

Wildlife Farmers' and Producers' Booklet #2:

The Collared Peccary/ Javelina/ Sajino/ Poco do Monte/ Wild Hog/ Pakira/ Patira/ Taitetu/ Catete/ Catto/ Quenk [*Tayassu tajacu, T. peccary*] Booklet and Producers' Manual

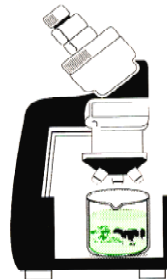
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[*Tayassu tajacu*, *T. peccary*]
Booklet and Producers' Manual**



**Gary Wayne Garcia, Gail G. Young, Kirk M. Amour, Desmond James,
Cicero H.O. Lallo, William Mollineau, Anil Roopchand,
Nirmala Ganessingh, Michelle Spencer, Marvin A. Prosper,
Raajesh Rooplal, Nadra Nathai-Gyan, Arnaud Steil, Alain Xande,
Anouk Bemelmans, Sérgio Gamma Nogueira Filho, Diva Guimaraes,
Hugo Gálvez and Pedro Mayor Aparicio**

**The Open Tropical Forage-Animal Production Laboratory
[OTF-APL]**



**Department of Food Production , Faculty of Science and Agriculture
The University of the West Indies
St Augustine, Trinidad, Trinidad and Tobago, W.I.**

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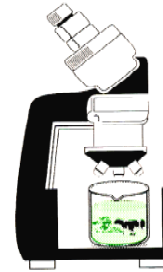
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WEST INDIES**
ST. AUGUSTINE CAMPUS



**The Open Tropical Forage-
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Laboratory (OTF-APL)**



**CHAMBRE
D'AGRICULTURE**
GUYANE



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de la Chasse
et de la Faune Sauvage**



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**Universidade Estadual
do Santa Cruz**



**UNIVERSITAT AUTÒNOMA DE BARCELONA
FACULTAT DE VETERINÀRIA
DEPARTAMENT D'ANATOMIA I SANITAT ANIMALS**

FACULTAT DE VETERINÀRIA DE BARCELONA



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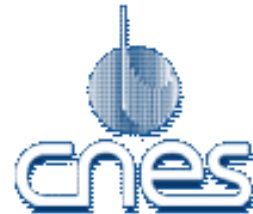
LA REGION GUYANE



Le FCR



LE CNES



DEDICATION

To: JOAO (NETO) BATISTA BARRETO (JBB) and all Peccary Lovers, Producers and Consumers, past, present and future



Figure 1 JOAO (NETO) Batista Barreto (JBB) and his favourite Peccasow (female Peccary)

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Some specific acknowledgements from the first author:

I would like to genuinely state my admiration to all the collaborators and authors of this document for the commitment that they all have exhibited to their work on the Peccary and other Neo-tropical wildlife species. I have been truly impressed by the ease with which you have all been willing to share your information with me that was written in Spanish, French, Portuguese and English. What I found most remarkable was the Doctoral Thesis of Pedro Mayor Aparicio that was written in a Spanish language framework but which included scientific papers written in English and Spanish, as well as his having done his work with French-Spanish and Portuguese-speaking collaborators. I know that we are all “aficionados de/do/of animales silvestres/animals salvaje/animaux sauvages/animais silvestres/wild animals” of the Neo-tropics. This is in keeping with the true spirit of the Open Tropical Forage-Animal Production Laboratory [OTF-APL] and the Open School of Tropical Animal Science and Production [OSTAS&P]. I also wish to acknowledge the UWI Credit Union for taking a risk in loaning me (for the second time) the money to publish a book on wildlife; and last but certainly not least I must personally thank Mr. Ronnie Chaitoo of TRINPAD Limited for his commitment and support towards this work.

Welcome



The Honourable Penelope Beckles: Minister of Public Utilities and the Environment of the Republic of Trinidad and Tobago

**WELCOME ADDRESS BY THE
HONOURABLE PENNELOPE BECKLES
MINISTER OF PUBLIC UTILITIES
AND THE ENVIRONMENT.**

**ADDRESS FOR THE LAUNCH OF BOOKLET AND PRODUCERS' MANUAL ON THE
COLLARED PECCARY**

Mr. Chairman, Emeritus Professor Lawrence A Wilson, Members of the Diplomatic Corp., Ambassador to Brazil, Mrs. Gilda Maria Ramos Guimaraes; Ambassador to France, Mr. Charley Causeret; Dr. Gary Wayne Garcia, Author and Senior Lecturer in Animal Production, Department of Food Production, Faculty of Science and Agriculture, The University of the West Indies; Ms. Gail Young Co-author; Ms. Nadra Nathai-Gyan, Head of Wildlife Section; Specially Invited Guests; Members of the Media; Ladies and Gentlemen

Good morning and a warm welcome to all.

It is indeed an honour and a privilege to be invited to address you on the official launching of the Booklet and Producers' Manual on the Collared Peccary.

At the onset, let me extend my sincere appreciation to the University of the West Indies and to Dr. Gary Wayne Garcia, Author and Senior Lecturer in Animal Production, for this opportunity to welcome you and to share a few thoughts on the topic with you.

Just about one year ago, specifically on July 6th 2004, the University of the West Indies invited me to launch the Booklet and Producers' Manual on the Agouti. Dr. Gary Garcia, principal author described that publication as the first in a series of Manuals on our indigenous terrestrial fauna, focusing on the game species.

Today, Dr. Garcia has made good on his promise and we are here to launch the second Manual, which addresses the Collared Peccary, As Minister with responsibility for Public Utilities and the Environment under which wildlife protection and management fall, you can well imagine my pleasure to be a part of this exercise.

The launching of this manual brings into focus the words of Kofi Annan, Secretary General of the United Nations in his message at the launching of the Millennium Ecosystem Assessment Synthesis Report, Quote: "Only by understanding the environment and how it works, can we make the necessary decisions to protect it. Only by valuing all our precious natural and human resources can we hope to build a sustainable future". End Quote.

The publication of this manual must be placed in that context of the importance of understanding and valuing, Wildlife Stock Management, Hunting, Development of Rural Wildlife Farming Industry, and Wildlife Research in our twin islands. Or, to put it in another way, understanding the socio-economic contribution of wildlife to the sustainable development of the country.

Over the years, the rich biological diversity of our two islands has been well documented and so too has the challenges that our growing population has imposed on that once pristine natural environment.

The demands that are being made by the population directly on our wildlife resources are by no means a recent phenomenon. The records show that as far back as 1933 the authorities being cognizant of the need to control the activities of hunters in the forests approved Legislation for the management of the Wild life population. You know this as the Conservation of Wildlife Act.

The enactment of the legislation, paved the way for the setting aside of areas of forests for the conservation of wildlife and in 1934, the first Wildlife Game Sanctuaries was established to serve as a refuge for the game animals. Today there are thirteen such sanctuaries strategically located throughout Trinidad and Tobago

While the sanctuaries have provided a refuge for the game animals in the country the present indications are that the populations are under tremendous stress mainly because of the removal of forest vegetation and the concomitant loss of wildlife habitat. As a result the animals are deprived of food, protection and breeding areas, important factors which contribute to their well being and survival.

Over the years Trinidad and Tobago has basically adopted two approaches to wildlife management; the first deals with the protection of individual species and populations; and the second, with the protection of the habitats in which the species live. Inherent in these two approaches are the legal protection for the species; management plans for their protection and ex-situ conservation.

The country has been practicing the former technique through our Legislative Acts and the selection of Wildlife Sanctuaries.

During the past twenty years the Ministry's Wildlife Section has been assisting members of communities throughout the nation in wildlife farming. This programme embraces the concepts of ex-situ conservation and the two hundred and thirty plus (230+) wildlife farmers who are registered with the Wildlife Section reflects the success of this programme.

This manual like its predecessor provides us all, the farmers, the lovers of wildlife, the students and the scientists with the knowledge that is required to ensure good and safe husbandry of the animal in captivity. Through the application of sound and scientific approach to wildlife farming, not only would wild-meat be easily available during the open season, but the conservation objective of releasing excess stock into the forest can be realized.

I wish to recommend this publication to the citizens of our nation and especially the staff at the Wildlife Section, Forestry Division as they continue in their efforts to encourage wildlife farming of the Peccary and other game species.

I take this opportunity to thank the University of the West Indies for inviting me to share my thoughts with you, and to heartily congratulate all who have been involved with this very timely publication. I need hardly remind you, that like you, I am looking forward to the future publications.

I welcome you, I thank you for your attention and I wish you well.

Foreword

According to Genesis, in the Bible, God created earth, water, light, vegetation, the sun, swarms of living creatures in the waters, birds, earth-creatures according to their kinds: cattle, creeping things, and beasts, and man, the last being given dominion over the fish of the sea, birds of the air, and cattle and every creeping thing that creeps upon the earth, as well as all the earth. If this was the beginning then the order of creation is instructive and the responsibility of man (and woman) is awesome.

How have we discharged our dominion over the animals which cohabit the earth with us? A 1958 report stated that, of approximately one hundred and six (106) species or sub-species of world mammals which have become extinct world-wide over the past two thousand (2,000) years, as many as forty-one (41) forms belong to the West Indies (which is part of the Neo-tropics) exclusively. For instance, the edible frog, known as the “mountain chicken”, is no longer found in St Kitts and the Leeward Islands and the edible iguana is extinct in St Kitts-Nevis. Imagine, some Atlantic fish are in jeopardy and some European fishermen are seeking new careers.

Prior to the arrival of Columbus in the New World, the American Indian in the Caribbean lived handsomely and harmoniously off of his domain. Early European settlers in the West Indies lived on “native foods” as well – iguana, turtle, agouti, peccary, etc. Later, the added slave population and monoculture of sugarcane tipped the West Indies into a dependency on imported human (and animal) foods.

A writer has designated Trinidad a “continental island”, with similar fauna to that of the nearby mainland from where caimans, lizards, snakes, fresh water turtles, and capybaras arrive from time to time when the Orinoco floods. Birds fly over. Most of the rest of the West Indies are “ocean islands” with much less fauna. I have not seen data which suggest that wild animals in Trinidad are in jeopardy but we should be alert to their welfare. Forest and hillside fires, illegal logging, cultivation of illegal crops in slashed forested areas, trap guns, and clearing for industrialization encroach on our precious wild cohabitants.

This document has gathered and illustrated valuable information about the collared peccary in particular. The proposal herein for its culture is a responsible one regarding the management of this valuable resource which, incidentally, is not as docile and easily prone to predial larceny as small ruminants and the agouti. In the long term, peccaries of superior qualities can be selected and bred on diets formulated to meet the various physiological requirements in conditions of greater comfort, hygiene, and health to match modern intensive swine production. If and when we arrive at the prospect of export, Trinidad & Tobago is free from the major communicable exotic diseases which hinder trade in livestock and livestock products in many countries, with the peccary.

The educational dimension of this document is not limited to the peccary producer, as the title suggests; it should extend to every local school library. We look forward to the promise, of this excellent endeavour, of similar documents in preparation on other wild animals here, in our domain, which deserve our attention.

Holman E Williams, DVM, M.Sc. (Wisc.), Ph.D. (Edin.), MRCVS
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UWI, St Augustine, Trinidad and Tobago
2004 September 01

TABLE OF CONTENTS

DEDICATION	XI
WELCOME	XIV
FOREWORD	XVII
INTRODUCTION AND HOW TO USE THIS BOOKLET	32
<i>How could you use this booklet?</i>	33
PART 1	35
.....	35
THREATS TO WILDLIFE AND WILDLIFE FARMING IN LATIN AMERICA AND THE CARIBBEAN	35
THREATS TO THE PECCARY AND WILDLIFE IN GENERAL WITH SPECIFIC REFERENCE TO THE NEO-TROPICS [Caribbean, Central and South America]	36
1. Human/Biotic Factors	36
2. Pollution	36
3. Climate Change	36
SUMMARY OF SOLUTIONS FOR THE PRESERVATION AND UTILIZATION OF NEO-TROPICAL WILDLIFE	37
A STRATEGY FOR WILDLIFE UTILIZATION IN LATIN AMERICA AND THE CARIBBEAN	37
A STRATEGY FOR WILDLIFE CONSERVATION IN FRENCH GUIANA	37
THE NORTH AMERICAN APPROACH	38
A STRATEGY FOR TRINIDAD AND TOBAGO [A SMALL ISLAND STATE]	38
THE PROBLEM WITH REGARD TO NEO-TROPICAL WILDLIFE	41
THE SOLUTIONS: THE APPROACH OF THE OPEN SCHOOL OF TROPICAL ANIMAL SCIENCE AND PRODUCTION [OSTAS&P]	44

THE ASSUMPTIONS OF THE OSTAS&P REGARDING NEO-TROPICAL ANIMAL PRODUCTION.....	44
THE PHILOSOPHY OF THE OSTAS&P	44
THE WAY FORWARD BEYOND THE YEAR 2004: HOW SHOULD PEOPLE WHO SUBSCRIBE TO THE OSTAS&P PROCEED	45
THE SUGGESTED APPROACH BY THE OSTAS&P	45
THE RESOLUTION OF THE PROBLEM: TASN	46
THE NEW HORIZONS	46
The Value of Wildlife	47
THE INITIATIVES WITH WILDLIFE FARMING IN FRENCH GUIANA OF THE CHAMBRE D'AGRICULTURE DE LA GUYANE	51
WORK IN BRAZIL WITH PECCARIES	54
THE WORK IN PERU AT IQUITOS IN THE AMAZON	55
COLLABORATIVE WORK ON THE PECCARY IN SOUTH AMERICA.....	55
PART 2	59
ARYANN'S QUESTIONS ABOUT THE PECCARY	59
What type of animal is the Peccary?	60
Where are peccaries found?	60
In what year was the Peccary discovered?	60
Do these animals grow continuously?	60
Does it bite or is it dangerous?.....	60
What is the color of the Peccary?	61
What ways can be used to catch a Peccary?	61
A Peccary can be hand caught ONLY if it is very young (almost newborn). Otherwise they can be caught using robust nets or baited cages with trap gates.	61
Why does it have such a complicated name?	62

How does it make its young and how many does it make?	64
Where does it eat?	66
When does it eat?	66
What does it eat?	66
How does it digest its food?	66
PART 3	68
A SCIENTIFIC REVIEW OF THE PECCARY	68
INTRODUCTION	69
CLASSIFICATION & NAMES	69
Artiodactyla	70
Suiformes	70
Suidae	70
[Pigs]	70
TYPES/ SUB SPECIES	71
DISTRIBUTION	71
APPEARANCE	72
Description.....	72
Pelage	72
Body size	72
ADAPTATION TO AMBIENT TEMPERATURE	73
DIET AND NUTRITION IN GENERAL	74
DIGESTIVE SYSTEM	74
Dentition	74
Oesophagus.....	76
Stomach	76
The rest of the Digestive System	79
NUTRIENT REQUIREMENTS	79
REPRODUCTION.....	81
Males	81
Females	81
Breedin	81

Gestation.....	82
<i>Post-partum Heat [Post partum estrus]</i>	82
Litter Size.....	83
Lactation	83
Weaning	86
HOUSING AND ENCLOSURES	86
BEHAVIOUR	87
RESTRAINT AND HANDLING	88
HEALTH AND DISEASE	89
TRADE STATUS	95
THE CASE FOR A PRODUCTION MODEL	96
Characteristics	97
CONCLUDING COMMENTS AND RECOMMENDTIONS	98
PART 4	99
THE COLLARED PECCARY PRODUCTION MANUAL	99
[A PRACTICAL GUIDE FOR INTENSIVE COLLARED PECCARY PRODUCTION]HOW TO START SETTING UP AN	99
HOW TO START SETTING UP AN	100
INTENSIVE COLLARED PECCARY PRODUCTION SYSTEM	100
Some Considerations before Setting up a Wildlife/ Non-domestic Animal Production Unit	100
The Principles behind setting up an Intensive Animal Production System	101
The Factors Affecting Animal/ Livestock Production	101
Physiological States	102
The effect of the Factors Affecting Animal Production on Wild Animals Reared in Captivity:	103
Intensive Animal Production Systems	103
Intensification	103
Features of intensification	103
The Implications of Intensification on Production	103
The Role of Housing and Equipment under intensive systems of production	104
Approaches to Developing Animal Production Systems/Concepts in Developing Intensive Animal Species Production Modeling	104
Considerations for species production modeling	105

THE OBJECTIVES OF THE PECCARY PRODUCTION SYSTEM	108
THE LIFE CYCLE OF THE PECCARY	108
THE PHYSIOLOGICAL STATES OF THE QUENK/PECCARY	108
PRODUCTION UNITS	109
HERD PROJECTIONS	112
BACKGROUND TO THE PECCARY PRODUCTION MODEL	119
Target Performance Coefficients for the Quenk or Collared Peccary	120
SOME HUSBANDRY PRACTICES AND GUIDELINES	121
[A] Practical Peccary Housing	121
[B] Peccary Restraint in the Farm Situation	121
[C] Practical Peccary Feeding	127
[D] Breeding and Culling Practices	127
[E] Daily Routines	129
[F] Monthly Routines	129
[G] Seasonal Routines	129
[H] Occasional Routines	129
[I] Animal Handling and Restraint	130
PART 5	135
A VISITS TO PECCARY FARMS	135
Collared Peccaries	138
White Lipped Peccaries	138
PHYSICAL DESCRIPTION (<i>ELEMENTS</i>) OF THE ENCLOSURES	138
VISIT TO PECCARY FARM: JOAO (NETO) BATISTA BARRETO (JBB)	141
WELCOME!	159
BACKGROUND:	159
LOCATION AND CLIMATE:	161
APPROXIMATE NUMBER OF ANIMALS FARMED:	161
FARM SIZE:.....	162
FARM ACTIVITIES:	162

ANIMAL HOUSING and ANIMAL: LAND RATIO:	162
FEEDS AND FEEDING:	163
BREEDING:	163
 PART 6	 175
PECCARY UTILIZATION	175
[THE CONVERSION OF PECCARY TO MEAT & PECCARY CUISINE].....	175
6.1 NEO-TROPICAL WILDLIFE CUISINE	176
6.2 THE DEMAND FOR THE MEAT OF THE PECCARY AND OTHER NEO-TROPICAL WILDLIFE [La Viande Gibier/ Carne de Monte/ Wild-meat]	179
6.2.1 <i>Information from a remote area in Brazil</i>	179
SPECIES	179
6.2.2 <i>Information on the Wildlife Industry in Trinidad and Tobago [A Small Twin Island Caribbean State]</i>	180
6.2.2.1 <i>THE METHODOLOGY USED IN DEVELOPING THE MODEL OF THE WILDLIFE INDUSTRY IN TRINIDAD AND TOBAGO</i>	182
6.2.2.2 <i>THE INDUSTRY FINDINGS</i>	183
SEASON	185
SEASON	186
SPECIES SOLD	186
AGOUTI	186
LIZARD	186
6.2.3 <i>Wildlife Utilization by Restaurants in French Guyana</i>	195
6.2.4 <i>Wild Meat Sale and Marketing to the Public</i>	198
6.3 THE CONVERSION OF ANIMALS' MUSCLE TO MEAT	204
Conversion of Animals' Muscle to Meat: The Harvesting of Muscle from Animals	204
<i>Ante Mortem</i> [AM] Inspection	204
Animal Slaughter	204
<i>Post Mortem</i> [PM] Inspection	204

Living muscle tissue	205
The muscle tissue after exsanguinations [bleeding]	205
Effect of pH on meat quality - water-holding	209
6.4 THE CONVERSION OF PECCARY ANIMAL TO MEAT.....	210
6.4.1 Peccary Slaughter and Dressing	210
<i>Animal Carcass Fabrication:</i>	216
6.6 PECCARY CUISINE	217
PART 7	230
SOME COMMENTS ON WHAT RESEARCH STILL NEEDS TO BE DONE WITH THE PECCARY	230
PART 9	237
LITERATURE CONSULTED	237
LITERATURE CONSULTED	238
NOTES:	249

COMMENTS AND SUGGESTIONS FOR THE AUTHORS 250

SECTION FOR REVIEWERS' COMMENTS 251

LIST OF FIGURES

Figure 1	JOAO (NETO) Batista Barreto (JBB) and his favourite Peccasow (female Peccary).....	xi
Figure 2:	Peccary Breeding Colony at the Emperor Valley Zoo in Trinidad and Tobago, W.I.	40
Figure 3:	A conceptual framework for the formation of a Tropical Animal Science Integrated Network (TASIN).....	42
Figure 4:	Soucoumou Experimental Station.....	53
Figure 5:	Integrated Aquaculture, Atipa or Cascadura (<i>Haplosternum littorale</i>) and Muscovy Duck Production at Soucoumou Experimental Station in 2003	53
Figure 6:	Granny Angela, Great Grandma Mildred, Anais Garcia and Aryann Garcia at right.....	59
Figure 7:	Peccary Dentition [Mr. Neto of Bahia, Brazil showing the four canines of his favorite Peccary on his 5 hectare Peccary Farm that contains about 450 animals of all ages and sexes].....	61
Figure 8:	White Lipped Peccary [<i>Tayassu pecari</i>].....	63
Figure 9:	A Peccary Female [Peccasow] suckling its two newborn peccaries [Peccasuckling] [Source: Hugo Galvez].....	64
Figure 10:	A Peccary having a meal whole pumpkins and green bananas at the Emperor Valley Zoo in Trinidad and Tobago.....	66
Figure 11:	Peccaries having a meal of cassava forage and banana pseudostems in French Guiana.....	67
Figure 14:	Normal dentition of the adult collared peccary and system of labelling the individual teeth.....	75
Figure 15:	Collared peccaries in concrete pens in Mausica, Trinidad, Trinidad and Tobago.	87
Figure 16:	Restraint of collared peccaries using hog snare consisting of a small cable inserted in a hollow pipe, with a loop at one end inserted behind the upper canine teeth and pulled taut.....	88
Figure 17:	A collared peccary colony in French Guyana at Neyrant Sawmill.	90
Figure 18:	IBAMA in Amazonas, Brazil.....	100
Figure 19:	Concepts for developing an animal production system for any species.....	107
Figure 20:	The Life Cycle of the Peccary	108
Figure 22:	Six Years Peccary Herd Projections beginning with 8 Peccasows and 2 Peccarams	112
Figure 23:	A conceptual floor plan layout for an intensive Peccary Production unit.....	114
Figure 24:	A Grassed Semi-intensive Production Pen for collared peccaries in Brazil [UESC] using chain linked fencing	115
Figure 25:	A Grassed Semi-intensive Production Pens for collared peccaries in Brazil [UESC] using chain linked fencing	116
Figure 26:	A large dirt collared peccary enclosure in the dry area of Irece Bahia	116
Figure 27:	Aspects of old experimental peccary Housing at Soucoumou in French Guiana.....	117

Figure 28: A Semi -intensive enclosure for peccaries on display at the Emperor Valley Zoo, Trinidad and Tobago	118
Figure 29: Farmer enclosure [Semi-intensive system] in French Guiana.....	118
Figure 30: A Proposed Floor Plan for Unit 1: Breeding Unit [Intensive Group Housing]	119
Figure 31: Practical Peccary water Troughs at Mr. Neto’s Farm in Bahia, Brazil.	122
Figure 32: Details of Peccary Corrals and Chute [Mr. Neto Farm, Bahia, Brazil].....	123
Figure 33: Aspects of Peccary Semi-extensive Enclosures at Monsieur Neyrat in French Guiana [1. Chute; 2. Feeding Area; 3. Fenceline towards the outside; 4. Fenceline towards the inside of the enclosure that consists of a wooded hillside; 5. Mr. Cicero Lallo (the UWI), Mr. Neyrat (Pilot Peccary Farmer in French Guiana) Miss Gail Young (Chambre d’ Agriculture & UWI); 6. Fenceline towards the roadside].....	124
Figure 34: Dimension of a Net [Source: Rengifo Pinedo and Navarro Torres (2002)]..	126
Figure 35: Capture & Restraint with Net [Source; Rengifo Pinedo and Navarro Torres (2002)].....	126
Figure 36: Transportation crates used to transport the peccaries at Monsieur Neyrat in French Guiana.....	130
Figure 37: Wooden Restraining Cage or Crush for the collard peccary [Entrance View]	131
Figure 38: Wooden Restraining Cage or Crush for the collard peccary [Side view]	131
Figure 39: Wooden Restraining Cage or Crush for the collard peccary [Side View with Cage on a Poatform Scale].....	131
Figure 40: Wooden Restraining Cage or Crush for the collared peccary [Closeup Side View].....	131
Figure 41: Plastic ear applied to the right side of a female peccary	132
Figure 42: Injecting a female peccary with a tranquilizer in the restraining crate	132
Figure 43: Tranquilized females recovering in a feeding pen	132
Figure 44: Tranquilized females recovering in a feeding pen	132
Figure 45: Feeding pen opening into the corral and holding area	133
Figure 46: Tranquilized female recovering in a feeding pen	133
Figure 47: View from the holding pen leading to the corral and into the Feeding pen ..	133
Figure 48: Side view of the corral from the Feeding pen into the holding area	133
Figure 49: Plastic Ear tag Applicator and Plastic Ear tag.....	134
Figure 50: Plastic Ear tag Applicator and Plastic Ear tag.....	134
Figure 51: UESC Experimental Farm.....	137
Figure 52: Visitors to UESC Farm.....	137
Figure 53: Net for Peccary Restraint	137
Figure 54: Restraining a Peccary with a Net	137
Figure 55: A Restrained Peccary	137
Figure 56: Handling of a restrained Peccary.....	137
Figure 57: Restraining Crush.....	140
Figure 58: Crush Use	140
Figure 59: Crush All the Way in.....	140
Figure 60: Crush Side View.....	140
Figure 61: Crush Handle.....	140

Figure 62: Crush Overview.....	140
Figure 63: Vote of thanks for the Visit	141
Figure 64: Peccaries feeding along the grain trail on the red earth soil.....	142
Figure 65: Rough Plan of Mr. Barreto’s Peccary Farm, Icere, Bahia, Brazil, July 2003.	143
Figure 66: Wooden fence with electric fencing on the inside.	144
Figure 67: Fencing arrangements showing the red plastic box protecting the electric fencing impulse generator.....	144
Figure 68: Base of a tree being protected by a metal barrel.	145
Figure 69: Shrubs not eaten by the peccaries being used as shading in one of the enclosures.....	145
Figure 70: Peccaries adjacent to the pond.....	146
Figure 71: Older brick water tank and drinking trough that is about 15 cms wide, the young sometimes fall into this trough.....	146
Figure 72: Concerte trough 10cms wide and somewhat high to prevent the young from falling in, the float valve is protected in the background.....	146
Figure 73: Grain stored in barrels within the feeding area.	147
Figure 74: Cactus [rchette] in trailers.....	147
Figure 75: Melons in trailers.....	148
Figure 76: The spacing between the verticals in the creep feeding area is about 12 cm	148
Figure 77: Side view of the creep feeding area.....	148
Figure 78: Front view of the Creep feeding area	149
Figure 79: Hinged main gate.....	149
Figure 80: Guillotine gate with a vertical lever	150
Figure 81: Guillotine gate with a rope and pulley	150
Figure 82: Main Corral	150
Figure 83: Chute	150
Figure 84: End of Chute, Crush and Transport box.....	151
Figure 85: Use of Bamboo in Corral Construction and manual guillotine gate.	151
Figure 86: Top view of crush.....	151
Figure 87: Side view of Crush	151
Figure 88: Front view of crush.....	152
Figure 89: Restraining an animal in the crush	152
Figure 90: Applying an ear tag to an animal restrained within the crush.	152
Figure 91: Guillotine gate entrance.....	153
Figure 92: Swing gate at side of the wooden chute	153
Figure 93: Top view of the chute	153
Figure 94: Guillotine gate at side of the chute.....	153
Figure 95: Wooden Crush area	153
Figure 96: Wooden Crush.....	153
Figure 97: Details of Wooden transport Box	154
Figure 98: Details of the Sliding door of the wooden transport box.	154
Figure 99: Area showing toilet adjacent to the sleeping area	155
Figure 100: Toilet area.....	155
Figure 101: Spreading the grain in trails.....	156
Figure 102: Animals feeding along the trails.....	156

Figure 103: Animals following the farmer at the feeding trails.....	156
Figure 104: Animals eating the melons and distributed grains.....	156
Figure 105: Animals entering the feeding yard	156
Figure 106: Animals feeding freely without any signs of true aggression	156
Figure 107: A 25 year old Peccary Female [Peccasow]	157
Figure 108: Over 50 peccaries feeding in the main feeding area and overnight pen.....	158
Figure 109: Welcome Discussions.....	159
Figure 110: Entrance to ZOOCRIADERO BIOAM.....	160
Figure 111: Entrance to the Farm	161
Figure 112: Entrance to the higher end of the valley where the pens are located	163
Figure 113: View of the pens from one side of the valley	164
Figure 114: View of the pens down in the valley	164
Figure 115: Close up view of two capybara breeding pens with the pond and aquatic plants in the middle of both pens	165
Figure 116: View of the pens down the middle of the valley showing the ponds in the middle	165
Figure 117: View from the lower end of the valley showing the water flowing down through a pipe in the middle of the foreground and flowing into a larger pen with the growing aquatic plants.	166
Figure 118: View of a peccary pen highlighting minimal removal of trees to maintain cover.....	166
Figure 119: View of a peccary pen at the extremity of the clearing highlighting minimal removal of trees to maintain the forest microclimate	167
Figure 120: View downwards into the valley from the pen shown in Figure 119	167
Figure 121: View into the pens from the side noting extensive use of forest raw materials for pen construction	168
Figure 122: A platform on the ridged side of a peccary pen	168
Figure 123: Looking down into the Peccary pen	169
Figure 124: Fresh water conch [<i>Pomacea urceus</i>] being grown in an artificially constructed pond/ dam	169
Figure 125: View of the conch growing chambers made of wire mesh in the artificial pond or dam	170
Figure 126: Side view of the pond or dam head made from an earth embankment and a row of concrete blocks.....	170
Figure 127: An individual grown crate for the river conch	171
Figure 128: Organic Chicken Production	171
Figure 129: Eating facilities of the Eco-tourism Facility with Wooden logs for the stools and five cms thick wooden discs for plates	172
Figure 130: Earth Oven at the Eco-tourism Facility	172
Figure 131: Capybara Growing pen.....	173
Figure 132: Adjacent Capybara Pens.....	173
Figure 133: Small peccary breeding pen containing covered feed troughs and isolation area	174
Figure 134: A Schematic Representation of the Ethnocuisineology Concept.....	177
Figure 135: Madame Remylienne SAIBOU, Kourou, La Guyanne Francaise.....	178
Figure 136: Location of Amazonian Rain Forest Sites censured by Peres (2000)	180

Figure 137: Diagram of the Wildlife Industry in Trinidad and Tobago; EVZ – Emperor Valley Zoo; OTFAPL – Open Tropical Forage Animal Production Laboratory; FD – Forestry Division of the Ministry of Agriculture.....	184
Figure 138: Urban setting for a Wild Meat Que [Bar B Q] in Trinidad	191
Figure 139: Advertisement for a Wild Meat Que [Bar B Q] in an urban area in Trinidad	192
Figure 140: Details of the advertisement for a Wild Meat Que [Bar B Q] in an urban area in Trinidad.....	192
Figure 141: Cooking of Wild Meat Que [Bar B Q] in an urban area in Trinidad	193
Figure 142: The Presentation of Cooked Wild Meat at a Wild Meat Que [Bar B Q] in an urban area in Trinidad.....	193
Figure 143: The served Wild Meat Que [Bar B Q] in an urban area in Trinidad [cooked mixed wild meat stew served with boiled dasheen (<i>Clocasia esculenta</i> (L.) Schott.) and Cassava (<i>Manihot esculenta</i>)]	194
Figure 144: Schematics of the actors in the trade in Neo-tropical Wild Meat in French Guiana.....	196
Figure 145: Cut up Agouti being sold in Persaud’s Supermarket in Rio Claro, Trinidad and Tobago.....	199
Figure 146: Smoked Armadillo [<i>Dasyopus novemcintus</i>] being sold in the Saint Laurent market in French Guyana.....	200
Figure 147: Smoked fresh water fish being sold in the Saint Laurent market in French Guyana	200
Figure 148: Smoked Peccary [<i>P. tajacu</i> or <i>T. tajacu</i>] being sold in the Paramaribo market in Suriname.....	201
Figure 149: Smoked Peccary [<i>P. tajacu</i> or <i>T. tajacu</i>] being sold in the Paramaribo market in Suriname.....	201
Figure 150: Smoked Quenk and Fresh Lappe [<i>Agouti paca</i>] being sold in the market in Paramaribo, Suriname.....	202
Figure 151: Peccary and <i>Agouti paca</i> meat being sold fresh in the Iquitos Market in Peru	202
Figure 152: Smoked Peccary meat being sold in the Iquitos Market in Peru.....	203
Figure 153: The Harvesting of Muscle from Animals.....	206
Figure 154: Relationship between meat tenderness and Aging	207
Figure 155: Factors affecting the quality of a cut of beef.....	208
Figure 156: Mature Peccaram [29kg Liveweight], shot in the head. Note:The long canines and the testicles. 211	211
Figure 157: Mature Peccaram [29kg Liveweight] showing the long canines	211
Figure 158: Mature Peccaram [29kg Liveweight]. Note: The testicles and the Dorsal Scent Gland.....	211
Figure 159: Hot water being thrown on the skin of the Peccaram to facilitate easy hair removal	211
Figure 160: Hair removal by scraping with a knife, note that the Dorsal Sent Gland is kept intact.....	211
Figure 161: After the hair has been scraped off the carcass is washed, precaution must be taken not to scrape the Dorsal gland as this has to be cut out as shown in the next figure.	211

Figure 162: Dorsal Gland cut off [bottom left hand corner of the picture] and evisceration begins	212
Figure 163: Evisceration of the Peccaram carcass	212
Figure 164: Removal of Testicular and Glandular Tissues	212
Figure 165: Removal of Testicular and Glandular tissue	212
Figure 166: The Four Quarters	212
Figure 167: The Four Quarters of the Peccaram Carcass	212
Figure 168: The Left Half of a Peccary Carcass.....	215
Figure 169: The Right Half of a Peccary Carcass.....	215
Figure 170: The Left Leg of a peccary Carcass.....	215
Figure 171: The Disected Sholder of a Peccary Carcass	215
Figure 172: The Ribs of a peccary Carcass	215
Figure 173: The Loin of a Peccary Carcass	215
Figure 174: Mr. Jean Claude Azema and Mrs. Ginette Clermont of “Ma Cuisine” and their guests who are farmers from France [July 2004].	217
Figure 175: Front Entrance of “Ma Cuisine” showing the “Ferme Auberge” certification	218
Figure 176: Front Entrance of “Ma Cuisine” showing the “Ferme Auberge” certification	218
Figure 177: La Carte [The Menu] of “Ma Cuisine”.	219
Figure 178: The Guests of “Ma Cuisine” who are farmers from France.....	220
Figure 179: The Guests of “Ma Cuisine” who are farmers from France.....	220
Figure 180: Cooking Uses of a Fabricated Carcass	221
Figure 181: Fricassee de Peccary et Citrouille [Stewed Peccary and Pumpkin]-Entrée	225
Figure 182: Fricassee de Peccary- Main Meal.....	225
Figure 183: A Semi-domesticated peccary in Brazil receiving a melon from a stranger	231

LIST OF TABLES

Table 1:	Taxonomy of the Collared peccary (<i>Pecari tajacu</i> or <i>Tayassu tajacu</i>).....	70
Table 2:	Common Names of the Collared Peccary	70
Table 3:	Volumes of cecum and different compartments of the stomach of <i>Tayassu tajacu</i> . [Relative volumes are expressed as percentages of total stomach volume.....	77
Table 4:	Reproductive Features of the Collared Peccary (<i>Peccari tajacu</i> or <i>Tayassu tajacu</i>).....	84
Table 5:	Reproductive parameters of the Collared Peccary (<i>Peccari tajacu</i> or <i>Tayassu tajacu</i>), comparing the exploitation of Belem (Brazil) (n=26) and Iquitos (Peru) (n=6).....	85
Table 6:	Reproductive potential of the Collared Peccary based on the information in Table 5	86
Table 7:	Blood and Renal Profiles of Peccaries reared in captivity.....	91
Tale 8:	Haematology of Captive Reared Peccary in Peru.....	92
Table 9:	Parasites present in captive reared <i>Tayassu tajacu</i>	92
Table 10:	Results from the treatment with Ivermectina in <i>Tayassu tajacu</i>	93
Table 11:	Presence of antibodies for Leptospirosis in peccaries reared in captivity in Iquitos Peru	93
Table 12:	Causes of Mortality in <i>Tayassu pecari</i> reared in the Peruvian Amazon	94
Table 13:	The nutritive Value of Peccary meat [as fed basis/ fresh]	95
Table 14:	Growth and Production Parameters for the Collared Peccary,	97
Table 15:	Estimates of Peccary Consumption per year by Low-Income & Rural Populations of the Brazilian Amazon	179
Table 16:	Area of forests in Trinidad and Tobago.....	181
Table 17:	Major Local Game Species hunted in Trinidad and Tobago	182
Table 18:	Wildlife Section, Forestry Division State Game Licences Programme Total Permits Sold, Revenue Collected & Total Number of Hunters During The Period 1989- 2003.....	185
Table 19:	Wildlife Section, Forestry Division State Game Licences Programme Permits Sold by Species during The Period 1989- 2003.....	186
Table 20:	Reported Harvest for Seasons 1990 Through 1995	187
Table 21:	Value [\$TT] of harvest for the Period 1990-1991	187
Table 22:	Value [\$TT] of harvest for the Period 1991-1992	188
Table 23:	Value [\$TT] of harvest for the Period 1992-1993	188
Table 24:	Value [\$TT] of harvest for the Period 1993-1994	189
Table 25:	Value [\$TT] of harvest for the Period 1994-1995	189
Table 26:	Number of Animals Harvested during the hunting seasons from 1999 to 2003.....	190
Table 27:	The Names of the different wholesale cuts of a Quenk/ Peccary Carcass.....	216

INTRODUCTION AND HOW TO USE THIS BOOKLET

The Purpose of this booklet....

This booklet, like the first in this series on the Agouti (Brown-Uddenberg *et al* 2004), has come about because it was realized that there was need for production models for Neotropical Wildlife species. This was required to complement the classroom experience of the UWI course “**AL65B Tropical Zoo and Wildlife Production and Management**” which has been offered since 1996 by the first author with support from Professor Stanley Temple [University of Wisconsin-Madison] and Dr. Howard Nelson [then his Ph.D. student and now the Scientific Advisor to The Asa Wright Nature Centre in Arima, Trinidad, Republic of Trinidad and Tobago]. This course is a Graduate Elective within the “**M.Sc. in Tropical Animal Science and Production**” programme of the Department of Food Production [DFP], Faculty of Science and Agriculture, St Augustine, Trinidad, Republic of Trinidad and Tobago.

Surveys conducted in Trinidad and Tobago suggested that there was interest in rearing the Peccary. In 2000 the database on 115 wildlife farmers in Trinidad revealed this situation. This was again reinforced by the 2004 database of 256 wildlife farmers. However, it should be noted that the National Agricultural Census does not include a category on wildlife farmers. In the classroom it was also realized that students were interested in the Peccary but did not have the type of information needed to develop a predictable production system. Farmers and wildlife lovers have also expressed a need for this type of information. In Trinidad and Tobago the only scientific report seen on the peccary [locally called the Quenk] was that by Amour and Garcia [2001]. However, Sowls (1984, 1997) has produced the most authoritative documents on the Collared Peccary to date. This has therefore provided the foundation upon which we were able to build. It has been complemented by our livestock production research and varied experiences gained from many local wildlife farmers and zookeepers in Trinidad [The Emperor Valley Zoo], Austria [The Salzburg Zoo], The United States, The United Kingdom, Germany [The West Berlin Zoo], Brazil and French Guiana [Station Experimentale de Soucomou of INRA and La Chambre Departementale de l’Agriculture de la Guyane]. The most recent publications on the Collared Peccary originated in Brazil by Nogueira Filoh (1998, 1999) [accompanied by a video in Portuguese on the Collared and White Lipped Peccaries] and Inagaki de Albuquerque *et al* (2004a, b and c) and in Peru by Rengifo Pinedo and Navarro Torres (2002), Galvez *et al* (2004), and Mayor Aparicio (2004) in both Peru and Brazil. These publications were instrumental in getting this document to this stage.

We have also recognized that the “**Multifunctionality of Agriculture**” requires that we not only conduct research and development work on the domestic species, but also expand the work to include those species with potential for domestication, both in regard to conservation and increased food production and food security in Latin America and the Caribbean [the Neo-tropics]. This “**Multifunctionality of Agriculture**” suggests that Agriculture performs the following functions:

1. producing **Public Goods** versus **Private Goods**,
2. producing **Primary Products** versus **Production for Processing**,
3. producing **Food** versus **Non food** items,
4. generating **Material Wealth** versus **Immaterial Wealth**, and
5. producing **Commercial Goods** versus **Non-Commercial Goods** (Hervieu, 2002).

Achieving these functions is particularly important within the **Neo-tropics** where exists more than 25% of the world's mammals, approximately 33% of the world's birds, 19% of the world's reptiles, and 46% of the world's amphibians (Ojasti, 1996). Thus the Neo-tropics is very important from an animal biodiversity standpoint considering that it occupies less than 20% of the world landmass. Overall these wider factors guided La Chambre Departementale d'Agriculture de la Guyane, l'Institute Nationale de la Recherche Agronomique (INRA), the Open Tropical Forage-Animal Production Laboratory (OTF-APL) of the University of the West Indies (UWI) and the Wildlife programme of "La Universidad Estadual do Santa Cruz, Bahia, Brazil" to collaborate in producing this booklet as part of the project:

“Connaissance de la faune sauvage de la Guyane: possibilités de gestion et de domestication [Knowledge of the Wildlife of French Guyana and possibilities for its management and domestication]”.

This collective initiative has begun with the Peccary, and we now welcome on board the contributions of our other collaborators in Peru, Brazil, CIRAD in France, and the Universitat Autònoma de Barcelona in Spain.

This booklet has therefore been written with the following objectives in mind:

1. **to outline the recognized threats to Peccary,**
2. **to be able to quickly answer some of the simple questions on the Peccary, entitled “Aryann’s Questions”, which were the questions that a thirteen [13] year old girl [Aryann Garcia] asked about this animal,**
3. **to provide an up-to-date scientific literature review on the Peccary,**
4. **to provide a framework for an intensive/ semi-extensive production model for the Peccary,**
5. **to share with you the reader the visits made to Peccary farming initiatives in Brazil and Peru and**
6. **to outline processing and utilization of the animal.**

The booklet is therefore organized in a manner that we hope all will enjoy.

How could you use this booklet?

This booklet is divided into the following six (6) sections:

1. Description of threats to wildlife and wildlife farming,
2. Aryann’s Questions on the Peccary,
3. Scientific Literature Review on the Peccary,

4. A Practical Guide or Manual for Peccary Production,
5. A visit to three Peccary Farms (two in Brazil and one in Peru), and
6. The Conversion of Peccary to Meat and Peccary Cuisine.

Aryann's Questions can be used by primary and secondary school teachers to answer any basic questions asked about the Peccary. Part 3 contains some condensed scientific information on the Peccary and can be used as a reference on the Peccary. Part 4 contains relevant information on the setting up of an intensive Peccary production unit and is designed to be a practical production manual. The Part 5 describes visits to three peccary rearing locations in Brazil and Peru and could be used in conjunction with Part 4 for setting up or improving your production system. Finally, Part 6 introduces peccary cuisine. We do hope that you enjoy reading this book as much as we have enjoyed providing the information for you as part of our effort at an international and inter-institutional scientific and developmental collaboration.

Part 1

Threats to Wildlife and Wildlife Farming in Latin America and the Caribbean

THREATS TO THE PECCARY AND WILDLIFE IN GENERAL WITH SPECIFIC REFERENCE TO THE NEO-TROPICS [Caribbean, Central and South America]

The **Peccary** and most other wildlife in the New World [Neo-Tropics] are being threatened or endangered by: Human/ Biotic Factors, Pollution and Micro-Climatic changes. These threats are outlined below:

1. Human/Biotic Factors

As human populations increase so does the need for additional housing settlements. "Towns and suburbs gradually encroach on the natural forests and bush-land areas thereby destroying the natural habitat of the wild animals."¹ The forested areas where these animals make their home, have not only been threatened by the clearing of land for housing construction, but have also been under threat from the building of motorways and access roads which fragment their natural habitat.

In many small-island states the aim of becoming self-sufficient in food has led to more land being devoted to agriculture. New agricultural areas are being rapidly developed in an attempt to supply these countries with food. Additionally, the removal of timber from the forests as well as forest fires have lessened the obstacles to hunters, and has led to further habitat destruction.

Other major causes for the decline in the number of Collared Peccaries are over-hunting and indiscriminate killing. Some hunters disregard the illegality of hunting in the closed season and therefore kill animals that may be potentially fertile or pregnant. This action is fuelled by the willingness of members of the society to purchase wild meat both during and outside of the legal hunting season.

2. Pollution

When the human population disposes of refuse using unsanitary or environmentally hazardous methods, there are negative effects on preservation of all wild animals.

3. Climate Change

Global and regional/local climate changes, both natural and manmade, adversely impinge on the environment and micro-climate of wildlife. Increasing rainfall and rising temperatures impact negatively on both the flora and fauna, thereby reducing food supplies, animal habitat and possibly their reproductive rates and health.

These threats have spawned strategies which are going to be discussed next.

¹ R. Holmes, "Our Duties to Endangered Species", Conservation and Values. (Colorado: Colorado University Press, 1998) 57.

SUMMARY OF SOLUTIONS FOR THE PRESERVATION AND UTILIZATION OF NEO-TROPICAL WILDLIFE

In an effort to halt the decline of the wildlife population in Latin America and the Caribbean four conservation approaches are reviewed below. The first general approach was suggested by Ojasti (1996), and it has nine (9) broad areas. The second approach is that practiced in French Guiana (Richard-Hansen and Hansen, 2002). The third approach is the generalized practice that is being used in North America. The fourth approach has been suggested by Kissoonsingh and Garcia (unpublished) for the Small Island States of the Caribbean. These four approaches are briefly outlined below.

A STRATEGY FOR WILDLIFE UTILIZATION IN LATIN AMERICA AND THE CARIBBEAN

Ojasti (1996), working in Venezuela, proposed a strategy for wildlife management for Latin America [wherein lies the Neo-tropics], based on the following nine [9] elements:

1. TOTAL PROTECTION
2. PROTECTED AREAS
3. SPORT HUNTING
4. CAPTIVE BREEDING
5. EXTENSIVE MANAGEMENT OF COMMERCIAL SPECIES
6. ENVIRONMENTAL EDUCATION
7. RESEARCH
8. WILDLIFE PROTECTION SERVICES
9. OTHER STRATEGIES.

The full details of this strategy can be downloaded from the FAO website, FAO Conservation Guide #25, FAO Rome.

A STRATEGY FOR WILDLIFE CONSERVATION IN FRENCH GUIANA

French Guyana is a unique neo-tropical location. It occupies an area of 91,000 square kilometers and has a population of 191,309 persons (July 2004 estimate). Hunting is still allowed year-round, but animals are categorized into three groups as follows:

- Animals that are **Red** listed and cannot be hunted (**red animals**), these representing the **Fully Protected Species**;
- Animals which can be hunted for personal use only and which are not to be traded, **Hunting permitted but not for trade** and
- **Animals which can be hunted and traded locally (green animals, totally unprotected)**, (Richard-Hansen and Hansen, 2002).

This green list consists of the following of eight (8) species of mammals:

1. Collared Peccary [*Tayassu tajacu*, *Pecari tajacu*]
2. White Lipped Peccary [*Tayassu pecari*]
3. Tapir [*Tapirus terrestris*]
4. Paca [*Agouti paca*]
5. Agouti [*Dasyprocta leporina*]
6. Capybara [*Hydrochaeris hydrochaeris*]
7. Nine-Banded Armadillo [*Dasypus novemcinctus*]
8. Armadillo [*Dasypus kappleri*]

The above species have been reported to account for 73% of all mammalian catch, based on a study on animal biomass harvested in the Brazilian Amazonia. The Collared Peccary accounted for 18.3% of this, representing 27,065 tonnes harvested annually by the low-income rural population (Peres, 2000).

THE NORTH AMERICAN APPROACH

The approach that is adopted in the USA and Canada is based on the "**The Practice of Wildlife Management**". This is defined as **the science/art of manipulating animal and plant populations and their habitats, to achieve specific human objectives.**

This approach has five components that are listed as follows:

- Management of Exploited species (**Game** species)
- Management of Over-abundant species (**Pest** species)
- Management of Rare and Declining species (**Endangered** species conservation)
- Management of Critical habitats/ecological communities (**Nature Parks and Reserves**) and
- Financing Wildlife Management.

The focus in this approach is on Management and Law Enforcement.

A STRATEGY FOR TRINIDAD AND TOBAGO [A SMALL ISLAND STATE]

Kissoonsingh and Garcia (unpublished) have suggested a Strategy for Trinidad and Tobago consisting of the following elements:

1. Enforcement of the existing Land Use Zoning Laws.
2. Enforcement of the Wildlife Conservation Laws with increased penalties.
3. Enactment of new Anti-Pollution laws.
4. Establishment of Wildlife Emergency Relief Centres.
5. Education of the population, and
6. Establishment of Captive Breeding Centres or the Empowering of Farmers to produce wildlife and in particular, the **Peccary** and other desirable wildlife species.

The following is a more in depth explanation of these elements.

1. *Enforcement of the existing Land Use Zoning Laws*

These are enacted laws dictating land use in order to preserve the natural habitat of many species of wildlife. These laws have not always been enforced. Unless the situation improves land use zoning will continue to be problematic and not be of any real benefit to conservation.

2. *Enforcement of Wildlife Conservation Laws*

In some small island states the concept of conservation is incorporated into the wildlife laws for protecting all wildlife against hunting. In Trinidad and Tobago for example the **Peccary** needs special attention because of its threatened status. There are weak law enforcement initiatives, while the monetary rewards from breaking these laws are high. Higher monetary penalties are necessary, accompanied by long terms of penal punishment, for both the lawbreakers and guilty law enforcement officers. In this way it may deter them from continuing the trade out of season.

3. *Enactment of New Anti-Pollution Laws*

The enactment of new pollution laws with an emphasis on the proper disposal of industrial waste, is critically needed in many countries. Meaningful penalties, including permanent closure of the offending industry, could be introduced to deter the indiscriminate dumping of effluent into water sources. Additionally, the burning of waste that causes air pollution would be included in these laws. However, in the legislative process, there is the human element, which too often is easily compromised.

4. *Establishment of Wildlife Emergency Relief Centres*

Wildlife emergency relief centres, once developed, can assist in the protection and rehabilitation of wildlife. These centres could be established in those populated areas near to forests to allow the retrievers easy access. Their services would include a mobile unit to recover wild animals from homes, disaster areas as well as young animals orphaned by hunters. The rehabilitation centre will act as the repository for breeding animals. This solution is costly and the human element poses the threat of compromise.

5. *Education of the Population*

Public education with special emphasis on hunters is an existing program. Unfortunately this has had minimum impact on the general trends. Ignorance by the status quo of the Peccary and other wildlife species, as well as the potential monetary gains associated

with the wildlife trade have rendered the education of commercial hunters invalid. This booklet is an effort towards strengthening this important educational effort.

6. *Establishment of Captive Breeding Centres/Empowering Farmers to Produce Peccary*

The establishment of captive breeding centres where young adults will be housed is the recommendation of choice for several reasons. ***This was recommended by Hislop (1987), a long time ago!!!***

Firstly, this would lend itself to intensive production. Secondly the centres would provide protection and a healthy environment for reproduction. “Predictable reproduction models will allow correct charting and knowledge of the animal’s cycle.”²



Figure 2: Peccary Breeding Colony at the Emperor Valley Zoo in Trinidad and Tobago, W.I.

The centres could be housed at stations that are already established and associated with the conservation, protection and reproduction of wildlife, such as the Emperor Valley Zoo and the OTF-APL [in Trinidad and Tobago]. The trained staff present there will be available to address medical and behavioral concerns. This is the role in conservation that zoos could fulfill. These centres could also act as relief centres for orphaned and traumatized animals, so rehabilitation and restoration of the animals can be handled in a proper manner and under secure conditions. This type of facility will reduce the threat of human compromise as there will be existing security measures at the Zoo.

² C.G.C. Rawlins, “Zoos and Conservation: The Last 20 Years.” Advances in Animal Conservation. (London: Zoological Society of London, 1984) 83.

Additionally all private persons and farmers could be encouraged to produce and manage the Peccary/Quenk commercially, thereby decreasing the dependence on the wild animal populations. The establishment of the first captive breeding centre could be constructed under the umbrella of The OTF-APL and a Zoo. This could become the blueprint for the other centres throughout the country where State institutions exist. These will provide the animals with trained professional health care and security [from attack by hunters through the security mechanisms, already established at the Zoo] comparable to that found at the Zoo. This approach would also assist in integrating wildlife conservation, management, production, utilization and cuisine.

THE PROBLEM WITH REGARD TO NEO-TROPICAL WILDLIFE

The Neo-tropical Wildlife Fauna or Terrestrial non-aquatic wildlife of the Caribbean is the group of animals most at risk of extinction for reasons of ignorance. Little attention is being given to them so there is uncontrolled and unsustainable harvesting and use. In addition there has always been confusion about who is responsible for the terrestrial animal wildlife, sometimes the Forestry Ministry, sometimes the Environmental Ministry, sometimes the Ministry responsible for Fisheries and sometimes the Ministry of Agriculture of the different Caribbean countries.

The Problematique of Neo-tropical Wildlife

The “Problematique’ with respect to Neo-tropical Wildlife revolves essentially around three areas: (1) the contradiction between the Private Sector and Public Sector needs and perspectives, (2) the conflict between the *in situ* and the *ex situ* conservation activists and (3) lack of knowledge of our Neo-tropical Wildlife species. These are now further elaborated on below.

1. The contradiction/competition between the Private vs Public Sector or Governments

Figure 3 presents a view of the world that reflects two polar extremes, from the perspective of the “Private Sector” and the “Governments or the Public Sector”.

2. The Conflict between *In situ* and *Ex situ* Conservation

The world is also shown in Figure 3 to be divided into two vertical hemispheres, “***In situ* Conservation activities**” and “***Ex situ* Conservation activities**”. *In situ* refers to conservation within the animals’ natural or undisturbed habitat, *ex situ* refers to animals being conserved or managed artificially outside of their natural habitats, e.g. Zoos and Wildlife Parks and Reserves. **However, all the scientific and social actors are called upon to service both the *in situ* and *ex situ* activities.**

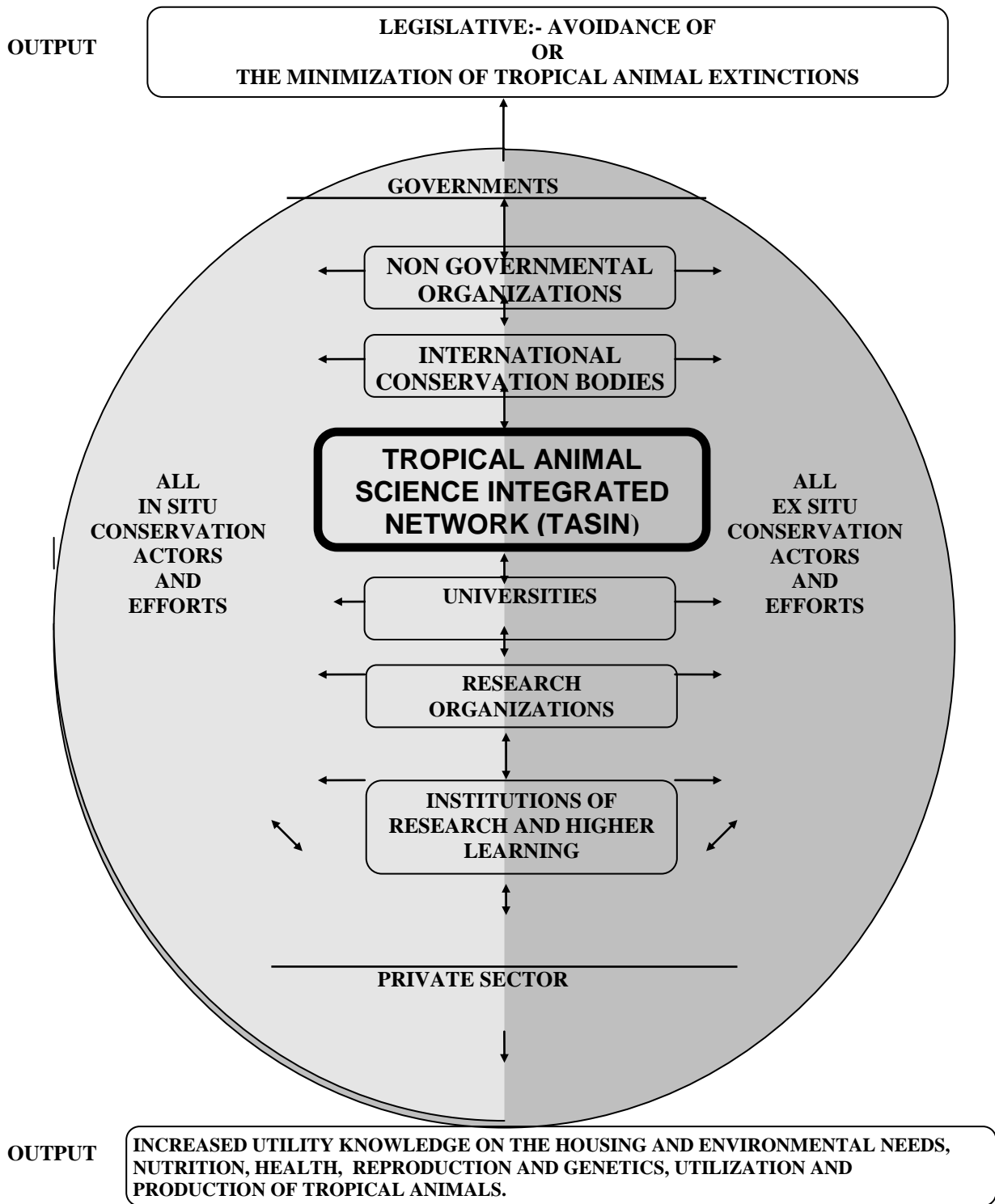


Figure 3: A conceptual framework for the formation of a Tropical Animal Science Integrated Network (TASIN)

3. Lack of Knowledge Knowledge and Education regarding our Neo-tropical wildlife vs Extensive Knowledge of the Domestic Species that have been imported into the Neo-tropics over the last five hundred (500) years

There is little knowledge of the Anatomy, Physiology, Behavior, Nutritional Needs and Husbandry regarding our thirty important Neo-tropical wildlife species. In addition only few scientific studies have been conducted on these species as opposed to the vast scientific literature to be found on the imported [non-neotropical] domestic species of livestock that have been generated by North American, Latin American, Caribbean, European, African, Asian and Australian Universities. In the case of Australia, where there is a vast repository of unique wildlife, research has been conducted through their Departments of Animal Science and Schools of Veterinary Medicine [Anon (1978), Anon (1989), Anon (1990), Anon (1992), Anon (1994a & b)].

The limited understanding of our wildlife by the general public is further reflected by the general lack of an “un biased awareness” of the existence and role within our ecosystems of these species. Additionally the topics of “Zoos and Wildlife” are not included at present in the School Curriculum in the Caribbean, and this topic is only now marginally included in the curriculum of Caribbean and Latin American Universities. What is urgently needed therefore is funding for the basic and applied research on the thirty (30) important Neo-tropical wildlife species as identified by Ojasti (1996). The preparation and delivery of the educational material arising from this research that pin points those species of commercial value would also be useful.

THE SOLUTIONS: THE APPROACH OF THE OPEN SCHOOL OF TROPICAL ANIMAL SCIENCE AND PRODUCTION [OSTAS&P]

THE ASSUMPTIONS OF THE OSTAS&P REGARDING NEO-TROPICAL ANIMAL PRODUCTION

The assumptions are as follows:

- I. the maintenance of Tropical Animal Biodiversity is essential for the well being of humankind on earth;
- II. tropical animals have been selected by nature to be adapted to tropical environments;
- III. there are five (5) factors governing the production of any species of animals or livestock and they are as follows:
 1. Nutritional and Feeding Factors
 2. Breeding, Genetics and Reproductive Factors
 3. Health and Disease Factors
 4. Environmental Factors
 - a) the physical environment (housing) and
 - b) the social environment (other animals) and
 5. Economic and Marketing Factors; and
- IV. all animal species can be produced using a Systems of Production Modeling Approach [Box 1 and Figure 19 in Part 4 of this manual] (Garcia and Archibald, 2001).

THE PHILOSOPHY OF THE OSTAS&P

The elements of the Philosophy are as follows:

1. the concept of the intensification of production is necessary whether *in situ* and / or *ex situ* conservation is practiced;
2. the use of the Systems of Production Modeling Approach has the features as described in Figure # 19 in Part 4 of this booklet;
3. Animal Production should be based to the greatest possible extent on the use of the local and available feed resources;
4. seek to understand the factors affecting animal production for each species being studied; in the case of new species, first attempt an understanding of the anatomy and functioning of the Digestive and Reproductive Systems;
5. “Production Systems” should be intensive in approach and integrated in nature, seek to find complementary animals and plants; and
- 6] “Systems of Production” must encourage plant and animal diversity (Garcia and Archibald, 2001).

THE WAY FORWARD BEYOND THE YEAR 2004: HOW SHOULD PEOPLE WHO SUBSCRIBE TO THE OSTAS&P PROCEED

Intensification for the development of this school of thought

This concept of intensification involves the bringing together of many animals into a single location, or within close proximity to each other with the problems attendant on increasing animal population densities.

Approaches to Developing Intensive Animal Production Systems

A philosophical approach that is being suggested for the development and planning of any system is based on two elements:

1. an understanding of **the factors affecting animal production** as well as
2. an understanding **the physiological states of the animal species in question**.

What must be noted is that there exists an interaction between the above two elements; and this interrelationship will determine the nature of the production system. The reason for this is that at each physiological state, the effect of each factor will be different **OR** the needs of and the threats to the animals' survival will be different.

The reality, however, is that the Tropical Animal Scientists, working in the tropical developing countries [wherein are the repositories of the abundant animal genetic material], do not have the resources [financial and otherwise] to be able to accept the challenge posed. Globalization and its consequent effect of decreasing research support from and for small states, has left them in a state of not looking after their own interest in exploiting their biodiversity and protecting their intellectual property rights. This is because these small states are not making the necessary investment in research into and the conservation of their own natural renewable resources. This is also helping to make this unfortunate situation even worse.

THE SUGGESTED APPROACH BY THE OSTAS&P

This new approach should have the following elements:

- (i) an **increased dialogue** between *in situ* and *ex situ* wildlife conservation efforts (the bringing together of **the different human elements**) ;
- (ii) the intensive production of species with the potential for domestication;
- (iii) the utilization of biotechnology for the conservation of useful genes from within the existing wildlife gene-pool;
- (iv) the expanded research into the anatomy (**digestive** and **reproductive**), health and husbandry of wildlife species;
- (v) the development of an "International Network on Animal Wildlife" [Non-domestic animal] research and development, which would include Zoos, Conservation Parks, Universities , Research Institutions and Private Collections; and

- (vi) using the CGIAR International Plant Genetic Resources Institute (IPGRI) Network Model as the basis for setting up the **Tropical Animal Science Integrated Network** [TASIN] as suggested in Figure 3 (Garcia and Archibald, 2001).

THE RESOLUTION OF THE PROBLEM: TASIN

The resolution being suggested is the initiation of the TASIN network that is directly linked to the New Horizons [Figure #3].

THE NEW HORIZONS

The future horizons for Tropical Animal Science and Production appear to lie in:

1. getting a better understanding of the wide range of under-utilized non domesticated tropical animal resources and
2. creating synergisms from the efforts of the 2300 Zoos world-wide [the *ex situ* conservation and research efforts] and the 4000 plus nature reserves worldwide [the *in situ* conservation efforts].

The integration of these two ideas can be founded on the complementarity of their individual conservation techniques. The complementary activity of the *in situ* and *ex situ* conservation techniques will pose new challenges for **Tropical Animal Science [TAS]**. The major challenges will lie in the intensification of production activities in both the *in situ* and *ex situ* conservation situations. It is for this reason that a **Tropical Animal Science Integrated Network (TASIN)** is being suggested as a component of the **OSTAS&P**. It is envisioned that this network could be funded and function in a manner similar to the International Board for Plant Genetic Resources (IBPGR). The first task of the OSTAS&P therefore would be to get this network going. The nature of the network linkages and the general expected outputs are presented in Figure 3. This would afford a better opportunity for the two conservation camps to interface and have constructive dialogue with all the stakeholders in Tropical Animal Science, [Domestic Livestock (Food, Companion and Laboratory Animals/ animals at different points in the productivity and utility to humanity continuum); Animals on the verge of Domestication; and Wild Animals]. TASIN was first suggested by Garcia (1999).

In order for **TAS** to fully blossom, 'blinkers' would have to be removed; our Eurocentric approach to Animal Science would have to be changed and **greater dialogue between the *in situ* and *ex situ* approaches to animal conservation, management and production must be engaged**. Blaut (1997) has suggested that this "Eurocentric diffusionism" has contributed to the current lack of success and overall development of tropical agriculture and has contributed to the destruction of small holder agriculture in Puerto Rico and the United States Virgin Islands. One should take note of this and avoid it having a negative effect on the future of **TAS** that is still in its infancy. Hence those who subscribe to the thinking of the "**The Open School of Tropical Animal Science and Production [OSTAS&P]**" would agree that there is a need to view **TAS** and

Tropical Livestock Development from a different perspective, if this science is to be advanced. A move possibly from "Dialectical" thinking to "**Trialectical thinking (critical thinking in the light of advancing the humanizing project)**" as was suggested by the late Dr Herb Addo in the last paper he wrote (Addo, 1996).

The new horizon therefore begins with the need for resolving the conflicts among the following:

- **Neo Tropical Wildlife Conservation**
- **Neo Tropical Wildlife Production**
- **Neo Tropical Wildlife Utilization and Cuisine.**

This would require the “Harmonious Coordination and Collaboration” among all stakeholders with a clear unemotional articulation of their respective points of view, **and “The Synergism of Neo-tropical Wildlife Conservation, Production, Utilization and Cuisine”** (Garcia 2004).

NEO-TROPICAL WILDLIFE FARMING INITIATIVES

We would now like to highlight for you the global importance of Wildlife. This is simplified in the following sections.

The Value of Wildlife

Chardonet, des Clers, Fischer, Gerhold, Jori and Lamarque (2002) have categorized the value of wildlife under the following headings:

1. The Economic Importance of Wildlife
 - ❖ Non-consumptive uses
 - ❖ Consumptive Uses
 - Wildlife Products
 - Products from Live Animals
 - Products from Dead Animals
 - Wildlife Farming
 - Wildlife Hunting
 - Subsistence Hunting
 - Commercial Hunting
 - Sport Hunting
 - Wildlife Husbandry
 - Wildlife Ranching
 - Reindeer Herding
 - Game Ranching
2. The Nutritional value of Wildlife
3. The Ecological Role of Wildlife
4. The Socio-cultural significance.

In the USA in 1996 it was estimated that 35.2 million individuals fished, 14 million individuals hunted, 9.5 million individuals hunted and fished, and 62.9 million individuals participated in at least one type of wildlife viewing activity [Chardonnet *et al* (2002) citing Anon (1996)]. They also reported that the total expenditure on all wildlife related activities in 1996 was an estimated US\$101 billion. Records corresponding to these are not very easily available from within Neo-tropical economies. It therefore makes it difficult to make a case to justifying funding for Neo-tropical wildlife research and conservation in these states.

The non-consumptive use of wildlife is associated with viewing wildlife and this generates revenue through money spent on accommodation, transportation, food, equipment and miscellaneous goods used by individuals enjoying wildlife-appreciation activities.

THE REASONS FOR THE CAPTIVE REARING OF ANIMAL WILDLIFE SPECIES

Captive-bred stock will prevent the possible extinction of the indigenous animal wildlife species within a country. In Trinidad and Tobago these animals might include the Agouti (*Dasyprocta leporina*), Lappe (*Agouti paca*), Cocrico (*Ortalis ruficauda*) and the Deer (*Mazama americana*) as these are the species that are some of the most hunted. In Guiana on the South American mainland, however, these animals are plentiful. On the other islands of the Caribbean other useful species but threatened species include the Mountain Chicken (*Leptodactylus fallax*) in Dominica; the Jamaican Rock Iguana (*Cyclura collie*) and the Bahamian and Jamaican Hutia (*Geocapromys brownii*) in Jamaica. These latter two species are in fact on the world list of endangered species. Wildlife Farming would therefore ensure the conservation of gene pool in the wild for future work on the improvement of the captive reared wildlife stock.

The role of wildlife farming

An examination of the literature suggests that wildlife farming has a multipurpose function in society. These functions can be categorized as follows:

- 1. production of food and commercial products;**
- 2. economic opportunities;**
- 3. rural development;**
- 4. recreation and aesthetics;**
- 5. religious activities;**
- 6. biological pest control;**
- 7. integrated farming;**
- 8. education and**
- 9. conservation benefits.**

THE EVOLUTION OF WILDLIFE FARMING IN THE CARIBBEAN AND FRENCH GUYANA

Wildlife farming has been practiced for several years around the Caribbean and Latin America and has taken many revolutionary and evolutionary paths. In this section a short description is provided.

Hislop (undated), defined wildlife farming as the rearing or keeping of (game) animals for the purpose of captive breeding. In Trinidad & Tobago possible candidates for successful farming include the following:

- (i) **-agouti** (*Dasyprocta aguti* now *D. leporina*),
- (ii) **-alligator/spectacled caiman** (*Caiman crocodilus/ C. sclerops*)
- (iii) **-cocrico** (*Ortalis ruficauda*), [this is one of the two national birds of Trinidad and Tobago];
- (iv) **-deer/red brocket deer** (*Mazama americana*),
- (v) **-iguana** (*Iguana iguana*),
- (vi) **-lappet/spotted paca** (*Agouti paca*),
- (vii) **-manicou/black eared opossum** (*Didelphis marsupialis insularis*),
- (viii) **-morocoy** (*Geochelene spp*),
- (ix) **-tattoo/nine banded armadillo** (*Dasypus novemcinctus*), and
- (x) **-wild hog /quenk/ collared peccary** (*Tayassu tajacu, Peccary tajacu*).

Hislop (1987)³ suggested that there appeared to be two categories of wildlife farmers, the hobbyist and the backyard farmer. Dr Carol James reported that captive rearing of wildlife has been practiced in many rural communities in Trinidad & Tobago for several years and has outlined the socio-economic benefits of this (James,1988)⁴. Such rearing was carried out as an underground operation because of the fear of prosecution. In 1986 an FAO expert suggested that there was no legal prohibition against the keeping of game animals in captivity (Asibey, 1986). However, it was cautioned that wildlife farmers should not dispose or trade their animals during the closed hunting season (i.e. April 1st to September 30th annually). More recently international conservation and development organizations have begun to lend support to captive-breeding of wildlife, as a basis for food production. These include the **International Union of Nature and Natural Resources**; the **Smithsonian Institution**; and the **United Nations Food and Agriculture Organization**. Recently, several governments, including that of the Republic of Trinidad & Tobago, have become aware of the importance of wildlife farming as a form of economic activity to be exploited or explored by rural communities. Official approval and encouragement of wildlife farming has led to the discovery of a large pool of active farms. These farms were run mainly as hobby units for recreation and retirement, or as a peasant/subsistence type operation to supplement incomes. With Dr. Asibey's encouraging initiatives in Trinidad and Tobago co-operation among existing farmers was fostered

³ Hislop,G. (1987). Wildlife Farming: Problems and Prospects, Wildlife Section, Ministry of Food Production, Marine Exploitation, Forestry and the Environment. 5pp Mimeograph.

⁴ James , C. (1988). The Socio-Economic Importance of Wildlife Farming in Trinidad and Tobago, Wildlife Section, Forestry Division, Ministry of Food Production, Marine Exploitation, Forestry and the Environment. 8pp Mimeograph.

through the formation in 1984 of the **Wildlife Breeders' and Farmers' Association of Trinidad and Tobago**. This association provided the ideal avenue for co-operation between the Ministry of Food Production Lands and Marine Resources and wildlife farmers.

Rooplal (2004) surveyed wildlife keepers and farmers in Trinidad and Tobago and from a list of 250 registered wildlife farmers [obtained from the Wildlife Section of the Forestry Division of the Ministry of Public Utilities and the Environment]. He reported that 81 were active, fourteen (14) of them never started farming and sixty four (64) of them stopped farming. The results showed that the majority of farmers were from rural districts and the majority of farmers reared the agouti (*Dasyprocta leporina*). The majority of them were also over 50 years of age and had both primary and secondary school education. Most farmers kept these animals for non commercial purposes, but some also kept them for commercial reasons. The majority of them depended on the wild for obtaining animals but some also sourced these animals from captive reared stock. The most important finding was that the wildlife farmers identified three (3) constraints to the expansion of wildlife production in Trinidad and Tobago as follows:

1. **Breeding Animals:** difficulties in obtaining breeding animals
2. **Information:** limited technical and production information on the neo-tropical species and
3. **No Support from the state for Wildlife Production:** a lack of state support for wildlife production.

At present within the Department of Food Production, Faculty of Science and Agriculture at the UWI, St Augustine there exists the **Open Tropical Forage–Animal Production Laboratory [OTF-APL]** where attempts are being made to develop animal production models and systems of production for the following non-domestic animal species:

Rodents:	Agouti Capybara Lappe	<i>(Dasyprocta leporina)</i> <i>(Hydrochoerus hydrochaeris)</i> <i>(Agouti paca)</i>
Reptiles:	Iguana Red tailed Boa Spectacled Caiman	<i>(Iguana iguana)</i> <i>(Boa constrictor constrictor)</i> <i>(Caiman crocodilus/ Caiman sclerops)</i>
Amphibians :	Mountain Chicken	<i>(Leptodactylus fallax)</i>
Marsupials:	Opossum/ Manicou	<i>(Didelphis marsupialis insularis)</i>
Ruminant:	Deer	<i>(Mazama americana)</i>
Avian:	Cocrico Scarlet Ibis Pawi/ Pipile Guam	<i>(Ortalis ruficauda)</i> <i>(Eudocimus ruber)</i> <i>(Pipile pipile pipile)</i>

Suiformes:	Collard Peccary or Quenk	<i>(Pecari tajacu/ Tayassu tajacu)</i>
Felines:	Ocelot	<i>(Felis pardalis/Leopardus pardalis)</i>
Armadillos:	Nine banded Armadillo/ Tattoo	<i>(Dasypus novemcinctus)</i>
Anteaters:	Lesser Anteater/ Tamanduas/ Matapel	<i>(Tamanduas tetradactyla)</i>
Sloths:	Poe me one	<i>(Choloepus didactylus)</i>

Also in Trinidad and Tobago work is ongoing with aquatic species in the Department of Life Sciences, Faculty of Science and Agriculture, The UWI, and at The Institute of Marine Affairs. In the wider Caribbean most Ministries of Agriculture have a Fisheries Division where information on aquatic species can sometimes be obtained.

THE INITIATIVES WITH WILDLIFE FARMING IN FRENCH GUIANA OF THE *CHAMBRE D'AGRICULTURE DE LA GUYANE*

The French Guiana wildlife work began as a response to their farmers continued demands. It has involved several partners. Their initiatives commenced in June 2000 and is embodied in the project entitled:

« Knowledge of the Wildlife of French Guiana: Possibilities for Intensive Production and Domestication »

The Institute Nationale de la Recherche Agronomique [INRA] of the French Republic and la Chambre de l'Agriculture de la Guyane [CAG] had conducted nutritional and reproductive studies on the Collared Peccary at the Experimental Station at Soucoumou in French Guiana [Figures 4 & 5]. In addition, Judas (1999) and Judas and Henry (1999) had conducted Ecological Studies on the collared peccary in the humid Amazonian forest in French Guiana. These studies spanned the decade of the 1990's. This scientific platform created on the Collared Peccary along with the interest expressed by the farmers for rearing this animal precipitated the CAG to request of INRA Antilles-Guyane assistance in developing a production system for the Collared Peccary that could be used by farmers. This led the INRA and la Chambre to the Open Tropical Forage-Animal Production Laboratory [OTF-APL], Department of Food Production, UWI in Trinidad and Tobago and the result was the development of a collaborative project.

This project is divided into two sub-projects- one that is taking place in French Guiana and the other that is taking place in Trinidad and Tobago. There are three main reasons for this initiative and they are as follows:

1. there is consumer demand for “wild meat” that is constantly expanding both in French Guiana and Trinidad and Tobago;
2. there has been a vision of the need to diversify the existing agricultural farms in French Guiana and
3. the agriculture in French Guiana is in the throes of a sustainable development thrust.

These realities have led the CAG to enter into cooperative activities with Trinidad and Tobago and Brazil which seek to obtain concrete results on producers’ farms as well as on the CAG Field Station at Soucoumou near to Kourou in French Guiana.

This project’s objectives include:

1. the placement of experimental peccary production units on selected farms;
2. identifying any limiting factors or knowledge that is limiting Peccary production and domestication;
3. working alongside the farmers in developing the production systems; and
4. working towards the developing of a wildlife production sector.

Expected output objectives:

1. production of a technical-economic booklet on the production system; and
2. studying the technical components involved in the setting up and unfolding of this experimental phase.

The following have been the activities to date:

- a) a technician has been made available to the French Guiana project, thanks to the scientific participation and commitment of the OTF-APL, DFP, Faculty of Science and Agriculture of the University of the West Indies, St. Augustine Campus, Trinidad and Tobago;
- b) contact has been established with workers in Brazil via a visit of the Peccary Project Team from French Guyana and UWI to the wildlife research initiatives at the Universidade Estadual do Santa Cruz, Ilheus, Bahia, Brazil; and
- c) information exchange has been productive to the point where the French Guiana part of the project is physically putting in place the 2nd phase of its semi-extensive production system of collared peccaries with its project farmers.

This phase is due to end in December 2005, while the project is slated to continue studying the setting up of production systems for the Agouti (*Dasyprocta leporina*), the Green Iguana (*Iguana iguana*) and the Capybara (*Hydrochoerus hydrochaeris*). The contents of this booklet are therefore an important contribution to this effort, for its multi-national, multi-lingual, multi-cultural, multi-institutional and multidisciplinary nature.



Figure 4: Soucoumou Experimental Station



Figure 5: Integrated Aquaculture, Atipa or Cascadura (*Haplosternum littorale*) and Muscovy Duck Production at Soucoumou Experimental Station in 2003

THE WORK OF INSTITUTE NATIONALE DE LA RECHERCHE AGRONOMIQUE [INRA-AG] WITH NEO-TROPICAL WILDLIFE

Work by INRA-AG on the collared peccary and on the white lipped peccary involved the captive rearing of these animals in the middle 1990's at the research station at Soucoumou near Kourou (where the European Union Space Station is located) in French Guyana. The focus of the work was aimed at getting a better understanding of the digestion of fibre and concentrate feeds by these two Peccary species. Scientists who had expertise with pig nutrition from the "Station de Recherches Porcines, INRA, St. Gilles" and "Institut Technique du Porc, Le Rheu", France conducted these trials. They found that the Peccaries digested the fibre very well and that the digestive system of these animals functioned more like that of ruminants than mono-gastrics or pigs. A very important feature of this work was the development of restraining cages and metabolism equipment modified from pig experimentation apparatus. The recommendation from this work was that there was the need for further physiological or biochemical data on the digestive capacity of the pancreas, the small and large intestine and the gut microflora. INRA-AG again became involved with work on Neo-tropical Wildlife when in 2000 they were asked for scientific assistance by the CAG for guidance in developing production models for the Collared Peccary and other Neo-tropical species. INRA Centre Antilles-Guyane then engaged the collaboration of the Open Tropical Forage Animal Production Laboratory (OTF-APL) of the University of the West Indies for collaborative support in this area. This book with the multinational authorship is the result of INRA's Antilles-Guyane's critical intervention.

WORK IN BRAZIL WITH PECCARIES

In Brazil there seem to be three (3) focal points for research work on the Collared Peccary. These institutions are as follows:

1. **UNIVERSIDAD ESTADUAL DE SANTA CRUZ,**
Departamento de Ciencias Agrarias e Ambientais, Rod. Ilheus-Itabuna, Km 16
45650-000 Ilheus, Bahia, Brazil.
Professor Sergio Nogueira-Filho and Professora Selene Siqueira Da Chuna Nogueira are the key workers in this area.
They are working with both the Collared and White Lipped Peccary. They also have very active collaboration with Peccary farmers in the state of São Paulo and Bahia. Reference is made to their work in Part 3 of this Book, and we would be visiting their facilities in Part 5 of this Book.
They also have an active M.Sc. Programme with the following title: **Programa de Pos-Graduacao- Zoologia Aplicada**, in which the training is in Neo-tropical Wildlife Species.
2. **EMPRESA BRASILEIRA DE PESQUISA AGROPECUARIA [EMBRAPA]**
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Dr. Rodiney Mauro, Dr. Ubiratan Piovezan and Dr. Jase Carlos Chaves are the workers there.

3] **UNIVERSIDADE FEDERAL DO PARA**

Departamento de Psicologia Experimental

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The workers there are Dr. Natalia Inagaki de Albuquerque (who is the leading worker with the Peccary), Dr. Diva Anelie de Araujo Guimares, Dr. Yvonnick Le Pendu (now at the Universidade Estadual do Santa Cruz), and Dr Viana da Silva. Their published work indicates that they have been working with the Agouti (*Dasyprocta leporina*), Paca (*Agouti paca*), and the Collared Peccary (*Tayassu tajacu*). They have been working towards the developing of “Alternative Systems for the Production of the Peccary for small farmers in Amazonia”.

These three groups of Brazilian workers share the same interest and have been working and publishing together.

THE WORK IN PERU AT IQUITOS IN THE AMAZON

The region of Loreto in Peru is one of the richest areas of animal biodiversity in the world. Here there are many *ex situ* wildlife initiatives (Zoocriaderos), however only two institutions are actively engaged in the production of Peccaries with scientific support. They are the Universidad Nacional Amazonia Peruana (UNAP) and BIOAM.

1] **UNAP-Centro de Cria de Maza y Sajino**

Barrio Florido, Sector Costanera, Rio Nanay, Maynas, Iquitos, Peru.

Snr. Martha Rengifo is the prime mover of this initiative, and she and her colleague have written a very useful and practical book on the Peccary that would be further explained in Part 3 of this book.

2] **Zoocriadero BIOAM (Biodiversidad Amazonica)**

La Empresa Biodiversidad Amazonica SRL

Km 23 Carretara Iquitos-Nauta, Iquitos, Departamento de Loreto, Amazonia, Peru

The principal worker here is Ing. Forestal Carlos Cornejo Arana with support from Dr. Hugo Galvez and others. We shall be visiting this farm in Part 5 of this book.

COLLABORATIVE WORK ON THE PECCARY IN SOUTH AMERICA

A collaborative project exists on the Collared Peccary between European Partners and South American Partners. The title of the project is:

“Development of different production systems for the sustainable exploitation of the collared peccary (*Tayassu tajacu*) in Latin America”.

Project acronym: Pecari. | [Reference: ICA4-CT-2001-10045](#)

Project Web Address: <http://antalya.uab.es/jcastella/index.asp>

Project Aims:

This project has as its main aim the improvement of the performances of Collared Peccary production systems. The main goal of the project is to design proper methods of breeding the collared peccary in such a way that farmers and consumers in Latin America can make use of the species without detrimental effect to the natural ecosystems and to the wild Collared Peccary populations. Two major issues will be addressed:

- **To increase the productivity of intensive farming systems run by small-scale farmers of Peru and Brazil.** In order to achieve this research the following questions are being addressed:
 - (i) What is the basic reproductive biology and proper management requirements for breeding these animals?
 - (ii) How can suitable diets be made from low-cost feed sources?
 - (iii) How to control the health and behavior factors that limit production?

- **To optimise the yield of quasi-natural Collared Peccary ranching systems.** In order to achieve this research the following questions are being addressed:
 - (i) How can sustainable productive harvesting schemes be done?
 - (ii) How to improve the carrying capacity of the Collared Peccary habitats?

Project Coordination:

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- Universitat Autònoma De Barcelona, Spain

- Universidade Estadual Do Santa Cruz, Brazil
- University of Kent At Canterbury, UK
- Universidad Nacional Mayor De San Marcos, Peru
- Universidade Federal Do Para, Brazil
- Museum National D'histoire Naturelle, France
- Centre de Cooperation Internationale en la Recherche Agronomique pour le Developpement [Cirad], France

Project Activities:

1. INCO PECARI PROJECT: First Meeting Programme 9-11th January 2002, CIRAD, Montpellier, Parc Agropolis, France.
2. INCO PECARI Boat Meeting: 21st -25th April 2003, Iquitos, Peru

Recent Project Output:

Doctoral Thesis - Pedro Mayor Aparicio [2004]

Title: "Fisiología reproductiva y desarrollo de métodos diagnósticos del estado reproductivo de la hembra de pécari de collar (*Tayassu tajacu*, Linnaeus 1758) de la Amazonia"

This work has enabled us to get a better understanding of the reproductive potential of the female Peccary within an intensive production framework. This would be further explained in Part 3 of this book.

Part 2

ARYANN'S QUESTIONS ABOUT THE PECCARY



Figure 6: Granny Angela, Great Grandma Mildred, Anais Garcia and Aryann Garcia at right

ARYANN'S QUESTIONS ABOUT THE PECCARY

What type of animal is the Peccary?

The Peccary is a mammal and is an animal that looks like a pig but is not a pig.

Is the Peccary a wild pig?

On the outside peccaries and true pigs look alike and have many similar habits, **but Peccaries are not pigs!!!**. But they both belong to the same Zoological Family called Suidae. Pigs are from the Old World (Europe, Asia and Africa) and Peccaries are native to the New World (Southern USA, Central and South America and the Caribbean).

Where are peccaries found?

The **Peccary** lives in a great variety of locations, from the wet and humid tropical forests of the Caribbean [Trinidad], Central and South America to the deserts [the very dry areas] of Arizona and Texas in the USA and Mexico. It lives as far north as Texas and Arizona, to as far south as northern Argentina and Paraguay. It is an animal that has been able to survive almost anywhere in the **Neo-Tropics**. This is the New World Tropics that Christopher Columbus rediscovered for the Europeans about 500 years ago.

In what year was the Peccary discovered?

The **Peccary** is found naturally from Arizona and Texas in the North, the Caribbean and Central America and all the way down to Brazil and Argentina. It has been around for a very long time and was an important source of meat for the native Indians long before Christopher Columbus came to the New World.

Do these animals grow continuously?

No. These animals grow quickly up to about four months of age. Then between five months and one year of age they grow slowly. The mature body weight is about 20kg. This is the weight at which the females begin to produce young (reproduce). These animals attain a maximum body weight of between 30 to 40 kg. As you see it is a lot lighter than a pig that grows to about 150kg.

Does it bite or is it dangerous?

Yes it is a VERY DANGEROUS animal because it has very sharp teeth. These very sharp teeth are called canines, these are the same type of teeth that dogs have to the front sides of their mouth. Peccaries are not poisonous and if the animal is obtained when quite young it can be tamed if handled and cared for on a daily basis, but it usually recognizes only one person. Figure 7 shows us how their teeth are arranged.



Figure 7: Peccary Dentition [Mr. Neto of Bahia, Brazil showing the four canines of his favorite Peccary on his 5 hectare Peccary Farm that contains about 450 animals of all ages and sexes]

What is the color of the Peccary?

The **Peccary** has the following colors, brownish black, reddish brown, golden brown.

What ways can be used to catch a Peccary?

A **Peccary** can be hand caught **ONLY** if it is very young (almost newborn). Otherwise they can be caught using robust nets or baited cages with trap gates.

Is the Peccary known by other names?

The collared peccary (*P. tajacu* or *T. tajacu*) is known by many names in Latin America and the Caribbean as the table below shows.

Common names of the Collared Peccary

COUNTRY	COMMON NAME
ARGENTINA	Tayasu, taitetu
BRAZIL	Angoro, Cateto, Catete, Caleira-lanca, Canela-ruvia, Chancos de Monte, Porco de Monte, Taitetu, Taicu-canigoara, Tayasu coagara
COLOMBIA	Zaino
ECUADOR East	Hungana, Lomochuchi
ECUADOR North	Tatabra
GUATEMALA	Ak, Citam, Cuyam, Kenken
GUYANAS	Patira
FRENCH GUYANA	Pakira
GUAYCURU	Chancho rosillo
MEXICO	Candangas, Coche de monte, Jabali, Pecari de collar Quitam
PANAMA	Bido, Bidove, Gutarra, Huedar, Pidove, Shtoko
PARAGUAY	Tayasu taitetu, Taitetu
PERU	Ondo, Sajino, Pecari de Collar, Chancho de Monte, Cerdo de Monte, Gnaxnam, Como Mero, Ineeni, Yugkioak, Utsak
PERU N.	Hungana
TRINIDAD & TOBAGO	Quenk, Wild Hog
U.S.A.	Javelina
VENEZUELA	Chacharo, La Baquira de collar

Why does it have so many names?

It has so many common names as it is found in so many countries that speak different languages and dialects and because it is also eaten by so many people.

Why does it have such a complicated name?

The **Peccary**'s scientific name is *Pecari tajacu* or *Tayassu tajacu*. The scientific name of an animal is made up of two main parts and these are the "Genus" and the "Species". Those scientists who are responsible for giving the scientific names to animals [animal taxonomists] would give an animal a Genus and/a Species and/Subspecies. Different animals with the same species name means that they would be able to reproduce if cross-bred and the offspring produced would be fertile. This means that these animals would be able to make other animals like themselves by mating among themselves.

For the **Peccary** the breakdown of the scientific name is as follows:

Genus: *Pecari or Tayassu*
Species: *tajacu*

The reason for using scientific names is so that people all over the world who speak different languages when discussing an animal can all be sure of exactly which type of

animal they are talking about so that there would be no confusion. The scientific name is written either in *italics* (*Pecari tajacu* or *Tayassu tajacu*) or underlined (Pecari tajacu or Tayassu tajacu). The genus begins with a capital letter and the species begins with a common letter.

Does the Peccary resemble any other animals?

The Peccary that we refer to in this book is called the Collared Peccary, and its scientific name is *Pecari tajacu* or *Tayassu tajacu*. But there are two other types of Peccaries and they all resemble each other. They are the White Lipped Peccary [*Tayassu pecari*] and the Chacon Peccary [*Catagonus wagneri*]. Figure 8 is a picture of the White Lipped Peccary. The Chacon Peccary is an **endangered animal** and is presently only found in the wild in Paraguay and Uruguay.



Figure 8: White Lipped Peccary [*Tayassu pecari*]

How does it make its young and how many does it make?



Figure 9: A Peccary Female [Peccasow] suckling its two newborn peccaries [Peccasuckling] [Source: Hugo Galvez]

The Peccary makes its young standing up, and it makes between 1 to 4 young at a time. But normally it makes about 1 or 2 young, twice per year.

Where does it make its nest or where does it live?

Peccaries could be found from sea level to elevations of at least 2,400 meters above sea level. The peccary does not lay eggs and therefore does not make a nest. It produces live young and it lives in a wide range of environments.

What is the life cycle of the Peccary?

The life cycle of the Peccary is very simple. The adults are male [Peccaram] and female [Peccasow] and they make young males and females which grow up to be adult males and females.

Does it get sick?

The Peccary seldom gets sick. Its main health problems are wounds received during fighting, either among adults or between aggressive males and younger animals. In French Guiana a farmer there (Mr. Neyrat) said that he had a male peccary live for 23 years, and that in eight years of rearing a colony of Peccaries he did not encounter any

health or disease problems. Another farmer in Brazil (Mr. Neto) said that he has had a female Peccary (Peccasow) for 25 years.

When it gets sick what could we do?

When the wounds develop all you have to do is to attempt to clean them or to prevent the screw worm flies from laying their eggs in their wounds.

Can this animal be a pet?

No! This animal would not make a good pet for a young child.

Can this animal be used as food?

Most certainly YES!!! That is the reason why it is hunted, even illegally outside of the hunting season.

When is the hunting season?

Different countries have different hunting laws. It all depends on their situation. In Trinidad and Tobago, which is a Small Island State (SIS), the hunting season is from the 1st October to the 28th February of the following year (5 months). However, in French Guiana eight mammalian species can be hunted year round.

What is the meat of the Peccary called?

Aryann's daddy [Dr. Gary Wayne Garcia] indicated that the meat of the peccary is commonly called the Quenk in Trinidad and Tobago and Pakira in French Guiana. But he suggested that a good universal name for this meat could be "Taku" (*Tayassu tajacu*).

Is Peccary a very tidy animal?

It is not an extremely tidy animal but is an animal of habit. It does its numbers in the same location every day in the pen or on the compound.

Where does it sleep?

It tends to sleep in an area close to where it does its numbers.

How does it eat?



Figure 10: A Peccary having a meal whole pumpkins and green bananas at the Emperor Valley Zoo in Trinidad and Tobago

This picture says it all.

Where does it eat?

It eats anywhere that there is food and where it is comfortable.

When does it eat?

In captivity, the animal tends to eat whenever you put a good meal before them.

What does it eat?

It eats almost anything. It can eat grass, vegetables, fruits, tubers, roots of trees, leaves, bananas and banana pseudostems [the banana stem that is fibrous and sticky and unable to be eaten by humans], baked foods, cooked rice and concentrate feeds.

How does it digest its food?

The **Peccary** has a complex stomach like that of ruminants [animals that have four stomachs that can digest fibre]; it also has a functional cecum [equal to our appendix]. However their cecum functions while our appendix does not.



Figure 11: Peccaries having a meal of cassava forage and banana pseudostems in French Guiana

What is a Mommy Quenk/Peccary called?

A “Peccasow”.

What is a Daddy Quenk/Peccary called?

A “Peccaram”.

What is a very young Quenk/Peccary called?

A “Peccasuckling”.

What is a mommy Quenk/Peccary called when she is young?

A “Peccayoungsow”.

What is a daddy Quenk/Peccary called when he is young?

A “Peccayoungram”.

Part 3

A Scientific Review of the Peccary

INTRODUCTION

The use of wildlife (non-domesticated animals) as sources of meat and other animal products is not new (Blankenship *et al* 1990, Payne 1990). Today, wild animals continue to make substantial contributions to the lives of indigenous peoples in many Neo-tropical countries. The abstracts contained in Anon (2004) and Ojasti (1996) reflect this. The concept of captive management of wild species aims at domestication as a means of supplying alternative sources of animal protein to a growing market (Asibey 1986; Carl and Brown 1985). A notable limiting factor, however, in the development of a wild-life-based industry is the sustainability of the animal resource. A major challenge therefore is the ability to provide a large enough population of manageable animals that can sustain an industry. Herein lies a challenge for the animal production scientists, who can certainly contribute to reducing the time frame for providing a viable and sustainable population of the desired species. If they are able to respond positively to the challenge this should result in a definite reduction of the harvesting pressure on wild animal populations. It would also positively affect the conservation efforts on the target species.

This review therefore attempts to highlight what is known about the collared peccary and its domestication. This includes information on its distribution and appearance, diet and nutrition, reproduction, housing, behaviour, handling and restraint, health and disease and socioeconomic factors. The experiences of the scientists and the peccary farmers or keepers who have piloted the research efforts will form the basis of a comprehensive peccary producers' manual that is badly needed at present and is presented in Part 4 of this booklet. Some excellent efforts to this effect have been added to the wildlife literature by Rengifo Pinedo and Navarro Torres (2002) in Spanish from Peru, Inagaki de Albuquerque (2004 a, b and c) and Nogueira-Filoh (1999) in Portuguese from Brazil. The last document is titled "*Criacao de Caititu e Queixada Viciosa*", a booklet of 70 pages, that is accompanied by a VHS video.

CLASSIFICATION & NAMES

The taxonomic order Artiodactyla, the even-toed ungulates, to which the Collared Peccary belongs, includes most of the mammals which have been domesticated by man, or which serve as major sources of animal protein (Table 1). Three families have been identified here:

1. *Camelidae*: Camels and Llamas,
2. *Bovidae*: that includes the Bovines, Ovines and Caprines and
3. *Suidae* including such animals as pigs and hogs, peccaries and hippopotamuses.

Peccaries are unique to the New World (Carl and Brown, 1985) and there are three (3) living species of peccaries:

1. the Collared Peccary (*Pecari tajacu* or *Tayassu tajacu*),
2. the White Lipped Peccary (*T. pecari*) and

3. the Chacon Peccary (*Catagonus wagneri*) which is the largest of the peccaries.

The Chacon Peccary has only been known formally to mammalogy since 1972 and has been considered vulnerable for some time. The Collared Peccary (*P. tajacu* or *T. tajacu*) is also known by many names in Latin America and the Caribbean (Table 2) attesting to its widespread distribution. There are at least 31 other names for the White Lipped Peccary (*T. pecari*), while the Chacon peccary (*C. wagneri*) is known as the Tagua (Sowls 1984, 1997).

Table 1: Taxonomy of the Collared peccary (Pecari tajacu or Tayassu tajacu)

Order	Artiodactyla				
Sub-order	Suiformes			Tylopoda	Ruminantia
Family	Suidae [Pigs]	Tayassuidae [Peccaries]	Hippopotamidae [Hippopotamuses]	Camelidae [Camels Llamas and Alpacas]	Bovidae [Antelope, Cattle, Goats and Sheep]
Genus	<i>Sus spp.</i> <i>Hylocherus</i> <i>spp.</i> <i>Potamo-</i> <i>cherus spp.</i> <i>Babyrousa sp.</i>	<i>Pecari /</i> <i>Tayassu sp.</i> <i>Catagonus sp.</i>	<i>Hippopotamus sp.</i> <i>Choeropsis sp.</i>	<i>Camelus</i> <i>spp.</i> <i>Lamma spp.</i> <i>Vicugna sp.</i>	<i>Bos spp.</i> <i>Capra sp.</i> <i>Ovis sp.</i>

Source: Adapted from Simpson (1984) and Nowak (1991, 1999)

Table 2: Common Names of the Collared Peccary

Country	Common name
ARGENTINA	Tayasu, taitetu
BRAZIL	Angoro, Cateto, Catete, Caleira-lanca, Canela-ruvia, Chancos de Monte, Porco de Monte, Taitetu, Taicu-canigoara, Tayasu coagara
COLOMBIA	Zaino
ECUADOR East	Hungana, Lomochuchi
ECUADOR North	Tatabra
GUATEMALA	Ak, Citam, Cuyam, Kenken
GUIANAS	Patira
FRENCH GUIANA	Pakira
GUAYCURU	Chancho rosillo
MEXICO	Candangas, Coche de monte, Jabali, Pecari de collar Quitam
PANAMA	Bido, Bidove, Gutarra, Huedar, Pidove, Shtoko
PARAGUAY	Tayasu taitetu, Taitetu
PERU	Ondo, Sajino, Pecari de Collar, Chancho de Monte, Cerdo de Monte, Gnaxnam, Como Mero, Ineeni, Yugkioak, Utsak
PERU N.	Hungana
TRINIDAD & TOBAGO	Quenk, Wild Hog
U.S.A.	Javelina
VENEZUELA	Chacharo, La Baquira de collar

Adapted from Sowls (1984) and Rengifo Pinedo and Navarro Torres (2002).

Superficially, peccaries and true pigs (Family *Suidae*) look alike and have many similar habits, but peccaries are not pigs. The most comprehensive texts on peccaries, with emphasis on the Collared Peccary, have been those produced by Sowls (1984) and (1997). Less is known about the White Lipped Peccary and the Chacon Peccary.

TYPES/ SUB SPECIES

Rehgifo Pinedo and Navarro Torres (2002) citing Gongora (2000) indicated that there were fourteen sub-species of the *T. tajacu* and that they were divided into three groups as follows:

1. the Tajacu or South American group that is grey in color with a pale collar and a black dorsal band;
2. the Patira or Black group with individuals with a slightly visible collar and
3. the Angalutas or Central American grey forms.

This information above underscores their widespread distribution throughout the Americas.

DISTRIBUTION

The species *P. tajacu* or *T. tajacu* and *T. pecari* are native to the neo-tropical rainforests. *C. wagneri* is limited to the dry thorn forests of the South American Chaco [Wetzel *et al.* (1975) in Kiltie (1982)]. The ranges of both *Tayassu* species extend further north and south than its native Neo-tropical forests, into drier scrub, semi-desert areas. More specifically this range extends from Texas, Arizona and New Mexico in the north to northern Argentina in the south. The collared peccary inhabits a wide variety of areas, with varying vegetative types including desert scrub, arid woodland, and tropical rainforests (Kiltie 1982, Nowark 1991 and Sowls 1984, 1997). This animal has been able to survive in many climatic conditions. The peccaries in Panama and Costa Rica existed in habitats of both coastal lowlands and at altitudes of 2,480 metres above sea level (Sowls 1984). Peccaries have also been reported to inhabit both coastal forests and brush lands up to an altitude of 1,860 meters above sea level, Sowls 1984 citing Hadley 1950. These coastal forests, including many other vast areas of Central America are dense, humid, tropical forests with no openings or clearings (Sowls 1984). The only Caribbean islands on which the collard peccary has been reported as native are Cozumel [near the coast of Mexico] and Trinidad [which is at its closest point, only twelve (12) kilometres from the South American mainland] [Sowls (1984) citing Joseph (1970), Varona (1973) and Hamblin (1980)]. On the other hand Woodcock (1867) and Ottley (1969/1971) also reported that it was native to the island of Tobago, but today it is now almost extinct in its native habitat there. Woodcock (1867) stated the following:

*“There are wild hogs to be found on the island, and the country abounds with the **pieary**, a sort of hog with short ears and a gland on their back; their grunting noise is loud and peculiar.”*

However, in Tobago, there are some farmers who rear the animals in captivity there with stock coming from Trinidad.

APPEARANCE

Description

The collared peccary is a small ungulate, which resembles a small pig. There are three (3) striking anatomical differences between the peccary and the common pig. Firstly, there is a subcutaneous scent or musk gland on the peccary's rump which is generally covered by the animal's stiff hairs and becomes visible when the hairs are erected as a result of stress or excitement (Anon 1975). Secondly peccaries have no inner dew-claws on the hind legs (Sowls 1984). Thirdly, the upper canines are well developed in the male peccaries and are directed downward (Anon 1975) unlike those of wild suids which are sharply curved and flared (Bissonette 1982).

Pelage

The colours of the individual hairs are generally black, with whitish annulations. The authors of this review have observed peccaries with light brown hairs [Figure 1], but not quite albino type colors within a breeding colony of 15 to 20 peccaries at the Emperor Valley Zoo in Trinidad, West Indies. The collar of whitish hair crosses the hind part of the neck, and extends obliquely upward and backward from the front of the shoulder to the black mane on the back. Seasonal variations in hair lengths occur (Sowls 1984), Figures 12 and 13.



Figure 12: Peccaries at the Soucoumou Station in French Guiana



Figure 13: Peccary showing the large canines

Body size

The head and body of adult peccaries range from 750 mm to about 1,000 mm; the shoulder height is 440 mm to 575mm (Nowak, 1991). Its average body weight of 19.3 kg for boars, and a weight of 14.8 kg and 13.6 kg for sows in Arizona have been reported (Eisenberg 1989). In weight tables presented by Sowls (1984; 1997) there was an

Collared Peccary Farmers Booklet [72] 10/12/2015
Garcia et al [2005]

apparent wide range of weights among adult animals, varying from 11.4 kg to almost 31.8 kg. Weight ranges of 14 kg to 30 kg for the *Tayassu* genus have been reported for animals throughout its range (Nowark, 1991; Kiltie, 1982, and Bissonette, 1982). The wide ranges in adult weights were as a result of the quality and quantity of food the animals were able to obtain (Bissonette, 1982 and Sowls, 1984). Sowls (1984) also suggested that the peccaries from Central and South America were smaller than those from Texas and Arizona, differing from Emmons (1990) who observed that the collared peccaries inhabiting dry open areas were small and gray, while rainforest animals were large and blackish.

The sex of a live specimen cannot be easily distinguished with the exception of the recognition of the scrotum when the males are observed at a close range (Sowls, 1984). He also reported that in captive-reared animals in Arizona, males and females attained adult weights of 16.4 kg to 20.0 kg at about 42 weeks of age. In some instances, when animals are kept on a good quality diet, they continued to grow slowly until about one year of age, attaining a weight of 23.6 kg. This suggested a growth rate of 0.43 kg per week or 62 g per day from birth (1kg) to one year of age.

ADAPTATION TO AMBIENT TEMPERATURE

Reports by Zervanos (1972, 1975), Zervanos and Hadley (1973), and Zervanos and Day (1977) cited by Sowls (1984) supplied data on thermoregulation, water relations and energy requirements under changing environmental conditions. They indicated that daily body temperatures of collared peccaries in Arizona varied from 37.5°C to approximately 49°C during all seasons; skin temperatures always exceeded surrounding air temperatures.

These authors cited by Sowls (1984) found that the pelage had a poor insulative value. Under temperate (cold winter) conditions the longer black winter pelage was advantageous. Their absorption of solar radiation helps to keep the animal warm. Additionally a significantly higher basal metabolic rate during the winter months, helps to compensate for the peccary's poor insulation (Sowls 1984). He further suggested that with the higher winter metabolic rate, food consumption is higher. Zervanos (1972, 1975) cited by Sowls (1984), reported that in the summer period, critical temperatures of 35°C and 29.5°C were the thermoneutral zone for the collared peccary. He also reported that the collared peccary is unable to prevent increased body temperature when exposed to direct summer sun at an air temperature above 30°C, and wind velocity above 60 m/second (Sowls 1984). To deal with high temperatures Sowls (1984) reported that animals were more active between sunset and sunrise (the cooler hours of the night), and bedded down during the heat of the day. To escape the high temperatures, animals seek the shelter of rocks or vegetation (Nowark 1991). Like the domestic pig, peccaries use wallows or at times, dust, to cool themselves (Nowark 1991). Bissonette (1982), on the subject of water conservation, reported that Zervanos and Headly (1973) were able to demonstrate that respiratory evaporation was the main avenue of water loss. However,

peccaries are able to reduce evaporative water loss by 68% and urinary water loss by 93%. This suggests that the peccary has an adaptive physiological mechanism for conserving fluids under stress and is able to survive for periods of up to six (6) days without drinking water (Bissonette 1982).

DIET AND NUTRITION IN GENERAL

The main staples in the Collared Peccary's diet are fruits, underground tubers, rhizomes and bulbs, green grass and green shoots. The well developed snout is used to root out bulbs, roots and tubers. In moist rainforests it's diet includes palm fruits, roots, snakes, grubs and caterpillars, insects and frogs (Sowls, 1984). Judas and Henry (1999) and Judas (1999) reported that the seasonal variation of the home range of the Collared Peccary in the tropical rain forests of French Guiana varied from 157 to 243 hectares, and overlapped greatly in space (46 to 81 hectares), but not time. They also reported that home range sizes were positively correlated with fruit production. During the low fruit season the mean home range was smaller than in the high fruit season. However, Rehgifo Pinedo and Navarro Torres (2002) citing Gongora (2000), reported that peccaries could occupy during their lifetime, a home range from 24 to 800 ha with home ranges of different family groups overlapping .

In reference to the desert areas of Arizona, Bissonette (1982) described the collared peccary as a **generalist herbivore**. In assessing the stomach contents of peccaries inhabiting rainforests, on average, plant reproductive parts constituted most of the finely ground material, followed by vegetative material and then trace amounts of animal material (Kiltie 1981a). Rainforest peccaries are primarily frugivores (Kiltie 1981a). In captivity the related species *T. pecari* was fed twice daily on carrots, yeast, wheat salad, seasonal vegetables and a small quantity of minced meat (Fradrich 1995). At the Emperor Valley Zoo [Trinidad and Tobago], the diet has been similar [but with no meat] for the animals on display for about a decade (Personal Communications from Zoo Keepers). Under these conditions of minimal protein intake, the animals have grown and have continued to reproduce in captivity. These animals have been described as omnivorous (Schmidt 1991).

DIGESTIVE SYSTEM

Dentition

The adult collared peccary has the following adult dental formula: Incisors 2-2/3-3, Canines 1-1/1-1, Premolars 3-3/3-3 and Molars 3-3/3-3, thus making a total of 38 teeth. The permanent dentition of the peccary is determined between 74 to 94 weeks (Kirkpatrick and Sowls, 1962).

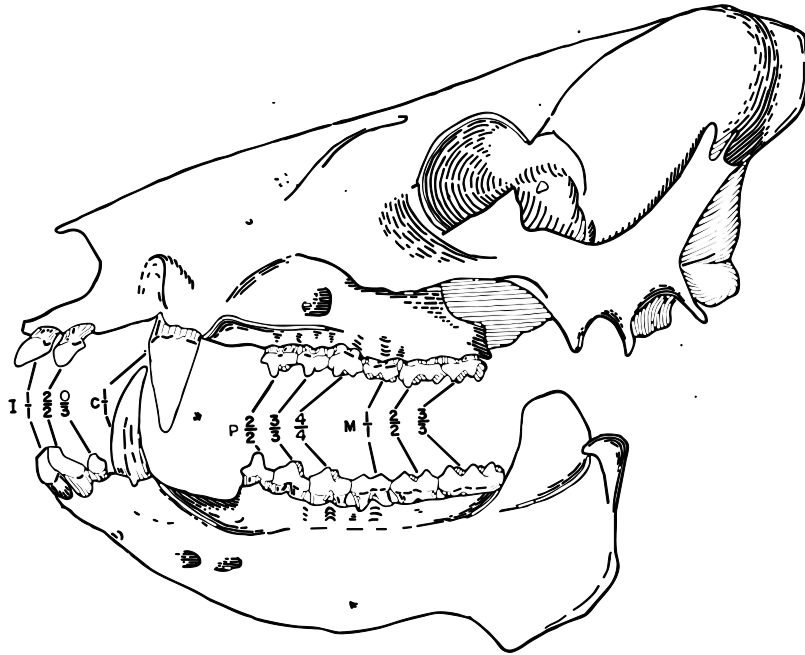


Figure 14: Normal dentition of the adult collared peccary and system of labelling the individual teeth
 [Source: Kirkpatrick and Sowls, 1962]

Dental Formula at Birth

Incisors 0/1: Canines 1/1 : Pre-molars 0/0 : Molars 0/0
 Total Teeth = [2/4] = 6 teeth

Adult Dental Formula

Incisors [I] 2/3: Canines [C] 1/1 : Pre-molars [P] 3/3 : Molars [M] 3/3
 Total Teeth = [18/20] = 38 teeth

At birth the collared peccary has all four temporary canines and the two lower incisors. The temporary incisors then erupt between week 3 and week 13. The temporary pre-molars next erupt between week 3 to week 8.

The permanent canines erupt between weeks 29 to 41 (7 to 10 months) this approximately coinciding with the onset of sexual maturity at 8 to 14 months. The permanent incisors erupt at 42.5 to 72 weeks (10.5 to 18 months). The permanent pre-molars erupt between 66 to 83 weeks (16.5 to 20.8 months). The first molars erupt at between 17 to 23 weeks (4.3 to 5.8 months), the second molars erupt at between 36 to 50

weeks (9 to 12.5 months) and the third molars erupt at between 74 to 94 weeks (18.5 to 26 months).

The collared peccary is one of the few non-carnivorous mammals that possess such large and sharp canine teeth [see Figures 13 & 14]. These pose a problem for domestication. Thus for successful domestication they may possibly have to be removed early in life as is done for domestic pigs. The upper canines are directed straight down while the lower ones straight up (Sowls, 1984 and Eisenberg, 1989) and they rub against each other thus maintaining sharp cutting edges (Eisenberg, 1989 and Kiltie, 1981b). Sowls (1984) suggested that the canines may be of little value for eating. They are modified into tusks but are small (Eisenberg, 1989) growing to a length of 30mm to 35mm (Bissonette, 1982). They, however, seem to be important for:

- (i) use as a defense mechanism against enemies;
- (ii) display during squabbles between herd members;
- (iii) generation of loud, clacking sounds or chatter as warning threats to enemies; and
- (iv) use in intraspecific situations (Sowls 1984 and Kiltie, 1981b).

These long interlocking canine teeth greatly reduce the side ways or grinding chewing motion of the mandible (Sowls, 1984). The only extensive chewing of food that can occur is an up and down movement that crushes the food (Herring, 1972 and Langer, 1979). The incisors of the peccary are well adapted to cropping the vegetation, which is swallowed after a minimum of chewing.

Oesophagus

No information was found on the oesophagus of the peccary.

Stomach

The peccary has a unique digestive system and has been regarded as a pseudo-ruminant in early work by Stewart (1964) cited by Shilvey *et al* (1985). It represents an artiodactyl species with an enlarged fore-stomach, divided into four (4) separate compartments. These compartments were described as a gastric pouch, two blind sacs and a glandular stomach (Langer 1979).

The blind sacs together with the gastric pouch, form the fore-stomach of the collard peccary (Langler, 1979). The fore-stomach volume was reported to be 85% of the total stomach volume (Table 3), which seemed to be less than those in other ruminants; sheep (90%) or cattle (88% or 91%) (Slijper, 1946; Maynard and Loosli, 1969 cited by Langer, 1979). The fore-stomach [functionally differentiated as a 'fermentation vat' anterior to the small intestine] has been suggested to be more efficient than a cecum (Langer, 1979).

Table 3: Volumes of cecum and different compartments of the stomach of *Tayassu tajacu*. [Relative volumes are expressed as percentages of total stomach volume

Compartment	Absolute Volume (cm³)		Relative Volume (%)	
Upper Blindsac	130	985	11.3	85.3
Anterior Blindsac	340		29.4	
Gastric Pouch	515		44.6	
Glandular Stomach	170		14.7	
Total Stomach	1.155		100	
Cecum	200		17.3	

Source: Adapted from Langer (1979)

The fore-stomach [the first three compartments] with a reported pH of 5.0 – 6.2 was found to be capable of sustaining a microbial population (Carl and Brown, 1983). The possibility of ruminant-like digestion in the peccary's large segmented stomach has been suggested by Langer (1979) and Carl and Brown (1983), as there is the presence of a large protozoan population. The animal was also showed to have a low protein requirement when compared to domestic swine and it was found that the digestibility of feeds was more closely related to the mono-gastric swine than that of ruminants (Carl and Brown, 1985 and Shilver *et al* 1985). On the other hand, Commizoli *et al* (1997) concluded from digestibility [involving total tract apparent digestibility (TTAD)] and rate of passage studies, that peccaries functioned more like a ruminant than like a mono-gastric. The peccary's diet, also unlike that of ruminants, consisted of only minor quantities of food, rich in cellulose and lignin, such as grass [Langer, 1979]. In an attempt to show the close relationship of the peccary's digestive system to that of ruminants, features of the peccary's stomach were suggested by Langer (1979) citing Shultz (1976):

- (i) the possession of a fore-stomach of cornified epithelium;
- (ii) anlage (rudiments) of a sulcus ventriculi; and
- (iii) cardiac glands found oral to the fundic glands.

The differences between the peccary's digestive system and that of ruminants that were highlighted as follows:

- (i) the peccary's inability to chew its ingesta as efficiently as ruminants; and
- (ii) neither grasses nor leaves play a major role as a food source.

Moir *et al* (1956, 1965) and Langer (1975) have been cited by Langer (1979) in providing six (6) criteria of ruminant-like digestion. These are now listed as they relate to the stomach of the peccary:

- (1) **Gastric chambers store the digesta and slow its rate of passage through the stomach-:** The fore-stomach of the peccary forms a storage chamber for its food. The folds slow down the rate of passage of food through the stomach (Langer, 1979).
- (2) **Micro-organisms help to digest the food-:** Microbial activity in the stomach which was confirmed by the presence of volatile fatty acids [VFAs] (Carl and Brown, 1983). VFA concentrations have been found to be seven times as high as in the cecum, ten times as high as the concentration in the anterior intestine, but only one-third to a half of those found in the ruminant fore-stomach, Dyson (1969) as cited by Langer (1979). Additionally Sowls (1984) reported that VFA concentrations in the stomach, small intestine and cecum, that were not in total agreement with the above. The stomach had higher levels of VFAs than the cecum, at 105.90 $\mu\text{m}/\text{me}$ and 88.19 $\mu\text{m}/\text{me}$, respectively. The percent molar proportions of the VFAs were showed to be 62.51% and 60.46% acetate and 28.29% and 29.27% propionate in the stomach and cecum, respectively.
- (3) **Microbial fermentation products are absorbed through the stomach wall-:** Both Langer (1979) and Carl and Brown (1983), indicated that the importance of VFAs in the diet was not easily determined. This was based particularly on the vagueness of the level of absorption of VFAs. Langer (1978) cited by Carl and Brown (1983) found no development of papillae in the peccary's fore-stomach. Papillae are common in the rumen and are known to function in VFA absorption [Carl and Brown (1983) citing Church (1979)]. The possibility of trans-epithelial absorption of VFAs therefore exists by virtue of the fact that the thickness of the wall of the peccary's fore-stomach is similar to that of the rumen, reticulum and abomasum of ruminants, Langer (1978) cited by Carl and Brown (1983).
- (4) **The host makes use of vitamins produced by the microbes-:** Vitamin B levels in the diet were found to be low. This led researchers to believe that the levels of Vitamin B were either low, or that they were met by microbial synthesis within the gut [Dyson (1969) cited by Langer (1979)].
- (5) **With the help of microbes, non-protein nitrogen can be used by the host-:** There was no conclusive evidence for the assimilation of non-protein nitrogen, [Dyson (1969) in Langer (1979)].
- (6) **In the young animal a ventricular sulcus is necessary-:** Langer (1979), citing Black and Sharkey (1970), indicated that a ventricular sulcus is found in the adult collared peccary. The structure in the adult appears to enable fine particles and liquids to bypass the fore-stomach.

Generally it was suggested by Langer (1979) that the available data on the physiology of the digestive system of the peccary were inadequate to allow for a proper classification of the animal as a fore-gut fermentor or hind-gut fermentor. But it was felt by Shilvey *et al* (1985) that the digestibility of feeds by peccaries was more closely related to the mono-gastric swine than that of ruminants. However, to the above list of ruminant features, some further points could be added to support its ruminant-like features based on the findings of Commizoli *et al* (1997), which are listed below.

- i. **The total tract apparent digestibility (TTAD) of fibrous constituents was consistently higher in the peccaries-** 62.0% for the Neutral Detergent Fibre (NDF) and 55.7% for the Acid Detergent Fibre (ADF).
- ii. **There was an increase in the mean retention time when animals were fed hay-based diets.**
- iii. **Peccaries reared in a semi-arid environment, can eat large amounts of cactus (*Opuntia lindheimeri*) or agave (*Agave fourerodes*) which contain high levels of fibre; 17.5% and 23.7% Crude Fibre (CF) on a dry matter (DM) basis, respectively, Commizoli *et al* (1997) citing Corn and Warren (1984).**

The rest of the Digestive System

The structure of the liver of the peccary is different from that of pigs, and additionally **the liver of the peccary does not have a gall bladder** (Mac Donald, 1991). Therefore its digestion of fats may be different from that of other mono-gastric animals. There is a dearth of information to be found on the functioning of the small and large intestines, the cecum, rectum and anus of peccaries. Sowls (1984) cited the unpublished work of Stewart (1964) which was a 31 page M.Sc. Thesis from the University of Arizona, Tucson, entitled 'The anatomy of the alimentary tract of the javelina *Tayassu tajacu*'. However, up to press time we were unable to see the contents of this document.

NUTRIENT REQUIREMENTS

True nutrient digestibility (TDN) was 0.96 for adult peccaries (Carl and Brown, 1985). The digestion coefficient was higher than that for white-tailed deer (*Odocoileus virginianus*) fawns at 0.84 and yearlings at 0.89 consuming pelleted feeds [Smith *et al*, 1975; Holter *et al*, 1979, in Carl and Brown, 1985]. There was similarity to the combined value 0.94 for various white-tailed deer and mule deer (*O. hemionus*) fed alfalfa or various browse species [Robbins *et al*, 1974, in Carl and Brown, 1985]. The value found in the peccaries studied, was also higher than that found in Hampshire pigs, 0.76 [Carl and Brown, 1985, citing Armstrong and Mitchell, 1955].

The following three points on the nutrient requirements of the collared peccary has been synthesized from the literature:

1. **An apparent digestibility of 0.305g N/kg^{0.75}/day** was obtained using pelleted commercial feed with increased apparent digestibility as dietary protein content increased (Carl and Brown, 1985). The apparent digestible nitrogen [ADN] value obtained was determined to be intermediate to white-tailed deer [Carl and Brown (1985) citing Robbins *et al* (1974), Smith *et al* (1975) and Holter *et al* (1979)]. In comparison to that of growing pigs, Carl and Brown (1985) citing work by Armstrong and Mitchell (1955) felt that peccaries showed higher ADN values.
2. **The maintenance nitrogen requirement was determined at 0.815gN/kg^{0.75}/day.** This was determined at 6.8% daily CP intake, which was lower than the 10% value for pigs [Armstrong and Mitchell (1955), Lassiter *et al* (1956) in Carl and Brown (1985)].
3. **The peccary's protein maintenance requirement appears to more closely match the relatively low requirement of deer [which are true ruminants], than that of the pig.** The possible implication is that in this instance, the peccary may have a digestive physiology closer to that of ruminants than that of domestic swine (Carl and Brown, 1985). This is supported by the findings of Commizoli *et al* (1997) as their data further suggested that the digestive potential of the peccary for fibre was particularly high. In their work on nutrition levels during pregnancy Lochmiller *et al* (1987) suggested a high quality diet of 165g/kg CP and 3500kcal digestible energy/kg. The mean consumption of dry matter obtained under experimental conditions, in Texas, was 451g DM/day, throughout gestation **and this is equivalent to about 2.3% Live Weight.** This was also supported by Commizoli *et al* (1997). The diet of the peccary during gestation had little effect on the neonate's weight 684 g (\pm) 23g, or on the gestation interval of 143-147 days (Lochmiller *et al* 1987). Poor nutrition (low energy and low protein) did adversely affect the condition of the pregnant female whose body tissue stores were utilized to support the developing foetus. There was also poor development of foetal organs such as the brain, heart, pancreas and paired adrenal organ.

Animals held in captivity as part of research programmes in Arizona, were maintained on hog pellets which contained 16.5 % crude protein, 2% crude fat and 6% crude fibre and with free access to water, were found to breed readily [Sowls (1984) and Le Pendu *et al* (2004)]. In their work on nutrition level during pregnancy, Lochmiller *et al* (1987) citing Gallager (1981) suggested a high quality diet of 16% CP and 3,500 kcal digestible energy/kg. They also reported mean daily digestible energy and protein maintenance requirements for adult peccaries to be 148 kcal/ kg^{0.75} body weight and 523 g/kg^{0.75} body weight, respectively. The suggested mineral and vitamin recommendations followed those of the NRC (1979) for swine as cited by (Lochmiller *et al* 1987). In attempting to determine the energy maintenance requirements of the collared peccary Carl and Brown (1985) found the digestible energy intake per unit body weight to range between 75.8 to

132.6 kcal/kg/day, with no loss of weight. Zeavanos and Hadley (1973) cited by Carl and Brown (1985) reported a summer maintenance requirement of 72.2 kcal/kg/day.

Conclusion on the Collared Peccary's Diet and Digestive Characteristics

The evidence contained in the literature on the digestive system of the peccary suggest that it:

- ◆ is not strictly a foregut fermentor (ruminant-like digestion);
- ◆ is not strictly a hindgut fermentor (pig-like digestion); and
- ◆ may be both a foregut and hindgut fermentor, i.e., it has a **flexible digestive system** which may be an adaptive mechanism so that the best digestion take place based on the types of feed available in the diverse habitats of this animal species.

REPRODUCTION

The collared peccary is the only wild ungulate of the Western Hemisphere with a long breeding season or with a year-round breeding season [Sowls,1984; Schmidt, 1991 and Anon, 1999]. Under favorable conditions in captivity, the collared peccary will breed and reproduce readily all year round (Sowls, 1984, Mayor Aparacia, 2004).

Males

Young males become sexually active at approximately one year and as early as 46-47 weeks [11.5 to 11.8 months]. Sowls (1984) citing Lowe (1970) reported that a decline in sperm production occurs after seven (7) years. However, perm production was found to be sufficient throughout the year for fertilization, allowing the possibility of breeding at all months of the year.

Females

The uterus is described as bicornate and small, Wislocki (1931) as cited by Sowls (1984, 1997). The tubes and ovaries are materially different from those of the domestic sow, with the peccary having a smaller uterus. Where females failed to become pregnant, the estrous cycle was repeated over the entire year [Bissonette, 1982 and Sowls, 1984] which advantages that give the species a very high breeding potential. The estrous cycle of captive animals in Arizona, was estimated to be between 22.6-24.6 days, and estrus varied between 3.5 and 4.8 days (Sowls, 1984). Reports with captive rearing in French Guiana indicated estrous cycle lengths of 23-34 days, with an average estrus duration of 4 ± 2.9 days (Anon, 1999). In Brazil the length of the cycle was reported as 24 days and the duration of estrus was 4 days (Pinheiro *et al* 1997).

Breeding

The age at first breeding approaches one year even in wild populations (Sowls, 1984). In captivity, this could be attained at about eight (8) months (Sowls, 1984), 10-14 months

(Anon 1999), and 8-14 months (Schmidt, 1991). Reporting on Lowe (1970), the earliest observed female copulation for Texas animals occurred at 44 weeks (11 months) of age, the earliest conception occurring at 48- 49 weeks (12 months) when females weighed about 16 kg (Bissonette, 1982). Parturition weight was 23 kg as observed by Sowls, 1984) who viewed the collared peccary as a prolific breeder, citing that captive animals were fecund for up to 14.5 years. This was confirmed from experiences in Brazil [Neto 2003, Personal Communication].

Gestation

In Arizona, an approximate gestation period of 145 days was reported by Sowls (1984). In South America Anon (1975) reported a gestation range of 140-158 days. Lochmiller *et al* (1987) obtained a gestation length ranging from 143-147 days for wild-caught females bred in confinement. Mayor Aparicio (2004) reported a gestation period of 138.3 ± 5.3 days.

The peccary, throughout its range, has shown peak periods of estrus and pregnancy to coincide with the availability of feed (Anon, 1975 and Sowls, 1984). Young born during periods of poor nutrition were found to mate as late as 21.5 months of age. In captive-reared facilities, a female fed a poor diet in the last trimester of pregnancy devoured her young (Sowls 1984). Under a diet of commercial pig feed, however, the same animal successfully reared three normal litters. Lutwak-Mann (1962) cited in Sowls (1984) identified B complex vitamins, ascorbic acid, vitamin E, vitamin A, and essential fatty acids as necessary ingredients in a diet for successful reproduction.

Physiologically in the peccary the nutritional effect on gestation resembles the responses of swine (Lochmiller *et al* 1987). These authors also suggested that moderate nutritional stress during gestation has minimal impact on litter size, litter weight, and foetal development. They obtained an average daily consumption of 451g throughout gestation and noted temperature as affecting daily food intake. Weight reductions were observed in pregnant females when fed diets of crude protein levels of 8.4%. Weight loss was assumed to be due to females using their own tissue proteins and energy reserves to support placental-foetal demand. The poor diet had no influence on litter weight, when only twin litters were considered. The average neonatal weight was 684 ± 23g (SE). An average day-old weight of 623g was reported by Sowls (1984). Carl and Brown (1985) reported a maintenance nitrogen requirement of 0.815 N/kg^{0.75} body weight of adult peccaries. Poor diets, was reported by Lowe (1970) in Lochmiller *et al* (1987) as possibly responsible for greater rates of implantation failures and anestrus occurred when fat reserves were depleted [Lochmiller (1984) cited by Lochmiller *et al* (1987)].

Post-partum Heat [Post partum estrus]

Among captive peccaries, Sowls (1984) found that copulation resulting in pregnancy occurred within 3-17 days after the young were removed. This may suggest the exhibiting of lactational anestrus. Therefore, within an intensive production system it would be necessary to early wean the young. **However, the recent reproductive work**

by Mayor Aparicio (2004) in Bélem (Brazil) and Iquitos (Peru) has definitely demonstrated that the Collared Peccary does not exhibit lactational anoestrus as *post-partum* estrus was observed at 8.6 ± 2.5 days. This was observed with 18 parturitions. In this study, 81.25% of the females demonstrated post partum estrus, with 50% of them being served at this time, and of those mounted 33% of them became pregnant. This all occurred while the animals were lactating.

Litter Size

Most life history accounts of the collared peccary indicated that the common litter size was two (2). Accounts of 4, 5 and 6 foetuses have, however, been reported by Sowls (1984). From research on the reproductive tracts of animals killed and animals in captivity, it was shown that 16% of the females gave single births, 73% twins, 9% triplets and 2% quadruplets (Sowls, 1984). Mayor Aparicio (2004) reported an average litter size of 1.89 ± 0.41 and 1.68 ± 0.49 in Bélem and Iquitos respectively.

Lactation

The female peccary appears to have four pairs of mammary glands- two pairs functional and two pairs non-functional. Their positions are described as follows: one pair inguinal, one pair post abdominal and two pairs pectoral. Only the two posterior pairs are completely functional. Droplets of milk can sometimes be obtained from the pectoral mammae. No galactophores were found in these anterior pairs of mammae, but all other mammae contained from one to four galactophores per nipple (Sowls, 1984). Milk secretion gradually declines in the terminal stage of lactation and an estimate of lactation length was between 6 and 8 weeks. The storage area for milk in the lactating sow is very small and the conformation of the inguinal region during periods of non-lactation is little different from its shape during lactation. The gross composition of the milk of the collared peccary is as follows: 3.1% to 4.0% Fat, 6.7% Lactose, 5.1% to 5.7% Total Protein, and 16.2% to 16.7% Total Solids (Sowls, 1984). The milk of the peccary seems to have a higher content of total solids than that of *Bos*. species cattle.

This review thus suggests the following reproductive target performance coefficients as seen in Table 4.

Mayor Aparicio (2004) have produced two tables on the reproductive parameters of the Peccary. The first one compares the reproductive performances at two locations, Table 5, and the second one is the reproductive potential based on the reproductive parameters measured, Table 6.

Mayor Aparicio (2004) drew five conclusions on the reproductive system and reproduction in the collared peccary and they are listed below:

1. The Wild Collared Peccary female from Northeastern Peruvian Amazon shows different morphometric and structural features in the tunica mucosa of the uterine

- tubes, uterine horns, cervix and vaginal epithelium, and ovary in accordance with the reproductive state of the female.
2. The features of the external genitalia and vaginal cytology are useful indicators of oestrus and the period of sexual receptivity in the female of the collared peccary maintained in captivity in the Eastern Amazon.
 3. Transabdominal ultra sonography is an efficient tool for the early pregnancy diagnosis and prediction of gestational age.
 4. Progesterone and oestradiol-17 β profiles in the pregnant female maintained in captivity in the Eastern Amazon have been monitored.
 5. The lactating female can show an ovulatory and fertile *post-partum* oestrus at the early *post-partum* period [as early as five days *post-partum*].

Table 4: Reproductive Features of the Collared Peccary (*Peccari tajacu* or *Tayassu tajacu*)

Characteristic	Value or Status	Source
Gestation length	138-158 days	Sowls (1984); Bissonette (1982); Lochmiller <i>et al</i> (1987); Anon (1999) ; Mayor Aparicio (2004)
Length of estrous cycle	22.6-34 days	Sowls (1984); Pinheiro <i>et al</i> (1997); Anon (1999)
Duration of estrus	3.4-4.8 days	Sowls (1984); Pinheiro <i>et al</i> (1997); Anon (1999); Mayor Aparicio (2004)
Fertile Lactational estrus	Exists	Mayor Aparicio (2004)
Lactational anestrus	Exists	Sowls (1984); Pinheiro <i>et al</i> (1997)
Weaning to conception	3-17 days	Sowls (1984, 1997)
Sexual Maturity	8-14 months.	Sowls (1984); Schmidt (1991); Anon (1999); Mayor Aparicio (2004)
Litter size	1 – 3	
Litter/ year	2	
Litter Interval	181-195 days	
Birth Weight	\pm 600g	
Lactation period	4 to 42 days	
Weaning age	As early as 4-5 days	Pinheiro <i>et al</i> (1997)

Table 5: Reproductive parameters of the Collared Peccary (*Peccari tajacu* or *Tayassu tajacu*), comparing the exploitation of Belem (Brazil) (n=26) and Iquitos (Peru) (n=6)

Reproductive Parameter	Belem	Iquitos
Age at first parturition (days)	615 ± 290.9	521 ± 84.1
Age at first parturition (months)	20.5 ± 9.7	17.4 ± 2.8
Age at first conception (days)	475 ± 290.9	381 ± 84.1
Age at first conception (months)	15.8 ± 9.7	12.7 ± 2.8
Length of estrus (days)	4.22 ± 1.27	
Length of Gestation (days)	138.3 ± 5.3±	
Off spring per parturition	1.89 ± 0.41	1.68 ± 0.49
Male : Female In the litter	0.46 / 0.54	0.52 / 0.48
Post partum estrus (days post partum)	8.6 ± 2.4	
Parturition Interval (days)	179.2 ± 55.6	227 ± 82.6
Parturition Interval excluding data >200 days (days)	155.2 ± 15.0	176 ± 21.2
Parturition to conception interval (days)	39.3 ± 55.5	87.0 ± 82.6
Parturitions per year (excluding data >200 days parturition interval)	2.35 ± 0.43	2.1 ± 0.2
Annual offspring per female	4.44 ± 1.8	3.34 ± 1.2

Source: Mayor Aparicio (2004)

Table 6: Reproductive potential of the Collared Peccary based on the information in Table 5

Reproductive Parameter	Belem	Iquitos
Age at first conception	241 days/ 8 months	321 days/ 11 months
Age at first parturition	381 days/ 13 months	461 days/ 15 months
Gestation Length	135 days	
Litter Size	2.33	2
Post Partum Estrus (days)	5 days	
Parturition Interval (days)	143 days	154 days
Services per conception	1	1
Parturitions per year (excluding data >200 days parturition interval)	2.55	2.37
Annual offspring per female	5.95	4.34

Source: Mayor Aparicio (2004)

Weaning

Weaning was suggested to be possible at as early as 4-5 days (Pinheiro *et al* 1997).

HOUSING AND ENCLOSURES

Peccaries reared in captivity have been housed under a variety of systems. Under experimental conditions a semi-extensive system was utilized by Lochmiller *et al* (1987). This consisted of an outdoor enclosure 30m x 30m, housing 16 adults ranging in age three years and above. Thus a stocking density of 56m²/head was used. Under intensive conditions, pairs of pregnant females have been housed in covered pens 3m x 2m, stocking density 3m²/head (Lochmiller *et al*, 1987 and NRC, 1991). At the Emperor Valley Zoo (Trinidad and Tobago), peccaries on display are accommodated in an enclosure 30m x 30m. Within this semi-natural environment, the mixed population has, over the years, ranged from 16 to 25 animals with a stocking density of 36m² to 56m²/head (Charles, 1997). At the Berlin Zoo, white-lipped peccaries were housed in an outdoor enclosure of 500m², at a stocking density of 51m²/head (Fradrich, 1995). In Trinidad, Republic of Trinidad and Tobago, a private keeper has been housing peccaries in concrete pens [3 m x 2m], with wire sides 1 m from the floor [see Figure # 15]. In

these pens, 1 male with 3 to 5 females and their offspring have been housed. However, no new animal introductions have been tolerated by any of the groups, so that all breeding groups including the offspring must be always separated from the other groups. This facility contains four (4) such pens, all separated by hinged and swinging gates so that the animals can be moved around. One pen must always be kept empty to facilitate movement. There have been no instances of disease or reproductive problems. The pens were washed daily and animals have been fed on market vegetable waste (Personal Communication James, 2001).

In developing housing facilities, consideration has to be made with respect to the behavior of the species of animal. Particular interest is to be placed on the peccary's high level of socialization and low tolerance for unfamiliar animals of all kinds and humans.



Figure 15: Collared peccaries in concrete pens in Mausica, Trinidad, Trinidad and Tobago.

BEHAVIOUR

Peccaries are a gregarious and highly socialized species, living in groups of sizes ranging from 2-50, but groups of 5-15 are not uncommon (Charles, 1997; Byers and Bekoff, 1981; Nowak, 1991; Ellisor and Harwell, 1969). Males do not compete vigorously for estrus females (Anon, 1975; Charles, 1997; and Nowak, 1991). The level of hostility during mating was observed to be negligible (Charles, 1997).

In free-ranging peccaries the alpha male copulates with most of the estrus females in the herd. Short tending bonds, which may last from a few hours to several days, were observed between the alpha male and estrus females Bissonette (1982) citing Lowe (1970). In penned conditions, females are dominant over males in most situations Bissonette (1982) citing Sows (1974). Though tolerant of other herd members, strange peccaries are never able to join new herds (Bayers and Bekoff, 1981; Pinheiro et al, 1997; James, 2001). Thus high genetic relatedness within groups may occur (Bissonette, 1982). Oldenberg *et al* (1985) and Ellisor and Harwell (1969) referred to some level of interchange of males between herds. The interchange between territorial groups in free ranging herds appears infrequent and association between groups depended on their level of contact and appears to be related to their scent gland (Bissonett, 1982). There was little aggression observed during feeding. Bayers and Bekoff (1981) revealed that there was tolerance between adults and juveniles, who enjoy much liberty up to 5 months.

RESTRAINT AND HANDLING

Peccaries intolerance to unfamiliar members of the same species and humans, and their very large and sharp canines result in these animals being potentially dangerous to handle, and must always be treated with respect and caution. Corral Traps [8 metres wide x 9 metres long] and Aluminum Deer Traps [1.3 metres wide x 3 metres long x 1.3metres high] have been reported on for trapping peccaries in the wild (Neal, 1959). It was suggested that the best time for trapping was during the dry season close to water holes. Animals were restrained by the use of a hog snare [see Figure 16].

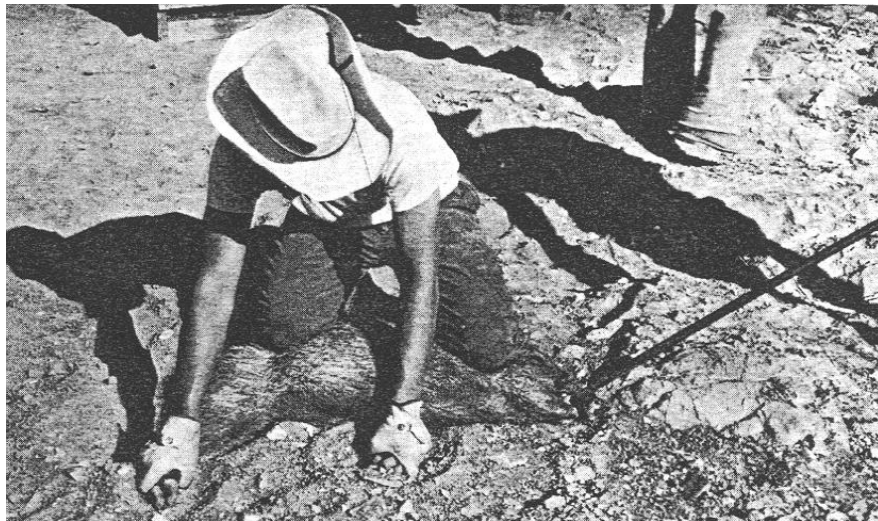


Figure 16: Restraint of collared peccaries using hog snare consisting of a small cable inserted in a hollow pipe, with a loop at one end inserted behind the upper canine teeth and pulled taut.

Source: Neal 1959

Various other methods have been used to handle peccaries in captivity one such chemical method is Nembutal [pentobarbital sodium] 60mg/ml intraperitoneally; another is Surital [thiamylal sodium] 25mg/cc and finally Chloroform [2ml liquid chloroform on a piece of cloth over the animal's nose] were used as anesthetics to sedate collared peccaries (Neal, 1959). With Nembutal the animals became anesthetized within 5 to 95 minutes and remained so for 4 to 27.5 hours; with Surital the animals became anesthetized between 15 to 60 minutes but the duration was unpredictable; and with Chloroform the peccaries became anesthetized within 1 minute and could be handled safely for 5 to 15 minutes. It was concluded that Chloroform was the best means of sedation.

In French Guiana Zoletil 100 [Tiletamine 250 mg and Zolazepam 250 mg] at the recommended dosage of 1.5 ml/15 to 25 kg of the peccary's live weight was used. The animals were tranquilized in about 10 to 15 minutes and took at least six (6) hours to awaken [Personal Experience of Gail Young in 2003 and 2004 and Gary Garcia in 2004].

HEALTH AND DISEASE

Peccaries have been reported by Sowls (1984, 1997) to have a variety of parasites in all their range. These included the sucking louse (*Pecaroeus javalina*), ticks, chiggers, biting lice and fleas. Internal parasites included nematodes, flukes, tapeworms and protozoa. Respiratory diseases occurred in the northern fringe of the range in Texas as a result of the changes in weather and the coming of winter. Digestive tract disorders with severe diarrhoea were observed. The causative organisms were found to be *Salmonella muenchen* and *Escherichia coli*.

Kidney hemorrhaging was also noted in captive animals and was found to be a result of oxalic acid poisoning (Sowls 1984). Two types of eye conditions were noted among both wild and captive peccaries. They are listed below.

- A white exudate, under the eyes of isolated animals or captive old adults, which turned to a crust. This was removed when animals were returned to communal conditions and animals were able to rub their jowls and faces over each other's scent glands.
- An acute eye infection, which results in blindness if not arrested by antibiotics (Sowls, 1984).

Skin diseases were uncommon. Some animals did show parakeratosis with heavy crusting and dry-cracking, horny material on the head and body.

James (personal communication in 2001) found no apparent disease problems with the animals intensively reared on concrete floors which were washed daily.

In French Guiana under the conditions shown in Figure 17 a colony of about 50 peccaries displayed no apparent health problems over an eight-year period [Neyrant Peccary owner Personal communication].

Because peccaries have been associated with true pigs, studies inferring the peccary as a source of infection for the pig have been conducted. The collared peccary was found to be resistant to African Swine Fever and susceptible to Hog Cholera, Rinderpest and two strains of the Vesicular Exanthema Virus of swine. The peccary was found to be less susceptible to Vesicular Stomatitis and not as severely affected by Foot and Mouth disease as the domestic hog (Sowls 1984).

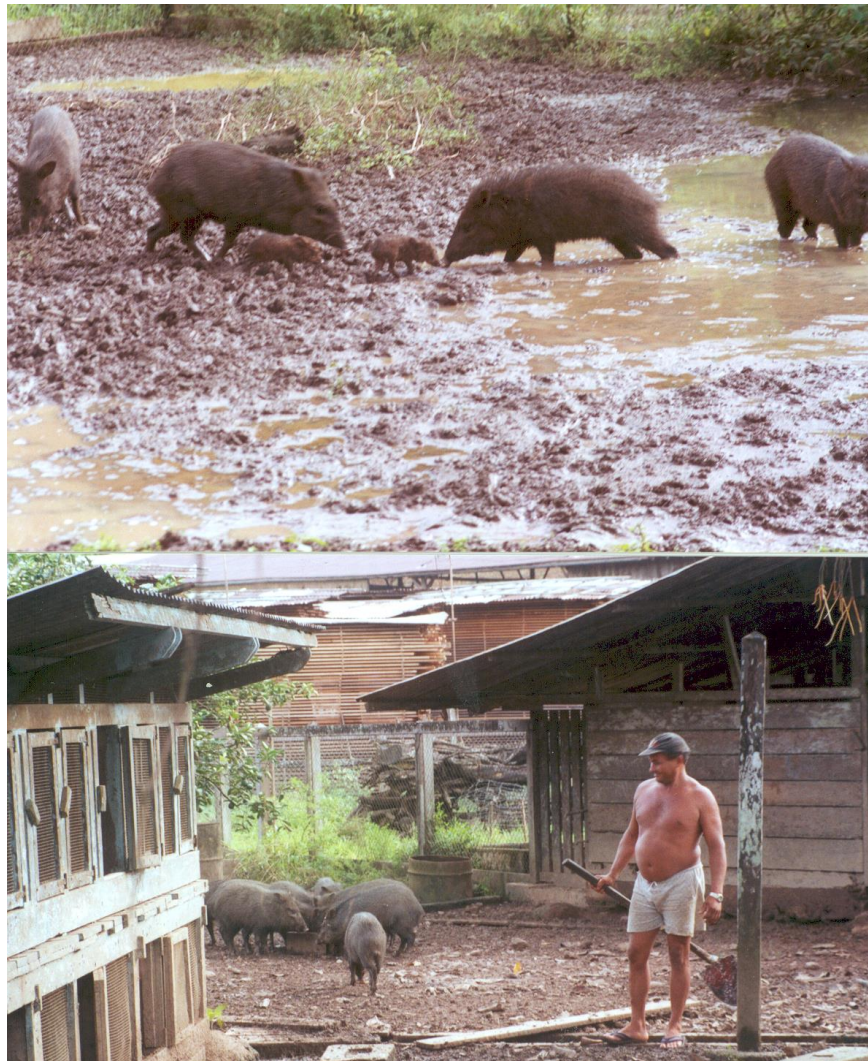


Figure 17: A collared peccary colony in French Guyana at Neyrant Sawmill.

Studies with endo-parasites were reported from Brazil [Coser Junior *et al* (2002)] and from Peru [Gálvez *et al* (2004)]. Coser Junior *et al* (2002) reported on a group of 24

animals reared in captivity made up of 8 weaned animals (60 days), 8 young animals (6 to 10 months) and 8 adult animals (over 11 months of age). The group consisted of equal numbers of males and females. Of the animals studied 87.5% were found to have parasites. All (100%) of the weaned and adult animals had parasites, while 62.5% of the growing animals had parasites. The frequency (% of the total number of animals infected) of the parasite species encountered were as follows: *Blantidium coli* 70.8%, *Entamoeba histolyca* 33.3%, *Ascaris suum* 8.3%. It was concluded that endo-parasites occurred in all physiological stages of collared peccaries reared in captivity, and that it was necessary to improve the sanitation protocol.

In the study by Gálvez *et al* (2004) 27 adults were monitored over two years. They monitored the animals for blood parameters [haematological composition] and the presence of Leptospirosis antibodies. In 100% of the cases positive results were obtained for presence of antibodies for Leptospirosis. In addition weekly faecal monitoring was done and they identified the presence of *Strongyloides sp.*, *Ascaris sp.*, *Strongylus sp.*, and *Balantidium coli*. Tables 7 and 8 presents the blood profiles reported.

Table 7: Blood and Renal Profiles of Peccaries reared in captivity

Blood Parameters	Mean	Range
Total Proteins (g/dl)	8.5	7.1-10.9
Albumin (g/dl)	4.4	3.2-5.6
Bilirubin Direct (mg/dl)	0.2	0.0-0.5
Total Bilirubin (mg/dl)	0.7	0.2-1.3
Cholesterol (mg/dl)	93.2	59.2-150.8
Alanine Amino Transferase (IU/l)	26.5	12-54
Asparate Amino Transferase (IU/l)	15.9	5-34
Fosfatasa Alcalina (IU/l)	27.5	7.8-62.1
Urea (mg/dl)	58.1	39.0-81.0
Creatinine (Serum) (mg/dl)	2.2	1.4-3.3

Source: Galvez *et al* (2004)

A parasite control programme was instituted using Ivermectina [T1, T2 and T3] and Doramectina 1% [T4, T5, T6] in doses of 1 ml, 0.75 ml and 0.5 ml per animal respectively. The results showed a reduction in the parasite load due to treatments as shown in Tables 10 and 11. Good parasite control was therefore obtained for up to sixty (6) days.

Tale 8: Haematology of Captive Reared Peccary in Peru

Parameters	<i>Tayassu tajacu</i>	
	Average	Range
Erythrocytes (x 10 ⁶ /mm ³)	8.46	9.24-12.35
Leukocytes (x 10 ³ /mm ³)	11.39	8.00-15.2
Hematocrit (PCV) (%)	44.4	43-52
Haemoglobin (g/100ml)	16.3	15.7-19.3
Esinophils (%)	10.5	7.14
Basophils (%)	0	0
Lymphocytes (%)	57.5	48-69
Monocytes (%)	0	0
Neutrophils Banded (%)	0	0
Neutrophils Segmented (%)	31.88	21-40
MCV (fl)	53.01	
MCM (pg)	19.4	
MCMC (g/dl)	36.56	

Source: Galvez *et al* (2004)

Table 9: Parasites present in captive reared *Tayassu tajacu*

Single Infection (22.2%)	<i>Ascaris sp</i> 0%	<i>Strongyloides sp</i> 11%	Protozoos flagelados 11%
Mixed Infection (77.8%)	Protozoos + <i>Strongyloides</i> 44.6%	Protozoos + <i>Ascaris</i> 22.4%	<i>Ascaris</i> + <i>Strongyloides</i> 11%
Negatives	0%		

Source: Galvez *et al* (2004)

Table 10: Results from the treatment with Ivermectina in *Tayassu tajacu*

Sampling Periods	24-72 hours		15 days		30 days		60 days	
	1st sampling		2nd sampling		3rd sampling		4th sampling	
Treatment	Pos (%)	Neg (%)	Pos (%)	Neg (%)	Pos (%)	Neg (%)	Pos (%)	Neg (%)
T1(1ml/animal)	75	25	0	100	0	100	0	100
T2(0.75 ml/animal)	25	50	0	100	0	100	0	100
T3(0.5 ml/animal)	75	25	0	100	0	100	0	100

Treatment	1st sampling		2nd sampling		3rd sampling		4th sampling	
	Pos (%)	Neg (%)	Pos (%)	Neg (%)	Pos (%)	Neg (%)	Pos (%)	Neg (%)
T4	0	100	0	100	0	100	0	100
T5	0	100	0	100	0	100	0	100
T6	75	25	50	50	25	75	25	75

Source: Galvez *et al* (2004)

Table 11 presents the data of the presence of antibodies for leptospirosis in collared peccaries reared in captivity in Iquito in Peru. Table 12 presents the causes of mortality in peccaries reared in this same location.

Table 11: Presence of antibodies for Leptospirosis in peccaries reared in captivity in Iquitos Peru

Sereotypes of <i>Leptospira interrogans</i>	Presence(%)
<i>autumnales</i>	11.1
<i>Bataviae</i>	11.1
<i>Borinacana</i>	25.9
<i>icterohemorragica</i>	7.4
<i>Tarasovi</i>	14.8
<i>bratislava</i>	25.9
<i>ballum S102</i>	7.4
<i>copenhageni</i>	3.7
	100

Source: Galvez *et al* (2004)

Table 12: Causes of Mortality in *Tayassu pecari* reared in the Peruvian Amazon

Physiological State	Sex	Cause
Subadult	F	Miasis in the Oral Cavity
Growing	M	Esophagitis
Subadult	F	Hypovolaemic shock
Adult	M	Malnutrition, Secondary Pneumonia
Growing	F	Multiple trauma
Adult	F	Intestinal obstruction, Endotoxaemia
Growing	F	Multiple Trauma

Surce: Galvez *et al* (2004)

UTILIZATION AND SOCIO-ECONOMIC FACTORS

CITES Status

Exploitation of the collared peccary for the international market has resulted in this animal being scheduled as an Appendix II species under the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) (Emmons 1990).

The meat is sold in Peru and Suriname in the fresh, salted and smoked [Rengifo Pinedo and Navarro Torres (2002), Galvez *et al* (1999) and personal observations by Gary Garcia]. Table 13 presents the chemical composition of peccary and other meats. What is most noteworthy is the low fat or ether extract content of peccary meat.

Table 13: The nutritive Value of Peccary meat [as fed basis/ fresh]

Animal	% Crude Protein	% Ether Extract	%Ca	% P
Sajino/ Peccary/Quenk/Javelina (<i>P. tajacu</i> , <i>T. tajacu</i>)	20.9	1.24		
Majaz (<i>Agouti paca</i>) Deer/ Venado (<i>Mazama americana</i>) Yellow foot tortoise (<i>Geochelone denticulaa</i>)	19.6	7.53		
Cuy / Guinea pig (<i>Cavia porcellus</i>)	19.0 to 24.4	1.6	0.29	
Rabbit	20.4	2.0-8.0	0.18-0.28	
Iguana (<i>Iguana iguana</i>)	24.4	0.9	0.25	
Pollo/ Chicken (<i>Gallus domesticus</i>)	16.0 to 21.6	2.4 to 31.5	0.01 – 0.23	
Cerdo/ Pork (<i>Sus scrofa</i>)	9.1 to 17.5	13.2 to 57.0	0.06 to 0.13	
Vacuna/ Cattle (<i>B. Taurus, B. indicus</i>)	13.7 to 21.4	2.4 to 41.4	0.04 to .16	
Ovino/ Mutton (<i>Ovis aries</i>) Cabra/ Goat (<i>Capra hircus</i>)	13.0 to 19.0	0.9 to 39.8	0.05 to 0.1	
Fish (Sardines)	19.0	8.5	0.03	0.21
Agouti (<i>Dasyprocta leporina</i>)	22.2	2.0	0.19	

Source: Galvez *et al* (1999), Rengifo Pinedo and Navarro Torres (2002), Ensminger, Oldfield and Heinemann (1990), CFNI (1974), Chang Yen, Kistow, Deonarayan and Garcia 2005 (Unpublished).

TRADE STATUS

Peccaries are useful for their meat, for sport hunting and hides. In fact these hides produce some of the finest leather. Redford and Robinson (1991) reported on the international trade in peccary hide, citing Broad (1984) and Huidberg-Hansen (1970e) who indicated that the collared peccary leather trade in Europe and Japan involved as many as 2,013,006 skins per year. A German importer trading with Paraguay made an annual purchase of 36,000 hides. From Argentina between the period 1976 to 1979, some 172,371 pelts, to the value of US \$1.025 million, were traded. The Mexican wild animal trade valued a collared peccary hide at US \$5. In the northern limits of its range, the species is gaining status as a big game species, here habitat preservation is a priority (Sowls 1984). In Trinidad and Tobago the collared peccary serves basically as an

indigenous source of meat, a delicacy that was sold at an average of US \$10/kg (Asieby, 1986). In French Guiana it is marketed to restaurants and both rural and urban consumers (Bemelmans 2003). This would be further elaborated on in Part 6 of this manual.

THE CASE FOR A PRODUCTION MODEL

In order to establish an economically viable industry around the peccary there will have to be competition with other already established livestock species. Improvements will be necessary in the areas of reproduction, growth rate, and feeding and nutrition. Any mechanisms, that could be developed to reduce overhead costs of production and the time to market, will serve to propel the collared peccary into the realm of a viable livestock industry. However, its longevity plus the ability of females to be fecund for up to 15 years are two key features of this species that gives it an advantage over most of the other domestic species (Tables 6 and 14).

This animal is now, however, being viewed as a candidate for domestication. under captive intensive or semi-intensive conditions as a new livestock species for domestication. This effort will aim at satisfying consumer demand for peccary meat in the first instance. Some of the assumptions which could be obtained within the model will be: (i) to grow-out animals to a market weight in 40 weeks, (ii) a gestation period of 146 days, (iii) a neo-nate weight of 0.623kg and (iv) a slaughter weight of 18kg. Bissonette (1982) and Nowark (1991) have both given accounts of animals exceeding 25kg live weight. Based on records in Sowls (1984), the growth rate of the collared peccary has been calculated at 62g/day. However, if the animal is to be commercialized improvements will have to be made in growth rate through feeding improvements. Table 14 compares performances between the collared peccary, the domestic pig and the goat reared under tropical conditions. This table suggests that the output from a peccary production model could better be compared with that of a tropical goat production system. Hellgren and Lochmiller (2000) reviewed the literature on the peccaries in North America, and they identified 93 references, none of which reported on intensive production modeling for this species. More recently Rengifo Pinedo and Navarro Torres (2002) presented the experiences of rearing of peccaries by families in which the fundamentals of a production model have been presented. Inagaki de Albuquerque *et al* (2004 a, b and c) also reported on their experience of intensively rearing peccaries in North Eastern Brazil from 1997 to 2004.

Table 14: Growth and Production Parameters for the Collared Peccary, Domestic Pig and Tropical Goat

Characteristics	Collared Peccary	Domestic Pig	Goat
Body Length (cm)	440-575	-	-
Tail Length (cm)	< 2.54	-	-
Mature Body Weight (kg)	+18	+100	80
Mature Body Weight (kg)	+18	+100	60-70 tropical goats
Birth Weight (kg)	0.623 to 0.75	0.9	1.5-2.0
Weaning Weight (kg)	7.0 kg		
Market / Slaughter Weight (kg)	18 to 25 kg	90	32-36
Market Age/ Slaughter Age (weeks)	40 weeks	22-26	24-32
Dressing Percentage (%)	62% to 74% to 80%	60-65%	40-45%
Growth Rate (g/day)	62 to 88 g/ day	570-675	100-150
Fertility	95%		
Parturitions / year	2	2.5	1.5 [3 parturitions every 2 years]
Number / litter	2	8 to 14	1 to 5
Number weaned	2		1 to 5
Mortality during suckling	0 %	5 to 20 %	5 to 40 %
Average days to weaning	45-60 days	28 to 42 days	60 to 90 days
First Selection for Breeding	2 months	2 months	2 months
Second Selection for Breeding	7 months		
Third Selection for Breeding	10 months		
Fourth Selection for Breeding	24 months		
Expected Reproductive Longevity	...to 15 years [Note: animals can live to 25 years]	5 to 10 years	5 to 10 years

Goats and Domestic Pigs: Payne (1990)

Collared peccary: Sowls (1984), Coser Junior (2002), Rengifo Pinedo and Navarro Torres (2002), Joao Batista Barreto (2003 Personal Communication), Inagaki de Albuquerque *et al* (2004 a, b, and c)

Dressing Percentage (DP) = [Carcass Weight/ Live Weight] x 100/1

CONCLUDING COMMENTS AND RECOMMENDATIONS

The review of the literature and discussions held with Zookeepers and persons interested in wildlife conservation and production suggest that the collared peccary could be reared in captivity with a good survival and reproduction rate and longevity. The evidence contained in the literature on the digestive system and nutrition of the peccary suggests that the collared peccary:

- ◆ is not strictly a foregut fermentor (ruminant-like digestion);
- ◆ is not strictly a hindgut fermentor (pig-like digestion); and
- ◆ may be both a foregut and hindgut fermentor, i.e., it has a **flexible digestive system** which may be an adaptive mechanism so that the best digestion take place based on the types of feed available in the diverse habitats of this animal species.

Some assumptions for a collared peccary production model therefore are that it could better be compared with that of a tropical goat production system. Sufficient data exists to properly design and test an intensive collared peccary production model. It is recommended that this could be best done at a zoo, which may already have a peccary-breeding colony. This would also promote *ex-situ* conservation which would complement the *in-situ* ungulate conservation and wildlife management being suggested by Bodmer *et al* (1988). The work presently being done in French Guiana is therefore quite important towards achieving this (Anon, 1990, and Young, Steil and Garcia, 2004).

Part 4
The Collared Peccary Production Manual
[A Practical Guide for Intensive Collared Peccary
Production]

HOW TO START SETTING UP AN INTENSIVE COLLARED PECCARY PRODUCTION SYSTEM

Some Considerations before Setting up a Wildlife/ Non-domestic Animal Production Unit

Before setting up your production unit there is some information that you need to get. It would be important for you to first obtain copies of the laws and regulations of your country or state that governs the keeping, rearing and breeding of domestic and non-domestic animal species. This you would need to know in order to get permission to keep animals as well as to rear non-domestic species.

Permission to be a Wildlife Farmer/ Eleveur des Animaux Sauvage/ Zoocriadero/ Criadouro Animais Silvestres

This permission must be obtained from the relevant authorities as follows:

Trinidad and Tobago: The Wildlife Unit, Forestry Division, Ministry of Public Utilities and the Environment, St Joseph Farm, Valsayn, Trinidad, Trinidad and Tobago,

French Guiana: The Office of the Prèfect of French Guyana

Brazil: Instituto Brasileiro do Meio-Ambientes dos Recursos Naturais Renovaveis [IBAMA], Ministerio do Meio-Ambiente, dos Recursos Hídricos e da Amazonia Legal,



Figure 18: IBAMA in Amazonas, Brazil

Peru: Instituto Nacional de Recursos Naturales [INRENA], Ministerio de Agricultura de Peru.

Venezuela: MARN, Oficina Nacional de Diversidad Biologica

In other countries: you would need to make enquiries with the following ministries, Agriculture, The Environment and Natural Resources, Forestry or other relevant authorities.

The Principles behind setting up an Intensive Animal Production System

Now that we have presented to you with what is known about the Peccary we would now like to outline for you the philosophical basis used in approaching or developing intensive animal production systems. This approach is based on the following two pillars:

1. an understanding of the **factors affecting animal production systems** and
2. a knowledge of the **physiological states** of the animal species in question.

What you would need to note at this point is that **there is an interaction between them; and this interrelationship will determine the nature of the production system.** The reason for this is that **at each physiological state the effect of each factor is different OR the needs of and the threats to the animals' survival will be different.**

But what does each pillar consist of? We shall explore each one next.

The Factors Affecting Animal/ Livestock Production

There are five (5) factors affecting the production of any animal species. They are:

1. Breeding and Reproduction,
2. Health and Disease,
3. Nutrition and Feeding,
4. Housing and Environment: Comfort needs and
5. Economic and Socio-economic.

In Part 3 of this manual we attempted to organize the information known on the collared peccary based on these five (5) factors listed above. These factors affecting livestock production can be further simplified as follows:

1. Genetic [Breeding and Reproduction System]
2. Health [Disease Prevention and Management System]
3. Nutrition [The Diets and the methods of Feeding make up a Feeding System]
4. Environment [The housing and Animal Welfare System]
5. Economic and Marketing [The Animal Products Harvesting and Marketing System]

Cost and availability of Land
Cost of animal inputs
Cost of non animal inputs
Market price of the products produced.

The first three factors can be easily controlled or improved through scientific research and improved management at the farm level. The fourth factor is god given, but science and management could be used to help the animals perform and produce more efficiently within the given environment. The fifth factor, however, is the one which determines the profitability and ultimately the economic sustainability of the production system. It, however is not always under the direct control of the farmers or producers.

Physiological States

What is “a” or “the” Physiological State of an animal?

Before we attempt a definition here, it is essential that we first put **the animal** in question, (whatever the species), into perspective. We shall first need to know the following about the animal:

- the species
- its sex
- is it in early growth?
- is it in late growth?
- is it undergoing puberty [the changes necessary for going into the reproductive phase of life] ?
- is the animal being prepared for reproduction?
- what is its reproductive state?
- is the animal lactating?
- what is its productive state (or growth state or desired growth rate)?
- is it a working animal and what type of work is it doing?
- what is the weight of the animal?

The physiological state of an animal can be seen therefore as a description of an individual animal or similar animals within a species, from the standpoint of their stage in their life cycle or productive state. This would then indicate to the Animal Manager or Production Facility Developer what **the animals’** needs would be for:

- Nutrients
- Housing and Environmental comfort
- Disease prevention
- Reproductive management, and
- Harvesting and Marketing the animal products.

Each physiological state of an animal creates different types of requirements for the animals’ comfort, well-being, and productive capability. This is in response to the

animals' immediate needs for maintenance, growth, production (eggs, milk, plumage), work and reproduction.

The effect of the Factors Affecting Animal Production on Wild Animals Reared in Captivity:

To fully appreciate the responsibility of the persons rearing animals in captivity, one must first appreciate that in the wild the animals live within a habitat in which they:

- have a place to live in safety and relative comfort (**housing**),
- get their food (**nutrition and feeding**),
- are able to locate suitable mates and to make their nests or reproduction sites for caring for their young (**breeding and reproduction**) and
- are free to isolate themselves and avoid diseases and predation (**disease prevention and control**).

Therefore when wild animals are kept in captivity all of the above requirements have to be provided, so that the keeper of these captive animals now has to ensure that all the functions performed by the habitat will now be provided within the new captive environment. This responsibility is increased when working in intensive production systems as outlined below.

Intensive Animal Production Systems

We would now like to turn your attention to the concept and practice of intensification and its requirements and consequences.

Intensification

This involves the bringing together of many animals in a single location or in close proximity to each other with consequent problems due to increasing animal population densities.

Features of intensification

- use of limited land, usually for the animals only and not for the production of feed
- high animal to land ratio
- high levels of technical and managerial inputs are required, particularly with regard to feeding and the prevention of diseases
- variable quantities of capital outlays are required
- very labor-demanding or may need forms of automation
- expected product output required.

The Implications of Intensification on Production

- Animals have to be fed optimal diets for the desired commodity to be produced. They must also be watered and have timely waste removal;

- Preventive techniques have to be instituted to avoid the introduction and rapid spread of diseases [Adequate disease prevention and hygiene].
- Animals' social behavior needs to be considered and catered for; and
- The design of the housing plays a key role in facilitating all of the above [Provision of a suitably modified environment for rearing].

The Role of Housing and Equipment under intensive systems of production

The roles of housing and equipment under intensive systems of production are as follows:

1. to protect the animal from the environment, predators and theft;
2. to ensure the timely and controlled supply of feed nutrients and water;
3. to exclude disease causing organisms and to eliminate or minimize the possibility of and spread of diseases;
4. to protect the animals from trauma;
5. to protect man and to facilitate the ease of handling of animals through :
 - a) special features and considerations for handling, restraint and treatment of animals,
 - b) having the animals arranged into different physiological states and ages;
6. to facilitate timely and efficient removal of waste;
7. to enable the grouping of animals into manageable units which could make the easy observation of animals individually;
8. to enable the easy handling of animals for either product collection (e.g. eggs) and or the sorting of animals for marketing;
9. to modify the environment to alleviate any stress which would be constraints to productivity; and
10. to provide specialist type of equipment to facilitate slaughter and processing.

The Key elements of livestock housing under intensive conditions therefore are:

1. Water Supply
2. Power Supply
3. Enclosure, Housing and or Handling Requirements based on species needs.

On this basis the next section deals with approaches to developing livestock production systems.

Approaches to Developing Animal Production Systems/Concepts in Developing Intensive Animal Species Production Modeling

In this section you will be exposed to those concepts and considerations which must be used when designing *any* “**Animal Production System**”. This information would be important as one day you may be asked to design a system without all the system's components being known. What you should then try to do is to gather all that is known about a more popular related species within the same family as follows:

- the nature of the digestive system [**Digestion and Feeding**]
- the nature of the habitat and nesting sites of the species under consideration [**Housing and Environment**]
- the reproductive system and habits [**Reproduction and Breeding**]
- the social habits of the animal [**Animal Behavior**]
- diseases which affect the species [**Disease Prevention and Control**]

Further considerations.....

The **objectives** of the production system must be clearly identified, established or known from the start in order **to identify which physiological states** would have to be included in the production model or system.

The **source of the animals** for the production system to be established will also need to be identified as follows: wild-Caught/Captive Breeders, Wild-Caught Juveniles for growth, and other such groups.

Considerations for species production modeling

The following Box presents a list of the **important considerations for species production modeling**. Figure 19 presents within a pictorial context the elements presented within the Box.

Box 1: CONSIDERATIONS FOR SPECIES PRODUCTION MODELING

The Species:

- I. The Objectives of the Production System or Model
- II. The Species Life Cycle
- III. The Physiological States for the Production Flow
- IV. Performance Coefficients or Growth Parameters
- V. Reproductive Parameters
- VI. Animal Specific Needs as influenced by the Factors Affecting Animal Production
Needs: Housing
 Nutrition and Feeding
 Health and Disease Control
 Reproductive Management
- VII. Animal Behavior and Sociology
- VIII. Design of the Physical Environment Required
 - Thermal Environment, Lower Critical Temperature (LCT), Upper Critical Temperature (UCT) and Thermo Neutral Zone (TNZ)
 - Ventilation
 - Humidity
 - Air Quality
 - Housing System [Space requirement; Trucking and Transport Considerations; Floor and Floor Surface type]
- IX. Management Routines Required
 - Daily
 - Weekly
 - Monthly
 - Seasonally
 - Annually
- [X] Variable Inputs Required
- [XI] Output Expectations of the Model/
Production Process Flow

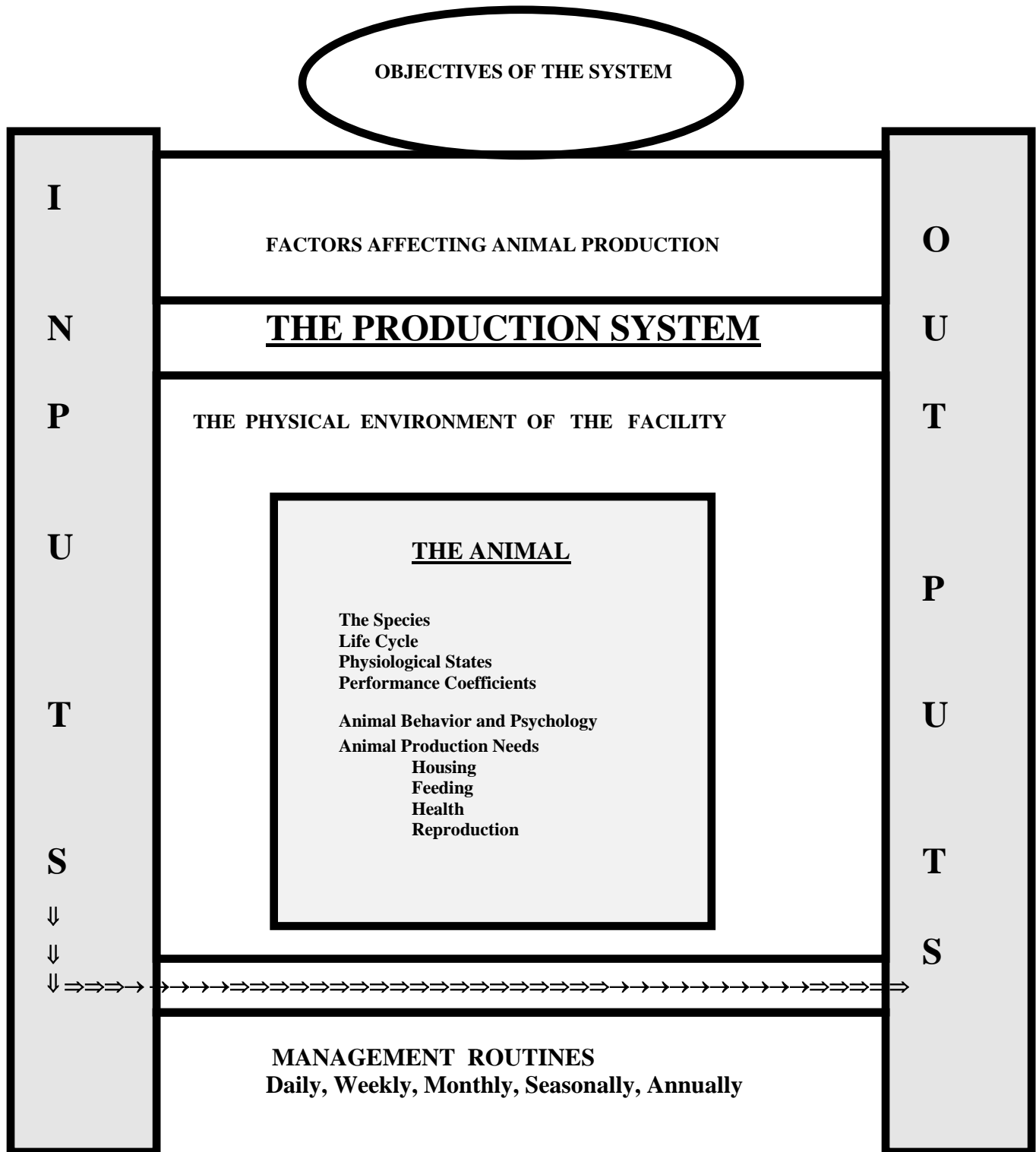


Figure 19: Concepts for developing an animal production system for any species.

THE OBJECTIVES OF THE PECCARY PRODUCTION SYSTEM

In order to develop your Peccary production system you must first begin with the end in mind, i.e. what are the objectives of your production system and what products or animals are you going to sell? This would determine what you do. These objectives could be one or all of the following:

- To produce surplus weaned and culled animals for meat
- To produce breeding stock
- To produce quality skins for tanning
- To produce animals for exporting to a zoo.

This would determine at what stage of the animal's life cycle you will intervene. To establish this one must know the peccary's life cycle which is shown below.

THE LIFE CYCLE OF THE PECCARY

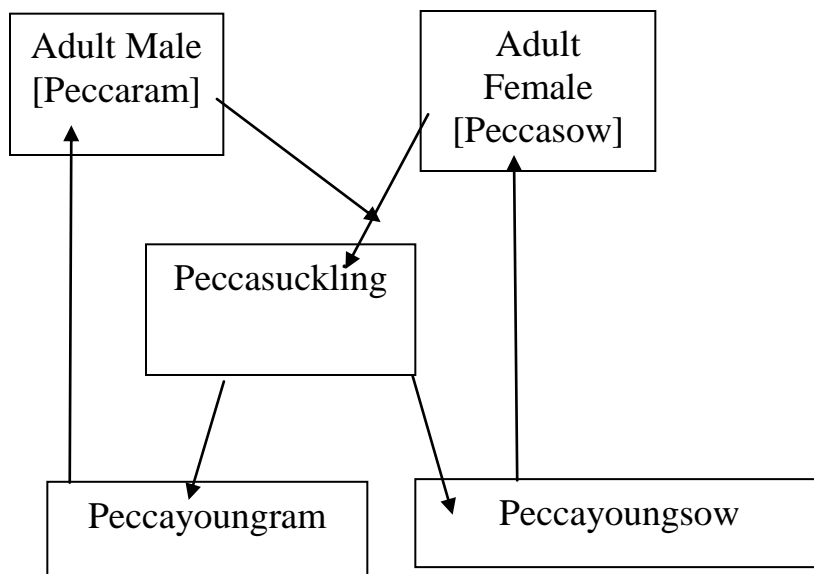


Figure 20: The Life Cycle of the Peccary

THE PHYSIOLOGICAL STATES OF THE QUENK/PECCARY

From the design above the peccary has five basic physiological states which can be further subdivided as follows:

Breeding Females [Peccasow]

Pregnant and Lactating

Pregnant

Not Pregnant

Breeding Males [Peccaram]

Suckling Young Peccary [Peccasuckling]

Young Growing Post Weaning but Sexually Immature Females [Peccayounsow]

Young Growing Post Weaning but Sexually Immature Males [Peccayoungam]

Sexually Mature Females [Replacement Peccasow]

Sexually Mature Males [Replacement Peccaram]

These states allow for the peccaries to be grouped into several production units which are now outlined.

PRODUCTION UNITS

At least four (4) production units/areas can be envisaged with a process flow as shown in Figure 21. Each unit is now described.

Unit 1: Breeding Unit [Group Housing]

Breeding Females [Peccasow]

Breeding Males [Peccaram]

Suckling Young Peccary [Peccasuckling]

Ratio of Peccaram: Peccasow = **2: 5 to 3: 12**

Note:

1. Since peccaries are very social animals which do not welcome strangers into the group, at least two (2) breeding males should be in each breeding group so that in the event that something happens to one of the breeding males there is an automatic replacement already within.
2. Breeding males within a group do not compete aggressively as is seen with other species.
3. As some peccaries may demonstrate lactational anestrous it is necessary to wean as early as possible [in less than four weeks], to get the females back on heat and quickly able to become pregnant again.

Unit 2: Grow Out Unit/ Replacement Breeders Unit [Group Housing]

Young Growing Post Weaning but Sexually Immature Females [Peccayounsow]

Young Growing Post Weaning but Sexually Immature Males [Peccayoungam]

Note:

1. This would consist of the weaned animals. As weaning could take place after one week or up to about four months, it would be necessary for us to determine up to what age young animals would tolerate new introductions into the group.
2. The majority of males from this group could be slaughtered at about six months. The larger and faster growing males should be kept with the females for reproduction.

3. It would be necessary to have at least two of these units. Since the Peccary would be expected to breed year round the young growing animals would have a six month spread.

Unit 3: Grow Out Unit/ Replacement Breeders Unit [Group Housing]

Same situation as for unit 2, but would contain the younger animals.

Unit 4: Utility Pen

The utility pen is an enclosure that must always be kept empty. This is to facilitate movement of animal groups from one pen into a safe area when their pen has to be cleaned or repaired or if an animal or animals have to be isolated for treatment or special attention. **This utility pen is extremely important for ensuring human safety.**

PECCARY PRODUCTION UNITS PROCESS FLOW

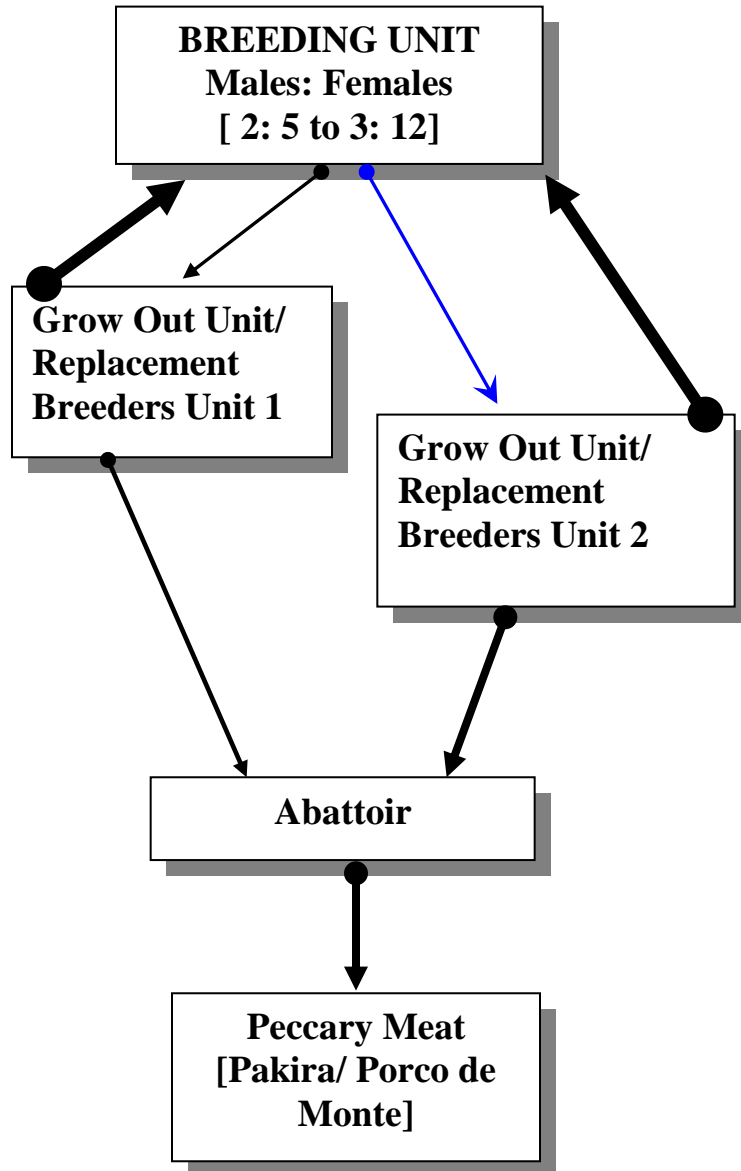
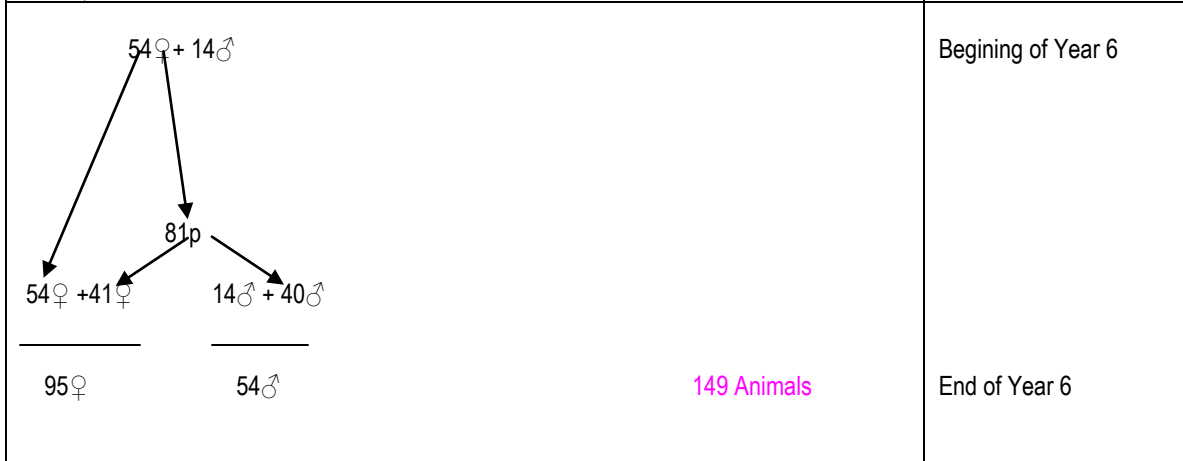
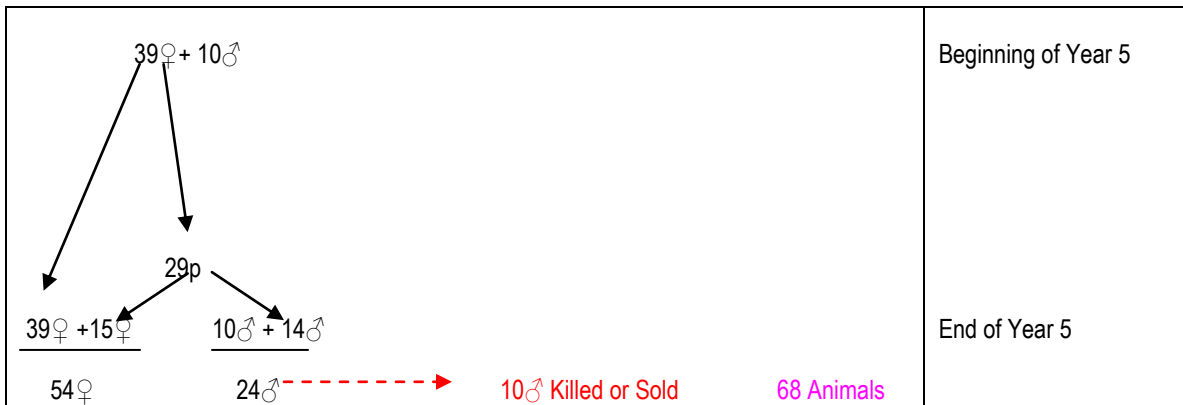
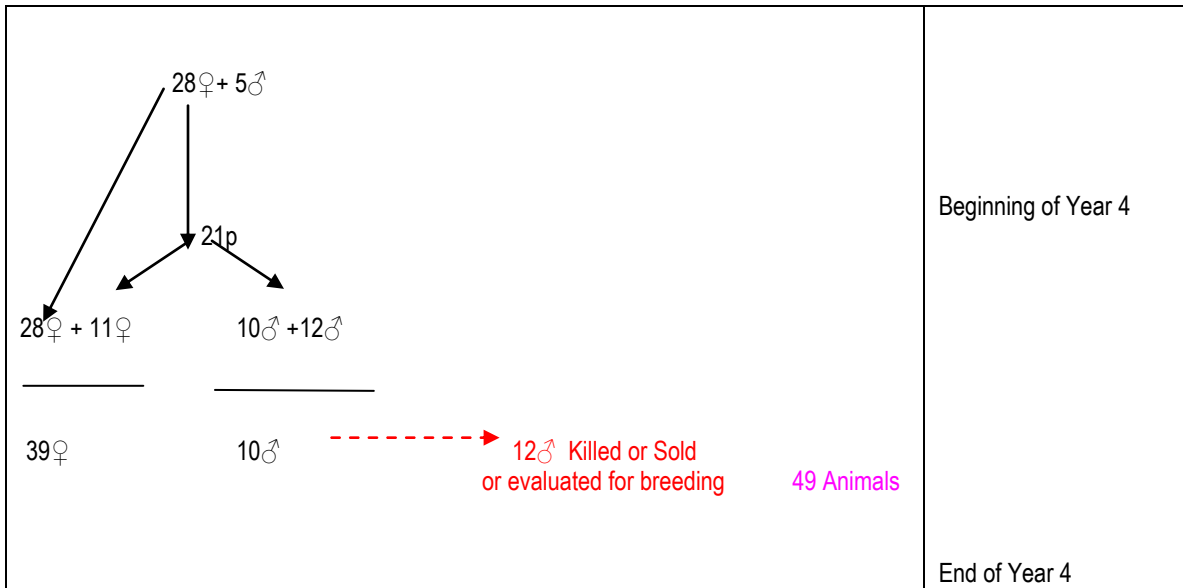


Figure 21: Peccary Production Units Process Flow

HERD PROJECTIONS

Figure 22: Six Years Peccary Herd Projections beginning with 8 Peccasows and 2 Peccarams

Projection	Year
<p>8♀ + 2♂</p> <p>16p [8♀ + 8♂] x 75%</p> <p>12p</p> <p>8♀ + 6♀ 2♂ + 6♂</p> <p>14♀ 8♂</p> <p style="text-align: right; color: magenta;">22 Animals</p>	<p>Beginning of Year 1</p> <p>End of Year 1</p>
<p>14♀ + 8♂</p> <p>11p</p> <p>14♀ + 6♀ 8♂ + 5♂</p> <p>20♀ 13♂</p> <p style="text-align: center; color: red;">8♂ Killed or Sold or evaluated for breeding</p> <p style="text-align: right; color: magenta;">33 Animals</p>	<p>Beginning of Year 2</p> <p>End of Year 2</p>
<p>20♀ + 5♂</p> <p>15p</p> <p>20♀ + 8♀ 5♂ + 7♂</p> <p>28♀ 12♂</p> <p style="text-align: right; color: magenta;">40 Animals</p>	<p>Beginning of Year 3</p> <p>End of Year 3</p>



Source: Young (2003)

FEATURES OF HOUSING FOR PECCARIES

In considering the housing for the peccaries you must first take into consideration the unique animal behavior of these animals. Here types of housing for the peccaries are presented for you, they are (i) Intensive and (ii) Semi-extensive Types.

Intensive Peccary Housing

The practical intensive peccary housing **must have four components** of housing as follows:

1. **Housing for the Breeding group** [an enclosure for parturition and provisions for the temporary isolation of the newborn and mother must be included]
2. **Housing for the group of weaned animals** that are to be used to form new breeding groups
3. **Housing for the Replacement Breeding Group/ New Breeding Group to be formed**
4. **Utility/Spare Pen**, always to be kept vacant.

The following figure is a conceptual layout for an intensive Peccary Production unit.

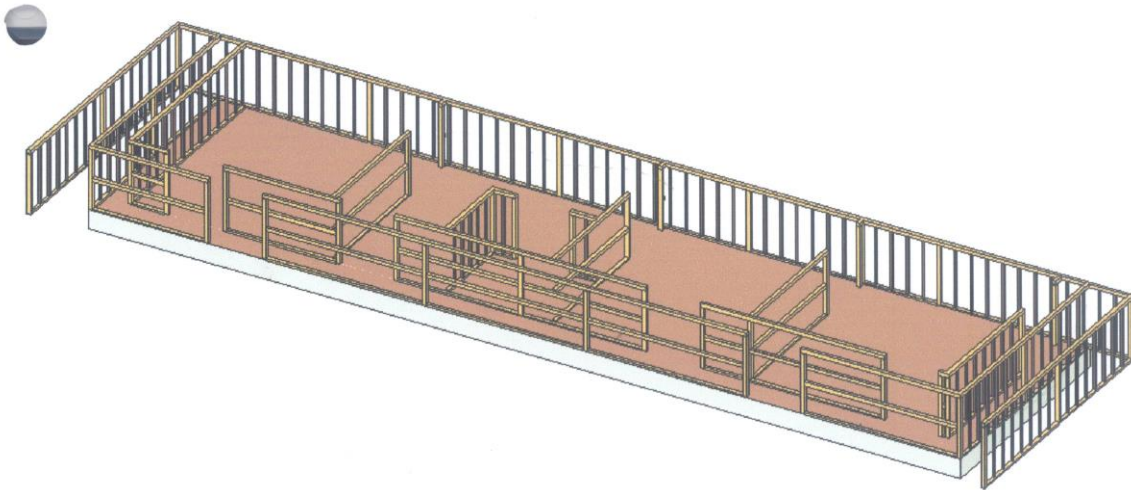


Figure 23: A conceptual floor plan layout for an intensive Peccary Production unit.

Semi-Intensive/Semiextensive Peccary Housing

I. Enclosures in French Guiana

At a farmer

At Soucomou Experimental Station

II. Enclosures in Brazil

(i) At Mr Neto's Farm in Bahia

(ii) At The Experimental Station of UESC in Bahia

(iii) At Semi Commercial Farm 1 in Sao Paulo

(iv) At Semi Commercial Farm 2 in Sao Paulo

III. Enclosures in Peru

At a mixed production centre [Peccary and Capybara Production]



Figure 24: A Grassed Semi-intensive Production Pen for collared peccaries in Brazil [UESC] using chain linked fencing



Figure 25: A Grassed Semi-intensive Production Pens for collared peccaries in Brazil [UESC] using chain linked fencing



Figure 26: A large dirt collared peccary enclosure in the dry area of Irece Bahia



Figure 27: Aspects of old experimental peccary Housing at Soucoumou in French Guiana



Figure 28: A Semi -intensive enclosure for peccaries on display at the Emperor Valley Zoo, Trinidad and Tobago



Figure 29: Farmer enclosure [Semi-intensive system] in French Guiana

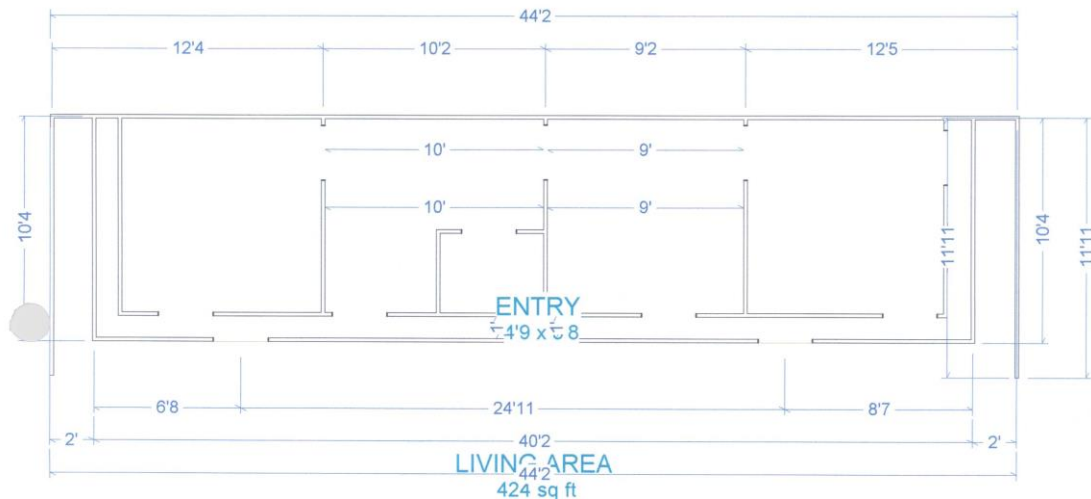


Figure 30: A Proposed Floor Plan for Unit 1: Breeding Unit [Intensive Group Housing]

BACKGROUND TO THE PECCARY PRODUCTION MODEL

The following experiences have demonstrated that peccaries could be reared intensively and reproduce successfully in captivity:

- ◆ the experience of the Emperor Valley Zoo [Republic of Trinidad and Tobago], the West Berlin Zoo [Berlin, Germany], Zoo Zürich and many other Zoos in Europe and the Americas;
- ◆ the experience of the Soucoumou Experimental Station in French Guiana;
- ◆ the work of Natalia Inagaki de Albuquerque, Yvonnick Le Pendu and Diva Gumaraes at EMBRAPA in Belem, Brazil;
- ◆ the work of Sergio Luiz Gama Nogueira Filho of the University of San Paulo and now at Universidad Estadual do Santa Cruz, Bahia, Brazil,
- ◆ the work of Instituto Veterinario de Investigaciones Tropicales y de Altura, Universidad Nacional Mayor de San Marcos, Iquitos, Peru and
- ◆ the work of Martha Rengifo Pinedo and Darvin Navarro Torres at the “Centro Piloto de Zoocria para la Amazonia” at La Universidad Nacional de La Amazonia [UNAP], Iquitos, Peru
- ◆ the work of and Pedor Mayor Aparicio, in Brazil and Peru, and Hugo Galvez in Peru; and
- ◆ the intensive backyard rearing experience of Desmond James in Mausica Trinidad, Republic of Trinidad and Tobago.

Using the production units suggested above, target performance coefficients are now suggested for the collared peccary as summarized in Table 15. Alongside these

appropriate husbandry practices would ensure that the animals' health status would be maintained.

Target Performance Coefficients for the Quenk or Collared Peccary

The expected Target Animal Performance coefficients are summarised in Table 15.

Table 15: Target Performance Coefficients and Signs of Estrus for the Quenk or Collared Peccary

Age of Sexual Maturity	8-14 months [average 10.5 months]
Average Weight at Sexual Maturity	16.4 to 20 kg
Expected Longevity of a Peccasow	7 to 15 years
Age at First Litter	13-15 months
Breeding	Year round
Expected Female Longevity	10-15 years
Length of Gestation	138-158 days
Return to Oestrus after parturition if the young dies	3-7 days
Lactational anoestrous	NO
<i>Post partum Estrus</i>	As early as 5 days post partum
Length of Oestrous Cycle	22.6 – 34.0 days
Duration of Oestrus	3.4 –4.8 days
Signs of Oestrus	<ol style="list-style-type: none"> 1. Females seen riding other females and males in the herd. 2. Nose to nose greetings. 3. Receptive Females raise their tails. 4. Vulva is seen as being red and swollen for about four days during which time the oestrus [heat or receptivity] is exhibited.
Number of Offspring per Litter (litter size)	1- 4
Minimum Number of Litters per Year per Female	1.25 (range 1-3)
Number of days between successive parturition (parturition interval)	143– 195 days
Average Birth Weight	623 g [0.6kg]
Weaning Age	4 days to 8 weeks
Weaning to Conception	3-17 days
Weight of Mature Male	21.1kg
Weight of Mature Female	19.0kg

SOME HUSBANDRY PRACTICES AND GUIDELINES

Before starting the outlining of the husbandry guidelines, it must be pointed out to you that maintaining good husbandry practices is essential for the success of any animal enterprise.

[A] Practical Peccary Housing

- Enclosures within the Breeding Unit Pens for females to be isolated before parturition of the pregnant animals.
 - Within the pen of each breeding group there must be an area or an enclosure where the females can go to make their young a few days before parturition. The animals can be kept there for a few days after parturition to protect the new-born from aggressive adults.
- Peccaries defecate in one location so that it is important to take this into consideration when setting up semi-intensive housing.
- Peccaries tend to sleep in a location adjacent to where they defecate.
- The water supply in an intensive system of production is important for all animals. Figure 31 shows that the troughs should not be greater than 10 cm wide to prevent the very young animals from falling in and drowning head-first.

[B] Peccary Restraint in the Farm Situation

Under very intensive systems of peccary production one could use two approaches of restraint:

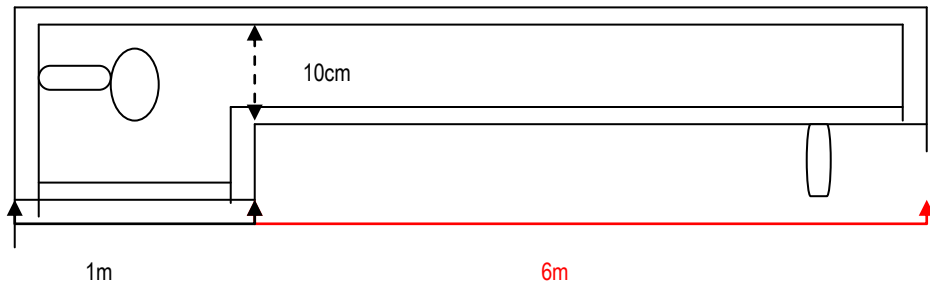
- always having an extra empty pen available for moving around the animals;
- the use of a small corridor or chute linking the pens.

Under semi-intensive systems of peccary production one could use two approaches:

- the use of Chutes and /
- the use of Corrals or Corridors [See Figures 32 and 33 for details] and/
- the use of nets.

Regardless of the approaches used for restraining peccaries the equipment must be sturdy and strong.

Details of the Water Supply System



Details of the Water Trough

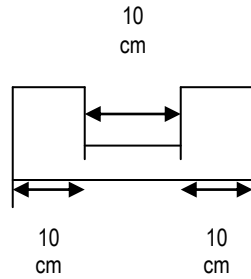


Figure 31: Practical Peccary water Troughs at Mr. Neto's Farm in Bahia, Brazil.

Details of the Chute or Corridor

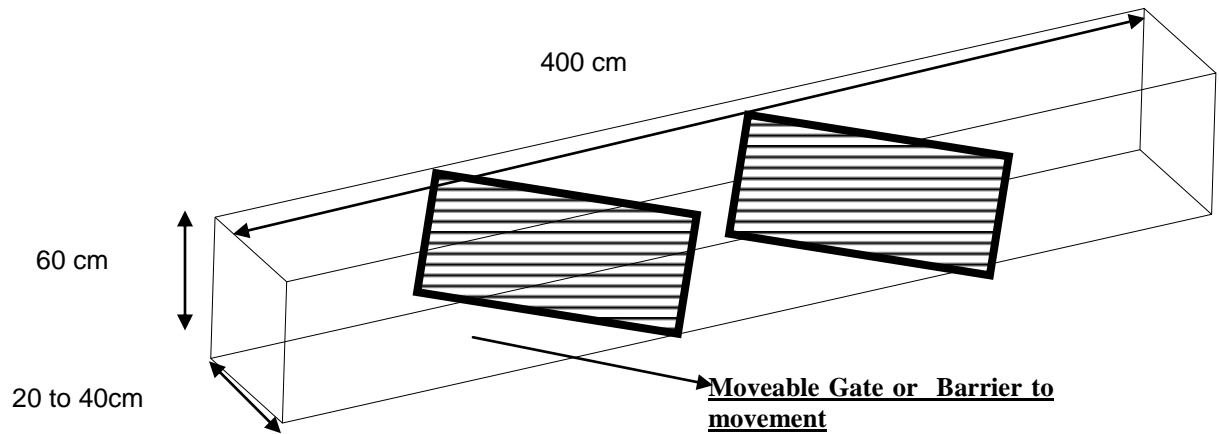


Figure 32: Details of Peccary Corrals and Chute [Mr. Neto Farm, Bahia, Brazil]



1.



2.



3.



4.



5.



6.

Figure 33: Aspects of Peccary Semi-extensive Enclosures at Monsieur Neyrat in French Guiana [1. Chute; 2. Feeding Area; 3. Fenceline towards the outside; 4. Fenceline towards the inside of the enclosure that consists of a wooded hillside; 5. Mr. Cicero Lallo (the UWI), Mr. Neyrat (Pilot Peccary Farmer in French Guiana) Miss Gail Young (Chambre d' Agriculture & UWI); 6. Fenceline towards the roadside]

Practical Management of Peccary

Important Note of Caution

1. The experience of all our wildlife farmers (in particular Mr Desmond James) and that of Rengifo Pinedo and Navarro Torres (2002) strongly suggests **that when working with peccaries one must be cautious at all times! Peccaries can be very unpredictable animals which are armed with four three-inch canines!**
2. Long nets can be used very effectively in capturing and restraining peccaries that have been reared in captivity or from birth or very young, or animals that have been wild and caught very young.
3. It is necessary to have the animals become accustomed to being handled from very young.
4. When handling young animals always place your hands on the glands (the dorsal glands) and have your hands impregnated with the substance which it secretes. Then spread this with your hands smoothly and gently over the rest of the animal's body.

Some Important Animal Husbandry Techniques

- (a) Put individual feeders separated spatially within the pens. [Note: in Part 5 of this book when you visit the Peccary Farm of Mr. "NETO" you will observe that he spreads the grain and feed in lines all over the feeding area (Figures 101 to 102).] This avoids infighting.
- (b) Do not allow persons to ill-treat or startle the animals.
- (c) Always keep corral gates and enclosures closed to avoid unnecessary risks.
- (d) When going into corrals to capture animals you must always be armed with your long net. Always be accompanied by another person. And you must remember that these are animals in the process of domestication.
- (e) Always attempt to feed the animals at the same time each day.
- (f) Use of Long Nets for capturing animals

Figure 34: Dimension of a Net [Source: Rengifo Pinedo and Navarro Torres (2002)]



Figure 35: Capture & Restraint with Net [Source; Rengifo Pinedo and Navarro Torres (2002)]

[C] Practical Peccary Feeding

We must begin here by recapping the remarkable digestive system of the peccary, having characteristics of both a foregut fermentor [a stomach make up like that of cattle, sheep or goats] and a hindgut fermentor [a stomach and cecum like pigs and horses]. It therefore has a flexible digestive system [earlier described in Section 3]. It suggests that this animal has the ability to digest almost any feed material. It can therefore be fed forages/ grasses such as Elephant Grass/ Sugarcane, Banana stems, Grains and Tubers. In French Guiana Mr Neyrat feeds the peccaries various feeds including chopped whole sugarcane, cooked rice and green bananas which they eat with gusto.

Feeding the Breeding Group

The breeding group would contain open or non pregnant peccasows, animals in early, middle and late gestation as well as pregnant and lactating animals. It is therefore important that all efforts be made to ensure feed availability.

Creep Feeding the Peccasuckling

The dental development of Peccaries indicates that they are born with only canines and incisors, six (6) teeth out of a total of 38 permanent teeth. The temporary incisors and pre-molars begin to erupt at about 3 weeks. Therefore it is being suggested that they be fed a creep feed [a diet resembling pig starter] to ensure that animals could be successfully weaned at 4 weeks.

Feeding the Growing Group

Once animals are weaned at about 4 weeks of age put them into separate pens so that they could form a growing group that can be as large as possible. It is believed that animals could be mixed up to about 4 months of age without too much aggression being exhibited among them. Discontinue adding new animals to the group as soon as signs of aggression are observed.

[D] Breeding and Culling Practices

1. Females could be bred for up to 15 years.
2. Animals born with deformities should not be used for breeding.
3. Avoid using aggressive males and females in breeding programmes.
4. Select males for breeding with good hind quarters and that have exhibited good growth rates.

Heat Detection OR Signs of heat/estrus in Peccasows

Signs of heat for the peccasow include the following:

1. Females seen riding other females and males in the herd.
2. Nose to nose greetings.
3. Receptive Females Raise their tails.
4. Vulva is seen as being red and swollen.

Management of the Peccasow, before, during and after parturition

Always try to ensure that animals close to giving birth or in late pregnancy are not under nutritional stress. If the system is very intensive and you observe that a female is close to giving birth, she should be put into the isolation box or enclosure. Ensure that she has adequate water and avoid having her disturbed.

After Parturition

Allow the female and the peccasuckling to be within site and smell of the group, but not in contact with them, to ensure that the newborn will not be attacked by aggressive adults. The killing of Peccasucklings by aggressive adults have been indicated by Monsieur Neyrant in French Guyana to be his major cause of animal mortality over an eight year period.

Selection of Replacements

Replacement animals should be selected with the following criteria in mind:

1. Good growth rate
2. Good docility
3. Ease of handling

In addition the females should come into first heat as close to eight months as possible and should conceive at the first or second service.

Females should also be selected from mothers who were prolific:

1. 2 to 2.5 litters per year and
2. 2 to 4 animals per litter

Males should come from fathers who had the following traits:

1. Good body conformation
2. Good Libido
3. Sired 2 to 4 animals per litter

[E] Daily Routines

This includes observing the animals and their physical surroundings, including cleaning of the pens.

Daily observation of animals for:

- illness including feed intake
- changes in stool/faeces texture
- wounds and treat as soon as possible
- signs of estrus
- signs of pregnancy and onset of parturition
- signs of them going off feed
- ensuring that the water supply is OK and functioning optimally
- any signs of abnormalities around the reproductive areas of the breeding males.

Feeding of Animals:

- It is important to ensure a regular daily feeding routine.

Pens should be observed daily for signs of:

- rodents becoming pests
- the entry of snakes and other predators of the newborn
- entry of other general predators.

Daily Cleaning/ Washing of Concrete Floored Pens:

- This is particularly important if the system is highly intensive. Washing the pens daily minimises any unpleasant smells and prevents flies from breeding.

[F] Monthly Routines

These include

- Preparing new pens for incoming weaned or adult animals;
- Keeping an inventory of the animals and equipment used.

[G] Seasonal Routines

- Selection of future breeding animals and culling could be done either seasonally or as often as is possible.

[H] Occasional Routines

Considering that peccaries are sturdy animals, apart from those routines outlined above, others can be done as needed and these include:

Animal Identification

This can be done

1. using the ear notching system as is done for pigs or
2. the use of ear tags (Figures 49 and 50).

In both cases the wound initially created could result in ear infection. This can occur if the animal is being reared in a semi intensive unclean environment and the animals are not observed daily. Therefore the following simple steps should be adopted when attempting to identify animals.

1. irrigate the tip of the ear with water containing bleach or with a liquid sanitizer, and/or wipe the area clean with alcohol;
2. apply the ear tag or ear notch;
3. apply a screw worm spray on both sides of the wound and or
4. apply an antiseptic or antibiotic cream to both sides of the wound;
5. or spray an iodine solution on both sides of the wound and cover with petroleum jelly to keep the wound free of flies.

Animal Transport

To facilitate this animals can be tranquilized to calm them and to reduce their stress levels and to prevent accidental death from trauma.

[I] Animal Handling and Restraint

Earlier, under the section on “Practical Management of the Peccary” it was highlighted how dangerous this animal could become due to the size of its canines. In Part 3 of this booklet [the Scientific Literature Review] this was again highlighted as well as methods of restraint. One type of restraint equipment can be the transport box shown in Figure 36. It could have the same dimensions as the Corral and Crush photos of which are presented in Part 5. Several transport boxes [made of light wood, steel rods or aluminium as shown in Figure 36] could be joined together to make portable corridors and corrals.



Figure 36: Transportation crates used to transport the peccaries at Monsieur Neyrat in French Guiana



Figure 37: Wooden Restraining Cage or Crush for the collard peccary [Entrance View]



Figure 38: Wooden Restraining Cage or Crush for the collard peccary [Side view]



Figure 39: Wooden Restraining Cage or Crush for the collard peccary [Side View with Cage on a Poatform Scale]



Figure 40: Wooden Restraining Cage or Crush for the collared peccary [Closeup Side View]

Figures 37 to 40 show the different aspects of a wooden peccary crush. Different aspects of a similar metal peccary crush are shown in Part 5 of this book.



Figure 41: Plastic ear applied to the right side of a female peccary



Figure 42: Injecting a female peccary with a tranquilizer in the restraining crate



Figure 43: Tranquilized females recovering in a feeding pen



Figure 44: Tranquilized females recovering in a feeding pen



Figure 45: Feeding pen opening into the corral and holding area



Figure 46: Tranquilized female recovering in a feeding pen



Figure 47: View from the holding pen leading to the corral and into the Feeding pen



Figure 48: Side view of the corral from the Feeding pen into the holding area



Figure 49: Plastic Ear tag Applicator and Plastic Ear tag



Figure 50: Plastic Ear tag Applicator and Plastic Ear tag

Plastic ear tags are applied on the right ear of females (Figures 41, 43, and 46) and on the left ear of males. This facilitates recognition of the sexes at a distance.

Part 5
Visits to Peccary Farms
in
Brazil and Peru

Now let us take a pictorial journey to Ilhéus and Ireê, Bahia, Brazil and we shall pay a visit to two (2) Peccary Farms. Then we shall travel to Iquitos, Peru and visit a farm that has both Peccaries [Sajinos] and Capybaras [Ronsocos]. In Brazil, the first one belongs to the Universidad Estadual do Santa Cruz, and the second belongs to a private farmer named Mr. Neto. In Peru, the farm is associated with a research station of the Instituto Veterinario de Investigaciones Tropicales y de Altura, Universidad Nacional Mayor de San Marcos, Iquitos, Peru.

VISIT TO UESC WILDLIFE FARM:



Figure 51: UESC Experimental Farm



Figure 52: Visitors to UESC Farm



Figure 53: Net for Peccary Restraint



Figure 54: Restraining a Peccary with a Net



Figure 55: A Restrained Peccary



Figure 56: Handling of a restrained Peccary

1. **LOCATION AND CLIMATE:** Humid Coastal Brazil, principally in the Cacao growing region of Bahia, Brazil.

2. **ANIMALS PRESENT:**

Collared Peccaries

- in three (3) Semi-intensive enclosures and
- in ten (10) concrete pens [with zinc roofing] which were originally designed for pigs.

White Lipped Peccaries

- in one (1) Semi-intensive enclosure

3. **ANIMAL: LAND RATIO:**

At present they are conducting animal density studies, but the experience of the Brazilian team suggests that a suitable stocking density would be 100 sq meters / animal.

4. **LAYOUT OF THE PECCARY ENCLOSURES / PECCARY HOUSING:**

Physical Description (*Elements*) of the Enclosures

- I. **Floors:**
- either earth pens planted with grass or
 - concrete floor pens
- II. **Fencing:**
- Height - 1 meter high/ Chain linked and wire fences.
Materials - The chain linked fence is embedded in about 15 cms of concrete in the ground. In the pens brick walls are used to form the barriers.
- III. **Shade:** Use of Coconut trees in the White Lipped peccary enclosure, or covered sheds in the collared peccary enclosure.
- IV. **Pond:** No ponds in either of the enclosures.
- V. **Drinking Water Supply:**
- Potable Water supply.
- VI. **Methods of Animal Restraint:**
- Use of Nets [Figures 53-56]
 - Use of a Restraining Crush [Figures 57-62].

5. HOW DO THEY GET ANIMALS FROM DIFFERENT GROUPS TO MIX?

Peccaries are highly social animals and they do not allow strange animals to enter the group, or when an animal leaves the group acceptance for re-entry into the group is very difficult, if not impossible.

To form a new breeding group with animals from different groups the following could be done:

- one group [2 or 3 animals] of compatible males from the same group must be put into an empty enclosure and left there for about two weeks;
- then a group of compatible females could be introduced with caution.

6. FEEDS AND FEEDING:

- i. Mineral Mix
- ii. Injectable Vitamin A and E
- iii. Animals fed whatever agricultural waste is available along with the grass that is available within the enclosures.



Figure 57: Restraining Crush



Figure 58: Crush Use



Figure 59: Crush All the Way in



Figure 60: Crush Side View



Figure 61: Crush Handle



Figure 62: Crush Overview

VISIT TO PECCARY FARM: JOAO (NETO) BATISTA BARRETO (JBB)

1. **ADDRESS:** Rua Prof. Joel Lopes No 443
IRECE, BAHIA, BRAZIL
Ph: 074 – 641 – 1397



Figure 63: Vote of thanks for the Visit

Miss Gail YOUNG: Technicienne Faune Sauvage [Chambre de l’Agriculture de la Guyane and Livestock Technician, OTF-APL, DFP, UWI]

Dr. Sérgio NOGUEIRA: Professor Animão Silvestre, UESC, Bahia, Brazil

Senor Joao [Neto] BATISTA BARRETO: Peccary Pioneer and Innovative Farmer, Irêce, Bahia, Brazil, July 24th 2003.

2. **LOCATION AND CLIMATE:** Dry inland Brazil, Oxisols (red earths) principally Xerophytic type plants in the environment, semi-arid [less than 100 cms of rainfall per annum] region of Bahia [Figure 64 gives a pictorial idea of the farm visited].



Figure 64: Peccaries feeding along the grain trail on the red earth soil.

3. **APPROXIMATE NUMBER OF ANIMALS:** 450 peccaries of all Physiological States.
4. **TOTAL FARM SIZE:** Approximately 40 hectares
5. **FARM ACTIVITIES:** Maize and Bean Cultivation [Main Enterprise] with a few cattle and little a citrus.
6. **TOTAL AREA UNDER PECCARIES:** 5 Hectares
7. **ANIMAL: LAND RATIO:** 90 Animals per Hectare [approximately 100 square meters/ animal]
8. **SYSTEM OF PRODUCTION:** Semi-intensive
9. **LAYOUT OF PECCARY ENCLOSURES / PECCARY HOUSING:**
(See Plan, Figure 65)

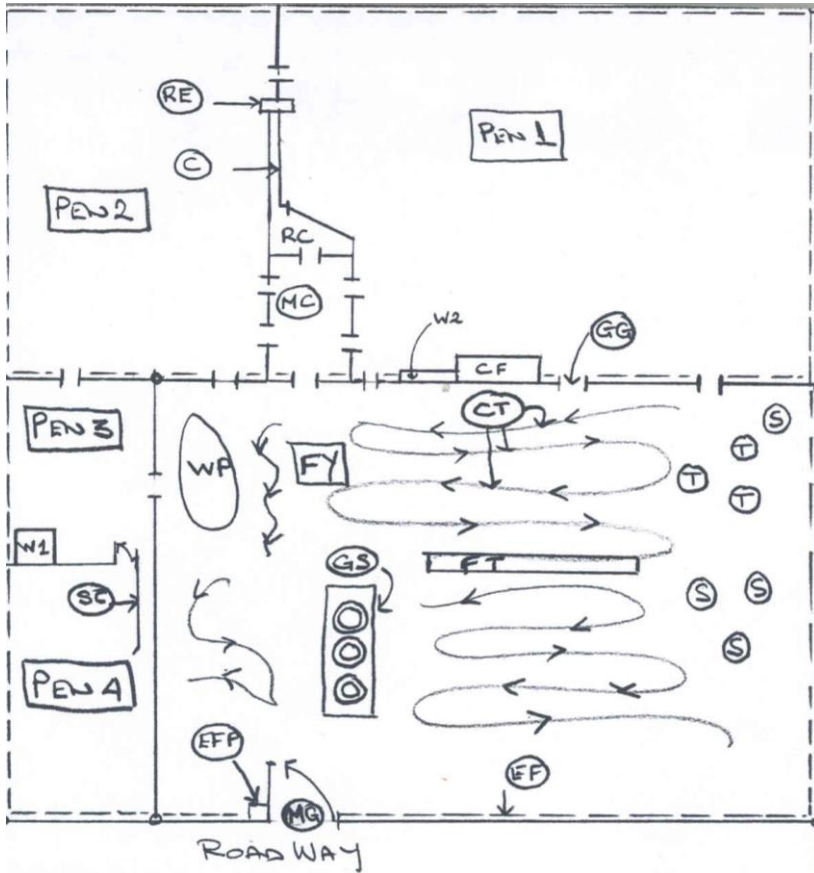


Figure 65: Rough Plan of Mr. Barreto's Peccary Farm, Icere, Bahia, Brazil, July 2003.

Code	Meaning	Fig #
C	Chute	83 & 84
CT	Corn Trail	64, 73, 101, 102
CF	Creep Feed	76, 77, 78
EF	Electric Fence [EF]	66, 67
EFP	EF Pulsator	67
FY	Feeding Yard	101 to 106
FT	Feed Trough	
GG	Guillotine Gate	81, 82, 85
GS	Grain Storage	73
MC	Main Corral	82
RE	Restraining Equipment	84, 86 to 90
RC	Restraining Corral	
S	Sleeping Area	99
SC	Small Corral and Wooden Chute	91 to 96
W1	Water Tank 1	71
W2	Water Trough	72
T	Toilet	100
WP	Water Pond	70
MG	Main Gate	79

Physical Description (*Elements*) of the Enclosures

Flooring: All the enclosures had earth floors. [Figures 66 & 67]

Fencing:

- Height: 1 to 1.5 metres
- Materials: Wooden Poles, Bamboo and Living Stakes
- Electric Fencing: Used on the inside of the fence, about a 0.5 m away and 0.3 x 0.6m high from the ground. [Figures 66 & 67]



Figure 66: Wooden fence with electric fencing on the inside.



Figure 67: Fencing arrangements showing the red plastic box protecting the electric fencing impulse generator.

Shade:

- Trees & Shrubs were used in the enclosures to provide shade and privacy.
- Protection of Trees: The trees need to be protected from animal damage to the bark 1 – 1.5 m from the ground. Barrels, galvanized or plastics, were used to surround the trees [Figure 68 and 69]



Figure 68: Base of a tree being protected by a metal barrel.



Figure 69: Shrubs not eaten by the peccaries being used as shading in one of the enclosures.

Pond:

- A pond measuring 15m x 10m x 0.5m deep is present in the main enclosure where the animals are fed and where they sleep. [Figure 53]



Figure 70: Peccaries adjacent to the pond

Drinking Water Supply:

- Water is available through a pond, tank and trough and a modified float and trough. [Figures 70, 71 & 72]



Figure 71: Older brick water tank and drinking trough that is about 15 cms wide, the young sometimes fall into this trough.



Figure 72: Concrete trough 10cms wide and somewhat high to prevent the young from falling in, the float valve is protected in the background.

- Tank & Trough [see Figure 71]:
- Modified Trough: The trough is about 10 – 15 cm wide and high enough so that the little ones do not get pushed into the water [Figure 72].

Feed Storage:

- Dried Grains [ground maize grain and cob] kept in covered barrels [Figure #73]



Figure 73: Grain stored in barrels within the feeding area.

- Cactus in Trailers. [Figure 74]



Figure 74: Cactus [rachette] in trailers.

- Melons kept in Trailers. [Figure 75]



Figure 75: Melons in trailers.

Creep Feeding:

- A creep feeding enclosure is used to feed grain. The vertical slats or barriers are 10 cm apart [Figures 76, 77 & 78]. The function here is the same as for piglets.



Figure 76: The spacing between the verticals in the creep feeding area is about 12 cm



Figure 77: Side view of the creep feeding area.



Figure 78: Front view of the Creep feeding area

Gates:

- ❑ Main Gate_ There is a long hinged gate 5 – 6m wide [Figure 79] serving as the enclosure's entrance.



Figure 79: Hinged main gate.

- Between the smaller enclosures there is the use of guillotine gates (1m height x 0.7 m wide) [Figures 80 & 81]



Figure 80: Guillotine gate with a vertical lever



Figure 81: Guillotine gate with a rope and pulley

Corral and Restraining Area:

There is a central corral/holding yard [Figure 82] that appears on both sides of two enclosures and terminates on one end in the main feeding yard/ nighttime enclosure and tapers towards the other end at the chute [Figure 85] and crush [Figure 84 and 86 to 90].



Figure 82: Main Corral



Figure 83: Chute



Figure 84: End of Chute, Crush and Transport box.



Figure 85: Use of Bamboo in Corral Construction and manual guillotine gate.

Restraining Crush and Transport box:

This is seen in Figure 84, 88 and 97.

Restraining Crush:

Figures 86 to 90 shows the metal crush from different aspects.



Figure 86: Top view of crush.



Figure 87: Side view of Crush



Figure 88: Front view of crush



Figure 89: Restraining an animal in the crush



Figure 90: Applying an ear tag to an animal restrained within the crush.

- There is also a small wooden handling pen, chute and crush within a small holding pen [Figures 91 to 96], this also serves for closer animal management and observations.



Figure 91: Guillotine gate entrance



Figure 92: Swing gate at side of the wooden chute



Figure 93: Top view of the chute



Figure 94: Guillotine gate at side of the chute



Figure 95: Wooden Crush area



Figure 96: Wooden Crush

The chute functions in such a way that several animals can be held within it at any one time. Through a series of laterally sliding gates the animals are advanced one at a time,

Transport Box:

When the animals need to be transported, after passing through the chute they come up to the transport box which is placed at the end of the restraining crush. The wooden box is kept adjacent to the crush [Figures 97 and 98].



Figure 97: Details of Wooden transport Box



Figure 98: Details of the Sliding door of the wooden transport box.

Sleeping Area:

- This occurs generally to one part of the yard [Figure 99].



Figure 99: Area showing toilet adjacent to the sleeping area



Figure 100: Toilet area

Peccary Toilet: The animals only defecate in a restricted area within the enclosure where they spend the night [Figure 100]. Adjacent to this area they generally tend to sleep.

ANIMAL ROUTINES:

In the morning the animals are let out into the shaded holding yard, where they can forage during the day.

In the evening the gates are raised and they are led into the feeding yard and nighttime area.

FEEDS AND FEEDING:**Feeding Materials:**

Philosophy-Feed what is available.

Materials used-Whole Grain, Ground Corn Cob, Cactus (Rachette), Desert Melon (Farm grown);

Mineral Mix (only purchased feed)

Feeding Routine:

Animals are fed in the evenings when the daytime heat is less. The grains spread in trails all through the feeding yard to avoid competition for feed. Animals are also given cactus (Rachette-) and melons [Figures 101 to 106].



Figure 101: Spreading the grain in trails



Figure 102: Animals feeding along the trails



Figure 103: Animals following the farmer at the feeding trails.



Figure 104: Animals eating the melons and distributed grains.



Figure 105: Animals entering the feeding yard



Figure 106: Animals feeding freely without any signs of true aggression

Quantity of Feed Used:

- This farmer uses about 100 kg of maize grain/ grain & ground cob /day to feed his animals.

Observations Made:

The farmer was very innovative in his use of materials and feed. He has applied principles of housing **for cattle [the corral system]** and **pig [the creep feed system]** production towards peccary production and management.

Creep Feeding:

This seems to be a recent innovation and its impact should be evaluated.

Use of ADE Injectable:

Wise use to ensure that vitamin A deficiency is not experienced due to a lack of green forage during the extended period of dry weather.

MARKETING:

Animals are sold as breeding stock, so no slaughtering is done.

ANIMAL LONGEVITY:

The oldest female on the farm is 25 years, but she has been kept in isolation for the last year or so and has not been used for reproduction for a few years [Figure 107].



Figure 107: A 25 year old Peccary Female [Peccasow]

Note: It is safe to suggest that a Peccary Female (Peccasow) could be kept reproductive for about ten (10) to fifteen (15) years.

ANIMAL IDENTIFICATION:

Plastic ear tags are used..

PERSONNEL:

It is important to note that only one person, MR. JOAO “NETO” BATISTA BARRETO”, feeds and handles these animals. It is only during the time for manipulating the animals for transport that he requires other assistance.

FARMER’S DATA:

Sex: Male

Age: 55 years?

Years in Farming: All of his life, 3rd Generation Farmer.

Experience: Cattle Management and grain and legume Cultivation.

Years rearing Peccary: 25 years

Years spent developing the Semi-commercial Model: = 15 – 18 years.

DISSCUSSION HELD WITH FARMER.

Marketing:

- ❑ He sells his animals live to persons who want to breed them (with a JBB ear tag)
- ❑ No authorized slaughter facilities are available so he is unable to sell the meat.
- ❑ The main market for peccary meat is São-Paulo, and it is very far away.

Breeding:

Year-round continuous breeding is carried out.



Figure 108: Over 50 peccaries feeding in the main feeding area and overnight pen

**VISIT TO A PECCARY AND CAPYBARA RESEARCH FARM:
ZOOCRIADO BIOAM
La Empresa Biodiversidad Amazonica SRL-BIOAM
Km 23 Carretara Iquitos-Nauta, Iquitos, Departamento de Loreto,
Amazonia, Peru.**

WELCOME!



Figure 109: Welcome Discussions

Dr. Feran JORI, Prof. Sergio NOGUEIRA, Dr. Hugo GÁLVEZ: and Ing. Forestal Carlos CORNEJO ARANA

BACKGROUND:

This visit will be a very interesting one for you the readers as it would highlight three very important concepts:

- Intensive Neo-tropical Animal Wildlife Species Production
- Integrated Neo-tropical Animal Wildlife Species Production [Collared Peccaries, Capybaras, Chickens and River Conchs] and

- The design of a facility for minimal disturbance of the forest and to suit the topography of the area [Environmentally Friendly Livestock Production Systems].



Figure 110: Entrance to ZOOCRIADERO BIOAM

This entrance shows that the “**Zoocriadero**” [Wildlife Farm] is located in an area that is typical of the Neo-tropical forest [Figure 110]. The other entrance to the farm from the main road, also has the same type of flora [Figure 111]. “**Zoocriaderos**” is the name given to those animal rearing facilities that has sustainable production of native fauna reared intensively in captivity (Ojasti 2002). This production facility is located in a small valley with a small stream running through the middle and a ridge on both sides. The small stream runs through the area that contains the livestock facilities. This stream provides:

- the water for the animals drinking
- the water to fill the ponds for the animal well being [as in the case of the Capybara] and
- a slow continuous movement of the water provides the necessary aeration for the aquatic species [see Figure 117].

HISTORY AND FORM OF OWNERSHIP:

This project began in 1996 with capybaras and in 1999 peccaries were introduced. The Project is privately owned and the objective here is to develop production systems for these and other native species, with scientific inputs from the local and international scientific community. The product output objectives are leather and prepared meats for sale to the local and international market. Below is a short description of the area.



Figure 111: Entrance to the Farm

LOCATION AND CLIMATE:

Humid Tropical Amazonian Tropics, on the border of Peru, Colombia and Brazil in South America

Average annual range of temperature: 22 to 32 °C.

Daily range of temperature: 4 °C.

Relative Humidity: 85%

Annual rainfall: 2600 mm to 3000 mm

APPROXIMATE NUMBER OF ANIMALS FARMED:

23 adult peccaries that were wild caught.

Capybaras of all Physiological States

FARM SIZE:

Approximately 300 hectares in natural forests;
2500 square metres devoted to the intensive production of capybaras;
1500 square metres devoted to the intensive production of peccaries.

FARM ACTIVITIES:

Peccary Production
Capybara Production
Fresh water Conch [*Pomacea urceus*] Production
Wild Poultry Production
Eco-tourism Model Development

ANIMAL HOUSING and ANIMAL: LAND RATIO:

The animals are housed as shown in the following figures.
The Capybara enclosures are 10 metres x 9 metres.

The Peccary enclosures are 25 metres x 9 metres.
Animal are kept in breeding groups of 3 to 4 animals with a
Male: Female of 1: 2 -3.
Peccary animal density was about 56 m²/ animal.

Physical Descriptive (*Elements*) of the Enclosures

Floors: All enclosures were earth floors. [All Figures]

Fencing:

- ❑ Height: 1.5 to 2 metres
- ❑ Materials: Wooden Poles, Cut wood and Living trees

Shade:

- ❑ Trees and shrubs are used in the enclosures to provide shade and privacy.
- ❑ Thatched Roofs over wooden Platforms [All figures]

Ponds:

- ❑ There is a pond in each of the Capybara enclosures about 3 m x 5 m located at the lowest point of the pen [Figure 113, 115, 116, 117, 131], this provides the drinking water as well

Drinking Water Supply:

- Water is available from the adjacent ponds of the Capybara pens. This water flows continuously from a small stream which flows through all pens [Figures 113, 115, 116, 117, 131]

FEEDS AND FEEDING:**Feeding Materials:**

The animals received a basal diet of what ever seasonal forest products were available. In addition they also received 200 g / animal / day of a concentrate supplement made up of maize grain and rice polishings, which is what is used regionally for the commercial feeding of poultry. Water was available free of choice.

BREEDING:

Animals are allowed to breed year round.



Figure 112: Entrance to the higher end of the valley where the pens are located



Figure 113: View of the pens from one side of the valley



Figure 114: View of the pens down in the valley



Figure 115: Close up view of two capybara breeding pens with the pond and aquatic plants in the middle of both pens



Figure 116: View of the pens down the middle of the valley showing the ponds in the middle



Figure 117: View from the lower end of the valley showing the water flowing down through a pipe in the middle of the foreground and flowing into a larger pen with the growing aquatic plants.



Figure 118: View of a peccary pen highlighting minimal removal of trees to maintain cover



Figure 119: View of a peccary pen at the extremity of the clearing highlighting minimal removal of trees to maintain the forest microclimate



Figure 120: View downwards into the valley from the pen shown in Figure 119



Figure 121: View into the pens from the side noting extensive use of forest raw materials for pen construction



Figure 122: A platform on the ridged side of a peccary pen



Figure 123: Looking down into the Peccary pen



Figure 124: Fresh water conch [*Pomacea urceus*] being grown in an artificially constructed pond/dam



Figure 125: View of the conch growing chambers made of wire mesh in the artificial pond or dam



Figure 126: Side view of the pond or dam head made from an earth embankment and a row of concrete blocks.



Figure 127: An individual grown crate for the river conch



Figure 128: Organic Chicken Production



Figure 129: Eating facilities of the Eco-tourism Facility with Wooden logs for the stools and five cms thick wooden discs for plates



Figure 130: Earth Oven at the Eco-tourism Facility



Figure 131: Capybara Growing pen



Figure 132: Adjacent Capybara Pens



Figure 133: Small peccary breeding pen containing covered feed troughs and isolation area

Part 6
Peccary Utilization
[The Conversion of Peccary to Meat
&
Peccary Cuisine]

6.1 NEO-TROPICAL WILDLIFE CUISINE

Neo-tropical Wildlife Cuisine: an Illusion or a Reality?

Neo-tropical animal wildlife cuisine has existed since humans and wildlife co-existed in this area of the world that we now refer to as the Neo-tropics. Thus, **Neo-tropical animal wildlife cuisine** is nothing new. It has, however, been seen for too long as the food (not meals or cuisine) of uncultured persons. It has also been felt that these dishes did not qualify to be called “**Cuisine**” [the art and science of cooking] in the same sense as that used to describe European and American dishes.

In this present work we would like to introduce the term “**Ethnocuisineology**”. This refers to all the activities surrounding cooking and gastronomy within a social, socio-economic and cultural context. The term “Gastronomy” is the art of good eating (Robuchon, 2001), the preparation and enjoyment of food and all things that peoples eat and admit into their gastro-intestinal system (Greek: “**Gastros**” meaning stomach). The term “**Ethno**” also has its origin in the Greek language... “**Ethos**” meaning “**nation**” and in English today **Ethno** means **Ethnic**. “**Ethnocuisineology**” is therefore a dynamic set of activities that has been evolved by groups and cultures initially out of their primeval survival needs. This was then further developed into daily social activities and ceremonial and festive events. The term has its roots in culture and gastronomy and therefore its manifestations would change with time as the eating customs change and become accepted by all. “**Ethnocuisineology**” could also be seen as the ways through which people within a specific cultural framework come together to enjoy food accompanied by the surrounding events linked to the preparation and eating of the food. Figure 134 presents a schematic representation of the **Ethnocuisineology** concept. Food is at the centre, but the process begins with its preparation, then merges into the social and cultural events and culminating with the enjoyment of the food.

In the introduction to the book “**Poultry and Game**”, Mc Andrew (1993) suggested that hunting wild game was a form of wildlife conservation. He also indicated “..... **Game and poultry always were, from the beginning of time, before battery and intensive farming, an important part of man’s diet**”.

Also in that book, (which seem to have been written through the eyes of an accomplished “Eurocentric Chef”), he excellently described the post slaughter, preparation and cooking of poultry and wild game (hare, rabbit, deer, and wild boar). Unfortunately no such book exists on the cuisine of our neo-tropical wild animal species, although some recipes do exist for some of our Neo-tropical wildlife species. Some of these recipes could be found in Adami (2002), Bergeon-Marty and Alibert (2002), and Parkinson (1999), but there is no comprehensive approach to developing recipes for the meats and cuts of meat derived from our Neo-tropical animals.

Compounding the situation is the fact that some of our local chefs (who are European or North American trained) have been forced into attempting to have the meats of our Neo-

tropical animals cooked in the European and North American tradition. This is not possible. What our chefs should attempt to do is to develop recipes for our Neo-tropical meats that would follow two paths that would celebrate:

1. strong wildlife flavors [**conserver le gout sauvage**], and
2. mild or modified flavors [**creer le gout comme les viandes domestique**],

[personal communication from Madame Remylienne SAIBOU, Kourou, La Guyanne Francaise, August 2004, see Figure 135].

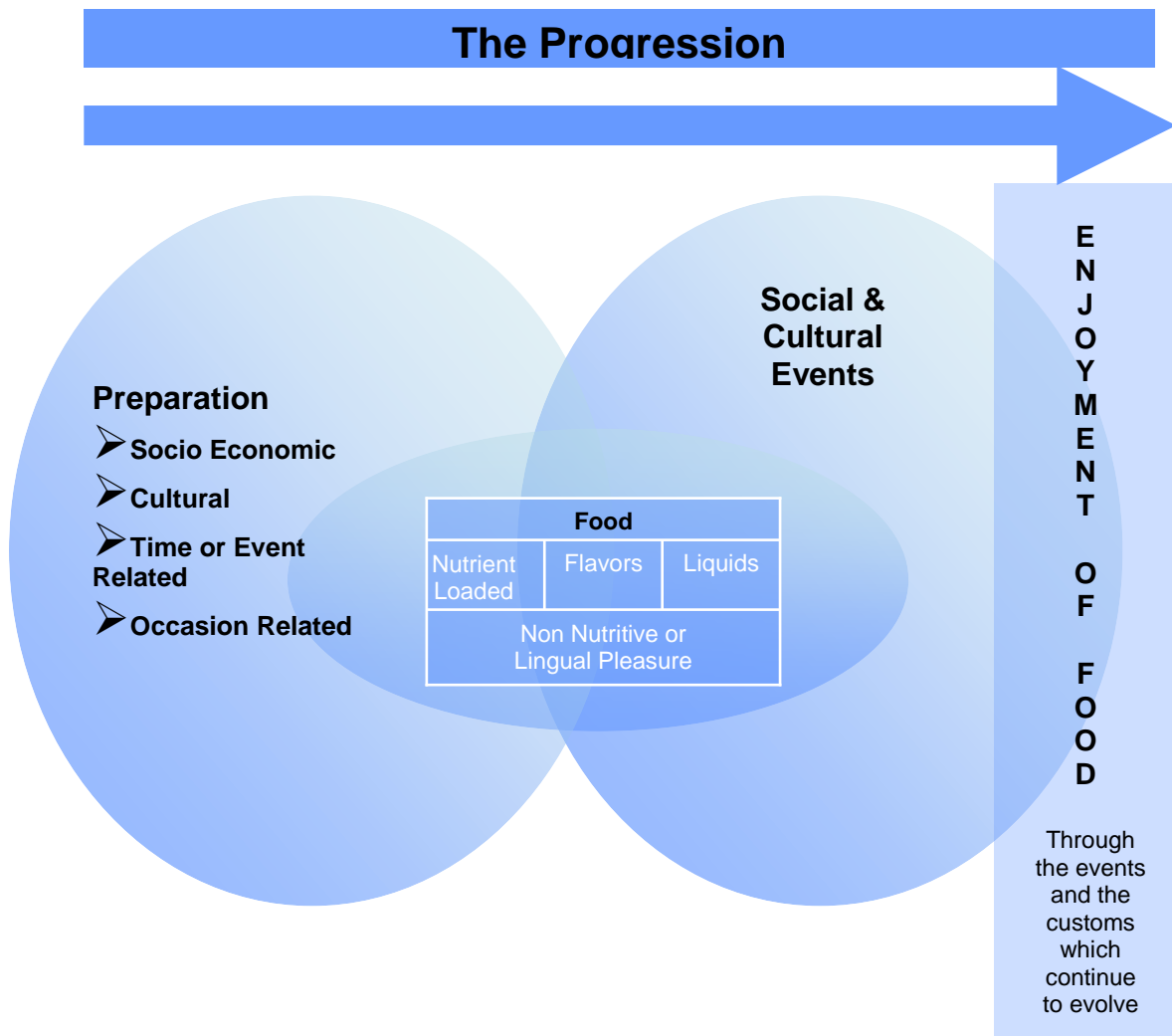


Figure 134: A Schematic Representation of the Ethnocuisineology Concept
[Source: Gary Wayne Garcia, 2004, unpublished]

To ensure this we need to follow the direction of developing a “complete Neo-tropical cuisine”. This would involve Neo-tropical root crops, fruits and vegetables with specific dishes suited to particular wildlife cuts of meats. Thus the dishes would have two components:

1. Neo-tropical food products and
2. Neo-tropical wild animal meat cuts.

This different approach would then form the basis of “**Neo-tropical Animal Wildlife Cuisine**”, and would further contribute to the evolution of “**Neo-tropical Animal Ethnocuisineology**”



Figure 135: Madame Remylienne SAIBOU, Kourou, La Guyanne Francaise

6.2 THE DEMAND FOR THE MEAT OF THE PECCARY AND OTHER NEO-TROPICAL WILDLIFE [La Viande Gibier/ Carne de Monte/ Wildmeat]

6.2.1 Information from a remote area in Brazil

Peres (2000) presented data on wildlife harvesting from Brazil Amazonia over a ten (10) year period from 1987 to 1996. Figure 136 shows the study zone covering an area of 5,065,384 km² with a rural population density of 1.61 individuals/km². He reported that the mean body mass of the animals harvested was 2.26 kg with a range of 0.82 to 3.98 kg. He divided the species into four groups based on body size as follows:

1. **Small species < 1 kg;**
2. **Medium sized species, 1-5kg;**
3. **Large species, 5 – 15 kg and**
4. **Very Large species >15kg.**

The latter group includes the **Collared Peccary** [*Tayassu tajacu* or *Pecari tajacu*], the **White-Lipped Peccary** [*Tayassu pecari*, *Pecari pecari*], the **Red Brocket Deer** [*Mazama americana*], the **Grey Brocket Deer** [*M. gouazoubira*] and the **Lowland Tapir** [*Tapirus terrestris*]. The total number of animals and biomass harvested are presented in Table 16.

Table 15: Estimates of Peccary Consumption per year by Low-Income & Rural Populations of the Brazilian Amazon

SPECIES	Animals Consumed [numbers]		Biomass Harvested [tonnes]		% of Mammals	% of Total
	Minimum	Maximum	Minimum	Maximum		
White Lipped Peccary [<i>Tayassu pecari</i> , or <i>Pecari pecari</i>]	511,527	1,499,318	15,655.1	38,382.5	25.9	23.3
Collared Peccary [<i>T. tajacu</i> or <i>Pecari tajacu</i>]	551,949	1,353,248	11,039.0	17,065.0	18.3	16.4
Total Mammals	6,444,266	15,789,999	60,425.7	148,149.7		
Total All Vertebrates	9,581,487	23,491,529	67,173.0	164,692.0		

Source: Adapted from Peres (2000)

If we are extracting around one million collared peccaries per year from the Brazilian Amazon alone, then there is room for genetic selection within the Collared Peccary to improve this

animal's performance in captivity. **The extraction rate of the collared peccaries in this area is calculated to range from 0.1 to 0.26 animals / km² / annum.**

In Trinidad and Tobago as in Brazil significant harvesting of wildlife occurs with similar consequences. In the following section, a synopsis of the situation regarding wildlife harvesting, commercialization and utilization is provided.

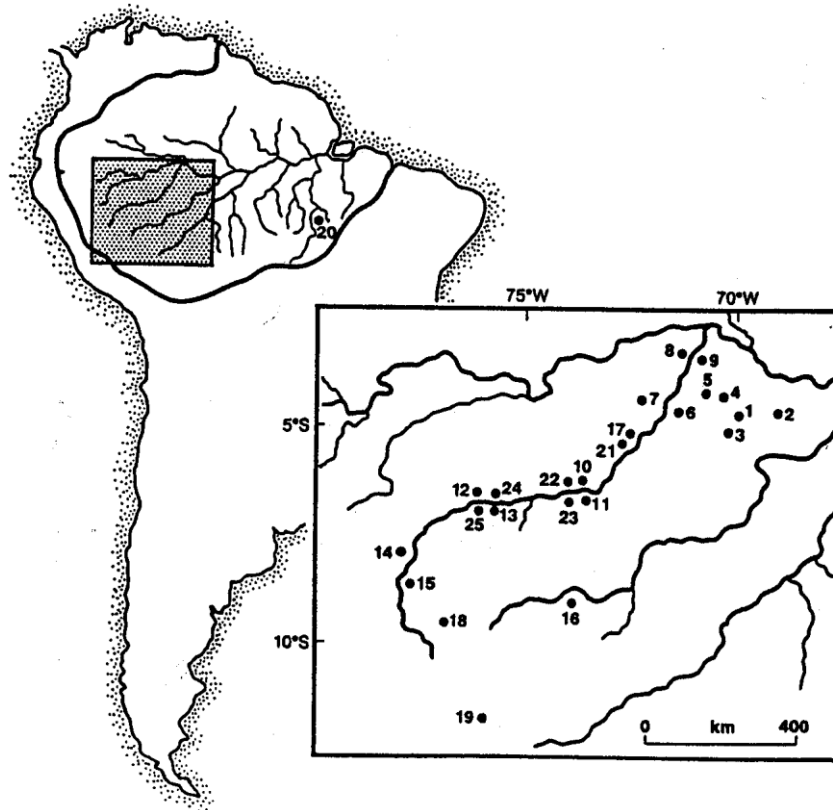


Figure 136: Location of Amazonian Rain Forest Sites censused by Peres (2000)

6.2.2 *Information on the Wildlife Industry in Trinidad and Tobago [A Small Twin Island Caribbean State]*

Trinidad is the larger of the twin island state of The Republic of Trinidad and Tobago. The island is located 10.50N latitude and 61.50W longitude and consists of 4,828 km². Tobago, just northeast of Trinidad, is 300 km². The average rainfall for the period May 1996 to May 1998 was 1,909mm. Maximum and minimum temperatures for this period were 32.30C and 22.90C respectively. The climate is described as a “Wet and Dry Tropical” climate with five (5) to six (6) months of dry weather (January to May or June) and five (5) to six (6) months of wet weather (May or June to December). The Central Ridge in Tobago is the oldest Forest Reserves in the Western Hemisphere [it was designated a forest reserve in 1765]. These forests are divided into legally constituted Forest Reserves and other forest or State Lands. On the island of Trinidad there are 161,524 hectares of forest reserves that are accessible to licensed hunters [Table 17].

Table 16: Area of forests in Trinidad and Tobago

CATEGORY	TRINIDAD (ha)	TOBAGO (ha)	TOTAL (ha)	% OF TOTAL AREA
Forest Reserves	99,435	3,958	103,393	20.1%
Forest on State Lands	62,089	3,366	65,455	12.7%
Total	161,524	7,324	168,848	32.8%

Source: Wildlife Section, Forestry Division of the Ministry of Agriculture, Land and Marine Resources)

This small twin island state consists of a population of 1,282,600 people of which 558,700 are employed. Trinidad and Tobago has an oil-based economy with a Gross Domestic Product in 1998 of 36,493.5 million TT\$ (6.3TT\$ = 1US\$, 1998-2000). Oil and Asphalt including Mining and Refining generated TT\$ 7,799.4 million while Agriculture contributed 744.6 million TT\$ in 1998. Two (2) main ethnic groups, African descendants and East Indian descendants, make up 39.6% and 40.3% of the population respectively. The four (4) dominant religions are Roman Catholics, Hindus, Anglicans and Muslims with percentages of 29.4%, 23.8%, 10.9% and 5.5% respectively (CSO, 1999). Whereas certain religions prohibit the eating of particular meats [for example Islam forbids the consumption of pork or pork products], there is likely no religion which strongly objects to the eating of any “wildmeat” (the meat of Neo-tropical wildlife species). A survey conducted by Mohammed (1999 unpublished) has supported this statement. The local wildlife includes game animals listed in Table 18. It should be pointed out that the Collared Peccary or the Quenk (which is commonly called wild hog) is not a pig (*Suis* sp) species. So Muslims can theoretically eat the meat of this animal as long as the animal was “hallalled”.

The fauna of Trinidad and Tobago is typical of that of the South American Tropics with a range of biological diversity that no other island within the Caribbean can match. Species such as the red squirrel, the green parrot and various sound birds are kept as pets. However the squirrel and the green parrot can also be considered a pest as both species attack local cocoa (*Theobroma cacao*) fields and damage the cocoa pods (Molineau *et al* 2003). The Cocrico (*Ortalis ruficauda*) (one of the two national birds) is also considered a pest in Tobago as it attacks fruit trees and orchards on the island.

Brown, Garcia, Manick, Poujade (1994) and Brown *et al* (2000) presented a case study of Wildlife Farming in Trinidad based on 1990 information. They concluded that wild meat is sold at a higher price per kilogram than the meat of domesticated animals, such as poultry, pork, chevron, beef and mutton. In addition, they suggested that once wildlife farmers can produce a steady supply of wild meat there could be some economic potential. They noted that there was little information on local game animals. In that study they reported that there were only 15-20 registered and accessible wildlife farmers.

By 2004 this number rose to 250 registered and 79 active wildlife farmers in Trinidad. They were registered with the Wildlife Section in the Forestry Division, Ministry of Public Utilities and The Environment. The present situation suggests that wildlife farming is growing in Trinidad, and with governmental support rural communities can attain some socio-economic benefits from this activity. The constraints to the expansion of wildlife farming, however, as perceived by them are outlined below:

1. **Breeding Stock:** this is seen as the major constraint to production as breeding stock is in great demand;
2. **Technical Information and Production Models** for the species in Trinidad and Tobago: this information is generally absent or unavailable, so far the only reliable information of this type has been recently published on the Agouti by Brown-Uddenberg *et al* (2004); and
3. **Some positive support and direction from the state:** the farmers surveyed see this as a badly needed pre-condition for success, [Rooplal, 2004].

Table 17: Major Local Game Species hunted in Trinidad and Tobago

ORDER	LOCAL NAME	SCIENTIFIC NAME
Mammalia	Agouti Manicou (black-eared opossum) Neo-tropical Red Squirrel Lappe or Spotted Paca Red Brocket Deer Tattoo or Nine Banded Armadillo Wildhog/ quenk	<i>Dasyprocta leporina</i> <i>Didelphis marsupialis insularis</i> <i>Sciuriur granatensis</i> <i>Agouti paca</i> <i>Manzama americana</i> <i>Dasypus novemcinctus insularis</i> <i>Tayassu tajuca, Pecari tajacu</i>
Birds	Cocrico Green Parrot Songbird species	<i>Ortalis ruficauda</i> <i>Amazona amzaonica</i> Very many species
Reptilia	Alligator or Spectacled Caiman Iguana Morocoy	<i>Caiman sclerops</i> <i>Iguana iguana</i> <i>Geochelene spp.</i>

All of this points to the immediate need for a model to be developed to serve as a basis for organizing or reorganizing the present industry.

6.2.2.1 The Methodology Used In Developing The Model Of The Wildlife Industry In Trinidad and Tobago

The model for the Wildlife Industry in Trinidad and Tobago was developed based on information obtained from the Wildlife Section, Forestry Division formerly of the Ministry of Agriculture, Land and Marine Resources, now of the Ministry of Public Utilities and the Environment, Republic of Trinidad and Tobago. This information included the number of hunting permits sold by the Wildlife Section during the period 1990 to 2003. Also used were data on the harvest of wildlife from the forest by the registered hunters. This consisted of the number of wildlife farmers, their personal

information, the various wildlife animals reared and their numbers. This was then used to calculate the supply potential of both the licensed hunters and wildlife farmers. A diagrammatic representation of the Wildlife Industry was then developed by Mollineau *et al* (2000) using these findings and other contributing components from the sectors which make up the Wildlife Industry. The components of a Livestock Industry have been classified as (1) Input Suppliers, (2) Processors, (3) Control Systems, (4) Research and Development and (5) Markets as suggested by Garcia, Young, John and Bridgewater (1999).

6.2.2.2 *The Industry Findings*

The wildlife industry in Trinidad (Figure 137) is small relative to other livestock industries within the country. It consists of a small niche market where the consumers comprise mainly the wild meat lovers and pet shops which purchase and sell wildlife as pets. Hunters and wildlife farmers are the main producers/supplies of wild meat to the market. Hunters also trap sound birds, parrots, monkeys and squirrels for the pet trade. The most consumed and intensively-reared wild meat appears to be the Agouti (*Dasyprocta leporina*). A breakdown of the hunting permits sold between 1989 and 2004, as well as the number of hunters are presented in tables 19 and 20.

The hunting season runs from October 1st of one year to February 28th of the following year [five months]. A hunting permit costs TT\$20.00 and it allows a person to hunt a specified species for the particular hunting season. This restriction was introduced in an attempt to protect, conserve and hopefully assist in increasing the wildlife population, that has been over hunted in recent years. However, the natural wildlife is under threat from poachers and bush fires during the dry season (that generally runs from December to May), and agriculture and development which compete for their habitats. Poachers use homemade guns, trap guns and other forms of cruel harvesting methods, which also endanger the lives of other persons who would like to use the forest resources. The poachers operate outside of the law and during the closed hunting season (March 1st to September 30th). Their catch may sell for double the amount demanded by the registered hunters. Each year bush fires damage the habitat of wildlife species placing added stress on their population survival chances. In addition forest are also deliberately burned by farmers to clear more agricultural lands for their crops (Mollineau *et al* 2000).

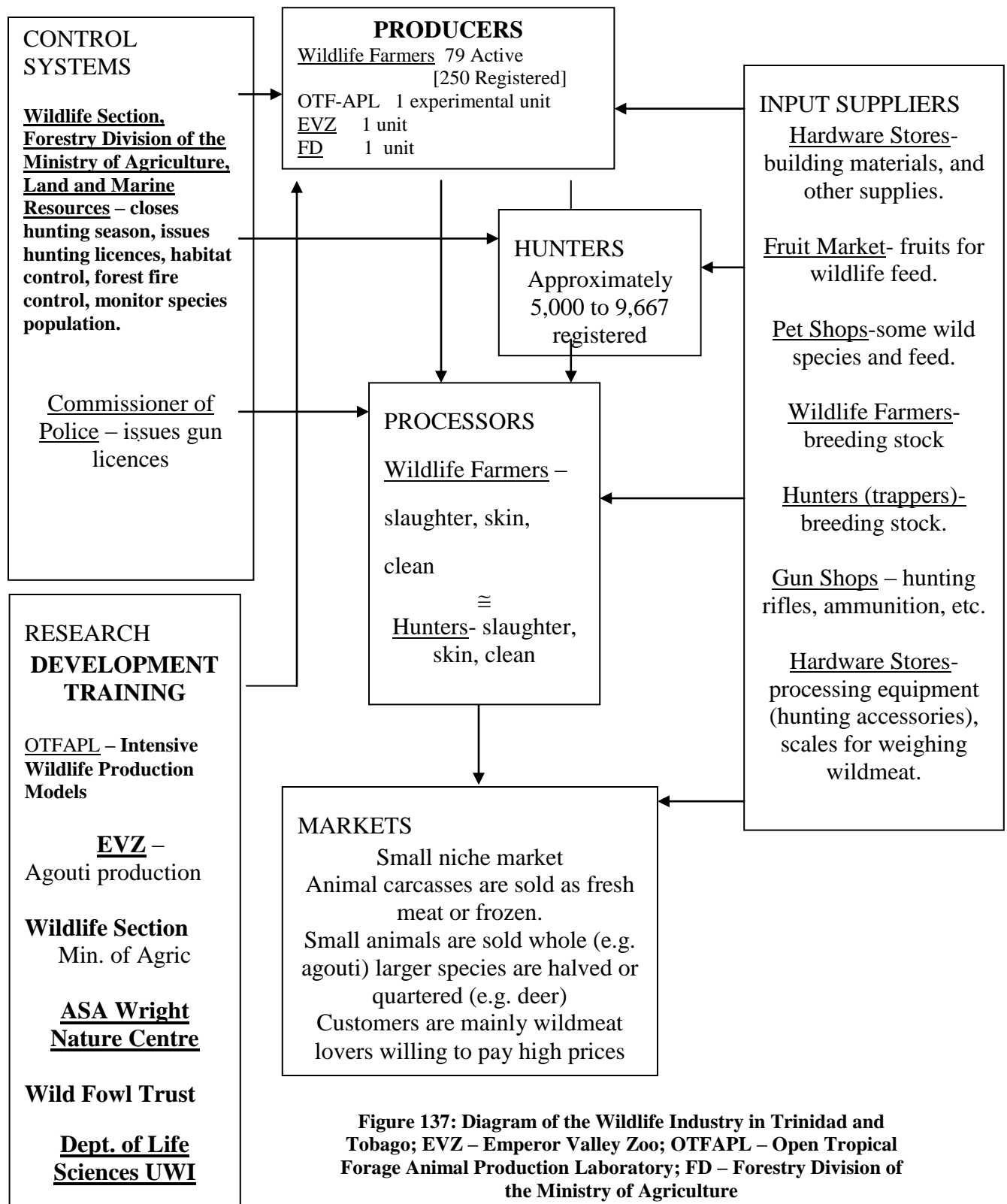


Figure 137: Diagram of the Wildlife Industry in Trinidad and Tobago; EVZ – Emperor Valley Zoo; OTFAPL – Open Tropical Forage Animal Production Laboratory; FD – Forestry Division of the Ministry of Agriculture

The revenue collected by the Wildlife Section for hunting permits during the period 1989-90 to 2003-04 ranged from \$23,560 to \$276,500 (TT\$) (Table 19). The total number of permits sold from 1989 to 2004 ranged from 1178 to 13,825, and the total number of hunters paying for permits ranged from 1142 to 9667 (Table 19 and 20). The total number of permits sold by species are detailed in Table 20. Upon purchasing the permits the hunters must return Mandatory Data Forms which would report their catch for the season. Failure to do so will result in disqualification for a permit the following season.

**Table 18: Wildlife Section, Forestry Division State Game Licences Programme
Total Permits Sold, Revenue Collected & Total Number of Hunters
During The Period 1989- 2003**

SEASON	TOTAL PERMITS	REVENUE COLLECTED (TT\$)	TOTAL HUNTERS
1989/1990	1178	23,560	
1990/1991	1428	28,560	1142
1991/1992	4737	94,740	3790
1992/1993	6970	139,400	5677
1993/1994	7467	149,240	6398
1994/1995	7455	149,100	6040
1995/1996	6943	138,860	5561
1996/1997	7265	145,300	5412
1997/1998	7342	146,840	5568
1998/1999	9253	185,060	5748
1999/2000	9379	187,580	7094
2000/2001	9765	195,300	6342
2001/2002	11220	224,400	9555
2002/2003	12704	254,080	9667
2003/2004	13825	276,500	8375

Table 19: Wildlife Section, Forestry Division State Game Licences Programme Permits Sold by Species during The Period 1989- 2003

SEASON	SPECIES SOLD								TOTAL PERMITS	REVENUE COLLECTED	TOTAL HUNTERS
	AGOUDI	CAGE-BIRDS	DEER	LAPPE	ALLIG. / LIZARD	QUENK	TATTOO/ ARMAD.	WATER -FOWL			
1989/1990									1178	23560	
1990/1991	3037	222	1214	986	111	309	1287	262	1428	28560	1142
1991/1992	1901	38	904	619	66	260	789	160	4737	94740	3790
1992/1993	3157	135	1190	850	65	239	1125	206	6970	139400	5677
1993/1994	3275	138	1262	903	91	302	1224	272	7467	149240	6398
1994/1995	3358	142	1238	916	92	301	1145	263	7455	149100	6040
1995/1996	3025	95	1173	887	128	269	1086	280	6943	138860	5561
1996/1997	3145	93	1269	944	193	334	968	319	7265	145300	5412
1997/1998	3083	116	1218	914	211	301	1053	446	7342	146840	5568
1998/1999	3300	106	1347	1098	295	358	1138	1611	9253	185060	5748
1999/2000	3818	125	1562	1226	397	411	1355	485	9379	187580	7094
2000/2001	3939	146	1584	1282	441	453	1404	516	9765	195300	6342
2001/2002	4511	182	1726	1468	612	496	1657	568	11220	224400	9555
2002/2003	4906	199	2038	1629	767	628	1836	701	12704	254080	9667
2003/2004	5197	228	2186	1790	904	671	2097	752	13825	276500	8375

These hunters trap and shoot the species such as the agouti (*Dasyprocta leporina*), the lappe (*Agouti paca*), the Red Brocket deer (*Manzama americana*), the iguana (*Iguana iguana*), the nine banded armadillo/tattoo (*Dasytus novemcinctus*), the collared peccary/wildhog/quenk (*Tayassu tajacu*), the manicou/black-eared opossum (*Didelphis marsupialis insularis*), the cocrico (*Ortalis ruficauda*), and the spectacled caiman/alligator (*Caiman sclerops*). The reported Hunter Harvests for the seasons 1990-91 to 1994-95 are presented in Table 21. The estimated value of the wildlife harvested for the respective years are presented in Tables 22 to 26. These values range from TT\$4.0 million to TT\$5.7 million. These hunters are made up of hobbyist to occupational hunters.

Table 20: Reported Harvest for Seasons 1990 Through 1995

Species	SEASON 90-91 % of Forms Returned 45%	SEASON 91-92 % of Forms Returned 75%	SEASON 92-93 % of Forms Returned 78%	SEASON 93-94 % of Forms Returned 73%	SEASON 94-95 % of Forms Returned 85%	Average	SD
Agouti	7,540	14,363	11,616	16,741	16,900	13,432	3,932
Cage Birds	99	29	80	75	63	69	26
Deer	850	1,299	967	1,230	1,254	1,120	199
Lappe	699	1,058	987	1,052	1,107	981	163
Lizards	185	378	88	252	479	276	155
Quenk	173	325	183	239	157	215	69
Tattoo	1,337	2,238	1,767	2,620	1,670	1,926	504
Water Fowl	1,943	2,419	1,055	2,076	1,494	1,797	531
Total	12,826	22,109	16,743	24,285	23,124	19,817	4,860
Average	1,603	2,764	2,093	3,036	2,891		
SD	2,482	4,768	3,893	5,612	5,693		

Table 21: Value [\$TT] of harvest for the Period 1990-1991

Species	# OF ANIMALS		DRESSED WT. kg/ Animal	DRESSED WT. kgs. 100%	PRICE TT\$/ kg	TOTAL Value TT\$
	45% RETURN	100%				
Agouti	7540	16756	2.27	38035	\$39.60	\$1,506,190.40
Cage birds	99	220	0.00	0	\$99.00	\$21,780.00
Deer	850	1889	15.91	30052	\$55.00	\$1,652,872.22
Lappe	699	1553	10.45	16232	\$50.00	\$811,616.67
Lizards	185	411	1.82	748	\$44.00	\$32,921.78
Quenk	173	384	34.09	13106	\$55.00	\$720,814.11
Tattoo	1337	2971	3.18	9448	\$66.00	\$623,576.80
Water fowl	1943	4318	1.36	5872	\$30.80	\$180,863.08
TOTAL	12,826	28,502				\$5,550,635.05

\$6TT = \$1US

Table 22: Value [\$TT] of harvest for the Period 1991-1992

Species	# OF ANIMALS		DRESSED WT. Kg/ Animal	DRESSED WT. kgs. 100%	PRICE TT\$/kg	TOTAL Value TT\$
	75% RETURN	100%				
Agouti	14363	19151	2.27	43472	\$39.60	\$1,721,491.73
Cage birds	29	39	0.00	0	\$99.00	\$3,828.00
Deer	1299	1732	15.91	27556	\$55.00	\$1,515,586.60
Lappe	1058	1411	10.45	14741	\$50.00	\$737,073.33
Lizards	378	504	1.82	917	\$44.00	\$40,360.32
Quenk	325	433	34.09	14772	\$55.00	\$812,478.33
Tattoo	2238	2984	3.18	9489	\$66.00	\$626,281.92
Water fowl	2419	3225	1.36	4386	\$30.80	\$135,102.76
TOTAL	22,109	29,479				\$5,592,203.00

\$6TT = \$1US

Table 23: Value [\$TT] of harvest for the Period 1992-1993

Species	# OF ANIMAL		DRESSED WT. Kg/ Animal	DRESSED WT. kgs. 100%	PRICE TT\$/kg	TOTAL Value TT\$
	78% RETURN	100%				
Agouti	11616	14892	2.27	33806	\$39.60	\$1,338,699.32
Cage birds	80	103	0.00	0	\$99.00	\$10,153.85
Deer	967	1240	15.91	19724	\$55.00	\$1,084,837.63
Lappe	987	1265	10.45	13223	\$50.00	\$661,163.46
Lizards	88	113	1.82	205	\$44.00	\$9,034.67
Quenk	183	235	34.09	7998	\$55.00	\$439,892.12
Tattoo	1767	2265	3.18	7204	\$66.00	\$475,458.92
Water fowl	1055	1353	1.36	1839	\$30.80	\$56,656.21
TOTAL	16,743	21,465				\$4,075,896.17

\$6TT = \$1US

Table 24: Value [\$TT] of harvest for the Period 1993-1994

Species	# OF ANIMAL		DRESSED WT. Kg/ Animal	DRESSED WT. kgs. 100%	PRICE TT\$/kg	TOTAL Value TT\$
	74% RETURN	100%				
Agouti	16741	22623	2.27	51354	\$39.60	\$2,033,624.29
Cage birds	75	101	0.00	0	\$99.00	\$10,033.78
Deer	1230	1662	15.91	26445	\$55.00	\$1,454,475.00
Lappe	1052	1422	10.45	14856	\$50.00	\$742,797.30
Lizards	252	341	1.82	620	\$44.00	\$27,270.49
Quenk	239	323	34.09	11010	\$55.00	\$605,558.18
Tattoo	2620	3541	3.18	11259	\$66.00	\$743,088.65
Water fowl	2076	2805	1.36	3815	\$30.80	\$117,512.82
TOTAL	24,285	32,818				\$5,734,360.50

\$6TT = \$1US

Table 25: Value [\$TT] of harvest for the Period 1994-1995

Species	# OF ANIMAL		DRESSED WT. Kg/ Animal	DRESSED WT. kgs. 100%	PRICE TT\$/kg	TOTAL Value TT\$
	85% RETURN	100%				
Agouti	16900	19882	2.27	45133	\$39.60	\$1,787,264.47
Cage birds	63	74	0.00	0	\$99.00	\$7,337.65
Deer	1254	1475	15.91	23472	\$55.00	\$1,290,956.12
Lappe	1107	1302	10.45	13610	\$50.00	\$680,479.41
Lizards	479	564	1.82	1026	\$44.00	\$45,127.44
Quenk	157	185	34.09	6297	\$55.00	\$346,314.29
Tattoo	1670	1965	3.18	6248	\$66.00	\$412,352.47
Water fowl	1494	1758	1.36	2390	\$30.80	\$73,624.32
TOTAL	23,124	27,205				\$4,643,456.17

\$6TT = \$1US

In 1995 these meats sold for between TT\$30.00/kg and TT\$66.00/kg depending on the species. But in 2004 these same meats sold for between \$111 TT [\$18 US] to \$198 TT [\$33 US]/kg dressed carcass. There is no official pricing structure in the industry and prices are determined mainly by supply and demand. The prices used in this report are prices estimated by the Wildlife Section, Forestry Division. However, the prices of caged birds may reach as high as TT\$5,000/ bird, if the bird is a very good whistler.

What is most interesting is the quantum of each of the species being hunted and removed from production in the wild. The earlier information (1990-1995) suggested that on average **at least 18,660 Agouti, 1,604 Deer, 1,395 Lappe, and 313 Quenk/ Collared Peccary** are harvested from the wild annually (calculated from Mollineau *et al* 2000). How sustainable is this we do not know, but the work of Nelson (1996) suggested that wildlife populations sizes may be decreasing. He based his conclusion on the results of a regression of catch versus effort for species harvested. The regression revealed a negative relationship, suggesting that wildlife species were being over-exploited. He estimated that the population sizes were declining at a rate of 15% per annum. He also used regression analysis to estimate agouti populations before harvesting. He estimated the approximate population numbers for 1990, 1991 and 1993, to have been 23,700, 14,391 and 11,745 respectively. His concern was so alarming that he recommended a 66% reduction in the length of the hunting season. This he said would be a logical first step in reducing hunting pressure, thus allowing wildlife population sizes to recover and maintain their concentrations.

Table 26: Number of Animals Harvested during the hunting seasons from 1999 to 2003

TOTAL	YEAR (1999-2000)	YEAR (2000-2001)	YEAR (2001-2002)	YEAR (2002-2003)
Agouti	17086	17559	22228	24570
Deer	882	1582	1582	1864
Lappe/ Paca	1051	1855	2044	2122
Tattoo	1355	2709	3261	3369
Quenk/ Peccary	162	408	415	531
Birds	58	112	127	144
Waterfowl	2526	3394	3459	3094
Iguana	998	1437	1771	2446
Totals	24118	29056	34887	38140

Table 27 suggests that in 2002-2003 24,570 Agouti were reported as having been harvested by hunters and this was more than twice the number projected by Nelson (1996) for the 1993 Agouti population. In addition Roopchand (2002) conducted an independent study with hunters to test their recall of their catch, and this data suggested that they were underestimating their reported catch (on the official Hunter Return Form) by a factor of 4.7 (**the Roopchand Factor**). This would take the present Agouti extraction rate at over 100,000 animals per annum. The Agouti population therefore appears resilient, but among the hunted mammals the Wild Hog/ Quenk or Collared Peccary seem to be the one with the lowest extraction numbers. This therefore makes a very strong case for the Quenk/ Peccary to be intensively reared for conservation purposes.

IMPORTANT TO NOTE!!!!!!!!!!!!!!!!!!!!!!

The data presented earlier from Peres (2000) suggested that in the area of the Brazilian Amazon studied the extraction rate of the Collared Peccaries ranged between **0.1 to 0.26 animals/km²/annum**. In Trinidad and Tobago (that is 4828 km²) the extraction rate of Collared Peccaries is estimated at **0.04 to 0.20 animals/km²/annum**. If we also correct for the fact that Trinidad and Tobago is 32.8 % forest then the extraction rate would be estimated to be **0.12 to 0.60 animals/km²/annum**, higher than the Amazon extraction rate!. This therefore strengthens the case for the following to occur in Trinidad and Tobago:

1. The need for greater control over hunting and
2. The need for captive rearing of our Neo-tropical wildlife species.

6.2.2.4 Use of Wild meat in Trinidad and Tobago

In Trinidad and Tobago, the harvest of wildlife species caters basically to the meat consumption trade for those persons wanting to keep in touch with their primeval roots. Figures 138 to 143 illustrate aspects linked to this wild meat consumption.



Figure 138: Urban setting for a Wild Meat Que [Bar B Q] in Trinidad



Figure 139: Advertisement for a Wild Meat Que [Bar B Q] in an urban area in Trinidad



Figure 140: Details of the advertisement for a Wild Meat Que [Bar B Q] in an urban area in Trinidad



Figure 141: Cooking of Wild Meat Que [Bar B Q] in an urban area in Trinidad



Figure 142: The Presentation of Cooked Wild Meat at a Wild Meat Que [Bar B Q] in an urban area in Trinidad



Figure 143: The served Wild Meat Que [Bar B Q] in an urban area in Trinidad [cooked mixed wild meat stew served with boiled dasheen (*Clocasia esculenta* (L.) Schott.) and Cassava (*Manihot esculenta*)]

6.2.3 Wildlife Utilization by Restaurants in French Guyana

Unlike what obtains in Trinidad Bemelmans (2003) indicated that in French Guiana there were 187 restaurants along the coast of which 27 (14.4%) served Neo-tropical wild-meat. The meats of wildlife species (also called “Gibier”) that were the most represented on the menus were as follows:

• Pakira [Collared Peccary- <i>Tayassu tajacu</i>]	85.2 %
• Cochon Bois [White lipped Peccary- <i>T. pecari</i>]	85.2 %
• Maipouri [Tapir- <i>Tapirus terrestris</i>]	85.2 %
• Agouti [Agouti- <i>Dasyprocta leporina</i>]	51.9 %
• Paca [Lappe- <i>Agouti paca</i>]	51.9 %
• Cabiã [Capibara- <i>Hydrochaeris hydrochaeris</i>]	44.4 %
• Tatou [Tatoo- <i>Dasybus novemcinctus, D. kappleri</i>]	40.7 %
• Hocco [<i>Crax alector</i>]	29.6 %
• Iguane [Green iguana – <i>Iguana iguana</i>]	18.5 %
• Marail [<i>Penelope marail</i>]	11.1 %
• Agami [<i>Psophia crepitans</i>]	11.1 %.

6.2.3.1 Background to the Wild-meat trade in French Guyana

Bemelmans (2003) reported that a very high consumer demand existed for Neo-tropical wild meat in French Guiana. The market channels that she described were based on an analysis of her findings as well as those reported by Magrat (2000) and Jori and Bonando (2001). This is presented in Figure 144.

Bemelmans (2003) summary of the situation was as follows.

1. The hunters existed, but it was difficult to evaluate their impact and the exact numbers of hunters, as there was no formal hunting organization and no hunting permits were issued.
2. Hunting could be a full-time or part-time form of employment.
3. In the North of French Guiana the full time hunters were more important, and subsistence hunting predominated in the South.
4. Some restaurants specialized in wild meat and are called “Les Restaurants de haut de gamme” and catered to a unique social level.
5. Some restaurants of “Cuisine metropolitaine” would only cook wild meat for requested functions.

6. Wild meat was sold only at the following markets, St. Laurent du Maroni and St. Georges de l'Oyapock.
7. The consumers of wild meat were both rural and urban (on special festive occasions) and occasional (mainly visitors and tourists).

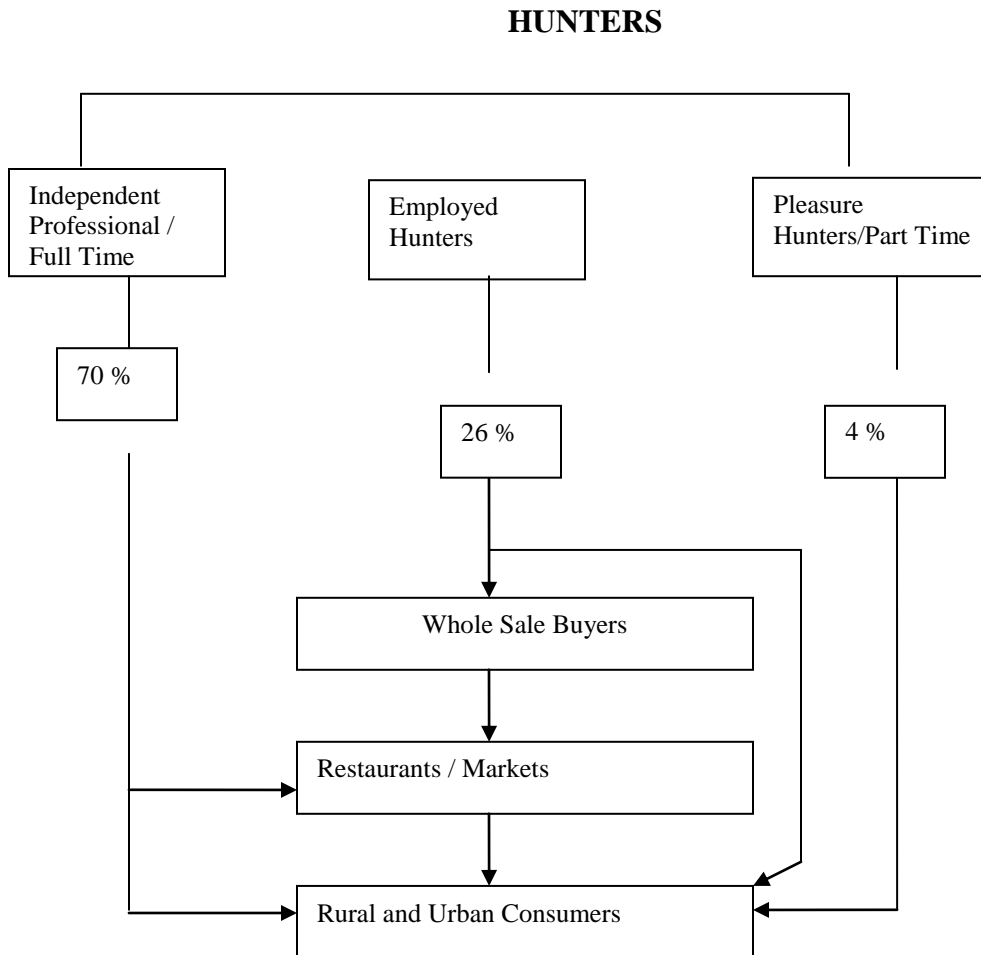


Figure 144: Schematics of the actors in the trade in Neo-tropical Wild Meat in French Guiana

6.2.3.2 The amount of neo-tropical Wild-meat consumed in French Guiana

Tyburn (1994) reported that when wild meat was sold in the Cayenne market the amount sold was 23 tonnes of wild meat carcasses/year. In Bemelmans 2003 study there were 185 registered restaurants, and of these seventy (70) were contacted and 47 responded to her request for an interview.

Total of known restaurants in French Guiana	= 185
Number Interviewed	= 47 (25.4%)
Number Selling Wildlife dishes	= 27 (14.61%)
Number Selling Metropolitan dishes	= 20 (10.8%)

[Source: Bemelmans (2003)].

This survey in 2003 led Bemelmans (2003) to estimate that the restaurants which served wild meat (Gibier) had a potential annual demand of 36.42 tonnes. This was based on the information obtained from the Cayenne restaurants which comprised about 50% of the sample size.

6.2.3.3 Supply of Wild-meat to the Restaurants in French Guiana

The sources of wild-meat supplied to the restaurants surveyed in French Guyana came from the follows:

- Hunters 67 %
- Wholesalers 8 %
- Own source 8 %
- Market 4 %
- Private 4%.

They also indicated that the wild meat was purchased in either of two forms:

- Some 52% as predetermined cuts and
- 33% as the whole animal with skin.

Total 85% of the respondents.

6.2.3.4 Approaches used in choosing Wild-meat for use by the Restaurants in French Guiana

The findings from thirty three percent (33%) of the responses given this question indicated that the following were a listing of the criteria that they used when buying Neo-tropical meat:

1. **Overall appearance-** Overall appearance
2. **Colour**----- The Colour of the muscle
3. **Odour**----- The Odour of freshness or rancidity
4. **Texture**-----The Texture and firmness of the flesh
5. **Price**----- Price of the meat offered
6. **Age**-----Age of the animal (30% of the restaurants)
7. **Presentation-**The method used in cutting up the meat
8. **Freshness**-----The freshness of the meat judged by the color of the flesh
9. **Confidence**---The confidence or trust between the owner and the hunter.

The Wild Meat Menu

The menus surveyed indicated that the most popular meats were the Collared Peccary (*Tayassu tajacu*), the White-lipped Peccary, the Tapir, the Agouti (*Dasyprocta leporina*), the Paca (*Agouti paca*), the Capybara (*Hydrochoerus hydrochaeris*) and the Nine-banded Amadillo/Tattoo (*Dasyopus novemcinctus*).

Types of Wildlife Dishes

The types of dishes served in restaurants were generally in the following forms:

- Stewed 67 %
- Steak 49 % (Tapir)
- Other 25 %

The dishes had a range of prices as indicated below:

Average Wild meat plate - 12.4 Euros
Tapir Steaks - 15.7 Euros
Whole Menu - 23.0 Euros.

A commentary: in the average plate or portion, there was approximately 250 grams (g) of meat. Thus the sale of the cooked wild meat was in the order of 50 E / kg. [Note one (1) E = 1.3 -1.7 US\$ in August 2004].

Quantity of Wild meat Sold in the Restaurants

Twenty three [23] of the 27 restaurants responded to this question. The total response was 1005.6 kg/ month with an average of 43.72 kg/ restaurant/ month. Bemelmans (2003) then estimated that the potential total demand for wild meat from the restaurants in French Guiana was 36,419 kg/year, (approximately **36 TONNES PER ANNUM**).

The Collared Peccary represents about 10-15 % of the total wild meat market. This represents between 260 -290 peccaries per annum.

6.2.4 Wild Meat Sale and Marketing to the Public

In Trinidad and Tobago wild meat is sold by:

- ❖ Hunters and
- ❖ Few Supermarkets- Initiatives are in place at Persad's Supermarket in Rio Claro [Figure 145] and the Triangle Supermarket in Chase Village.



Figure 145: Cut up Agouti being sold in Persaud's Supermarket in Rio Claro, Trinidad and Tobago

The initiative of Mr. Trevor Rattansingh of the Triangle Supermarket in Chase Village is instructive. He purchases hot or chilled whole eviscerated carcasses, with the feet intact, to ensure freshness, wholesomeness and authenticity of the carcasses. Peccaries are purchased without the head, but the meats of the Agouti, Lappe/Paca and Manicou are all purchased with the head. The animals are then frozen and sold either whole or cut-up frozen.

In French Guiana wild meat is sold:

- ❖ At the St. Laurent Market
- ❖ At the Cayenne Market [outside at about 30 E/ 2-4 lbs Agouti].



Figure 146: Smoked Armadillo [*Dasyus novemcintus*] being sold in the Saint Laurent market in French Guyana



Figure 147: Smoked fresh water fish being sold in the Saint Laurent market in French Guyana

In Suriname wild meat or wild animals are sold:

- ❖ In the Paramaribo Market
- ❖ At special roadstands, Fish and “Bush” markets.

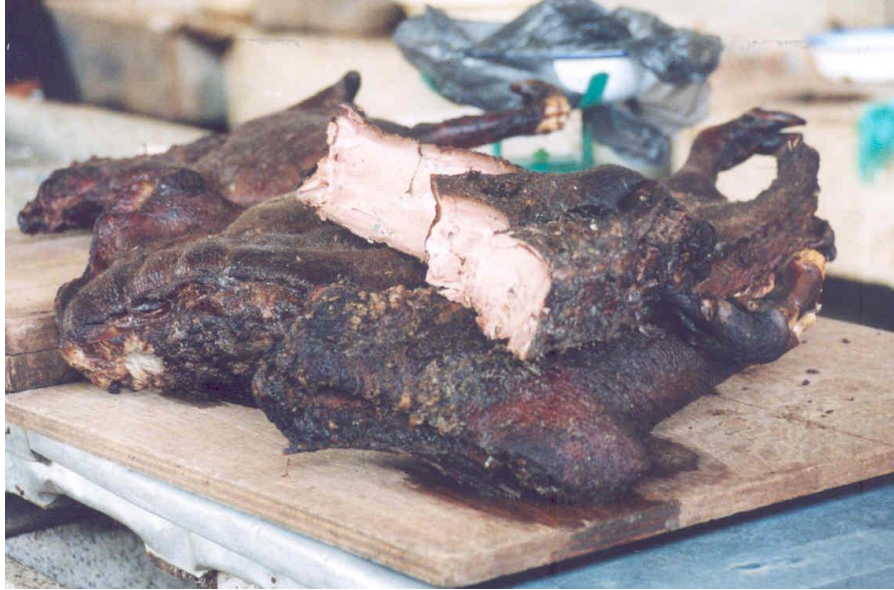


Figure 148: Smoked Peccary [*P. tajacu* or *T. tajacu*] being sold in the Paramaribo market in Suriname

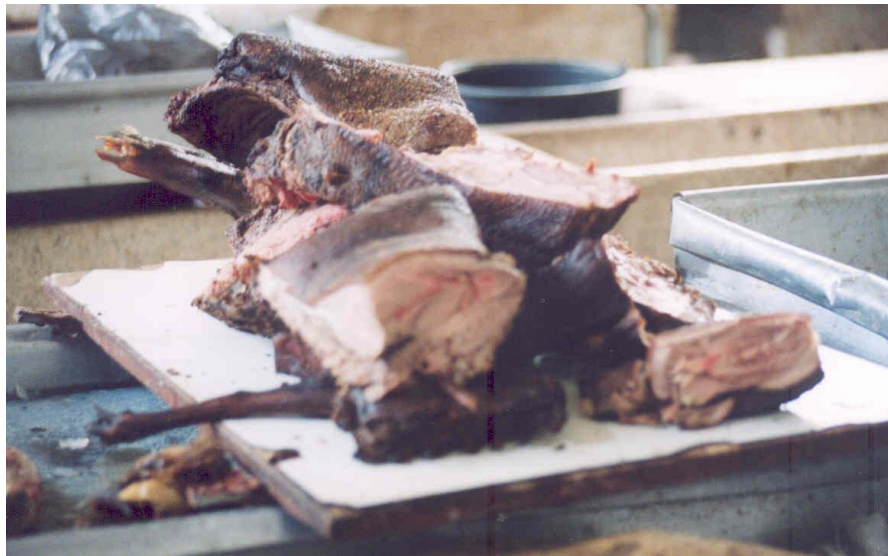


Figure 149: Smoked Peccary [*P. tajacu* or *T. tajacu*] being sold in the Paramaribo market in Suriname



Figure 150: Smoked Quenk and Fresh Lappe [*Agouti paca*] being sold in the market in Paramaribo, Suriname

In Iquitos, Peru wild meat or wild animals are sold:

- ❖ In the Public Market



Figure 151: Peccary and *Agouti paca* meat being sold fresh in the Iquitos Market in Peru



Figure 152: Smoked Peccary meat being sold in the Iquitos Market in Peru

6.3 THE CONVERSION OF ANIMALS' MUSCLE TO MEAT

These two upcoming sections [6.3 and 6.4] have been written to explain to you how the live animal is transformed from being on the hoof [alive] to meat suitable for human consumption. This would then lead us logically to Peccary Cuisine.

Conversion of Animals' Muscle to Meat: The Harvesting of Muscle from Animals

This section attempts to simplify for you the process of converting animal muscles and edible parts into safe and wholesome edible animal products. It should be pointed out here that the unique features of the many Neo-tropical meats are still to be understood. The harvesting of muscle from live animals requires that the animals must first be certified to be of good health, then the animals' lives must be terminated and finally the meat and other animal products removed from the lifeless animal. Finally, the animal products so harvested must then be certified safe for human consumption. This set of activities can be simplified as follows:

***Ante Mortem* [AM] Inspection**

This is the inspection of the animal 24 hours before slaughter (before the animal is humanely put to death). First there is the external physical examination, the taking of the rectal temperature (to ensure that the animal is in a normal state of health) and the physical examination of the animal to ensure that the animal does not display any obvious signs of disease.

Animal Slaughter

Next in the process flow is animal slaughter. It is the steps involved in taking the animals' life and safely collecting the products from its lifeless body.

Before slaughter, however, the animal must be fasted/or not fed for 24 hours.

A very important feature of this process is the live animal entering at one end of the facility to the kill floor, and its parts [containing the parts of the digestive system] coming out in one direction and the edible meat and organs in the opposite direction. This ensures that the edible meat and organs are not contaminated by the faeces or contents of the digestive system.

***Post Mortem* [PM] Inspection**

This involves the inspection of

- the Animal's Head and Glands around the neck region;
- the Liver
- Kidneys

- Heart and
- The general condition of the carcass.

Figure 153 presents the process flow chart for the general harvesting of muscle from different kinds of animals.

The Conversion of Muscle to Meat

The muscle on the animal at slaughter is a living tissue with complex biochemical and physiological properties. We impose a series of treatments, changing its temperature, tension, and fluid and gaseous environment, and it changes from muscle to meat.

Living muscle tissue

In living muscle, the complete oxidation of carbohydrate to carbon dioxide and water requires the intervention of oxygen, and it releases a lot of energy. Much of this energy is captured by adding a phosphate group to another molecule that already contains two phosphate groups. This chemical in the muscle tissue is called adenosine diphosphate (ADP) and it is converted to adenosine triphosphate (ATP). The ATP molecule carries this energy within the muscle fibre, and it may be released to another biochemical system by cleaving off the added phosphate ($ATP \rightarrow ADP + P$). Muscle contraction is a primary user of ATP in the living animal, but substantial amounts of ATP are also used by the membranes around and within the fibre for maintaining ionic concentration gradients.

The muscle tissue after exsanguinations [bleeding]

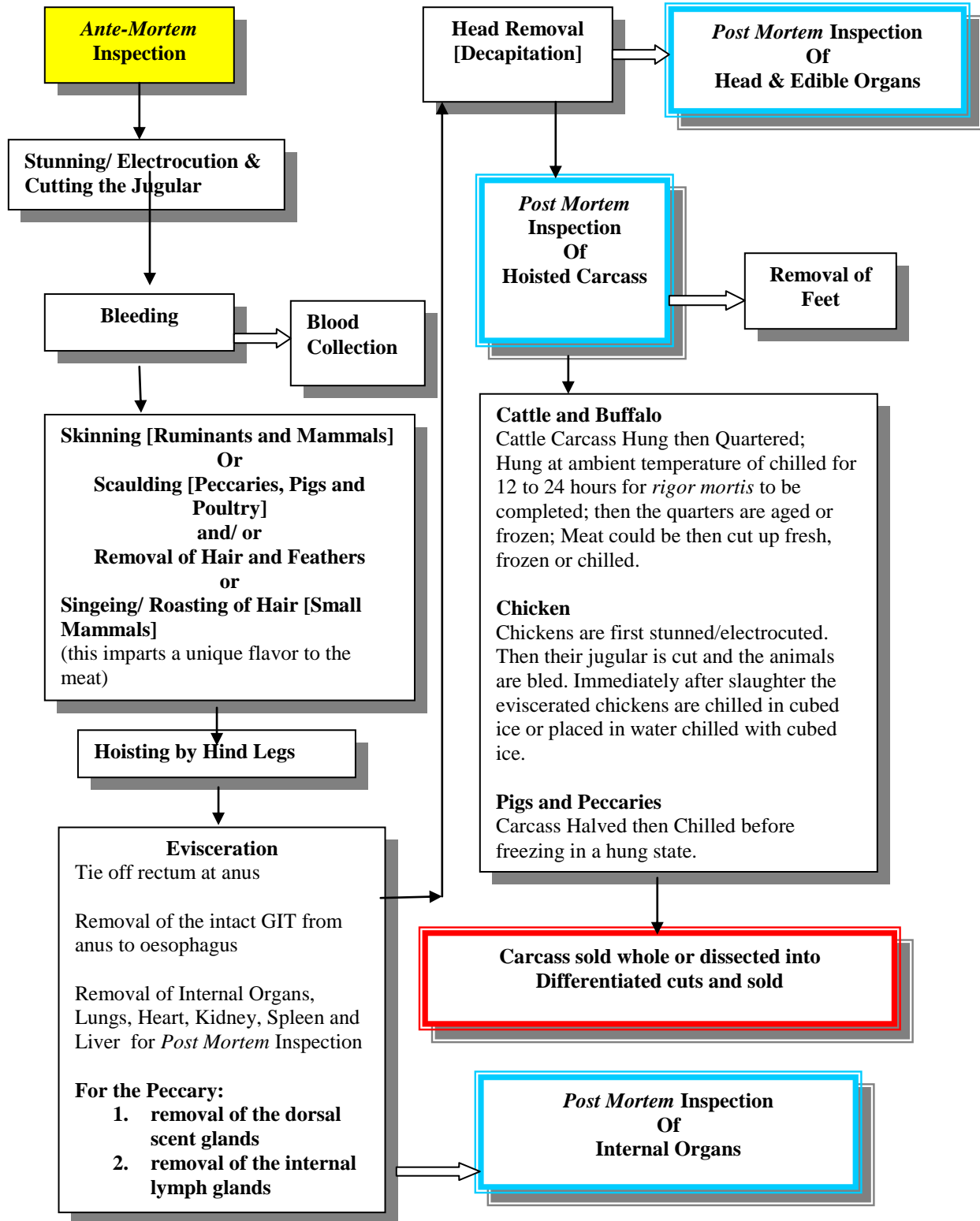
Once the animal has been exsanguinated, the oxygen present within the muscles is rapidly used up effectively starting the process of converting muscle to meat.

Rigor Mortis

Rigor mortis is a Latin word which means “stiffness to death”. This is the changes in the contraction and relaxation of the muscles of animals that occur after death at ambient temperature. It is simply stated as the temporary stiffening of a body after death. It can also be referred to as the state a body reaches when the oxygen supply to the muscles ceases by the cells but continue to respire without oxygen.

In the literature there is no information on the changes that takes place in the muscles of the Peccary after death. We know that *rigor mortis* affects cooking and eating quality of the meats from ruminants, and less so in pigs, therefore it may be that the meat of the peccary with respect to *rigor mortis* may be somewhat in between that of pigs and ruminants.

Figure 153: The Harvesting of Muscle from Animals
 [Source: Gary Garcia (unpublished)]



Aging

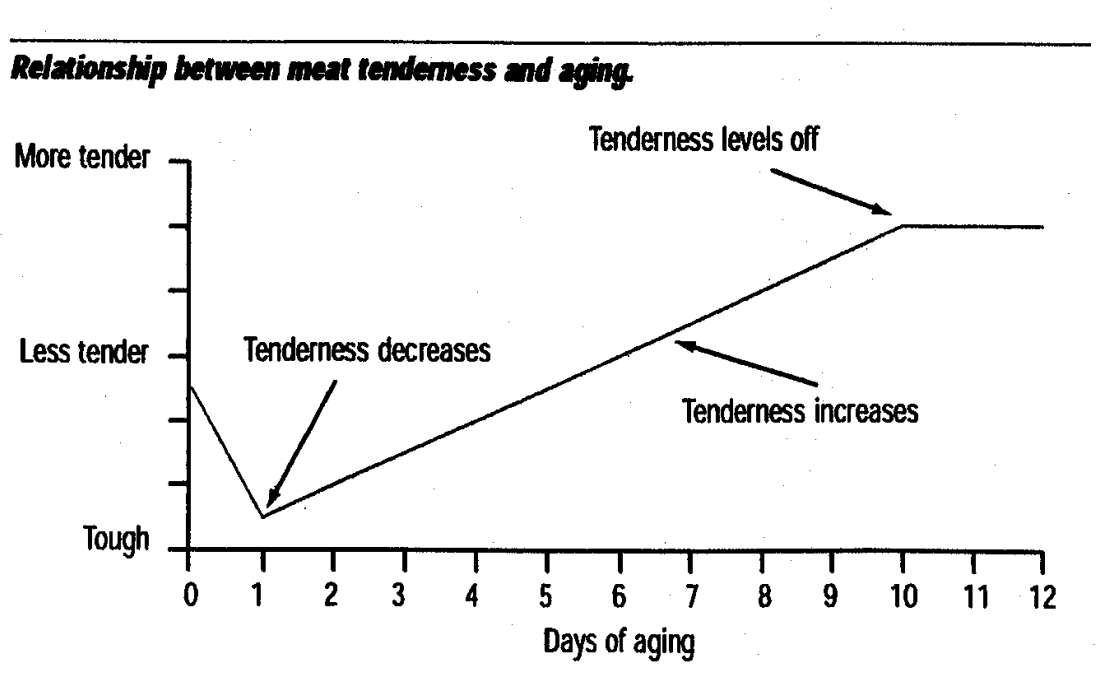


Figure 154: Relationship between meat tenderness and Aging

Source: Processing of Wild Game and Fish; College of Agricultural Sciences, Penn State University, USA.

Aging of meat is also known as **seasoning, ripening** or **conditioning**. This is the practice of holding carcasses or cuts under low controlled temperature and humidity for several days to enhance flavor, to tenderize them and to complete the curing reactions. Game meat or wild meat is aged to tenderize the meat, this occurs when enzymes breakdown or degrade complex proteins in the muscles of the dead animals over time. Figure 155 above presents this relationship. The meat has to be held cooled at between 1 to 5 °C. Peccary meat could possibly be aged with the skin on it but the Dorsal Scent Gland must be removed. This is an area of immediately needed research for the Peccary.

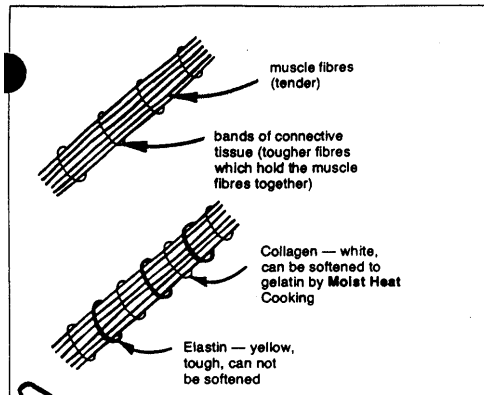
Mc Andrew (1993) in his book on the cooking of “Poultry and Game” has suggested the following hanging times for different European Wild animals:

- Rabbits: 2-3 days
- Hares: 4-5 days
- Venison/Deer: 7-12 days.

This type of information is still to be determined, however, for the meats of our neotropical wildlife species.

THE STRUCTURE OF BEEF

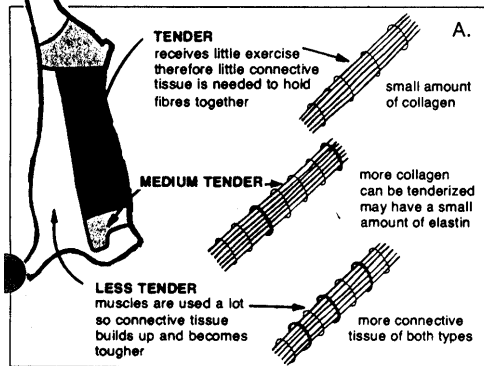
Beef is made up of muscle fibres held together in bundles by tougher fibres called connective tissue. There are 2 types of connective tissue — one called collagen which can be tenderized and a tougher type called elastin which can not be tenderized.



FACTORS AFFECTING THE TENDERNESS OF A CUT OF BEEF

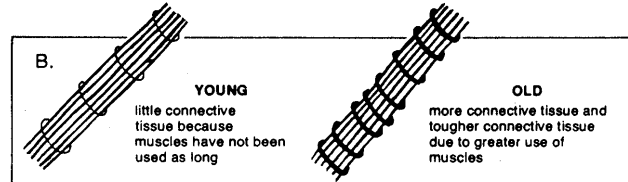
A. Location of Cut on the Carcass:

Not all cuts of beef are equally tender. Some areas of the animal are used or exercised more than others, and therefore become tougher since a greater amount of connective tissue is necessary in these hard working muscles.



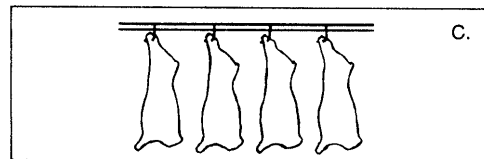
B. Age of the Animal:

Beef from younger animals will be more tender due to less connective tissue.



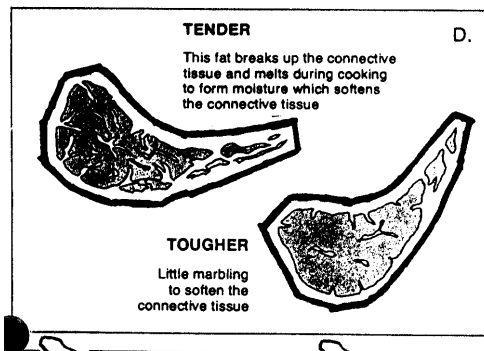
C. Length of Aging Time:

Carcasses are allowed to hang 7 to 10 days (approximately). Enzymes in the beef help to tenderize the connective tissues.



D. Amount of Marbling (Streaks of fat throughout the lean)

The more marbling the beef has, the more tender it will be.



E. Quality of the Beef:

The higher the quality of beef, the more tender it will be.

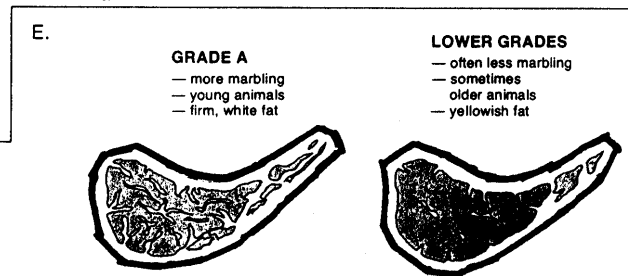
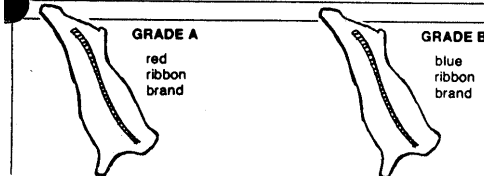


Figure 155: Factors affecting the quality of a cut of beef.

Factors Affecting the Quality of a Cut of Meat (Beef)

Figure 155 presents graphically the known factors affecting the quality of a cut of domestic beef. These factors and their effect on meat quality will now be explained.

- **The age of the animal:** Generally the older the animal gets the tougher the meat.
- **The sex of the animal:** Generally the meat produced from a mature male is tougher than the meat coming from a young male or female.
- **The location of the muscle:** The active muscles tend to be tougher, see the previous figure.
- **Aging:** Aged meat is generally more tender.
- **Post Mortem Changes-** the onset of *rigor mortis*: If the carcass is frozen before the completion of *Rigor Mortis* the meat tends to be tough.
- **Method of cutting the meat:** Always cut meat across the muscle or at right angles to the direction of the length of the muscle, when the meat is cut along the length of the muscle when it is cooked it is tough to eat.
- **Marbling:** When the cut of meat is well marbled [i.e. when it has fat distributed throughout the muscle] it can be easily baked or grilled. Meat that is not well marbled must be baked or grilled using moist heat cooking or must have fat or oil added to it during the cooking process. Without the fat or oil the meat would be quite dry when cooked. The meat of the Peccary is low in fat and there does not seem to be the evidence of marbling.
- **Castration:** Generally the meat from castrated males tends to be more tender than the meat from uncastrated males. However, see the note below with respect to the peccary.

A Note on the Effect of Castration on Meat Quality

Coser- Junior *et al* (2002) reported that castration had no effect on the carcass traits and meat quality of the Collared Peccary. These animals were reared in captivity and were killed at 300 days of age and weighed 17kg live weight. So they were not very old, which could have influenced the meat quality.

Effect of pH on meat quality - water-holding

The pH of meat generally declines after slaughter as the lactate accumulates as a by-product of the process which releases energy in an attempt to keep the cell alive. This also decreases the water holding capacity of the meat.

6.4 THE CONVERSION OF PECCARY ANIMAL TO MEAT

6.4.1 Peccary Slaughter and Dressing

When the animal is hunted it is usually shot in the head. However, in an intensive farming situation it is best to restrain the animal and stun it using a “captive bolt piston gun”. As soon as the animal goes down it is best to cut its jugular and then bleed the animal (exsanguinations). Figure 153 describes the process flow for generalized animal slaughter. After exsanguinations what is done next will be based on if you are going to skin the animal for the skin to be preserved for later use or if you are going to use it for meat with the skin intact.

There are two approaches in extracting the meat from the animal as follows:

1. Skinning the animal first:
or
2. Not Skinning the animal, and this would involve:
 - (i) Burning off the hair, or
 - (ii) Scraping off the hair using boiling water.

General practices for either approach

The very first word of caution is “**do not allow the knife to cut the external part of the dorsal scent gland**”.

If the animal is going to be skinned to preserve the skin the dorsal scent gland comes off with the skin.

If the animal is going to be used for meat with the skin intact, then the dorsal scent gland must be carefully cut off as shown in Figure 161 and 162.

The standard techniques used for slaughtering small ruminants are applicable to the Peccary but with the caution as stated above. Figure 153 presents the generalized slaughter process as earlier stated.

1. Skinning the Animal

Start with the Peccary on its back. Make cuts from the inside of the legs from below the knee to the belly incision. You should skin out the hind quarters by cutting around the hock and peeling the hide back. Remember do not cut into dorsal the scent gland, it will peel off with the hide. Hang the Peccary from the hind legs and pull the hide down, using your knife as required, to the base of the skull. Make a circular cut around the neck to the bone at the base of the skull. Hold the skull stationary, while turning the body and the body would separate from the skull. Once the skinning is finished, split the chest, remove any remaining viscera in the upper rib cage and neck area. Remove any hair and debris by washing with clean cool water. Cover carcass and hang.



Figure 156: Mature Peccaram [29kg Liveweight], shot in the head. Note: The long canines and the testicles.



Figure 157: Mature Peccaram [29kg Liveweight] showing the long canines



Figure 158: Mature Peccaram [29kg Liveweight]. Note: The testicles and the Dorsal Scent Gland.



Figure 159: Hot water being thrown on the skin of the Peccaram to facilitate easy hair removal



Figure 160: Hair removal by scraping with a knife, note that the Dorsal Scent Gland is kept intact.



Figure 161: After the hair has been scraped off the carcass is washed, precaution must be taken not to scrape the Dorsal gland as this has to be cut out as shown in the next figure.



Figure 162: Dorsal Gland cut off [bottom left hand corner of the picture] and evisceration begins



Figure 163: Evisceration of the Peccaram carcass



Figure 164: Removal of Testicular and Glandular Tissues



Figure 165: Removal of Testicular and Glandular tissue



Figure 166: The Four Quarters



Figure 167: The Four Quarters of the Peccaram Carcass

2. Not Skinning the Animal

If the hair is going to be burned - hold the animal over a fire and slowly roast off the hair, then scrape and follow the procedure as described below.

If the hair is going to be scraped off with boiling water then follow the steps as shown in Figures 156 to 161.

Place the Peccary on its back. Starting at the anus, cut through the skin around the anus (and sows genitals as applicable). Pull colon free far enough to tie off with string. Normally, at this point you will need to clean fecal matter which was "produced" during this step. Be sure to clean knife and area thoroughly with water to prevent contamination with meat during remainder of the dressing process (Figure 162).

Next slit the abdomen using your fingers to guide the knife and keep the blade away from the stomach and intestines. Remember keep the knife at a low angle and cut only deep enough to slice through the skin. You can split the rib cage next (Figure 163).

The diaphragm separates the chest and body cavities and must be cut away. Reach inside the chest cavity and loosen the heart, liver, and lungs from connective tissues. Use a plastic bag to put the heart and liver in.

Roll the carcass on its side so you can remove the entrails. Most of the entrails will pull away easily. Carefully cut and loosen any connective tissues-Pay attention NOT to puncture the bladder. Ensure the colon and anus which were tied with string pull back through the pelvic channel.

CARCASS EVALUATION OF AN OLD MALE PECCARY

The carcass data on the male slaughtered in French Guiana in Figures 156 to 167 are presented below.

Estimated Age >10 Years: Estimated Live Weight = 29.47 kg.

Carcass Component	Weight (kg)	% Live Weight.	% Carcass
Head	3.07	10.25	
Liver, Heart, Lungs	0.91	3.10	
Stomach & Intestines	2.90	9.68	
Front Leg (left)	4.25	14.19	19.0
Ribs	2.27	7.58	12.4
Front Leg (right)	4.10	13.69	18.4
Ribs	2.53	8.45	11.4
Hind Leg & Foot (L)	4.45	14.86	20.0
Hind Leg & Foot (R)	4.19	13.99	18.8
Hind Gland	0.16	0.53	
Blood	0.64	2.13	
TOTAL	29.95	98.45	100.0

DRESSING PERCENTAGE = $(21.79/29.47) \times 100/1 = 73.9 \%$

Subsequent to this in Trinidad and Tobago we were able to describe different cuts for the peccary carcass along those already known for the Domestic Pig. These are shown in Figures 168 to 173.

6.5 THE FABRICATION OF A PECCARY CARCASS



Figure 168: The Left Half of a Peccary Carcass



Figure 169: The Right Half of a Peccary Carcass

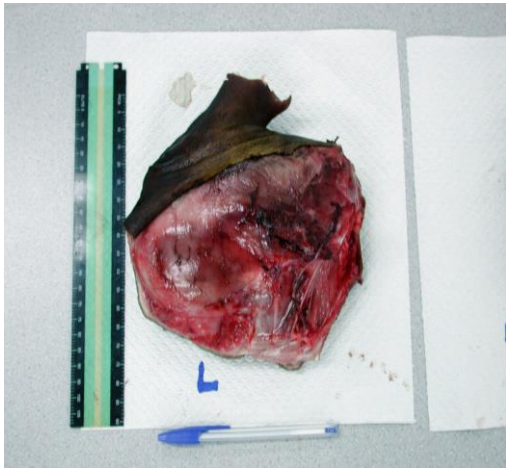


Figure 170: The Left Leg of a peccary Carcass



Figure 171: The Dissected Shoulder of a Peccary Carcass



Figure 172: The Ribs of a peccary Carcass

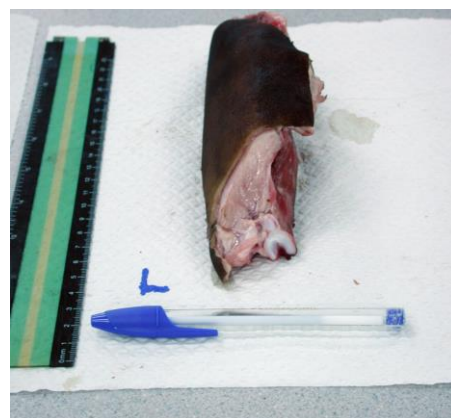


Figure 173: The Loin of a Peccary Carcass

Animal Carcass Fabrication:

Animal carcass fabrication is defined as the cutting up of the carcass into its component parts for culinary purposes. This is necessary for the following reasons:

1. in order to obtain the maximum added value from each cut of meat;
2. to be able to have cuts of meat suited to specific or specialized dishes;
3. to be able to get the highest price possible for the higher valued cuts;
4. to be able to make the best possible use of the carcass;

Table 27: The Names of the different wholesale cuts of a Quenk/ Peccary Carcass

English	French	Spanish	Portuguese	% Carcass Weight
Head	Tete	Cabeza	Cabeca	
Loin Chop/ Tenderloin	Cadre & Filet	Lomo/ Filete/ Solomillo	Lombo/	18 %
Belly	Plait de Cotes & Poitrine	Barriga/ vientre	Barriga, bojo	8 %
Blade Bone	Palette	Paletilla	Paleta	34 % includes Blade Bone and Spare ribs
Spare Ribs	Echine	Costillas	Costela	
Hand, Hock and Knuckle	Jambonneau & Pied	Mano y pieds		6 %
Leg	Jambon/ Jambe	Pierna	Perna	34 %

6.6 PECCARY CUISINE

In French Guiana wildlife cuisine is the mainstay at Agro-tourism locations called “**Ferme Auberge**”. Translated into English this means “**Inn on the Farm**”. One such location is “**Ma Cuisine**” just outside of Kourou [Figures 174 and 180]. Their menu carries “**Fricassée de gibier ou volaille de la Ferme**”...in English this means “**Stewed Wildlife or Farm Grown Birds**” [Figure 177 presents the menu]. The specialty of this “**Ferme Auberge**” is “**Fricassée de Peccary**”, and the recipe’s secret is carefully guarded by Mrs. Clermont. However, careful review of their menu would reveal truly Neotropical Gastronomy [Figure 178].



Figure 174: Mr. Jean Claude Azema and Mrs. Ginette Clermont of “Ma Cuisine” and their guests who are farmers from France [July 2004].



Figure 175: Front Entrance of “Ma Cuisine” showing the “Ferme Auberge” certification



Figure 176: Front Entrance of “Ma Cuisine” showing the “Ferme Auberge” certification

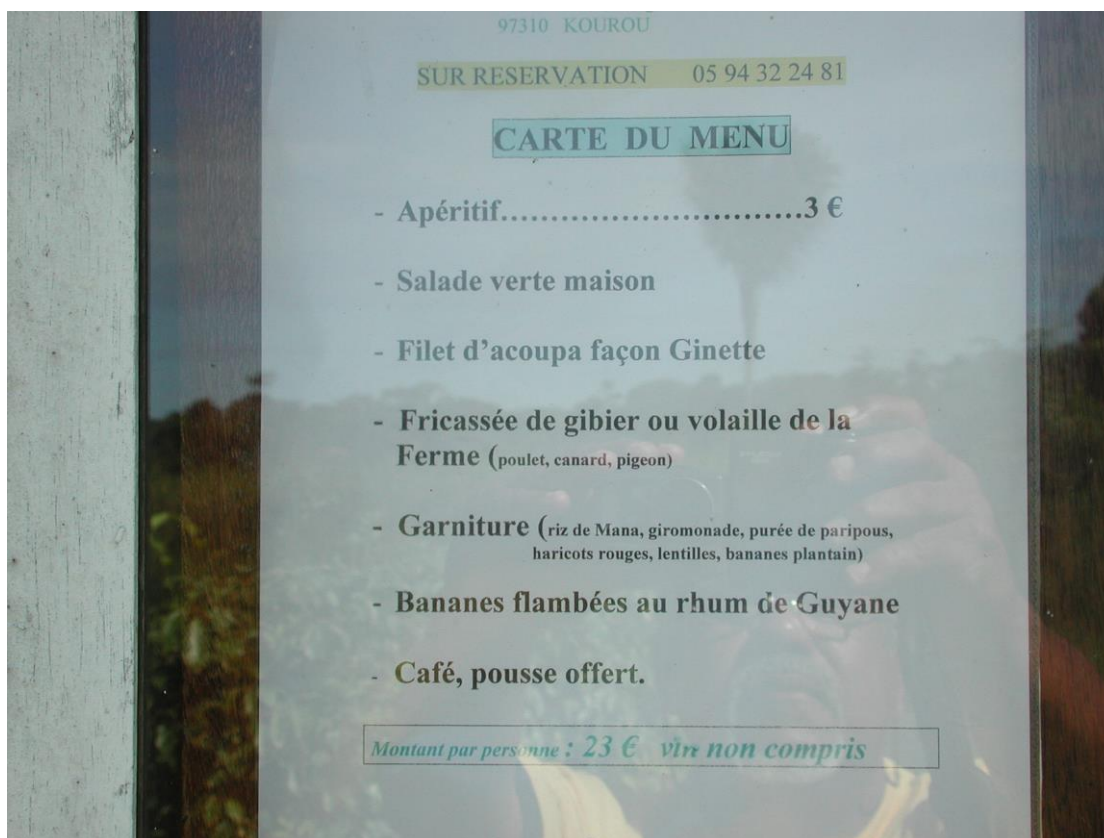


Figure 177: La Carte [The Menu] of “Ma Cuisine”.

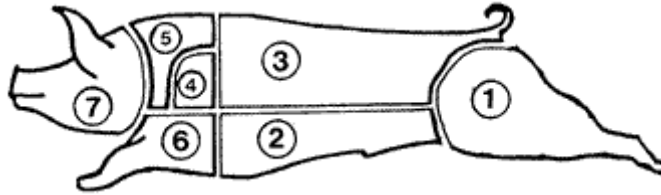


Figure 178: The Guests of “Ma Cuisine” who are farmers from France.



Figure 179: The Guests of “Ma Cuisine” who are farmers from France.

Peccary Cooking and Recipes



	English	French	American	Approximate % of Carcass [Weight from a 20kg Carcass]	Uses
1	Leg	Jambon	Leg (ham)	34 % [6.8 kg]	Roasting, baking and boiling eg. Roast Leg of Peccary in Moist Heat
2	Belly & Ribs	Plait de Cotes & Poitrine	Spare Ribs/Belly	8 % [1.6 kg]	Boiling, Pickling, Roasting eg. Bar-b-que spare ribs, but must first be steamed and then braised in an oil based Bar B Q sauce.
3	Loin Chop/Tenderloin	Cadre & Filet	Lion	18 % [3.6 kg]	Roasting, frying, and grilling eg. Roast Loin of Peccary, but must be cut up thin
4 & 5	Boston Butt and Picnic Shoulder	Palette and Echine	Blade Bone	34 % [6.8 kg]	Roasting and Stewing in Moist Heat
6	Hand, Hock and Knuckle	Jambonneau & Pied	Shoulder & Trotter	6 % [1.2 kg]	Stewing

Figure 180: Cooking Uses of a Fabricated Carcass

What is unique about Peccary Meat?

1. Table 11 on page 74 indicated that it has an average protein/crude protein content of 20.9 % and **it is very low in fat [1.24 % Ether Extract or Fat]**. Lappe (*Agouti paca*) meat has five times the fat content of peccary meat while Rabbit meat has about six times the fat content and Pork has at least eight to ten times the fat content of peccary meat. Thus peccary meat is therefore very low in fat. The meat has to be cooked in such a way that it will be kept moist throughout the cooking process.
2. Peccary meat that has been hunted will also tend to be tough for the following reasons:
 - the animals would not have been slaughtered under calm conditions
 - The carcass may or may not have been hung (or aged) before freezing, and
 - therefore it may have been frozen before the completion of *rigor mortis*.

What to look for when buying Peccary or Quenk Meat?

It is best to purchase quartered chilled carcasses. Do not buy frozen Peccary meat if you have no experience. The foot/hooves must be on each quarter to ensure that it is peccary and not pork meat (see Figures 128, 136).

How to decide on how to cook the Peccary?

Figure 180 suggests some cooking uses for the fabricated carcass; but you should always remember that whatever you decide to do you must use a “moist heat”, or moist cooking technique. This is important because peccary meat is low in fat and this would lead to the drying out of the meat during cooking.

What is “Moist Heat” Cooking?

This is a technique of cooking in liquid or baking in sealed containers with tight lids or covered with foil. The objective is to cook the meat in a broth or with steam, to keep the meat moist at all times throughout the cooking process.

Some other points to consider about Peccary/Quenk meats

Peccary meat has its own unique flavor: it is exotic, it has a wild flavor, it is very different from and much tastier than Pork. In order to capture the true flavor of this meat it is always best to **marinate it for at least 12 hours but preferably for 24 hours**. This meat makes good stews.

Some Recipes for Peccary

The following are five recipes for which peccary meat can be used.

1. **Fricassée de Cochon Bois** [(Adam 2002)]
You might want to bake this in a Baking or Roasting Pan with a cover or bake in a container covered and sealed with foil. This recipe is best used for mixed cuts of meats or for the meat of very mature animals,
2. **Cuisseau de Pakira au Four / Roasted Loin of Quenk/Pakira**
[Bergeon-Marty & Albert (2002)] – Baking time: 1 hr 20 mins
3. **Pernil assado/Roasted or Baked Peccary Leg** [Nogueira Filoh, (1999)]
Bake sealed in foil for about 2 hours)
4. **Carne ao Molho de Vino/Loin in Wine Sauce** [Nogueira Filoh (1999)]
5. **Goulash** [Nogueira Filoh (1999)]

Recipes with Coloured Peccary and White Lipped Peccary

Meats from Coloured Peccary and White Lipped Peccary have idiosyncratic flavour, typical of games of pray, each one with its own characteristics, and much more tasteful than meat from tamed pigs.

It is always advisable to marinate these meats from 12 to 24 hours, in a clay or china recipient, in dry white wine and other seasonings, in order to enhance and intensify their flavour.

If roasted, they should be served with sauce made of fruits like jabuticaba (a cherry like Brazilian berry), currant, mango, or bittersweet sauces. Because of their low level of fat, both the Coloured Peccary and White Lipped Peccary have a better taste if stewed or cooked in the Goulash way.

Fricassee de Cochon Bois

Ingredients

- 1-5kg white lipped/collared peccary meat*
- 1 Bouquet Garni – a bunch of herbs consisting of*
 - 2 bundles of chives*
 - 2 bunches celery*
 - 2 bunches parsley*
 - 2 6-8 inch small stems or bundles of fine leaf or French thyme*
 - 2-3 Cayenne peppers*
- 2 large Onions*
- 5 mls Cooking Wine*
- 6 heads of garlic*
- 6-8 cloves, piece of ginger, salt, oil, vinegar, black pepper, 4-6 bay leaves, ground all spice (bois d'Inde)*
- 2- 4 large West Indian peppers*

Method

- 1. Cut up the meat and wash with lime.*
- 2. Leave to marinate for 24 hours with vinegar, lime, black pepper, salt, garlic, 5ml wine, all-spice, and cloves*
- 3. Boil the meat for 20 minutes or so in plenty water [but save the marinate liquid for further use]. Drain off the water*
- 4. Marinate the meat again with some of the spices.*
- 5. Brown the meat in hot oil to get it golden.*
- 6. Add the ginger, the spices (except the onion) and brown for five minutes.*
- 7. Add the onion, lime juice, the juice from the marinade and simmer for 15 minutes*
- 8. Season to taste and cover with water and allow to boil for 1-1/2 hours.*

Another process may be to bake or broil with the addition of some oil.

Marinating for 24 hours allows the spices, etc. to penetrate the meat; a modification of this might be to marinate for about 2 to 3 hours at ambient temperature and between steps 3 and 4, steam the meat with about half of a finely chopped green papaya with the skin. This would be to help tenderize the meat.



Figure 181: Fricassee de Peccary et Citrouille [Stewed Peccary and Pumpkin]-Entrée



Figure 182: Fricassee de Peccary- Main Meal

Cuisseau de Pakira au Four - Rosted Loin of Peccary

Ingredients

- 1] 2-1/2 kg Loin
- 2] Potatoes
- 3] Herbs/spices of the province/bouquet garni (see previous recipe), salt, black pepper, oil

Method

1. Scald and scrape the skin of the loin, but do not remove the skin.
2. Saturate/soak with oil, salt and herbs and then heat the oven.
3. Wash the potatoes with the skin and cut into two.
4. In a saucer, mix the seasoning ingredients and mix with the potatoes.
5. 30 minutes before completion of baking open the oven and put in the marinated potatoes around the loin with the cut sides of the potatoes facing upwards for them to obtain a golden color.
6. Bake for about 1 hour twenty minutes.

Pernil Assado Roasted or Baked Peccary Leg (ham)

*1kg of leg
50g of green spices
½ nutmeg
1 large red pepper
2 bay leaves
80g of pit less black olives
80g of pit less green olives
150g of onions cut in small pieces (julienne)
2 crushed garlic cloves
½ cup of limejuice
½ cup of red wine vinegar
1 cup of water
Salt (at your discretion, or a flat soup spoon for each Kilogram of meat)*

- 1. Put together all ingredients for the seasoning;*
- 2. Clean and wash the leg with lime, make holes in it with a knife, and put salt on the outside, and inside the holes;*
- 3. Insert olives, green seasoning and other seasoning in the holes;*
- 4. Let it marinate for at least 12 hours, from one day to the other;*
- 5. Wrap it up in foil and roast until it becomes tender (2 hours for large pieces);*
- 6. Unwrap foil in order to give the meat some color;*
- 7. Suggestion for Sauce: put seasoning apart and liquify it; prepare a tick sauce with corn flour, put it in a pan, and bring it to boil always stirring with a wooden spoon. Serve separately from the meat.*

Carne ao Molho de Vinho: Loin in Wine Sauce

1.5kg of loin

½ cup of dry white wine

2 leaves of bay

¼ of a teaspoon of black pepper

1 teaspoon of red pepper sauce

½ cup of oil

Salt at you discretion

- 1. Season meat with salt, pepper, wine and chopped bay leaves. Make holes in the loin with an ice pick on a narrow knife to the meat retain the sauce;*
- 2. Let it marinate from one day to another;*
- 3. Fry it on oil, pouring water occasionally to give it colour. Add the sauce after it acquired color.*
- 4. Cut the meat in slices;*
- 5. Drain what was fried, add water, make it ticker with corn flour, and spread it over the sliced meat;*
- 6. The sauce should have a light, suave, taste, with no wine in excess.*

Goulash

*800g of muscle or loin
200ml of oil
2 big onions cut in small pieces (julienne)
1 liqueur glass of cognac
3 ripe tomatoes
2 cups of dry white wine
1 litre of meat broth
4 large potatoes peeled and cut in cubes
4 carrots cut in thick circular slices
A pinch of basil
A pinch of paprika
1 leaf of bay
30g of green spices
Salt and black pepper at your discretion*

- 1. Clean the meat, take the bones out, and cut it in medium size cubes. Put them in a recipient of clay or china, together with the white wine, tomatoes, onions, carrots, green seasoning, basil, salt, and pepper. Leave it marinating for 12 hours in the fridge. Put the bones and some cubes with fat in a large cooking pan, add one litre of water and bring to boil in order to prepare the meat broth.*
- 2. Fry the meat in portions, until it acquires a golden color, with little oil.*
- 3. Put the fried meat and the rest of the ingredients in a deep cooking pan. Add the tomato pulp and half of the meat broth. Cook it for 30 minutes in high flame. Add the cognac and make it flambé.*
- 4. Dilute the paprika separately in some broth, drain it to avoid sticking and unnecessary thickness, add the remaining broth, and pour a little of water in the event of the sauce becomes too thick. Taste it for the salt.*
- 5. Cook it in low flame for five minutes, stirring occasionally with a wooden spoon. Serve in a deep recipient.*

Part 7
**Some comments on what research still
needs to be done with the Peccary**



Figure 183: A Semi-domesticated peccary in Brazil receiving a melon from a stranger

1. There is need to conduct studies on the post slaughter changes in the chemical composition and structure of the Peccary meat.
2. Culinary Studies; Comparison of the organoleptic qualities of Peccary meat, Poultry and Pork using different cooking techniques.
3. Animal Handling and Restraint techniques; The design and testing of efficient animal handling equipment that is cheap, portable and efficient.
4. Animal Psychology Studies.
5. Dental Manipulation of the Animals
6. Nutritional Studies
7. Reproductive Studies
 - (i) Super ovulation studies aimed at getting the animals to produce multiple births, 3 and 4 offspring/ parturition.
 - (ii) Super-ovulation and Embryo transfer studies
8. Genetic Studies
9. Scent Gland Studies
10. Techniques for captive reared animals to be re introduced into the wild.

PART 8

GLOSSARY OF TERMS

ALL FETE AND NO SLEEP POSSE™ invites you to the long awaited
SECOND ANNUAL Original WILD MEAT QUE
SATURDAY 7TH FEBRUARY 2004
VENUE: 20 Nagib Elias Drive, Diego Martin TIME: 12 NOON - 4:00 PM

SELECTION OF WILD MEAT INCLUDES
AGOUTI • LAPPE • IGUANA • TATTOO • WILD HOG • DEER • DUCK
 LIMITED TICKETS ON SALE served with dumplings, plantain & provision. LIMITED TICKETS ON SALE
 pick up and run, if yuh want... pick up and run, if yuh want...

choice of three (3) meats
\$70.00 per box

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GLOSSARY OF TERMS

- **Anus:** This is a horizontal cleft bordered by two large labia, that facilitates the removal of waste from the intestines at the end of the large intestine.
- **Cecum and Colon:** These sac-like structures hold ingesta (food and other substances that is eaten by the animal) to facilitate the removal of water and electrolytes (minerals). The cecum of ruminants is not very well developed and plays a rather insignificant role in digestion. The cecum in herbivours [sheep, goats, cattle, horses] and rodents function as digestors of fibrous materials such as forages. Avians have two blind sacs (ceca) where a limited amount of bacterial activity and subsequent absorption has been observed.
- **Creep Feeding:** This is the provision of special feeds for the suckling animals behind a slatted partition that does not admit adults. This is done to get the suckling animal on to solid feed as early as possible to facilitate early weaning. This is particularly important with animals which show Lactational anoestrous.
- **Estrus:** Period of sexual receptivity of the male by the female and the time during which conception is possible.
- **Estrous/ Oestrous Cycle:** The reproductive cycle in the female of which estrus is a part.
- **Forages/ Roughages:** These are derived from the green plant material produced by photosynthesis. They contain fibre that is eaten and digested by ruminants. Wilted plant materials such as hays would not therefore be green.
- **Gestation length:** Length of pregnancy.
- **Herbivours:** Animals that eat grasses and forages. Those that have a single stomach are called Mono-gastric Herbivours, and those with four stomach compartments are called Ruminants.
- **Lactation period:** The length of time the female is able to produce milk.
- **Lactational anestrus:** No oestrous cycling while the animal is lactating, so no estrus/ heat occurs.
- **Large Intestines:** In addition to being a passage-way for waste materials, it absorbs water from the mass that comes from the small intestines. It consists of the cecum and colon.
- **Length of the oestrous cycle:** The number of days between successive estrus/ oestrus/ heat periods, [period of receptivity of the male by the female].
- **Litter interval/Parturition interval:** The number of days between successive parturitions
- **Liver:** The liver comprises two lobes, and incorporates the gallbladder. Its primary role in digestion and absorption is the production of bile. Bile facilitates the solubilization and absorption of dietary fats, and also aids in the excretion of certain waste products.
- **Ovulation:** The time of the production of the fertile female cells for reproduction.
- **Parturition:** The actual process of giving birth.

- **Peccary:** This refers to *Tayassu tajacu*
- **Peccasow:** an adult female peccary
- **Peccaram:** an adult male peccary
- **Peccayoungsow:** a young female peccary
- **Peccayoungram:** a young male peccary
- **Peccasuckling:** a young suckling peccary
- **Postpartum Estrus:** Estrus displayed a short time [up to a few days] after parturition or the bringing forth of the young by the female.
- **Puberty:** The period when the animal's reproductive organs begin to function.
- **Rectum:** This is a short passage, which empties into the anus.
- **Rodent:** Those animals with very long and continuously growing incisors.
- **Ruminant:** Herbivours that have stomachs with four compartments.
- **Sexual Maturity:** The time in the animal's life when they are able to successfully reproduce or puberty.
- **Small Intestines:** The walls of the small intestines are lined with many projections called villi. It is through these villi that nutrients are absorbed into the blood and lymph stream, and carried to the various cells throughout the body. The main function of the small intestines is to digest and absorb food nutrients. While digestion is taking place, the muscular walls contribute to the process by rhythmically contracting to mix the food with the digestive juices. This brings the nutrients in contact with the villi for more complete absorption to occur, and pushes the mass along the tract. The small intestines comprise the duodenum, ileum and jejunum.
- **Stomach:** This organ is responsible for churning and mixing ingesta with acidic gastric juices and digestive enzymes. Ruminants have four stomach compartments the Reticulum, Rumen, Omasum and Abomasum. This last one is equivalent to the Mono-gastric or Simple Stomach.
- **Weaning:** The event when the suckling young are removed from the female and no longer are able to get mothers milk.
- **Weaning age:** The age at which weaning takes place.

PART 9

LITERATURE CONSULTED

LITERATURE CONSULTED

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INDEX

Aging	213	Crush.....	156
<i>Agouti Paca</i>	190	<i>Dasyprocta Leporina</i>	190
Amazonian Rain Forest Sites	184	<i>Dasyopus Novemcinctus</i>	190
Animal Longevity.....	161	Developing Animal Production Systems	
Animal Production Systems		Approaches	108
Intensification	107	<i>Didelphis Marsupialis Insularis</i>	190
Animal Slaughter.....	210	Digestive System	
<i>Ante Mortem</i>	210	Dental Formula At Birth	78
Cactus In Trailers	151	Dentition	78
<i>Caiman Sclerops</i>	190	Nutrient Requirements	82
Carcass Evaluation	220	Oesophagus	79
<i>Carcass Fabrication:</i>	222	Stomach.....	79
Centro De Cria De Maza Y Sajino	58	Dimension Of A Net.....	130
<i>Chambre D'agriculture De La Guyane</i>	54	Dorsal Scent Gland.....	216
Chute	127, 154	Dressing Percentage	220
Catagonous Wagneri	66	Drinking Water Supply	150
<i>Collard Peccary</i>		Earth Oven.....	176
Adaptation To Ambient Temperature	76	Embrapa.....	57
Appearance	75	<i>Ethno</i>	180
Behaviour.....	91	Exsanguinations.....	211
Body Size.....	76	Feed Storage	151
Chemical Composition	98	Ferme Auberge	223
Classification And Names	72	Flexible Digestive System	102
Common Names	73	Forestry Division State Game Licences	
Demand For Meat	183	Programme	189
Description.....	75	Fresh Water Conch	173
Diet And Nutrition.....	77	Gastros	180
Digestive System	77	Glossary.....	238
Distribution	74	Grey Brocket Deer.....	183
Extraction Rate	184	Guillotine Gate	154
Peccaram.....	70	Harvesting Of Muscle From Animals.....	212
Peccasow.....	70	Health And Disease	93
Peccasuckling.....	70	Blook And Renal Profiles	95
Peccayoungram.....	70	Endo-Parasites.....	94
Peccayoungsow.....	70	Parasite Control.....	95
Pelage.....	75	Herd Projections	116
Restraint And Handling	92	Housing And Enclosures	90
Sub Species.....	74	Breeding Unit.....	123
Tayassu Peccary.....	66	Features	118
Utilization	98	Peccary Restraint	125
Practical Management.....	129	Husbandry Practices	125
Conch Growing Chambers	174	<i>Iguana Iguana</i>	190
Constraints To The Expansion Of Wildlife		Implications Of Intensification	107
.....	53	INRA	57
Conversion Of Animals' Muscle To Meat		Intensive Animal Production System	
.....	210	Principles.....	105
Corral.....	154	Iquitos I.....	58
Creep Feeding.....	152	Joao (Neto) Batista	145
<i>Collared Peccary Farmers Booklet</i>			
<i>Garcia et al [2005]</i>		[247]	10/12/2015

Lactation		<i>Rigor Mortis</i>	211
Composition Of The Milk.....	86	River Conch.....	175
Life Cycle.....	112	Role Of Housing.....	108
Living Muscle Tissue	211	Selection Of Replacements.....	132
Lowland Tapir	183	Species Production Modeling.....	109
<i>Manzama Americana</i>	190	Strategy.....	37
Multifunctionality Of Agriculture	Xxxii	The North American Approach.....	38
Neo-Tropical Wildlife	180	Trinidad And Tobago.....	38
Cuisine	180	Wildlife Conservation In French Guyana	
Ethnocuisineology	180	37
Newborn Peccaries	67	Wildlife Utilization In Latin America And	
Open School Of Tropical Animal Science		The Caribbean	37
And Production [OSTAS&P]	45	Summary Of Solutions	37
Philosophy	45	Supply Of Wild-Meat To The Restaurants	
Assumptions Of The OSTAS&P	45	203
<i>Ortalis Ruficauda</i>	190	TASIN	48
Peccary In South America	59	New Horizons	48
Peccary Production System	112	<i>Tayassu Tajacu</i>	190
Physiological State	106	The Effect Of Castration On Meat Quality	
Physiological States.....	112	215
<i>Post Mortem</i>	210	The Role Of Wildlife Farming	50
Practical Peccary Feeding.....	131	The Roopchand Factor.....	195
Problem With Regard To Neo-Tropical		The Value Of Wildlife	49
Wildlife	41	Threats To The Peccary And Wildlife.....	36
Problematique	41	Trade Status	99
Production Model.....	100	<i>Trinidad And Tobago</i>	184
Production Parameters.....	101	UESC Experimental Farm	141
Production Units.....	113	Universidad Estadual De Santa Cruz.....	57
Recipes	229	Universidade Federal Do Para	58
Red Brocket Deer	183	Value [\$Tt] Of Harvest.....	192
Reported Harvest.....	192	Water Supply System	126
Reproduction	84	White Lipped Peccary	66
Breeding.....	85	Wholesale Cuts	222
Females	84	Wild Meat Que	198
Gestation	85	Wildmeat	
Lactation	86	Approaches Used In Choosing.....	203
Litter Size.....	86	Dishes.....	204
Males.....	84	Menu	204
Post Partum Estrus	86	Quantity Sold In Restaurants	204
Reproductive Features	86	Range Of Prices	204
Reproductive Parameters	88	Wild-Meat Consumed In French Guiana	202
Reproductive Potential.....	90	Wooden Transport Box.	158
Weaning.....	90	Zoocriadero Bioam	58
Restraint With Net.....	130	Zoocriado Bioam	163

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