may promote interest in the consumption of the partridge tinamou.

The squab market survey indicated that restaurants felt that squab was a high priced poultry product. In 1995 the wholesale price of Chukar partridge averaged \$7.25/lb., quail \$4.40/lb., duck 4.99/lb., silkie \$4.55/lb., cornish hens \$1.75/lb. and squab \$8.40/lb. (E. Ng., pers. comm.). The suggested wholesale price for the partridge tinamou was recommended to be less than squab and comparable to that of the Chukar partridge (T. Cameron, Hills Bros. Foods, pers. comm.). This price would provide a competitive pricing structure for a bird that would be similar in size to the Chukar partridge. A restaurant study conducted in 1996 (Tinamou restaurant trial - in progress) indicated that the North American and European restaurants would be reluctant to purchase a product that similar in price to that of squab.

The reasons given by the chefs was that that the cost of raw food product constituted approximately 33% of the menu price. Entree price of >\$30.00/person were prohibitive in North American and European type restaurants.

## **Chapter 7      SUMMARY AND CONCLUSIONS**

The purpose of this thesis was to examine and evaluate the potential for the commercialization of the partridge tinamou as a new species of poultry. Preliminary observations (Cheng et al., 1992) suggested that the partridge tinamou possessed the necessary characteristics for commercialization. The breeding behavior of the birds, their feeding habits and uniqueness of their carcass advocated intensive production. Several questions seek answers:

1. Could the partridge tinamou be successfully reproduced and reared under indoor conditions and fed commercially available poultry rations?
2. Could a niche market be located and the partridge tinamou marketed within the existing frame work of the B.C. game bird industry?

This thesis has demonstrated that the hypothesis was correct in its assumptions. At the start of the study in 1993, the partridge tinamou breeding flock consisted of 8 females and a total of 52 chicks were hatched. In 1995, the breeding flock consisted of 78 females, 510 chicks were hatched. During the 1996 breeding season the partridge tinamou breeding flock consisted of 213 females, a total of 2,314 chicks were hatched (Kermode and Cheng, in prep.). During the study period all breeding and juvenile birds were fed commercially available turkey rations. The thesis research also located a niche market for the partridge tinamou in the Chinese, North American and European restaurant markets.



In chapter 2, the B.C. game bird industry was evaluated to determine the existing state of the industry, its strengths, weaknesses and future growth potential. The study concluded that the B.C. game bird industry has good growth potential. Increase in consumer, restaurant and retail demand for game birds are driven by growing Asian and ethnic population.

There is a potential future for the partridge tinamou as a game bird product among the existing non-traditional poultry products. Squab, silkie and quail are produced in large numbers, however the B.C. chuckar partridge industry has collapsed (E. Ng., L. Stobbe, pers. comm.). The partridge tinamou has the potential to substitute for the chuckar partridge on Chinese, North American and European menus. Consumer demand is dynamic, as consumer tastes evolve and mature, new products must be developed. The partridge tinamou provides the novelty of a new product, a white meat bird with a game bird flavor. The low fat content of the tinamou carcass may provide a niche market and cater to the health conscious consumer.

The biology, captive breeding and rearing of the partridge tinamou are not well studied or documented.. The objectives of the housing and management study (Chapter 4) were to compare three different types of nest systems and study their effect on egg production, fertility and hatchability. The study concluded that nest type significantly affected egg production. Female tinamou in the A-frame nests laid significantly more eggs than those in the lean-to's and cubicles. The research indicated that fertility was not affected by nest type, however hatch effect was highly significant. Feed consumption regressed significantly on the number of eggs produced and feed consumption was not influenced by nest type.

The significance of this finding indicates that the partridge tinamou does not require specialized equipment or facilities for successful reproduction. Modified nest boxes and wood shavings are the only specialized equipment required for egg production. Traditional poultry equipment, and management techniques are used, thereby lessening the costs involved in capital expenditures (housing, equipment, incubation etc.).

Perhaps the most note worthy findings from the nesting and management study were the behavior observations of the partridge tinamou. The territorial nature of the male partridge tinamou suggested dominance and aggression particularly in high density housing situations. However, during the study, there was no evidence of aggression, cannibalism, or feather pecking among the birds. This confirms the assumption that the partridge tinamou can be bred and reared in a high density production setting.

Weekly egg collection proved to be an interesting task. It was found that majority of the eggs were located in a single primary nest, occasionally there would exist smaller secondary nests. The primary nests would hold from 12 to 20 eggs, with secondary nests holding 5-10 eggs. Since in this species, it is the males who are doing the incubation and brooding, the females do not become broody and continue to lay throughout the breeding season. Preliminary studies indicated that with artificial lighting, the partridge tinamou will lay eggs 'out of season' (K. M. Cheng, pers. comm.) thus extending the breeding season. These characteristics indicated that the partridge tinamou are well adapted to commercial production.

Feed formulation for a newly domesticated species posed unique challenges. The feed had to be acceptable to the birds and had to be adequate to sustain the health, well being

and growth of the birds. Traditionally, turkey feeds have been used successfully as ration for quail, pheasants and chuckar partridge. The objective of Chapter 5 was to compare the performance of young tinamou (from 3 weeks to 12 weeks of age) fed a 21% protein Turkey Grower Diet with those fed a 17% protein Turkey Finisher Diet. The study concluded that although the asymptotic weight of the birds fed the two diets were not significantly different however, the growth pattern of the birds was different. Birds fed the 21% protein grower diet grew faster before week 8 and were significantly heavier at week 8 than the birds fed the 17% protein finisher diet. The study concluded that a 17% protein turkey finisher diet was not satisfactory for the growth of the partridge tinamou.

The consequence of the finding indicated that the partridge tinamou can be raised using commercial turkey feed, thus eliminating the formulation of specialized, high cost rations. More research is required to determine specifically what type of turkey ration would maximize tinamou growth.

The objectives of Chapter 6, was to provide information to guide the production and marketing efforts of the partridge tinamou. The study found that the wholesale and restaurant markets for squab continue to be very strong, consumer demand far outstrips B.C. production capacity. The success of the squab market lies with the continued growth of the Asian and ethnic communities and their appetite for game birds and squab in particular.

The significance of the squab market study was the suggestion that there may exist a niche market for the partridge tinamou. The squab market study indicated that several points could be considered when marketing the partridge tinamou.

Wholesalers and restaurateurs suggested that the physical and marketing attributes of a poultry product were important. The size of bird, fresh vs frozen, availability and supply of product and price were considered important attributes in the purchasing decision. The single most concern of the wholesale and restaurant sector was the availability of the game bird product. Ensuring a good supply of a fresh product would be paramount in the marketing of the partridge tinamou.

The market survey indicated temporal demands for squab in the Asian restaurant market. This was in contradiction to previous squab and game bird marketing assumptions. The survey indicated that there was a primary demand for squab during the summer months and a secondary demand during the Christmas and Chinese New Year festive season. It could be assumed that the demand for the partridge tinamou would follow in the same patterns. Temporal demand was not as evident in the North American or European type restaurant markets, and it is expected that the partridge tinamou would show similar demand trends.

Pricing structure was a major concern to both wholesalers and restaurants. In general, the price of squab was thought to be too high. Wholesalers suggested that a suitable wholesale price for the partridge tinamou would be less than the price of squab (\$8.70/lb) however, the price should be comparable to that of the chucker partridge (\$7.25/lb). This type of pricing structure would allow the partridge tinamou to compete with other game birds and provide an incentive for wholesalers and restaurants to experiment with a new poultry product.

The wholesale and restaurant markets for game birds are divided into two distinct markets, the Chinese and South East Asian and the European and North American type markets. These two markets will demand differences in attributes of the partridge tinamou. For example the partridge tinamou may be marketed in the European and North American markets as a healthy, low fat alternative to quail or pheasants. The uniqueness of the white meat carcass is comparable to Cornish game hens and provides a starting point for marketing. In the Asian market, the dark meat game birds are preferred. Once again the uniqueness of the white meat carcass and the appetite for different types of poultry products may provide a focal point for the marketing of the partridge tinamou.

The wholesale market for game birds is composed of several large Chinese wholesalers that provide the majority of game bird products for the Asian restaurant and retail markets. There are several small European and North American type wholesalers that supply product to the European and North American restaurant market. The Chinese restaurant and retail markets are extremely loyal to their wholesalers and it is difficult for the European or North American type wholesaler to enter the Chinese wholesale market. It is suggested that the marketing of the partridge tinamou be conducted in both of these wholesale distribution channels.

The studies conducted in this thesis are preliminary and exploratory in nature and cannot be considered as conclusive. It must be emphasized that the thesis provides a compass, and not a road map for the commercial development of the partridge tinamou. The successful production and commercialization of the partridge tinamou is dependant on

continued technical advances in nutrition and management. An effective marketing strategy will ensure a competitive edge for the partridge tinamou.

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**APPENDIX 2.1     B.C. GAME BIRD PRODUCER SURVEY**

## 1994 GAME BIRD PRODUCER SURVEY

I am a Graduate Student at U.B.C., Department of Animal Science. As part of my Master's Thesis I am re-writing the Game Bird Commodity Strategy for British Columbia. This survey is to provide information to the game bird producers (pheasants, silkies, pigeons, quail and partridges) concerning industry inventory levels of birds, their retail and wholesale prices and the marketing of game birds. I will personally analyze the data, and all data will be held in the strictest confidence. The survey will only report industry totals or averages and will not identify individual farms. Do you have a few minutes to answer some questions that I have?

### BACKGROUND

Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_  
Telephone \_\_\_\_\_

#### A. PRODUCTION AND INVENTORY (Farm Totals in general)

1. How many birds, in total and by species, did you have on your farm in 1993 and 1994?

	species	1993	1994
Pheasants	_____	_____	_____
Silkies	_____	_____	_____
Pigeons	_____	_____	_____
Quail	_____	_____	_____
Partridge	_____	_____	_____
Others (specify)	_____	_____	_____

2. How many female and male breeders did you have in 1993 and 1994?

	1993 females	males	1994 females	males
Pheasants	_____	_____	_____	_____
Silkies	_____	_____	_____	_____
Pigeons	_____	_____	_____	_____
Quail	_____	_____	_____	_____
Partridge	_____	_____	_____	_____
Others (specify)	_____	_____	_____	_____

- 2a. Where do you obtain your breeding stock from?

\_\_\_\_\_

- 2b. Where do you obtain your chicks from?

\_\_\_\_\_

3. How many market weight birds did you produce in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

3a. Based on 1994 production (number of birds produced and sold at market weight), what is your anticipated production for 1995 and 1996?

	1995	1996
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

B. MEAT PRODUCTION

4. Do you produce birds for meat, ie. the retail, wholesale and processing markets?

Yes \_\_\_\_\_ No \_\_\_\_\_

If No, go to question #5

4a. If Yes, How many birds did you produce for meat in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

i) FARM GATE SALES

4b. Do you have any on farm sales, that is, birds that are either sold live or slaughtered and packaged on your premises and sold from your door?

Yes \_\_\_\_\_ No \_\_\_\_\_

If No, go to question #4f

4c. If yes, how many birds did you sell from your farm gate in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkie	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

4d. What was your average price/lb. obtained from farm gate sales 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkie	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

4e. What is your anticipated number of birds sold from farm gate sales in 1995 and 1996?

	1995	1996
Pheasants	_____	_____
Silkie	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

ii) RETAIL SALES

4f. Do you do any custom slaughter, that is have the birds slaughtered and packaged at a processing plant, then market the product yourself?

Yes \_\_\_\_\_ No \_\_\_\_\_

If No, go to question 4L

4g. If yes, where do you market your custom slaughtered birds?

Retail Stores	_____
Hotels	_____
Restaurants	_____
Institutional	_____
Others (specify)	_____

- 4h. How many birds did you sell direct to hotels, restaurants retail stores and institutions in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

- 4i. What was your average price/lb. obtained from hotel, restaurant, retail and institutional sales in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

- 4j. What is your anticipated direct sales to hotels, restaurants, retail and institutions in 1995 and 1996?

	1995	1996
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

- 4k. What was your kill, evisceration and packaging charges for custom slaughter in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

iii) WHOLESALE/BROKER SALES

- 4l. Did you have direct sales to a Wholesaler or Broker in 1993 and 1994?

Yes \_\_\_\_\_ No \_\_\_\_\_

If No, go to question #4o

**4m. If Yes, how many direct sales to Wholesalers or Brokers did you have in 1993 and 1994?**

	1993	1994
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

**4n. What is your anticipated direct sales to Wholesalers or Brokers in 1995 and 1996?**

	1995	1996
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

**Who is your wholesaler/broker?**

\_\_\_\_\_

**iv) PROCESSING**

**4o. How many live market weight birds (not including custom slaughter birds) did you ship to licensed processors in 1993 and 1994?**

	1993	1994
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

**4p. What was your average price/lb. obtained from the processor in 1993 and 1994?**

	1993	1994
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____



4q. What was the kill charge from the processor in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkie	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

4r. What processing plant do you ship your birds for slaughter?

\_\_\_\_\_

### C. EGG PRODUCTION

5. Do you produce table eggs or eggs for incubation purposes:

Yes \_\_\_\_\_ No \_\_\_\_\_

If No, go to question #6

5a. Do you produce eggs for incubation

Yes \_\_\_\_\_ No \_\_\_\_\_

If No, go to question #5c

5b. If Yes, how many eggs did you produce for incubation in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkie	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

Do you supply chicks to other growers?

Yes \_\_\_\_\_ No \_\_\_\_\_

5c. Do you produce table eggs for retail sale?

Yes \_\_\_\_\_ No \_\_\_\_\_

5d. How many dozen table eggs did you produce in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkie	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

5e. What was your average price/dozen obtained for table eggs 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkie	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

5f. What is your expected table egg production in 1995 and 1996?

	1995	1996
Pheasants	_____	_____
Silkie	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

5g. Where do you market your table eggs?

Specialty stores	_____
Wholesaler	_____
Others (specify)	_____

#### D. HUNTING/RELEASE PROGRAMS

6. Do you produce birds for a hunting/release program?

Yes \_\_\_\_\_ No \_\_\_\_\_

If No, go to question #7

6a. If yes, How many birds did you produce for a hunting/release program in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Quail	_____	_____
Partridge	_____	_____
Wild Turkey	_____	_____
Others (specify)	_____	_____

6b. What is your anticipated number of birds to be produced for your hunt/release production in 1995 and 1996?

	1995	1996
Pheasants	_____	_____
Quail	_____	_____
Partridge	_____	_____
Wild Turkey	_____	_____
Others (specify)	_____	_____

6c. Where do you sell your birds produced from the hunt/release program:

Falconers	_____
Ducks Unlimited	_____
Private Hunting Club	_____
Others (specify)	_____
_____	_____

6d. How many birds did you sell to:

	Number of birds
Falconers	_____
Ducks Unlimited	_____
Private Hunting Club	_____
Others (specify)	_____
_____	_____

6e. What is your average price received per bird for hunt/release in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Quail	_____	_____
Partridge	_____	_____
Wild Turkey	_____	_____
Others (specify)	_____	_____

#### E. EXPORT SALES

7. Do you Export any game birds in 1993 and 1994?

Yes \_\_\_\_\_ No \_\_\_\_\_

If No, go to question #8

7a. Did you Export any live birds in 1993 and 1994?

Yes \_\_\_\_\_ No \_\_\_\_\_

If No, go to question #7e

7b. If Yes, how many live birds did you export in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkie	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

7c. How many live birds do you expect to export in 1995 and 1996?

	1995	1996
Pheasants	_____	_____
Silkie	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

7d. Where do you export your birds to:

\_\_\_\_\_

7e. Did you export any processed birds in 1993 and 1994?

Yes \_\_\_\_\_ No \_\_\_\_\_

If No, go to question #8

7f. If yes, how many processed birds did you export in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkie	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

7g. How many processed birds do you expect to export in 1995 and 1996?

	1995	1996
Pheasants	_____	_____
Silkie	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

#### F. IMPORT PURCHASES

8. Do you import any birds in 1993 and 1994?

Yes \_\_\_\_\_ No \_\_\_\_\_

If No, go to question #9

8a. If yes, did you import chicks for growing to market weight?

Yes \_\_\_\_\_ No \_\_\_\_\_

If No, go to question #8e

8h.. Where do you import your breeders from?

---

8i. Do you import any slaughtered and packaged birds in 1993 and 1994?

Yes \_\_\_\_\_ No \_\_\_\_\_

If No, Go to question #9

8j. If yes, how many slaughtered and packaged birds did you import in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

8k. What was your average price per pound paid for the imported processed birds in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

8l. How many processed birds do you expect to import in 1995 and 1996?

	1995	1996
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

8m. Where do you import your birds from?

---

**8b. How many chicks did you import in 1993 and 1994?**

	1993	1994
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

**8c. How many chicks do you expect to import in 1995 and 1996?**

	1995	1996
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

**8d. Where do you import your chicks from?**

\_\_\_\_\_

**8e. Did you import any birds for breeding purposes in 1993 and 1994?**

Yes \_\_\_\_\_ No \_\_\_\_\_

If No, go to question #8i

**8f. How many birds did you import for breeding purposes in 1993 and 1994?**

	1993	1994
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

**8g. How many bird do you anticipate to import for breeding purposes in 1995 and 1996?**

	1995	1996
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

**G. INPUT COSTS**

9. What was your average feed cost/bird from chick to market weight in 1993 and 1994?

	1993	1994
Pheasants	_____	_____
Silkies	_____	_____
Pigeons	_____	_____
Quail	_____	_____
Partridge	_____	_____
Others (specify)	_____	_____

10. How many acres are devoted specifically for the raising and growing out of your birds?

\_\_\_\_\_ acres

- 10a. How many square feet of buildings do you have specifically for the rearing and growing out of your birds?

\_\_\_\_\_ square feet

**H. INDUSTRY GROWTH/CONCERNS**

11. What do you feel are the limits to the growth of the game bird industry?

Equipment costs \_\_\_\_\_  
Feed costs \_\_\_\_\_  
Land costs \_\_\_\_\_  
Restrictions to trade  
(tariffs, health inspection,  
packaging restrictions etc.) \_\_\_\_\_  
Others (specify) \_\_\_\_\_

12. What kind of mechanisms are needed to market game birds domestically?

\_\_\_\_\_  
\_\_\_\_\_

13. What kind of mechanisms are needed to market game birds internationally?

\_\_\_\_\_  
\_\_\_\_\_

**COMMENTS**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**APPENDIX 2.2      SECTOR ANALYSIS OF THE B.C. GAME BIRD  
INDUSTRY**



## **Sector Analysis Of The B.C. Game Bird Industry**

### **1. Pigeons/Squab**

Squabs have been successfully produced in the Fraser Valley for the past decade. Housing for pigeons and squabs consists of the traditional "California" style housing system that consists of a pigeon house with three enclosed sides and an open mesh side facing away from the prevailing winter winds. Double nest box systems are used to hold 12 to 16 adult pairs and these pairs are rotated on a 4 year cycle. Pigeons are fed a pigeon pellet ration and a mixture of wheat and corn. An average pair of pigeons will produce 8 to 10 squabs per year.

The squab shows excellent growth rate for meat production. It reaches 60 times its hatch weight at 28 days of age, the highest multiple of any commercial bird. A broiler chicken reaches 26 times its hatch weight in 28 days.

Most pigeon/squab enterprises are situated on small land bases. The majority of the operations in the Fraser Valley have land bases of less than 10 acres. Average squab operations in the Fraser Valley consists of 1400 breeding pairs. Squabs are a marginally profitable agricultural enterprise. The high cost of land, feed, and labor combined with low productivity contribute to the low profitability of the industry.

**Processing and Marketing:** In Canada the major markets for squab are Vancouver, Toronto, Montreal and other large urban centers. Canadians consume approximately 500,000 squabs per year (B.C. Game Bird Development Commodity Strategy, 1989). In addition to the 67,860 squabs produced in B.C., approximately 98,631 squabs are imported from the U.S.

At present all squab production is processed through a federally inspected facility with specialized modern equipment to handle, process and package small birds. The processor also performs the marketing function for all of the squab producers and has established a clientele of wholesalers, distributors, retailers and restaurants.

## **2. Pigeons - Breeders**

Consumer demand for squab is estimated at 280 million squab annually. The squab market requires five million breeder pairs as replacement stock each year valued in excess of \$240 million, based on conservative estimates. The Canadian and U.S. markets for squab (and hence breeder parents) are relatively undeveloped as yet and provide an excellent opportunity for development given the high per capita income. It is estimated that 1.5 million squab are consumed annually in Canada and the U.S.

If B.C. is going to compete in the pigeon breeding industry, it must be prepared to compete with large, well established breeders in California and South Carolina as well as breeders in France. Much of the technology used in squab production in North America is outdated. Use of purebreds rather than hybrids is common. An opportunity exists for B.C. breeders to develop inbred lines which can be used to produce hybrid crosses with strong reproductive and maternal characteristics. This would create reliable breeders and create a dependency on the B.C. pigeon breeding industry for a continuous supply of parent stock. This breeding strategy is the foundation of the existing chicken meat and egg industry in North America and Western Europe.

To "catch up" and to fully exploit the opportunity to develop a pigeon breeder industry in B.C., a pigeon breeding/genetic development center should be established, preferably at U.B.C. where a professional game bird geneticist is available. This would require reliable, long-term financing, much of which will have to come from government, until the industry increases in size.

Key obstacles to establishing a pigeon breeding industry involves high capitalization required to develop a gene pool, and the contradiction between the stable growth requirements of a breeder operation versus cyclical demand in the squab market. Further, squab producers would have to be convinced to purchase replacement stock from B.C. producers rather than breed their own parents or buy parents from the U.S. The final obstacle is the high cost of transporting parent pair to international markets which often doubles the cost of the parent pairs (pigeon hatching eggs do not transport well).

### **3. Pigeons / Research**

There is a market in Canada for sales of pigeons for use in scientific research. Research pigeons are purchased by biology, psychology, and zoology departments of universities for use in research and demonstration laboratories, and by drug companies for use in drug testing. This market is not price sensitive and enjoys large profit margins. Research pigeons need to be pure strains and disease free. Presently there are no Canadian suppliers of research pigeons to Canadian universities and research facilities. The U.S. is presently the major supplier of research pigeons to Canada. It is estimated that the annual market value of

research pigeons in Canada is \$75,000.00 (B.C. Game Bird Commodity Development Strategy, 1989).

#### **4. Japanese Quail/ Meat**

Japanese quail meat strains can be divided into heavy and light meat strains. The small bodied egg production strains and the breeding stock are also sold in the market place for meat consumption.

Japanese quail have some characteristics which are ideal for meat production. They can be brooded at high density (70-100 birds per sq. meter in groups of 1000 per room). In battery cages, 5,000 birds can be kept until they reach market size in an area 10 meters by 30 meters. Broiler quail are 6-10 grams at hatch and weigh 275 grams at six weeks with a dress out weight of approximately 185 grams. This compares with the Japanese laying quail which dresses out at 85 - 115 grams at 10 weeks. However, the Japanese quail has some disadvantages compared to broiler chicken. The Japanese quail reaches 30 times its hatch weight at 42 days compared to 40-45 times hatch weight for broilers and quail are markedly less efficient converters of feed at 3.0 to 3.5 kg feed per kg meat.

B.C. Game bird producers grow a larger broiler quail which dresses out at 200 grams in 10 weeks using specialized management systems. These quail are as large as any Japanese quail produced in the U.S. Large quail are more attractive to the consumer and have more flavor and a firmer texture than the smaller strains. Presently, the major market in B.C. is for a 105-110g. quail marketed on a "piece" basis rather than on a "weight" basis. However, the trend in B.C. is towards production and consumption of the larger strains of meat quail.

There is opportunity for improvement in Japanese quail meat and egg strains with proper application of scientific poultry breeding procedures. Most quail producers choose their quail breeding birds from commercial flocks with culls going to the processor. There is little scientific selective breeding followed by line development and line crossing in search of hybrids with potential, done in B.C. The industry could use assistance and direction in this area. U.B.C. has the scientific capability to produce a heavier quail which could be sold throughout North America. Quebec is presently looking at a provincial government subsidized breeding program for production of heavy strains of quail for sale in B.C. and other areas of North America.

Most of the Japanese quail processed in B.C. are consumed locally. There is excellent potential for continued growth in quail meat consumption as a result of B.C.'s rapidly growing population and changing ethnic mix.

There a number of potential markets in B.C. for Japanese quail including opportunities in secondary processing. These markets relate to some extent to the ethnic and cultural background of consumers. In Taiwan, the Chinese like to eat 12 day old male culls which are byproducts of the egg laying industry. The Japanese like small quail which are dressed, cooked in oil and eaten whole, including the bones. Quality and proper preparation and cooking are particularly important to them. North Americans prefer deboned quail and Canadians in particular like stuffed, deboned quail. The Chinese like quail with bones in, but they do not eat the bones.

Japanese quail may be served in gourmet restaurants as either an entrée or main course cooked like Cornish hen. Recipes are available for roast quail, quail stew, quail demoville and

sautéed quail a la mouquin. Roasted quail on a spit is popular in France and Italy and suggests cooking on a rotisserie would work well. Japanese quail could be sold to caterers and restaurants for use in garnishes, in cold plates or in other meal accessories. Smoked quail also has market potential. A major market for quail in B.C. today is in soups and appetizers. The 110g. quail is popular in these markets.

The quail meat industry should direct its marketing efforts at urban centers, upper middle class markets, gourmet restaurants, hotel trade, retail stores, specialty meat store and large volume food chain stores.

It is estimated that fresh Japanese quail, particularly the heavier quail, could reach Cornish volumes in certain sectors of the U.S. within a few years, especially if sold in the stores from the fresh meat case and distributed through chain distributors. While the Canadian market lags behind that of the U.S. because of size and technological development, similar opportunities for expanded markets in Canada/B.C. exist for B.C. Japanese quail producers. B.C. producers can increase their market through effort to improve product quality and clearly define their broiler quail product.

## **5. Japanese Quail /Eggs**

The quail egg business in B.C. has potential based on the biological fundamentals of the quail layer. Japanese quail can produce 290 eggs/year compared with 260 to 270 eggs per year for chicken and 285 eggs per year for ducks. Each quail egg is 8-10% of the quail's body weight. Japanese quail are also more efficient converters of feed to eggs than chickens; 2.4 kg. feed per kg egg compared to 3.2 to 3.4 kg feed per kg egg for chickens and 2.6 for ducks.

Japanese quail layer rearing has the advantage of minimal capital outlay which means faster proceeds to the farmer. Japanese quail begin laying at 6 to 7 weeks of age compared to 20 to 24 weeks for chickens. Two peaks of over 90% are possible if two replacement flocks per year are used. Japanese quail lay 75% of their eggs between 3:00 and 5:00 p.m. making egg collection easy. Induced moulting and light management programs work well with quail. Quail readily adjust to multi-tiered cages and high density rearing. The proceeds from spent layers heavily subsidizes egg production costs - some producer consider their eggs to be free. Since Japanese Quail is more efficient in converting feed to egg mass than other poultry, but less so for meat, it is logical to use quail as an egg producer instead of a meat producer.

The potential for the quail egg industry is debatable. In the U.S. the failure of a quail egg industry to develop is interpreted as proof of the lack of economics of the business. B.C. quail producers who hold this position emphasize meat production. However, in Southeast Asia the quail production emphasis is on eggs. Hong Kong produces 12 million dozen quail eggs per year. In the New Territories alone, 350,000 quail produce 100 to 110 million eggs annually. In Singapore there are 90 farms with 30,000 quail producing 8.7 million eggs annually. In China, the Beijing Poultry Breeding Farm in Dong Sha/Beijing produce 2.9 million eggs annually and have 18,000 breeder quail for supplying hatching eggs to communes and local farmers. Large operations also exist in the Philippines, Japan, and other countries of Southeast Asia.

The potential for building a domestic B.C. quail egg industry is founded in B.C.'s increasing Asian population, well developed gourmet restaurant trade and growing acceptance

of Asian dishes by our local population. While quail eggs are a rarity on European menus, they are common on oriental menus, particularly on Chinese menus.

Quail eggs are attractive in salads and as hors d'ourves. They have a potential market, boiled and pickled. Quail eggs contain less fat, less cholesterol and more protein compared to chicken and duck eggs. The Japanese make a tasty delight by dipping hard boiled quail eggs in tempera batter and frying them in deep fat and using them raw in sushi.

In Japan, Japanese quail eggs are considered a delicacy and are consumed raw, hard boiled, pickled or smoked and are often presented as gifts. In the Philippines quail eggs are consumed boiled, pickled or as "balut" eggs. Balut eggs are quail eggs that have been incubated until the chick is near full development, then broken open, cooked and eaten.

There are three problems associated with the use of Japanese quail eggs in the breaker trade; the small size of the egg, thick shell membranes and a fragile egg shell. Quail egg breaking is labor intensive and involves expensive handling. As long as chicken breaker eggs remain inexpensive and processing costs for quail eggs are high there is little likelihood of Japanese quail eggs being used in the breaker trade. However, should effective, specialized handling and breaking equipment be developed, quail eggs may be able to be used in the breaker trade. Japanese quail eggs can easily be use in all recipes calling for chicken eggs. They make excellent meringues, mayonnaise, cakes and other baked products.

There have been numerous recent developments throughout the world that could improve the economics of quail egg production. Farmer Automatic of Germany has introduced a quail cage with chain type trough feeders which is competitively priced. Italy has developed automatic feeders with overhead conveyors and down spouts. The Taiwanese have



developed a gruel (water mixed with feed) feeding procedure which simplifies the feeding and watering process.

Pickled Japanese quail egg production has been slow because of the difficulty encountered with peeling the heavy shell membrane from the eggs. The Taiwanese have recently developed a machine capable of peeling 16,000 eggs per hour using only two operators.

The marketing of quail eggs should be directed at urban centers, other ethnic markets (as well as oriental markets), gourmet restaurants, upper income level consumers, and cholesterol conscious food buyers.

## **6. Pheasant / Meat**

The Pheasant meat producers have faced some difficult obstacles and challenges in the past 5 years. In January 1989, the U.S. placed a 9% duty on game birds entering the U.S. Market. Pheasants traditionally dependent on the export market, found that they could not maintain their competitive advantage in the U.S.

New export markets for Canadian pheasants have been difficult to establish. Packaging restrictions and health regulations have effectively prevented the export of Canadian pheasants to the European market. Similarly, it has been difficult establishing markets in the Pacific Rim. China and Japan both desire a consistent year-round supply of product. With the small number of pheasant producers, consistent supply may be difficult to achieve.

Domestic markets for pheasants have proven to be difficult to establish. Pheasants are considered a luxury, specialty item and may be found in specialty poultry shops or served at high-end restaurants. Pheasants are also price and recession sensitive, and has resulted in the substitution of other lower price products for the higher priced pheasant. It has also been difficult to stimulate consumer demand for pheasant at the retail level. In Europe, pheasant is a traditional festive food product, however in Canada, turkey and chicken have maintained their position and accompanying market share as the traditional poultry product.

Pheasants do have their own uniqueness, the meat is low in fat and calories - 151 calories per 100 grams compared to 239 for chicken, 326 for duck, 168 for quail and 298 for Cornish hen. Pheasant meat contains 24.3 grams of protein per 100 gram of meat, second only to quail meat.

B.C. pheasants should be raised so as to retain their unique flavor. Consumers do not want to pay high prices for pheasants that taste like chicken. Successful pheasant producers raise pheasants on free range in large outdoor pens. The pheasants are fed a variety of grains supplemented with turkey feed to ensure that they maintain their unique flavor. Pheasants can be raised indoors but require more space than broilers due to their cannibalistic behavior.

The pheasant is one of the last fowl that has remained dark feathered and is still processed for meat. Flintshire Farms in Canada has developed a white feathered bird which dresses out at 0.92 kg to 1.36 kg (2-3 lbs.) at 16 weeks which is sold all over the world. A major B.C. producer has been producing a white feathered pheasant since 1981. More research is needed to improve the fertility, egg production, hatchability and feed conversion of the white feathered lines in B.C. if production economics and consumer preference are to be

optimized. Particular emphasis need to be placed on research and artificial insemination procedures for the heavier strain of white pheasants which are experiencing fertility problems.

## **7. Partridge**

The Chukar partridge is the major partridge produced in B.C. Partridges are often raised by individuals raising quail because of the similarity in cage requirements.

A number of commercial partridge producers have found low hatchability which could relate to either lack of fertility in the breeders or application of incorrect hatching procedures. There is a lack of information available in B.C. on commercial partridge production.

Most of the Chukar partridges raised in B.C. are used for hunting. However, the industry does sell significant amounts of the product to the restaurant trade. There exists potential for increased sales to both the retail and restaurant trade. The industry requires an effective advertising and marketing program designed to improve consumer awareness of their product.

## **8. Silkies**

Silkies are a black skinned bird used by the Oriental community for medicinal purposes. The meat is dry, lean and unmarbled and so is not commonly eaten. Silkies have a high cost of production and grow slowly, however profit margins are excellent. The market in B.C. is small, stable and specialized with good growth potential. The export market, particularly the U.S., provides opportunities for new markets for B.C. producers.

## **9. Game Bird Byproducts**

Cage reared game birds such as quail and pheasants provide a source of high quality organic fertilizer analyzing at a relative constant 8-6-5. This product can be used by the bulb/tropical plant/ornamental shrub growers and organic gardeners with good results. Quail down is of equal quality to eider duck down. Pheasant feathers are used in tying quality fishing flies, for hat patches and millinery. Cull pigeon, quail and pheasant breeder stock are used for dog training.

**APPENDIX 2.3      RECOMMENDATIONS FOR THE B.C. GAME BIRD  
INDUSTRY**

## **RECOMMENDATIONS FOR THE B.C. GAME BIRD INDUSTRY**

### **1. B.C. Game Bird Industry**

It is recommended that the B. C. game bird industry:

- a. organize a formal industry structure to more effectively work with government agencies and research institutions and to facilitate communication of information.
- b. participate and contribute funding to research and development projects
- c. become more innovative with respect to the application of technological and scientific advances
- d. work more cooperatively within the industry - emphasize constructive cooperation rather than competition
- e. work together to expand their markets rather than compete for part of the existing market
- f. develop a breeding industry
- g. become more information oriented - the gaining and sharing of information is necessary for the long term viability of the industry.

### **2. B.C. Ministry Of Agriculture Fisheries And Food**

It is recommended that the BCMAFF:

- a. Work with U.B.C. Quail Resource Center/Animal Science Department and game bird industry to implement development projects:
  - i) Produce educational projects, including publications, videos, seminars directed at producers, feed companies and processors on breeding, management, nutrition and product development
  - ii) Conduct fundamental and applied research to facilitate the long term viability/competitiveness, growth and development of the game bird industry in B.C.

- b. Facilitate the development of a producer/processor association directed at building an infrastructure for the game bird industry in B.C. through improved communication, identification of common problems and cooperative strategic action to expand and develop the industry
- c. Work with Agriculture and Agri-Food Canada to develop regulations on grading and inspection which provide standards for product quality and safety.
- d. Develop, through the Animal Health Center, disease control and prevention programs for the game bird industry
- e. Work with other ministries of the B.C. government to create an economic environment which facilitates growth and development of the B.C. game bird industry
- f. Discourage the subsidization of exports from other provinces of game birds into B.C.
- g. Address the issue of protective duties which reduce B.C. game bird producers' competitive position in the U.S. market
- h. Work with industry to enhance marketing through improved packaging and consumer education to encourage partridge consumption
- i. Facilitate technology transfer of further processing equipment for peeling and pickling quail eggs and deboning quail
- j. Farm Management Branch and Poultry Specialist to continue to prepare enterprise budgets on the financial and economic viability of the following businesses: squab, pigeon breeder, partridge, pheasant, quail and silkies
- k. Farm Management Branch conduct break even analysis and sensitivity analysis on different size game bird operations

### **3. University Of British Columbia**

It is recommended that U.B.C., the U.B.C. Quail Resource Center, Animal Science Department:

- a. Work with the B.C. Ministry of Agriculture, Fisheries and Food, and industry in implementing development projects:

- i) Prepare material relevant to the game bird industry for use in a game bird producers's field day
- ii) Prepare videos and slide shows on game bird production, disease management and A. I. procedures
- iii) Prepare a regular association newsletter on game bird production and disease management, market opportunities and new producers as a communication vehicle for B.C.'s growing game bird industry
- iv) Prepare up-to-date game bird production manuals for quail, squab and pheasants
- v) Conduct applied research directed at the development of a robotic pigeon feeder for commercial application of existing formulated pigeon milk replacers
- vi) Evaluate the potential for use of the egg from the white egg quail mutant in the breaker trade and if found viable, work with the Agricultural Engineering Branch to develop processing equipment
- vii) Develop improved breeding stock for the game bird industry
- viii) Conduct research into the use of pelleted feeds in the game bird industry
- ix) Compare newly developed game bird feeds produced by local feed companies against mixed grains fed cafeteria style
- x) Develop A. I. procedures for heavy strains of white pheasants
- xi) Develop a mold for production of a quail egg tray with a clear, flat surface on top for labels and expiry dates
- xii) Collaborate on other game bird extension projects as they arise.

#### **4. Agriculture And Agri-Food Canada**

- a. It is recommended that Agriculture and Agri-Food Canada work with the BCMAFF to develop regulations on grading and inspection which provides standards for product quality and safety



- b. Work with other ministries of the provincial government to create an economic environment which facilitates growth and development of the B.C. game bird industry
- c. Address the issue of U.S. protective duties on game bird imports which presently reduce B.C.'s competitive position in the U.S. market.

## **APPENDIX 3.1      THE TINAMOU OF SOUTH AMERICA**

## The Tinamou Of South America

Genus and Species	# of Subspecies	Common Name	Distribution
<i>Northoprocta perdicaria</i>	2	Chilean Tinamou	North central to south central Chile
<i>Northoprocta ornata</i>	3	Ornate Tinamou	North eastern Chile, Bolivia, central Peru and north western Argentina
<i>Northoprocta cinerascens</i>	2	Large Bushland Tinamou	Paraguay and eastern Bolivia
<i>Northoprocta pentlandii</i>	3	Canyon Tinamou	North eastern Chile and southern Bolivia
<i>Eudromia elegans</i>	8	Crested Tinamou	Argentina and southern Chile
<i>Tinamotis ingoufi</i>	0	Patagonian Tinamou	High steppes of Chile and Argentina
<i>Tinamotis pentlandii</i>	0	Puna Tinamou	Northern Chile, Bolivia and southern Peru
<i>Nothura darwinii</i>	3	Pale Spotted Tinamou	North western Argentina, south eastern Peru and Bolivia
<i>Nothura maculosa</i>	7	Spotted Tinamou	Northern Argentina, Brazil, Paraguay and Uruguay
<i>Tinamus solitarius</i>	0	Solitary Tinamou	Eastern Paraguay and south eastern Brazil
<i>Crypturellus obsoletus</i>	6	Brown Tinamou	Eastern Paraguay, eastern and southern Brazil
<i>Crypturellus undulatus</i>	6	Undulated Tinamou	Eastern Bolivia, Paraguay and southern Brazil
<i>Crypturellus tataupa</i>	4	Blue Tinamou	South eastern Bolivia, Paraguay and south eastern Brazil
<i>Rhynchotus rufescens</i>	4	Red Winged Tinamou	Northern Argentina, south eastern Bolivia, Paraguay, Uruguay and southern Brazil

**APPENDIX 5.1      SEASONAL FOODS OF THE PARTRIDGE TINAMOU**

# SEASONAL FOOD HABITS FROM CROP ANALYSIS OF PARTRIDGE TINAMOU

## Seasonal Food Habits from Crop Analysis of 44 Partridge Tinamou

Plant Scientific Name	Parts eaten	Season of Collection			
		Spr.	Sum.	Fall	Win
Amaryllidaceae					
Nothoscordum gramineum	seeds, fruits			1	
Nothoscordum sp.	seeds			1	
Boraginaceae					
Echium vulgare	seeds		2	11	
Compositae					
	fruits			1	
Centaurea melitensis	seeds		1		
Centaurea sp.	seeds		1		
Cichorium intybus	seeds		1	6	
Cirsium lanceolatum	seeds		2	2	
Hypochoeris sp.	seeds			2	
Madia sativa	seeds		1	1	
Senecio sp.	flowers		1		
Convolvulaceae					
Convolvulus hermanniae	seeds		1	3	
Dichondra repens	seeds, fruits			1	
Dioscoreaceae					
Dioscorea sp.	fruits			2	
Epipetrum humile	seeds, fruits, corms			6	
Fagaceae					
Nothofagus obliqua	fruits			2	
Gramineae					
	seeds			1	
Avena sp.	seeds			2	

Plant Scientific Name	Parts eaten	Season of Collection			
		Spr.	Sum.	Fall	Win
Bromus mollis	fruits			3	
Bromus sp.	seeds			3	
Gramineae					
Cynosurus echinatus	seeds			1	
Danthonia sp.	seeds			1	
Digitaria sp.	seeds, leaves			1	
Echinochola crusgalli	seeds			4	
Festuca sp.	seeds		3		
Lolium sp.	seeds		5	18	
Panicum sp.	seeds		2	2	
Paspalum sp.	seeds		1		
Piptochaetium stipoides	seeds		2	5	
Piptochaetium sp.	seeds			2	
Setaria sp.	seeds			1	
Stipa duriuscula	seeds			1	
Stipa sp.	seeds			2	
Tristeobromus hirtus	fruits			1	
Triticum aestivum	seeds	1	1	6	1
Iridaceae					
Sisyrinchium sp.	seeds			2	
Labiateae					
Stachys sp.	seeds, fruits			1	
Leguminosae					
	seeds, fruits			1	
Adesmia sp.	seeds fruits			1	
Astragalus sp.	seeds		1		
Cytisus monspessulanus	seeds			2	
Lathyrus sp.	seeds		5	4	
Lens culinaris	seeds		2	1	
Medicago sp.	seeds			2	
Pisum sativum	seeds		1	5	
Trifolium subterraneum	seeds, fruits			2	
Trifolium sp.	seeds, fruits, flowers	1	1	6	
Vicia sp.	seeds, fruits	1		5	
Minosaceae					
Acacia dealbata	seeds			1	
Acacia sp.	seeds			1	

Plant Scientific Name	Parts eaten	Season of Collection			
		Spr.	Sum.	Fall	Win
Plantaginaceae					
Plantago sp.	seeds			4	
Polygonaceae					
Polygonum aviculare	fruits			3	
Polygonum convolvulus	seeds	1	1	4	
Polygonum persicaria	seeds			2	
Polygonum sp.	seeds	1		1	
Rumex acetosella	seeds			6	
Rumex crispus	seeds			1	
Rhamnaceae					
Colletia spinosa	seeds			1	
Colletia sp.	seeds			1	
Discaria articulata	seeds		2	2	
Discaria crenata	seeds		2		
Discaria sp.	seeds			1	
Rosaceae					
Margyricarpus setosus	seeds, fruits			5	
Quillaja saponaria	seeds			4	
Sanguisorba minor	seeds, fruits		2	9	
Santalaceae					
Quinchamamlum sp.	seeds		2	1	
Solanaceae					
Fabiana imbricata	fruits			1	
Tecophilaeaceae					
Conanthera simsii	fruits, corms			2	
Umbelliferae					
Ammi visnaga	seeds, leaves			1	
Apium sp.	seeds			1	
Daucus montanus	fruits			1	
Eryngium paniculatum	fruits		1		
Vitaceae					
Cissus striata	seeds		1		

Animal Scientific Name	Parts eaten	Season of Collection			
		Spr.	Sum.	Fall	Win
Coleoptera					
Tenebrionidae	beetles		2		
Diptera	flies		1		
Orthoptera					
Acrididae	grasshoppers		7	12	
Crustacea	sow bugs			1	
Mollusca	snails		1	4	
Unidentified insects, pupae			2	7	

Source: Bohl (1972).



**APPENDIX 6.1      SQUAB MARKET SURVEY - RESTAURANTS**

Letter of Introduction - English and Chinese

Restaurant Survey - English/Chinese

# SQUAB MARKET SURVEY - RESTAURANTS

貴餐館是否有乳鴿供應? 如有, 請直答第二題.

1. Do you serve squab? Yes ( ) 是 If yes, please go to question # 2

No ( ) 否

如無, 以前曾否有供應?

If No, have you ever served squab?

Yes ( ) 有

No ( ) 無

如以前有供應, 為何終止?

If Yes, why did you stop serving squab? \_\_\_\_\_

如一向無供應, 原因為:

If No, why don't you have squab on your menu? \_\_\_\_\_

COMMENTS:

Reason 原因	✓
Squab is too expensive	
Customer demand for squab is too low	
Squab is not a speciality of the restaurant	
Supply of squab is inconsistent	
Quality of squab is inconsistent	
Customer is not aware of squab as a food product	
Other reasons (please specify):	

一般顧客認為價錢太貴

顧客需求量不足

乳鴿非貴餐館之專長

乳鴿來源不穩定

乳鴿品質參差

顧客不認識乳鴿可用作食物

其他因素(請列明):

貴餐館有否供應以下禽類:

2. Do you serve other high end game bird products :

Quail 鵪鶉 Yes ( ) 有

No ( ) 無

Pheasant 山雞 Yes ( ) 有

No ( ) 無

Partridge 鸚鵡 Yes ( ) 有

No ( ) 無

其他:

Other (Please Specify): \_\_\_\_\_

Squab restaurant market study

貴餐館於去年曾經購多少磅乳鴿？

3. How many pounds of squab did you purchase from a broker/wholesaler in 1994?

COMMENTS:

Type and Form of Squab	Lbs. purchased 磅數
Fresh 新鮮	
Frozen 凍藏	
Other (please specify) 其他	

當時購入乳鴿來價為多少？

4. What was the purchase price range in 1994 for the squab you purchased?

COMMENTS:

Type of Squab	Price Range/lb. 每磅
Fresh 新鮮	
Frozen 凍藏	
Others (please specify):	

貴餐館所賣乳鴿是本地產品

5. Do you purchase domestic (B.C.) produced squab

Yes ( ) 是

No ( ) 不是

乳鴿供應來源及數量

If yes, who do you purchase these squab from and how many pounds (1994) did you purchase?

Source - Domestic 本地	Number of lbs. purchased 磅數	Name of supplier (optional) 供應商
Direct from Producer 農場		
Full Service Meat Wholesaler 肉商		
Speciality Poultry Wholesaler 雞鴨商		
Others (please specify): 其他:		

COMMENTS:

Squab restaurant market study

是否購買從外地輸入乳鴿？  
6. Do you purchase imported squab?

Yes ( ) 是

No ( ) 否

乳鴿的供應來源及數量：

If yes, then who do you purchase these squab from and how many pounds of squab did you purchase in 1994?

Source - Import	Number of lbs. purchased 磅數	Name of supplier (optional) 供應商
Direct from Producer 外地農場		
Full Service Meat Wholesaler 肉商		
Speciality Poultry Wholesaler 雜貨商		
Broker 進口商		
Other (please specify) 其他		

購買從外地進口乳鴿每磅價值為加幣  
7. What was your per pound purchase price range for imported squab in 1994? (In Cdn. \$) \_\_\_\_\_ /lb.

曾否有遇到以下問題：  
8. What are the problems associated with:

供應不足  
a. Supply (Consistency of availability and supply of squab)

需求不足  
b. Demand (Consistent demand from your customers)

品質與賣相不佳  
c. Quality (Scalding problems, skin colour problems etc.)

乳鴿大小參差  
d. Package Size (Squab are too big or too small)

包裝欠佳  
e. Packaging

其他原因  
f. Other Concerns

Squab restaurant market study

貴餐館入貨時之決定因素：

9. How important are the following physical attributes when buying squab? (Rank on a scale of 1 to 5 with 5 being the most important physical attribute.)

Physical Attributes	質素	不重要	—————→				重要
Size of Bird	大小	1	2	3	4	5	
Colour of Meat	肉色	1	2	3	4	5	
Taste of Meat	肉味	1	2	3	4	5	
Texture of Meat	肉質	1	2	3	4	5	
Freshness	新鮮	1	2	3	4	5	
Squab is well bled		1	2	3	4	5	
Other (please specify)	其他	1	2	3	4	5	

COMMENTS: 評語：

10. How important are the following marketing attributes when buying squab? (Rank on the scale of 1 to 5 with 5 being the most important marketing attribute).

Availability of squab	來源充足	1	2	3	4	5
Delivery (is it delivered)	保證送貨	1	2	3	4	5
Packaging	包裝方便	1	2	3	4	5
Price of Squab	價錢合理	1	2	3	4	5
Others (please specify)	其他	1	2	3	4	5

COMMENT

11. How would you rank the following on the basis of quality (1 to 5 with 5 being the highest quality)

Fresh Squab	新鮮	1	2	3	4	5
Frozen Squab	凍藏	1	2	3	4	5

請從下列選出四項可令貴餐館增購乳鴿之重要因素:

12. What are the TOP 4 reasons that would encourage you to increase your purchase of squab:  
(1 to 4 with 1 being the top reason) (由一至四,一為最重要)

\_\_\_\_\_ Lower price 價錢合理  
 \_\_\_\_\_ Consistent quality 品質良好  
 \_\_\_\_\_ Consistent supply 來源充足  
 \_\_\_\_\_ Increased client demand 客人需求  
 \_\_\_\_\_ Suitable bird size 大小適中  
 \_\_\_\_\_ Suitable minimum order size 最低訂購數量適中  
 \_\_\_\_\_ Brand name for squab 有牌子保證  
 \_\_\_\_\_ Quality Assurance guarantee 質量有保證  
 \_\_\_\_\_ Availability of promotional material 供給對顧客推銷宣傳資料

COMMENTS: 評語:

顧客對乳鴿售價增減是否會有反應?

13. Have you found that your customers are sensitive to a change in the menu price of squab? 有 無  
Yes ( ) No ( )

If Yes, How sensitive are your customers to menu price changes of squab?

Very Sensitive \_\_\_\_\_ 非常敏感  
 Moderately Sensitive \_\_\_\_\_ 普通  
 Not Sensitive \_\_\_\_\_ 輕微

如乳鴿來源不足或來價太貴,你會以那種禽類代替?

14. If squab was not available or too expensive, would you substitute one of the following?

Quail 鵪鶉 Yes ( ) 是 No ( ) 否  
 Pheasant 山雞 Yes ( ) 是 No ( ) 否  
 Partridge 鶉 Yes ( ) 是 No ( ) 否  
 Others (please Specify) 其他 \_\_\_\_\_

- 如果全年都有新鮮乳鴿供應,你是否願意出較高價錢購入?  
 15. If fresh squab was made available on a year-round basis, would you be willing to pay a higher price for squab?

Yes ( ) 是  
 No ( ) 否

If Yes, how much more? \$ 價錢/磅 /Lb

- 如果來價降低,你會增購多少?  
 16. How much MORE squab do you think you would purchase if the price from the wholesaler decreased?

COMMENTS: 評語:

Price Change (decrease) 來價降低	How much more would you purchase (% increase)? 增購之百分比
.20 cents less/pound 每磅	
.40 cents less/pound ↘	
.60 cents less/pound ↘	
.80 cents less/pound ↘	
\$1.00 less/pound ↘	

- 如果來價升高,你會減購多少?  
 17. How much LESS squab do you think you would purchase if the price from the wholesaler increased?

COMMENTS 評語:

Price Change (increase) 來價升高	How much less would you purchase (% decrease)? 減購之百分比
.20 cents more/pound 每磅	
.40 cents more/pound ↘	
.60 cents more/pound ↘	
.80 cents more/pound ↘	
\$1.00 more/pound ↘	

通常購買乳鴿次數？

18. How often do you purchase squab (tick the appropriate box)?

COMMENTS: 評語:

Daily	每天一次	
Weekly	每星期一次	
Monthly	每月一次	
Quarterly	每季一次	
Semi-Annually	每半年一次	
Annually	每年一次	
Other (please specify)	其他	

每季銷量有份率？

19. When do you serve the most squab?

COMMENTS:

Season	季節	% of total annual consumption
Jan - Mar.	1-3月	
Apr - June	4-6月	
July - Sept.	7-9月	
Oct. - Dec.	10-12月	

於節日銷量之有份率

20. How much squab do you sell during the following holidays (% of total annual sales of squab)?

COMMENTS:

Event		% of total annual sales of squab
Christmas	聖誕	
Chinese New Year	農曆新年	
Other (please specify)	其他	



以下何類乳鴿

21. What size squab do you prefer to buy for your restaurant?

COMMENTS: 評語:

8.0 to 12.0 ounces 8-12安士	
12.0 to 15.0 ounces 12-15安士	
15.0 to 20.0 ounces 15-20安士	
other sizes 其他	

貴餐館屬那一類形?

22. What type of restaurant do you have?

COMMENTS: 評語:

Chinese (Mandarin) 京滬菜	
Chinese (Cantonese) 廣東菜	
Japanese 日本菜	
Other Asian 亞洲食品	
North American 北美食品	
European 歐洲食品	
Other (please specify) 其他	

一般餐價

23. Entree price range per serving:

午餐 Lunch \$ \_\_\_\_\_

晚餐 Dinner \$ \_\_\_\_\_

貴餐館能容納顧客數目

24. What is your Restaurant Capacity?

\_\_\_\_\_ People 人

貴餐館屬那一類?

25. What is the location of your restaurant?

Within Hotel 酒店附屬

Independent (stand alone) 獨立

26. Name and Position of Person Interviewed?

如想收到調查報告結果,請填姓名及回郵地址。

**APPENDIX 6.2      SQUAB MARKET SURVEY -WHOLESALEERS**

**SQUAB MARKET SURVEY - WHOLESALERS**

**1. Do you wholesale squab?      Yes ( )    If yes go to question # 2**  
**No ( )**

**If No, have you ever sold squab? Yes ( )**  
**No ( )**

**If Yes, why did you stop selling squab?** \_\_\_\_\_

**If No, why don't you wholesale squab?**

**COMMENTS:**

Reason	
Squab is too expensive	
Customer demand for squab is too low	
Squab is not a speciality of the wholesaler	
Supply of squab is inconsistent	
Quality of squab is inconsistent	
Customer is not aware of squab as a food product	
Other reasons (please specify):	

**2. Do you sell other high end game bird products :**

Quail                      Yes ( )  
                                    No ( )

Pheasant      Yes ( )  
                    No ( )

Partridge      Yes ( )  
                     No ( )

Other (Please Specify): \_\_\_\_\_

**3. What forms of squab did you sell in 1994? (% of annual total sales of squab)**

COMMENTS:

Form of Squab	% of total annual sales of squab
Fresh	
Frozen	
Other (please specify)	

**4. What was your per pound purchase price range from the processor/broker for squab in 1994?**

COMMENTS:

Type of Squab	Price Range/lb.
Fresh	
Frozen	
Other (please specify)	

**5. Do you purchase domestic (B.C.) produced squab**

Yes ( )

No ( )

**If yes, who do you purchase these squab from and how many pounds (yearly) did you purchase?**

Source - Domestic	# of lbs. purchased	Name of supplier (optional)
Direct from Producer		
Direct from processor		
Others (please specify)		

COMMENTS:

6. Do you purchase imported squab?

Yes ( )

No ( )

If yes, who do you purchase these squab from and how many pounds of squab did you purchase in 1994?

COMMENTS:

Source - Import	# of lbs. purchased	Name of supplier (optional)
Direct from Producer		
Direct from Processor		
From Broker		
Other (please specify)		

7. What was your per pound purchase price range for imported squab in 1994? (In Cdn.\$) \_\_\_\_\_/lb.

8. What are the problems associated with:

a. Supply (consistency, availability etc.)

b. Demand (consistency of purchases from retail/restaurant trade)

c. Quality (processing problems, scalding etc.)

d. Package Size

e. Packaging

f. Other

Squab wholesaler market study

**9. How important are the following physical attributes when wholesaling squab? (on a scale of 1 to 5 with 5 being the most important).**

Size of Bird	1	2	3	4	5
Colour of Meat	1	2	3	4	5
Colour of Skin	1	2	3	4	5
Freshness	1	2	3	4	5
Squab is well bled	1	2	3	4	5
Others (please specify)	1	2	3	4	5

COMMENTS:

**10. How important are the following marketing attributes when wholesaling squab? (On a scale of 1 to 5 with 5 being the most important attribute)**

Availability of squab	1	2	3	4	5
Delivery ( is it delivered)	1	2	3	4	5
Packaging	1	2	3	4	5
Supply	1	2	3	4	5
Price of Squab	1	2	3	4	5
Others (please specify)	1	2	3	4	5

COMMENTS:

**11. How would you rank the following on the basis of quality (1 to 5 with 5 being the highest quality)**

Fresh Squab	1	2	3	4	5
Frozen	1	2	3	4	5

COMMENTS:

12. If fresh squab was made available, would you be willing to pay a higher price? Yes ( )

No ( )

if yes, how much more would you be willing to pay for fresh squab? \_\_\_\_\_

COMMENTS:

13. What would make you increase your purchase of squab? (Top 4 reasons)

\_\_\_\_\_ Lower Price

COMMENTS:

\_\_\_\_\_ Consistent quality

\_\_\_\_\_ Consistent supply

\_\_\_\_\_ Increased client demand

\_\_\_\_\_ Suitable bird size

\_\_\_\_\_ Suitable minimum order size

\_\_\_\_\_ Brand name for squab

\_\_\_\_\_ Quality assurance guarantee

\_\_\_\_\_ Availability of promotional materials

- 14a. What is the current per pound price from the processor/broker for squab? \_\_\_\_\_
- b. What is your current yearly purchase volume of squab (in pounds)? \_\_\_\_\_
- c. What additional volume of squab would you order weekly if it were available at the following prices?  
(This is not a commitment to purchase)

Price	Fresh		Frozen	
	current volume purchased (lbs.)	additional volume purchased (lbs.)	current volume purchased (lbs.)	additional volume purchased (lbs.)
\$5.00/lb				
\$5.25/lb				
\$5.50/lb				
\$5.75/lb				
\$6.00/lb				
\$6.25/lb				
\$6.50/lb				
\$6.75/lb				
\$7.00/lb				
\$7.25/lb				
\$7.50/lb				
\$7.75/lb				
\$8.00/lb				

COMMENTS:



**15. How often and how many pounds of squab do you sell?**

COMMENTS:

How Often	# of lbs. sold
Daily	
Weekly	
Monthly	
Quarterly	
Semi-Annually	
Annually	
Other	

**16. What size squab do you prefer to buy from the processor/broker?**

COMMENTS:

8.0 to 12.0 ounces	
12.0 to 15.0 ounces	
15.0 to 20.0 ounces	
Other Sizes (please specify)	

**17. What is the minimum acceptable size of squab?**

COMMENTS:

8.0 to 12.0 ounces	
12.0 to 15.0 ounces	
15.0 to 20.0 ounces	
Other Sizes (please specify)	

18. What types or forms of squab do you want? (Tick the appropriate box)

Fresh		Frozen	
Whole		Whole	
Half		Half	
Cut up		Cut up	
Others (please specify)		Others (please specify)	

COMMENTS:

19. Who are your customers and what is the % of total annual sales for each category of customer?

COMMENTS:

Outlet	% of total annual sales
Restaurant	
Retail	
Cruise Ship line	
Airline	
Institutions	
Others (please specify)	

20. What types of restaurants do you sell squab to?

COMMENTS:

Type of restaurants	% of total annual sales
Chinese	
Japanese	
Other Asian	
North American	
European	
Others (please specify)	

21. What types of retailers do you sell squab to?

COMMENTS:

Type of Retailers	% of total annual sales
Chinese	
Japanese	
Other Asian	
North American	
European	
Others (please specify)	

22. Advertising - What is needed to efficiently increase retail/restaurant demand for squab?

23. What can the B.C. squab producers and processors do to help you sell more squab?

24. Would a producer/processor/retailer funded promotion program help you sell squab?

25. Would you participate in this program?

26. Do you advertise that you sell squab?

Yes ( )

No ( )

if yes, what type of advertising do you do?

27. Name of Wholesaler

28. Name and position of person interviewed

Squab wholesaler market study