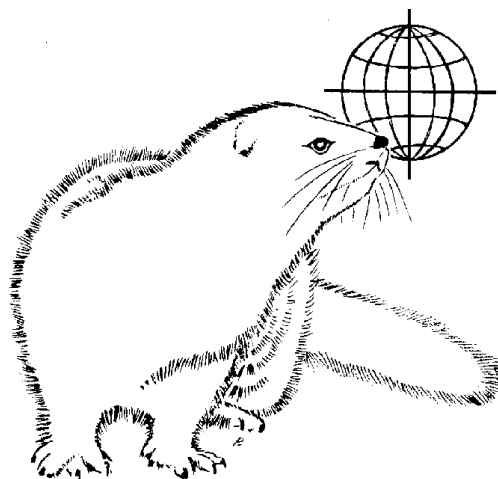


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**Proceedings of the VIIth International Scientific Congress
in Fur Animal Production**

Volume I: Scientific Program and Abstracts

Volume I : Scientific Program and Abstracts

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September 13, 2000

To the Delegates of the VII IFASA Congress, Kastoria, Greece

On behalf of the International Fur Animal Scientific Association (IFASA), I am most pleased to welcome you to the VII IFASA Congress, held in the beautiful Greek city of Kastoria. This city has a long history of importance to the fur industry, dating back several centuries, and, as you can easily discern, production of fur garments here remains an important part of the local economy. Thus, it is a fitting venue for our Congress.

The goal of the Congress is to bring together scientists from around the world to present new data, and to discuss the scientific aspects of the production of fur animals. As can be seen from the program, this goal has been met. We have manuscripts and presentations from Europe, the Americas, Asia and New Zealand, and we can look forward to lively scientific interaction at the Congress. A second goal of the Congress is to provide a forum for discussion of the social issues that are associated with the fur industry, and we expect that the program will promote this sort of discussion. Thirdly, IFASA, as an organization, is only as strong as its membership, and it is our hope that the members will actively participate in the decisions made at this Congress which will shape the future of the Association.

This Congress is the culmination of an organizational process that began in 1999, and it came to fruition as the result of the coordinated efforts of the Organizing Committee, the Scientific Committee, the Technical Committee and Symvoli Conference Organizers. I am certain that you will find the arrangements to your liking. Please participate in the scientific and social discussions, express your views about the future of IFASA, and, most important, enjoy your stay in beautiful Kastoria.



Einar J. Einarsson
President, IFASA


PREFACE TO THE PROCEEDINGS

These six volumes comprise the Proceedings of the VII IFASA Congress held in Kastoria, Greece, 13-15 September 2000. They can also be found in PDF format at the IFASA website (IFASANET.ORG). The proceedings are printed in black and white for budgetary reasons, nonetheless, color graphics, where present, can be viewed in the PDF versions of the manuscripts on the website. These manuscripts represent the original submissions of the authors, which were received and forwarded by the staff at Symvoli Conference Organizers, Kaitie Papadimitriou, Vicky Papadimitriou, and Alexia Tsiranidou. These articles were then sent to experts in each field for critical evaluation, then further edited before being printed.

I am grateful to the following individuals who reviewed manuscripts and provided their valuable editorial comment: Øystein Ahlstrøm, Birthe M. Damgaard, Vivi Pedersen, Niels Enggaard Hansen, Leif Lau Jeppesen, Leena Blomstedt, Steen H. Møller, Hans Henrik Dietz, Jan Elnif, Hilmer Sørensen and Outi Lohi. The Aleutian Disease Workshop volume was edited by the workshop moderator, Marshall Bloom, and the Workshop on Health and Disease in Mink production by the moderators, Steen H. Moller and Hans Henrik Dietz.

After review and editing, Micheline Sicotte made the revisions in the manuscripts, and Outi Lohi successfully undertook the enormous task of layout of more than 500 pages of text. Odette Hélie then converted the manuscripts into print format, which were transmitted back Symvoli, then to the printer. All this was completed in a relatively brief period, and thus it was not usually possible to return the manuscripts to the authors, either for editorial revision or for proofreading of the penultimate version. Many of the manuscripts required little or no editorial correction. Where extensive editing was required to meet the standards of form and syntax, I endeavored, to the best of my ability, to maintain the integrity of the text and figures as presented by the authors.

I am most grateful to all those who aided in this endeavor. The responsibility for the scientific content of the Proceedings lies with the authors. I accept the responsibility for any errors or omissions in the text.



Bruce D. Murphy
August 29, 2000

Overview of the Scientific Program

Wednesday 13.09.2000

		I		II		III	
		Session	Room	Session	Room	Session	Room
		Chairperson	Room	Chairperson	Room	Chairperson	Room
Wednesday 13.09.2000	09:00	Opening Ceremony	A				
	09:15	Opening Ceremony					
	09:30	Opening Ceremony					
	09:45	Opening Ceremony					
	10:00	Coffee					
	10:15	Coffee					
		Sponsored lecture <i>Wim Verhagen</i>					
Wednesday 13.09.2000	10:30	B. M.Spruijt	A				
	10:45	B. M.Spruijt					
	11:00	B. M.Spruijt					
	11:15	B. M.Spruijt					
		Behaviour/Welfare I <i>Niels Agergaard</i>		Reproduction I <i>Anastasios Kovatsis</i>			
Wednesday 13.09.2000	11:30	Plenary lecture: Mikko Harri	A	Olga Seleszczuk Tatiana Demina N.N. Tyutyunnik S. Amstislavsky	B		
	11:45	Mikko Harri					
	12:00	Mikko Harri					
	12:15	Vivi Pedersen					
	12:30	Lunch and Poster Session I	Hall- Way	Lunch and Poster Session I		Lunch and Poster Session I	
	12:45	Genetics		Genetics		Genetics	
	13:00	Reproduction		Reproduction		Reproduction	
	13:15	Behaviour- Welfare		Behaviour- Welfare		Behaviour- Welfare	
	13:45						
		Health Workshop I <i>Hans Henrik Dietz</i>		Genetics I <i>Outi Lohi</i>		Fur Properties I <i>Daniel Allain</i>	
Wednesday 13.09.2000	14:00	Robert Westlake	B	Plenary lecture: Peer Berg Peer Berg Peer Berg Kristin Sørensen Ludmila Osadchuk Andrzej Jakubczak	A	S. Fukunaga Bent Riis Keiji Kondo Teppo Rekilä A. J. Pearson	C
	14:15	I. A. Domski					
	14:30	Garry Durrant					
	14:45	Hans Henrik Dietz					
	15:00	Claus Willadsen					
	15:15	Knut Nordstoga					
	15:30	Coffee					
	15:45	Coffee					
		Health Workshop II <i>Steen Møller</i>		Genetics II <i>K.-R. Johannessen</i>		Reproduction II <i>Ludmila Osadchuk</i>	
Wednesday 13.09.2000	16:00	Bert Urlings	B	Bente K. Hansen Dag Inge Våge R. G. Thébault A.V. Kharlamova Tatyana Petrina Andrzej Jakubczak	A	Anne Lene Hovland Nikolay Balakirev Ryszard Choleva Xiaomin Wu Lia Kozhevnikova	C
	16:15	Mariann Chriél					
	16:30	Steen Møller					
	16:45	Eva Aldén					
	17:00	Steen Møller					
	17:15	Lena Englund					

Scientific Program in the:

VIIth International Scientific Congress in Fur Animal Production

Kastoria, Greece 13 - 15 September 2000

Date and time	Session and lecture	Room
	Plenary lectures	
13.09 11:30	Effect of Housing Environment on Fur Animal Welfare <i>Mikko Harri</i>	A
13.09 14:00	Balancing Response to Selection and Rate of Inbreeding <i>Peer Berg</i>	A
14.09 09:00	Development and Maintenance of Fertility in the Mink Testis <i>R.-Marc Pelletier, Suk Ran Yoon, Ouafae Kabbaj and, María L. Vitale</i>	A
15.09 09:00	Nutrient Management in Carnivore Fur Bearers <i>Kirsti Rouvinen-Watt</i>	A
15.09 10:30	The Diversity of Mammalian Pelage <i>Keiji Kondo</i>	A
13.09.2000	Reproduction I: Chair: Anastasios Kovatsis	B
11:30	Developmental and Seasonal Changes in Testicular Structure and Function in the Nutria (<i>Myocastor coypus</i> Mol.) Male <i>Olga Szeleszczuk, Piotr Niedbala</i>	
11:45	Prediction of American Mink Male Productivity (<i>Mustela vison</i>) <i>Tatiana M. Demina</i>	
12:00	The Hormonal Status in Mink and Fox during the First Year of Life <i>Nikolai N. Tyutyunnik, Lyudmila N. Sirotkina, Nikolai L. Rendakov</i>	
12:15	Embryo Technological Approach to the Problem of <i>ex situ</i> Preservation of Endangered Mustelidae Species <i>S. Amstislavsky, H. Lindeberg, J. Aalto, K. Piltti, M. Järvinen, E. Kizilova, G. Zudova, Yu. Ternovskaya, and M. Valtonen</i>	
13.09.2000	Reproduction II: Chair: Ludmila Osadchuk	C
16:00	Social Competition Capacity and Reproduction in Blue Fox <i>Anne Lene Hovland, Bjarne O. Braastad and Morten Bakken</i>	
16:15	Reproductive Peculiarities of Marmots (<i>Marmota bobac</i>) Bred in Cages <i>Nikolay A. Balakirev, Tatiana I. Kazakova, Elena A. Tinaeva</i>	
16:30	Some Indicators of Reproduction Performance of Foxes Having Different Distance from an Observer <i>Ryszard Cholewa</i>	
16:45	Study of Freezing Semen Technology in Arctic Fox <i>Xiaomin Wu, Defei Li, Baochan Li, Xiaoyuan Geng</i>	
17:00	Prevention of Weaning Stress in Farm Mink by Injection of Mebicar <i>Lia K. Kozhevnikova, Nikolai N. Tyutyunnik, Victor M. Oleinik, Vjacheslav A. Berestov</i>	

14.09.2000	Reproduction III <i>Chair: Maija Valtonen</i>	A
09:00	Development and Maintenance of Fertility in the Mink Testis <i>R.-Marc Pelletier, Suk Ran Yoon, Ouafae Kabbaj and, Maria L. Vitale</i>	
09:45	Photoperiodic Conditions, Sexual Maturation and Fertility in Mink (<i>Mustela vison</i>) <i>Klotchkov D.V.</i>	
13.09.2000	Genetics I <i>Chair: Outi Lohi</i>	A
14:00	Balancing Response to Selection and Rate of Inbreeding <i>Peer Berg</i>	
14:45	Allometric Analysis of Body Measurements in Mink from Two Selection Lines <i>Kristin Sørensen and Wiebe J. Koops</i>	
15:00	Effects of Genetic Selection for Domestic Behaviour on Hormonal Control of Reproduction in the Silver Fox <i>Ludmila V. Osadchuk.</i>	
15:15	Genetic Trends in Population of Pastel Fox <i>Andrzej Jakubczak, D. D•browska, G.Jeóewska, S. Socha, G. Zi“ba</i>	
13.09.2000	Genetics II <i>Chair: Kai-Rune Johannessen</i>	A
16:00	Genetics of Kit Growth and Maternal Weight Changes during Lactation in Mink <i>B.K. Hansen & P. Berg.</i>	
16:15	Penetration of Red Hairs in the Coat of Silver Foxes <i>Dag Inge Våge, Elin B. Stavdal & Helge Klunland</i>	
16:30	Selection Scheme and Genetic Improvement of <i>Orylag</i>® for Fur Production <i>R.G. Thébault, D. Allain , H. de Rochambeau and J.L. Vrillon</i>	
16:45	The Influence of Heterozygosity for “Black crystal” Mutation on Cranial Size and Shape in Mink <i>Kharlamova A.V., Faleev V.I., Trapezov O.V.</i>	
17:00	Some Anomalies in the Axial Skeleton of the Sable (<i>Martes zibellina</i> L) <i>Tatyana N. Petrina</i>	
17:15	Practical Utilisation of Picture Digital Analysis for Estimation of Polar Fox Body Size <i>Andrzej Jakubczak, Graóyna Jeóewska, Tomasz Sakowski, Grzegorz Zi“ba</i>	
14.09.2000	Genetics III <i>Chair: Kerstin Smeds</i>	A
16:00	Live Grading as a Tool in Pelsdyrkontrollen <i>Kai-Rune Johannessen, Ejner Børsting & Helen Kristiansen</i>	
16:15	Selection for Increased Confidence in Foxes, and Possible Consequences for Production Economy <i>Nina V. Nordrum, U. T. Brenøe, Kai-Rune Johannessen and M. Bakken</i>	
16:30	Confident Behaviour and Production Traits - Results from a Field Study of Foxes <i>Sanna Nikula, K.Smeds, H.Hietanen, H. Kenttämies and Matti Ojala</i>	
16:45	What May Be the Consequences of Mink Selection for Aggressive and Domestic Behaviour ? <i>O.V. Trapezov</i>	
17:00	Genetic Change in Confidence and Some Production Traits in Blue Foxes (<i>Alopex lagopus</i>) Selected for Confident Behaviour <i>Hilkka Kenttämies and Kerstin Smeds</i>	

13.09.2000	Fur Properties I <i>Chair: Daniel Allain</i>	C
14:00	Expression and Activity of Mink Skin Tyrosinase during Autumn Molt <i>Shigeharu Fukunaga, K.Kohno, K. Takenouchi, F.Nakamura, Keiji Kondo</i>	
14:15	Capillary Electrophoresis Analysis of Glycosaminoglycans in Mink and Fox Skin and its Potential for Predicting Quality of Pelt and Tanning <i>Bent Riis</i>	
14:30	The Beauty of Mink Pelage Observed with SEM <i>Keiji Kondo and Milan Vanek</i>	
14:45	Relationship between Feed Intake, Body Mass and Skin Length in Blue Foxes <i>Teppo Rekilä, Hannu Korhonen, Ilpo Pölönen and Mikko Harri</i>	
15:00	Effect of Steroids on Ferret Winter Pelage Growth <i>A.J. Pearson</i>	
15.09.2000	Fur Properties II <i>Chair: Leena Blomstedt</i>	A
10:30	The Diversity of Mammalian Pelage <i>Keiji Kondo</i>	
11:15	Phenotypic Colour Relationship in Brown Mink (<i>Mustela vison</i>) Characterised by Sensory and Colorimetric Methods <i>Palle V. Rasmussen</i>	
14.09.2000	Nutrition I <i>Chair: Spyros Tsitanmis</i>	B
09:00	Effect of Feed Extrusion Temperatures on Digestibility of Protein, Amino Acids and Starch in Mink <i>Kari Ljøkjel and Anders Skrede</i>	
09:15	Effect of Dietary Protein Level and Quality on Growth Rate and Fur Parameters in Mink <i>M.Kerminen-Hakkio, T. Dahlman, Niemelä, Jalava, Rekilä, Syrjälä-Qvist</i>	
09:30	Effect of Feed Protein Level on Fur and Skin of the Blue Fox <i>Dahlman, Tuula & Blomstedt, Leena</i>	
19:45	Effects of Dietary Protein and Carbohydrate Supply on Feed Consumption, Growth performance and Blood Parameters in Mink Dams during the Nursing Period <i>Birthe M. Damgaard, Christian F. Børsting and Rikke Fink</i>	
14.09.2000	Nutrition II <i>Chair: Øystein Ahlstrøm</i>	C
16:00	¹⁴CO₂ Breath Test in Fed and Fasted Mink (<i>Mustela vison</i>) Using Methionine, Leucine and Valine as Substrates <i>Børsting, C.F. & Riis, B.</i>	
16:15	Effects of Dietary Mineral Content on Mineral Metabolism and Performance of Growing Blue Foxes <i>Jarmo Valaja, Ilpo Pölönen, T. Jalava, S. Perttilä and P. Niemelä</i>	
16:30	Effect of Dietary Folic Acid Supplementation on Formate Metabolism in Blue Foxes (<i>Alopex lagopus</i>) <i>Ilpo Pölönen, J.Valaja, T.Jalava, S.Perttilä, R. Sauna-Aho, S.Kariluoto</i>	
16:45	Effects of Lactic Acid Fermentation and Heat Treatment of Wheat and Barley on Digestibility in Mink <i>Anders Skrede, Grete Skrede and Stefan Sahlstrøm</i>	
17:00	Detailed Study of Digestive Enzyme Activities in Fur-Bearing Animals during Postnatal Ontogeny <i>Oleinik V. M., Svetchkina E. B.</i>	
17:15	Thiamine Status in Farmed Mink <i>Petrova Galina, Ilyina Tatyana, Tyutyunnik Nikolay</i>	

15.09.2000	Nutrition III <i>Chair: Anders Skrede</i>	A
09:00	Nutrient Management in Carnivore Fur Bearers <i>Kirsti Rouvinen-Watt</i>	
09:45	Metabolic Antagonisms in Mink: a Review <i>J.E. Oldfield</i>	
15.09.2000	Nutrition IV <i>Chair: Birthe Damgaard</i>	B
10:30	Preservation and Storage Stability of Poultry Silage Feedstuffs <i>Kirsti Rouvinen-Watt, Margot White, Lori Longmire and Michael Johnson</i>	
10:45	Water Requirement of Farmed Foxes <i>Randi Oppermann Moe, Liv Lønne Dille, Morten Bakken</i>	
11:00	Effect of Succinic Acid on Hypotrophic Kits of Farm Mink <i>Unzhakov Alexei R., Kondrashova Marija N., Kozhevnikova Lia K., Tyutyunnik Nikolai N., Meldo Hilda I.</i>	
11:15	Measurement of Milk Production in Blue Fox Dams with Different Litter Size Using an Isotope Dilution Technique <i>Øystein Ahlstrøm, S. Wamberg, Gorm Sanson and Anne-Helene Tauson</i>	
13.09.2000	Behaviour / Welfare I <i>Chair: Niels Agergaard</i>	A
11:30	Effect of Housing Environment on Fur Animal Welfare <i>Mikko Harri</i>	
12:15	Alternative Housing and Reproduction in Silver Foxes (<i>Vulpes vulpes</i>) <i>Vivi Pedersen</i>	
14.09.2000	Behaviour / Welfare II <i>Chair: Vivi pedersen</i>	A
14:00	A Family Housing Experiment in Raccoon Dogs <i>Kasanen Sari, Mononen J., Harri M., Ahola L. & Pyykönen T.</i>	
14:15	A Family Housing Experiment in Mink <i>Jaakko Mononen, S.Kasanen, Harjunpää, Harri, Pyykönen, Ahola</i>	
14:30	Stress-Induced Responses in Farmed Blue Foxes <i>Mikko Harri, Heli Karhunen, Jaakko Mononen & Sari Kasanen</i>	
14:45	Information Value and Applicability of Mink Welfare Indicators for on Farm Assessment <i>Steen H. Møller & Steffen W. Hansen</i>	
15:00	Fifteen Years of Otter Breeding <i>O.V. Trapezov, L.I.Trapezova</i>	
15:15	The Effect of Response Type on the Demand for Food in Mink <i>Steffen W. Hansen, Margit B. Jensen, Lene J. Pedersen, Jan Ladewig and Lindsay Matthews</i>	
15.09.2000	Behaviour / Welfare III <i>Chair: Jaakko Mononen</i>	B
09:00	Do Silver Foxes Become Feral when Housed in Outdoor Enclosures? <i>Leena Ahola, Mikko Harri, Jaakko Mononen, Teija Pyykönen</i>	
09:15	Peculiarities of Keeping, Feeding and Breeding of Steppe Marmots (<i>Marmota bobak</i> Mull.) and Black-capped Marmots (<i>M. camtschatica</i> Pall.) <i>Igor A. Plotnikov, Yuri S. Zabolotskikh</i>	
09:30	Behavioral Traits and Adrenal Function in Mink Selected for Tameness and Aggressiveness <i>Gulevich R. G., Kharlamova A. V., and Trapezov O. V.</i>	
09:45	What is the Attitude towards Protection of Animal Rights? <i>O.V.Trapezov, L.I.Trapezova, A.L.Simanov, E.M.Koldaeva</i>	

14.09.2000	Aleutian Mink Disease Workshop I <i>Chair: Marshall Bloom</i>	B
14:00	Perspectives on Aleutian Disease <i>John R. Gorham</i>	
14:30	Aleutian Mink Disease Parvovirus Infections: Practical Insight from Basic Research	
15:00	<i>Marshall E. Bloom</i> Mink Plasmacytosis Vaccines <i>Bent Aasted</i>	
14.09.2000	AD Workshop II <i>Chair: Marshall Bloom</i>	B
16:00	Impact of Outbreaks of Acute Aleutian Disease in Danish Mink Farms <i>Mariann Chriél</i>	
16:15	Aleutian Disease: Current Thought on Eradication <i>Gary R. Durrant</i>	
16:30	Cleansing and Disinfection Procedures in Connection with the Danish Aleutian Disease Eradication Programme <i>J. Østergaard, M. Chriél and C.M. Willadsen</i>	
16:45	Effect of <i>Mytilus</i> Hydrolyzate in the Mink at Reproduction and Viral Plasmacytosis <i>Nikolai Tyutyunnik, Ludmila Uzenbaeva, Victor Ilukha, Hilda Meldo</i>	
17:00	Prevalence of Genital Microorganisms in Aleutian Mink Disease Parvovirus (ADV)-Infected Female Mink <i>Pablo Martino, Nestor Stanchi and Juan Jose Martino</i>	
17:15	Modified Dot Immunoenzyme Assay of Antibodies against Mink Aleutian Disease Virus <i>Taranin A.V., Faizulin R.Z., and Miroshnichenko S.M.</i>	

13:09.2000	Health Status Workshop I: Health and Diseases in Mink <i>Chair: Hans Henrik Dietz</i>	B
14:00	Current Infectious Disease Problems in United States Mink Distemper <i>Robert Westlake, DVM; John R. Gorham, DVM; PhD; Gary Durrant, DVM, PhD</i>	
14:15	Specific Prophylaxis of Salmonellosis, Carnivore Distemper and Adenovirus Infections in Caged Fur-Bearing Animals <i>Domski I.A., B.M. Zhitkov, Ulasov V.I., Malakhov Yu.A., Zakharova Ye.D.</i>	
14:30	Mortality in Ranch Raised Mink: A Year in Review <i>Gary R. Durrant</i>	
14:45	Health Surveillance in Danish Mink Farms - a Prospective Study <i>Hans Henrik Dietz, Thomas Holmen Andersen & Mariann Chriél</i>	
15:00	Outbreaks of Mink Distemper in Denmark during 1999: Epidemiological Observations <i>Claus. M. Willadsen</i>	
15:15	Lipogranulomatous Lesions in Mink with Hyperlipoproteinemia/Typ.I <i>Knut Nordstoga, Bjørnar Ytrehus, B. Christophersen, Gunilla Olivecrona</i>	
13.09.2000	Health Workshop II: Health, Management and Welfare in Mink <i>Chair: Steen H. Møller</i>	B
16:00	Disease and Production Management in Mink Farming. <i>Bert Urlings, Haiko Koenen</i>	
16:15	Medication in Danish Mink Farms <i>Mariann Chriél and Hans Henrik Dietz</i>	
16:30	Health Effects of Feeding Strategies in the Pre-Mating and Gestation Periods of Mink <i>S. H. Møller & M. Chriél</i>	
16:45	Some Aspects of Feeding and Welfare of Mink <i>Eva Aldén</i>	
17:00	Indicators of Health and Welfare Observed at Pelting of Mink <i>Steen H. Møller</i>	
17:15	Reflections on the Relationship between Genetics, Nutrition and Health in Modern Mink Production <i>Lena Englund</i>	

Poster Program

VIIth International Scientific Congress in Fur Animal Production

Kastoria, Greece 13 - 15 September 2000

Poster session I

Wednesday 13.09.2000 12:30 - 14:00

Genetics

- 1. Characteristics of Selected Morphological and Chemical Blood Indices of Polish Ring Neck Fox**
Czerkas R., Frindt A., Grogowski R., Majewska B, Winnicka A., Kluczyński W.
- 2. Heritability of Motion Activity in Ferrets (*Mustela putorius*) under Open Field Conditions**
Ján Rafay
- 3. Genetic Diversity of Farmed Finnish Silver Fox (*Vulpes vulpes*)**
Minna Rintamäki & Jaana Tähtinen
- 4. Phylogenetic Aspects of Study on Variability of Alpha-Macroglobulins of the American Mink among Closely Related Species of the *Mustelidae* Family and some Other Taxons**
Margarita A. Savina, Ivan G. Gorelov, Victor I. Yermolaev
- 5. The Heritability and Correlation Coefficients of Selected Traits in Common Silver Foxes (*Vulpes vulpes* L.)**
Stanislaw Socha, Grażyna Jeżewska, Aldona Gontarz
- 6. Effect of Behaviour on the Expression of Coat Colour Mutations in American Mink**
O.V. Trapezov
- 7. Mink Domestication and Homologous Coat Colour**
O.V. Trapezov
- 8. Behaviour and Expression of White Piebaldness in Mink**
O.V. Trapezov
- 9. Selection of Mink for Behaviour Affects the Reproductive Function and Time of Eye Opening**
O.V. Trapezov
- 10. Asymmetry in the Expression of White Piebaldness in Mink and its Relation to Reproductive Function**
O.V. Trapezov

Poster session I

Wednesday 13.09.2000 12:30 - 14:00

Reproduction

- 11. The Evaluation of Selected Reproductive Parameters of Mink in Relation to the Coat Colour Variety**
Felska Lidia, Sulik Małgorzata
- 12. Vitamins A and E in Mink Blood during Reproduction**
Ilyina Tatyana, Ruokolaynen Tatyana, Petrova Galina.
- 13. Early Embryonic Development of Standard Dark and Sapphire Mink whose Parents Were Exposed to Reduced Daylight**
Galina K. Isakova, Rimma G. Gulevich, and Dmitry V. Klochkov
- 14. October hCG Challenge of Estrus Cyclicity as a Predictor of Folliculogenesis and Fertility in Mink**
Klotchkov D.V., Eryuchenkov P.A
- 15. Effect of an Empty Cage between Female Ranch Mink (*Mustela vison*) in the Reproduction Period**
Lise Overgaard
- 16. The Analysis of the Seasonal Character of the Chinchilla (*Chinchilla velligera* M.) Reproduction**
Stanislaw Socha, Agnieszka Wrona
- 16. Development of Assisted Reproductive Techniques in Farmed Fur Animals**
M. Valtonen, H. Lindeberg and M. Järvinen
- 17. Folliculo-stellate Cells of the Mink Anterior Pituitary and the Control of Anterior Pituitary Hormone Secretion**
María L. Vitale and Julie Cardin
- 18. Ultrastructural and Cytochemical Study of the Cleavage of the Mink Embryo**
Helen A. Kizilova, Alevtina N. Golubitsa, Antonina I. Zhelezova, Sergey I. Baiborodin, Oleg L. Serov

Poster session I

Wednesday 13.09.2000 12:30 - 14:00

Behaviour and Welfare

19. **Activity and Stereotypic Behaviour in Mink Dams Fed *Ad Libitum* or Restricted during the Winter**
Birthe Houbak & Steen H. Møller
20. **Relationship between Weather Conditions and Cub Losses in Farmed Blue Foxes**
Ilukha, V., Harri, M., Rekilä, T.
21. **Stress-Induced Hyperthermia in Confident and Fearful Mink**
H. Korhonen, S.W. Hansen, J. Malmkvist and B. Houbak
22. **Measuring Maternal Care in Mink: Kit Retrieval Test**
Jens Malmkvist and Birthe Houbak
23. **Raising of Young Muskrat (*Ondatra zibethicus*) in Cages of an Industrial Type**
Mukhamedvail M. Mukhamedyanov
24. **Reaction of the European Polecat to the American Mink Introduction in Experiments**
Andrey A. Petrin
25. **Characteristic and Optimization of Husbandry Conditions of Herbivorous Fur-bearing Animals**
Igor A. Plotnikov, Oleg Yu. Bespyatyh, Victor Z. Gazizov, Igor A. Donski
26. **How to Farm Sables**
O.V.Trapezov, L.I.Trapezova, A.V.Sajdinov
27. **Measuring the Essentiality of Swimming Water for Farmed Mink by a Classic Conditioning Technique**
C.M. Vinke and B.M. Spruijt

Poster session II

Thursday 14.09.2000 12:00 - 14:00

Fur Properties

- 28. The Concentrations of Selected Elements (Ca, Cu, Zn, Mg, P) in Mated Polar Fox Female Hair.**
Danuta Dzierżanowska-Góry & Robert Gągowski
- 29. The Effect of Melatonin Treatment on Feed Intake, Body Weight, Fur Maturation Period and Fur Length in Growing Chinchillas**
József Lanszki, Daniel Allain, René-Gérard Thébault, Zsolt Szendrő
- 30. The Effect of Melatonin Treatment on Hair Follicle Activity in Growing Chinchillas**
József Lanszki, Daniel Allain, René-Gérard Thébault, Zsolt Szendrő
- 31. Effect of Biostimulator Mival on the Quality of Mink Hair-coat Covering**
Pavel P. Orlov, Nelya A. Shulyatyeva
- 32. Assessment of Selected Quality Parameters of Chinchilla Pelts Offered by Polish Breeders on the CFC (Copenhagen Fur Center) Auction**
Małgorzata Sulik, Lidia Felska, Grzegorz Mileżuk

Poster session II

Thursday 14.09.2000 12:00 - 14:00

Nutrition

33. **Meat-and-bone Meals from Different Animal By-products as Protein Sources for Fur Animals**
Øystein Ahlstrøm, Anders Skæde, Ole Sylte Heggset, Oddvar Mikkelsen and Sissel Frogner Tangen
34. **Comparison of Feed Digestibility Determined *in vivo* in Nutria and *in vitro* by Laboratory Methods**
Bogusław Barabas
35. **The Decrease of Food Losses in Feeding Nutria**
Oleg Yu. Bespyatykh, Igor A. Plotnikov
36. **Different Energy Distribution in the Feed for Mink Females in the Winter and Reproduction Period.**
Carsten Hejlesen and Tove N Clausen
37. **Body Length and Pelt Length Relationship**
William L. Loeschke and Mark Michels
38. **Determination of Body Composition in Mink (*Mustela vison*) Kits Using Hydrogen Isotope Dilution and Direct Carcass Analysis**
Heather N. Layton, Kirsti I. Rouvinen-Watt and Sara J. Iverson
39. **Effects of a New Generation Feed Supplement on Some Performance Indices and Health State in Mink**
Lorek M. O., Gugołek A., Szarek J., Przeździecka D.
40. **Nutrient Excretion and Manure Management in the Mink Industry**
Cory W. Newell, Kirsti I. Rouvinen-Watt, Derek M. Anderson and Michael A. Johnson
41. **Effects of Different Fat Supplements on Liver Lipids and Fatty Acids and Growth of Mink**
Ilpo Pölönen, Reijo Käkelä, Maija Miettinen and Juha Asikainen
42. **Use of Culled Hens and Hen Silage in Growing-Furring Diets for Mink**
Kirsti Rouvinen-Watt, Margot White, Tanya Morse, Daphne Boudreau and Michael Johnson
43. **Potato Industry By-products as Feed Ingredients for Mink during the Growing-Furring Period**
Kirsti Rouvinen-Watt, Margot White, and Michael Johnson

PLENARY SESSION ABSTRACTS

Effect of Housing Environment on Fur Animal Welfare

Mikko Harri

The idea that fur animals have poor welfare and that this poor welfare is causally related to their housing environment sounds attractive. However, this idea is both trivial and naive: i) Current housing systems are based on long-term developmental work. In them, animals remain healthy, grow and reproduce well and produce a high-quality skin. These goals are not contrary to good welfare, rather the opposite holds true. ii) Animal welfare is largely an ethical issue. The relative importance that individuals attach to different elements of animal welfare is, by the very nature of the issue, not a purely factual matter, nor can it be made a purely factual matter by any known type of scientific research. iii) Selection for or against a trait and positive man-animal contacts can improve the welfare of fur animals more than even large modifications in their housing design. iv) The positive welfare effects of any new system should be weighed against the negative effects of the system. For example, larger space, or a possibility for concealment provides animals with a more complex environment, but also prevents contacts with human resulting in more stressed and more fearful animals. Research has shown that a resting platform, a concealment screen and a gnawing block may have more positive than negative effects on fox welfare, whereas a solid floor, a possibility to dig or a larger cage do not. A nest box with a tunnel entrance or a nest box mounted on the roof of the cage may improve reproductive success of primiparous vixens. Mink need a nest box, but not a larger cage. Recent research has been focused on need for swimming water for mink, on social environment in foxes and raccoon dogs, and on group housing in mink, foxes and raccoon dogs. Both positive and negative results have been obtained and still more research is required before conclusions can be drawn.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIIth International Scientific Congress in Fur Animal Production, Vol. II, 3-10

Balancing Response to Selection and Rate of Inbreeding

Peer Berg

In a finite population, inbreeding increases with time. In selected populations, the rate of inbreeding is further increased by increased variation in the contribution of individual families to future generations. There are two major decisions influencing the progress of a breeding scheme, which animals to select for breeding and how to mate them. Strategies to reduce the rate of inbreeding or increase response to selection at a given rate of inbreeding are based on changing systems of mating, selection methods or both. Constraining the rate of inbreeding or penalising selected animals for their effect on the rate of inbreeding reduces response to selection in the short term. But as a lower rate of inbreeding results in a smaller reduction in genetic variation, larger response to selection is obtained in future generations. An example is given for the short-term trade-off between response to selection and rate of inbreeding in mink. Effects of current selection decisions on inbreeding should be taken into account in order to maximise response to selection in the longer term.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIIth International Scientific Congress in Fur Animal Production, Vol. II, 11-15

Development and Maintenance of Fertility in the Mink Testis

R.-Marc Pelletier, Suk Ran Yoon, Ouafae Kabbaj and, María L. Vitale

It has been estimated that up to 20-30% of male mink experience some form of reproductive disturbances including primary or secondary infertility. Puberty is indefinitely delayed in primary infertility. In the secondary infertility, males spontaneously develop pathological features consistent with an inflammation of the testes called auto immune orchitis (AIO) that leads to infertility. The present study assesses the relation between the changes in the permeability status of the blood-tissue barriers of the male reproductive system to

vascularly infused tracers and 1) the content of the germ cell and 2) the serum levels of anti-sperm antibodies (Ab) measured by ELISA and immunofluorescence microscopy during post natal development and during the annual reproductive cycle of the adult mink. The results show that periods of transient permeability of the barrier are not accompanied by significant increase in serum anti-sperm Ab. Infertile adult mink showed significant transient increase of their serum anti-sperm Ab. In addition, serum testosterone levels were significantly lower in infertile than in fertile mink. There was no significant difference in the intratubular levels of Fas ligand between fertile and infertile mink. Fas intratubular levels were significantly higher in fertile than in infertile mink. Apoptosis measured by cell death detection ELISA was maximal coincidentally with the disappearance of the spermatocytes and round spermatocytes. The result show that the blood-tissue barrier is not an immunological barrier.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. II, 16-24

Nutrient Management in Carnivore Fur Bearers

Kirsti Rouvinen-Watt

This plenary paper will summarize selected topics in the area of nutrient management in carnivore fur bearers over the past decade, using primarily the mink as a model animal. It will apply a "head to tail" approach and will focus in areas of digestive development, nutritional requirements, nutrient digestion, absorption and metabolism, as well as nutrient excretion and manure nutrient management. Nutrient management in conditioning of breeding and nursing females and in prevention of urinary calculi are highlighted. Some of the topics covered are excerpts from Rouvinen (1996) and are used here with the permission of the Canadian Feed Industry Association.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. II, 25-35

The Diversity of Mammalian Pelage

Keiji Kondo

The integument plays an important role in the survival of metazoans by separating and protecting them from a hostile environment. Its function ranges from protection against injury and infection, participation in the regulation of the body temperature and water balance, to respiratory activity. The morphology of integument differs among vertebrates, Amphibia are coated by mucus, Reptila by scale, Aves by feather and Mammalia by hair.

The great changes in earth's environment that happened in Mesozoic era ruined the dinosaurs, and resulted in their replacement by mammals. One of the factors that made mammalian survival possible under the drastic environmental changes was their covering of hair.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. II, 36-41

REPRODUCTION ABSTRACTS

Developmental and Seasonal Changes in Testicular Structure and Function in the Nutria (*Myocastor coypus* Mol.) Male

Olga Szeleszczuk, Piotr Niedbala

Studies on characterisation of seasonal and growth changes in spermatogenic and steroidogenic activities were carried out on 34 males which were, at the beginning of experiment, aged: Group I -10 months; Group II -6 months; Group III -2 months. Blood and sections for histological and histochemical investigations were collected from May 1995 to April 1997 at the beginning of each month. Testosterone level was determined in blood sera using RIA method. Functional status of testes was defined based on spermatogenic index, as well as on diameter measurements and wall thickness of seminal ducts. Steroid activity in male testes was examined by activity measurement of $\Delta^5 3\beta$ steroid dehydrogenase (HSD).

The presence of all developmental stages of spermatogenesis was observed in nutria males throughout the year. During the period of increased sexual activity, the number of seminal ducts containing spermatids transformed into spermatozoa was increased. The highest spermatogenic index occurred during winter months, with a decreasing tendency in spring and summer. HSD and diaphoresis activities were present all year round and were significantly higher during the period of increased breeding activity. The highest testosterone level was observed in September and October (1190 and 1149.6 pg/ml respectively), with lower values in the summer months (149-268 pg/ml).

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 3-5

Prediction of American Mink Male Productivity (*Mustela vison*)

Tatiana M. Demina

The aim of the present research was to search for signs that characterize future male reproductive ability. Every month, body mass of 248 males (from 3 to 6 months old) was determined to find out

termination date of body mass increase. Termination of mink growth was defined by body mass increase during a month. If it was equal to 0, growth was finished. Then reproductive ability of males, whose growth was finished at different age, was analyzed. Males with prolonged growth (increase of mass finished in October and later) had lower productivity indices in comparison with rapidly grown mink (that ceased growth in August-September): 21 cubs against 26, $P < 0,001$.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 9-10

The Hormonal Status in Mink and Fox during the First Year of Life

Nikolai N. Tyutyunnik, Lyudmila N. Sirotkina, Nikolai L. Rendakov

The endocrine function of thyroid gland, adrenal cortex and gonads in dark-brown and colored mink and arctic foxes in relation to physiological events (mating period, pregnancy and lactation), stage in the postnatal ontogenesis period, influence of the season and species were investigated. Radio-immunoassays were used to investigate the hormonal status (thyroxine, triiodothyronine, cortisol, testosterone, progesterone and oestradiol) in the serum of peripheral blood of the animals on various fur farms. High thyroid, cortisol and oestradiol hormone levels were recorded in kits, aged two - four months. The peak of triiodothyronine, cortisol and testosterone activity coincided with the beginning of mating period.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 11-13

Embryo Technological Approach to the Problem of *ex situ* Preservation of Endangered Mustelidae Species

S. Amstislavsky, H. Lindeberg, J. Aalto, K. Piltti, M. Järvinen, E. Kizilova, G. Zudova, Yu. Ternovskaya, and M. Valtonen

A number of Mustelidae species are nowadays endangered and even threatened to be extinct. The

European mink (*Mustela lutreola*) is a high priority species for European *ex situ* conservation programs. Different approaches for mustelidae embryo transfer and embryo cryobanking have been compared within the framework of this study using polecats (European polecat, steppe polecat and domestic ferret) as the model species. Embryo transfers from European polecat to the conspecifics or domestic ferret were successful in the majority of the cases when pseudopregnant females mated in advance to surgically or genetically sterilized males were used as the embryo recipients. Cryopreservation technology was adapted to mustelid embryos. Effectiveness of different cryoprotectants was compared and viability of frozen-thawed embryos was investigated. Prospects of European mink *ex situ* preservation are discussed.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 14

Social Competition Capacity and Reproduction in Blue Fox

Anne Lene Hovland, Bjarne O. Braastad and Morten Bakken

Social status is previously shown to be related to reproduction in silver fox vixens. In this study 40 primiparous blue fox vixen cubs were selected for high (n=20, H-group) or low (n=20, L-group) social competition capacity based on previous food-competition tests. The vixens were housed singly in standard wire cages with food and water *ad libitum*, and given access to a breeding box with tunnel at delivery. Development of heat, mating date, litter size at delivery and at weaning were recorded for all vixens. The results showed that 60% of the vixens in the H-group delivered and successfully weaned cubs compared to 15% of the vixens in the L-group.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 15

Reproduction Peculiarities of Marmot (*Marmota bobac*) Bred in Cages

Nikolay A. Balakirev, Tatiana I. Kazakova, Elena A. Tinaeva

The present research was conducted on the State pedigree farm "Pushkinskiy" situated in Moscow region. Its aim was to create a highly productive marmot population adapted to cage breeding. The peculiarities of marmot reproduction were studied on 54-60 pairs of marmots annually for 3 years. Influence of age structure of the population on reproductive success was estimated in some experiments. Percentage of females bearing litters, number of males effective in insemination, and fertility were taken into account. Possibilities for marmot reproduction with a level of polygamy of 1:2 were established. Characteristics of reproductive organs were studied by histological methods. A cohort of 30 % young females successfully reproduced. The greatest proportion of females with young (66.7 - 50 %) were found among 4-5 year old cohort.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 16-19

Some Indicators of Reproduction Performance of Foxes Having Different Distance from an Observer

Ryszard Cholewa

Tests on foxes representing two species suggested that behavioral differences in the animals can also have an influence on their reproductive performance. These influences may be manifested in various ways, depending on the species and/or sex. For a better understanding of those issues, experiments were carried out to define the effects of distance from observer to nest box. An attempt was made to determine if there is a correspondence between the distance - fox and observer, and indicators of reproduction performance in the fox. A smaller distance between a fox and an observer was tolerated by polar foxes, compared to silver foxes. During subsequent observations (carried out monthly) the distance between the animal and the

observer became smaller. Conditions of accommodation (type of box) were of little importance and did not influence the animal reaction to man.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 20

Study of Freezing Semen Technology in Arctic Fox

Xiaomin Wu, Defei Li, Baochan Li, Xiaoyuan Geng

During the 1999 breeding season, we obtained the sperm of arctic fox by electroejaculation. We studied freezing sperm. We determined a prescription of semen freezing diluent at the ShaanXi Institute of Zoology No. 01. By added egg yolk, citrate and glycerol, the sperm was preserved until thawing. Its motility was preserved after thawing. We also determined the rate of lowering the temperature, and the time required for semen freezing. The thawing temperature and effect of freezing were further studied.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 21-22

Prevention of Weaning Stress in Farm Mink by Injection of Mebicar

Lia K. Kozhevnikova, Nikolai N. Tyutyunnik, Victor M. Oleinik, Vjacheslav A. Berestov

With the use of spectrophotometry methods the activity of blood serum enzymes – lactate dehydrogenase (LDH), alkaline phosphatase (AP), aspartate-aminotransferase (ASAT), alanine-aminotransferase (ALAT) and level of plasma corticosteroid hormones were determined in the period when the young mink were weaned from their mothers. The high level of corticosteroids, ASAT, ALAT and decline of LDH activity was observed in kits and females under weaning stress. The injection of Mebicar had a pronounced antistress effect – normalizing the level of plasma corticosteroids and activity of serum enzymes. Mebicar addition at a dose of 250 mg per kg body

weight to daily ration had no negative effect on mink metabolism, fertility or fur quality.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 23-25

Photoperiodic Conditions, Sexual Maturation and Fertility in Mink (*Mustela vison*)

Klotchkov D.V.

Physiological aspects of puberty are of great importance for acquisition of reproductive capability. Young standard mink females were taken as a model for experiments. Initiation of early autumn was provided by the two light regimes: 1. Permanent lighting from June 20 to July 20 with subsequent maintenance of animals under a shortened 8 hours of daylight from July 21 to October 10 (Group I); 2. Maintenance of animals under the regime limited to 8 hours of light from July 21 to October 10 (Group II). The dynamics of estrous cycles for the autumn and winter months were studied by vaginal smears.

Long before the reproductive season (March) mink kept under natural light were in the state of estrus. The percentage of mink in estrus corresponded to 3.3, 9.1, 27.0, and 88.4 at Nov. 1, Nov. 15, Dec. 7 and Jan. 11 respectively. The time of appearance of estrus changed significantly in experimental light conditions, 12.5, 44.0, 50.0, 59.4, and 85.0 percent of females of group I were in estrus at Oct. 15, Nov. 1, Nov. 15, Dec. 7, and Jan. 11 respectively. Females of group II experienced an earlier estrus compared to control but this was less evident than in group I. It was shown that mink of group I had earlier and decreased number of matings and increased level of fertility. A study of vaginal smears of mink (n=1411) in December (18-28) showed that the fertility of mink in anestrus in December was 6.78 ± 0.07 , while in those showing signs of estrus in December was 7.09 ± 0.07 ($P < 0.01$). An activation of folliculogenesis in females with signs of estrus in November was revealed by histological analysis.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 26-29

The Evaluation of Selected Reproductive Parameters of Mink in Relation to the Coat Colour Variety

Felska Lidia, Sulik Małgorzata

Profitability of farm production depends, in large extent, on the reproductive results such as mating and time of birth, and the number of young delivered per litter. The present study was aimed at analysis of selected reproductive parameters of mink, depending on a variation of conditions of large-scale breeding. The data were collected within 1998-1999 on a large-scale mink farm. In 1998 the brood stock consisted of 3899 females and in 1999 of 4389 females. Three colour varieties of mink were investigated: standard, pearl and wild. All animals were kept under the same nutritional and housing conditions. Females of all colour varieties mated in both reproductive seasons between 9-20 March, according to the system of triple mating 1 + 1 + 7-8. The subsequent analysis of reproduction revealed that in the second year of breeding, females of all colour varieties started to give birth earlier and the percentage of infertility was reduced. According to Venge (1973) pregnancy lasting more than 50 days increases the number of infertile females and lowers the litter size. The best reproductive success was observed for the mink of the pearl and wild varieties. The standard variety females had the shortest pregnancy. Their average size of litter, however, was the lowest and their percentage of infertile individuals was the highest. In the standard variety the length of pregnancy is inversely correlated with the number of the young delivered. Taking into account the highest market demand for the skins of this particular colour variety of mink it should be worth continuing the present study in order to determine the causes of this phenomenon.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 30-34 (Poster)

Vitamins A and E in Mink Blood during Reproduction

Ilyina Tatyana, Ruokolainen T., Petrova Galina.

The concentration of vitamins A and E in the blood serum of mink was studied using high-performance liquid chromatography. The results demonstrate that a significant difference in the vitamin A concentration was observed between females and males during pre-mating and mating periods. At mating, an increase of the vitamin E in the blood of mink females in comparison to males, can be seen. Pregnancy was characterized by the change of vitamin level in response to the stress of gestation.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 35-37 (Poster)

Early Embryonic Development of Standard Dark and Sapphire Mink whose Parents Were Exposed to Reduced Daylight

Galina K. Isakova, R.G.Gulevich, D.V. Klochkov

Standard Dark and Sapphire young mink were exposed to natural (control) or reduced (8L: 16D, from July 22 till October 10) daylight. Seven days after single mating in March, all females were examined for their pregnancy state. In Standard Dark mink, a reduced daylight regime was found to cause the more frequent arrest of embryonic cleavage. In Sapphire mink, the experimental subjects showed an increase in the number of eggs per female, a decrease in the proportion of unfertilized eggs, and delay in transition of embryos from oviduct to uterus. The level of progesterone in peripheral blood was on average 1.8 ng/ml both in Standard Dark and Sapphire control females, and 2.6 ng/ml in experimental mink.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 38-41 (Poster)

October hCG Challenge of Estrus Cyclicity as a Predictor of Folliculogenesis and Fertility in Mink

Klotchkov D.V., Eryuchenkov P.A

The reactivity of sexual system of mink in October to the intramuscular injection of chorionic gonadotrophin (hCG, Profasi R, Italy) in doses 10, 20, 50, 100 IU was studied. The vaginal smears

were assessed during the two weeks following hCG injections. The stages of the cycle were estimated by traditional method and were classified as anestrus (A), anestrus-proestrus (AP), proestrus (P), proestrus-estrus (PE), estrus (E). Progressive shifts in development of vaginal epithelium begin from day 2 and reach maximal value on day 6 after hCG injection. It was concluded that the dose of 20 IU of hCG (injection in October 10) was useful for assessment of functional polymorphism of mink reproductive function. The females (n=185), on day 6 after injection of this hCG dose, displayed the following estrous cycle characteristics : A-71(38.4%), AP-37(20.0%), P-30 (16.2%), PE-14(7.6%), E-33(17.8%). A statistically significant increase of fertility was registered in groups AP and P, with mean litter sizes of 6.8 ± 0.4 and 6.3 ± 0.4 respectively. The level of fecundity in control and groups A, PE, E were 5.4 ± 0.1 , 5.4 ± 0.3 , 4.7 ± 0.9 , 5.6 ± 0.5 respectively.

A histological investigation of ovary in November showed that potential fertility of mink females can be determined by assessment of the capability to generate maximal number of vesicular follicles. The overall number of follicles was less informative.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 42-44 (Poster)

Effect of an Empty Cage between Female Ranch Mink (*Mustela vison*) in the Reproduction Period

Lise Overgaard

The aim of this study was to evaluate whether the density of animals in a shed would affect the reproduction of female mink and the behaviour of the females during the nursing period. The study was conducted during two reproduction periods in primiparous standard mink. One group was placed with an empty cage between females, while in other group females were in adjacent cages. The number of kits born and weaned was recorded and the kits were weighed at weaning. The female reactivity was evaluated according to how often they varied between being in the nest box and in the cage during 10 minute observation periods over five weeks. To assess female nesting ability a 'kit-retrieval-test' was done. Females placed in every second cage weaned

more and larger kits, and had lower kit mortality from birth to weaning. They were less reactive and were less willing to leave their nest boxes. It was concluded that fewer mink in a shed had a positive effect on female welfare.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 45-48 (Poster)

The Analysis of the Seasonal Character of the Chinchilla (*Chinchilla velligera* M.) Reproduction

Stanislaw Socha, Agnieszka Wrona

The aim of our study was analysis of chinchilla female fecundity, taking into consideration the analysis of seasonal character in reproduction and litter size. We studied the chinchilla reproduction over five years (1994–1998). In this period 462 litters were obtained on the farm. Two basic traits related to reproduction were recorded, the number of born and the number of weaned chinchilla. The greatest frequency of whelping was in March (13% of the year), slightly less in April and July (12%). The number of kits was much lower in winter months (3.6% in December and 2.8% in January). The mean number of chinchillas born varied from 1.81 to 2.36 per litter, according to the month. The mean number of chinchillas weaned varied from 1.57 to 1.98 (apart from January), but differences were not statistically significant.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 49-52 (Poster)

Development of Assisted Reproductive Techniques in Farmed Fur Animals

M. Valtonen, H. Lindeberg and M. Järvinen

Artificial insemination, embryo transfer and *in vitro* production of embryos as well as cryopreservation of oocytes, embryos and spermatozoa are assisted reproductive techniques used today in a variety of animals. In fur animal production, only artificial insemination of foxes is used routinely. Embryo transfer and *in vitro* production are rare in fur industry. These techniques serve better research

purposes which aim at conservation of endangered carnivores, using farmed foxes and mustelids as model species. So far, surgical embryo transfer has been successful in the silver fox, the blue fox and the polecat. In the blue fox, transcervical embryo transfer has been successful. Transfer of frozen-thawed embryos has been successful only in the polecat, but implantation sites in uteri of the blue fox indicate possible success in the near future. These techniques can also be utilized commercially in fur industry.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 53-55 (Poster)

Folliculo-stellate Cells of the Mink Anterior Pituitary and the Control of Anterior Pituitary Hormone Secretion

María L. Vitale and Julie Cardin

Folliculo-stellate (FS) cells of the anterior pituitary are agranular, non-endocrine cells with a characteristic stellate shape. Several roles have been ascribed to these cells. Initially, they were thought to be mainly supportive cells and to be involved in phagocytosis. More recently, an important role in the control of the immune response and hormone secretion has been suggested. FS cells express proteins, such as the S-100 protein, that are not expressed by endocrine cells of the anterior pituitary. Mink anterior pituitary possesses two morphologically different S-100 immunopositive cells. Type I were stellate-shaped cells that were more abundant during periods of high prolactin secretion. Type II were rounded cells that were more abundant during periods of high gonadotropin secretion. The total number of S-100 positive cells of the mink anterior pituitary did not vary during these two periods of the annual reproductive cycle suggesting that type I and type II are two different

states of the same cell. Mink S-100 positive cells possessed Cx43-labelled gap junctions, and the number of these junctions increased concomitantly with the increase in type I S-100 positive cells and with the increase in prolactin secretion. The present results suggest that type I S-100 positive cells may contribute to the release of prolactin by modulating communication among cellular elements involved in the control of prolactin secretion.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 56-61 (Poster)

Ultrastructural and Cytochemical Study of the Cleavage of the Mink Embryo

Helen A. Kizilova, Alevtina N. Golubitsa, Antonina I. Zhelezova, Sergey I. Baiborodin, Oleg L. Serov

Fifty-four normal embryos flushed from 10 females (Standard) were studied using transmission-electron microscopy and Ag-NOR staining. First signs of blastomere polarization were observed at the 8-12-cell stage. Redistribution of organelles, vesicles and granules, appearance of apical microvilli and lateral cell contacts took place at this stage. Compaction began at 20-28-cell stage, but at least 2 cell cycles need to complete the cavitation process. Abundant lipid granules were structurally modified during the blastomere differentiation to ICM and trophoblast. The development of a functional nucleolus with fibrillar and granular components were observed from 6-8 to 12-16-cell stages. The results indicate activation of embryonic RNA synthesis in mink embryo at the 10-12-cell stage.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-A, 62 (Poster)

GENETICS ABSTRACTS

Allometric Analysis of Body Measurements in Mink from Two Selection Lines

Kristin Sørensen and Wiebe J. Koops

The objective of this study was to analyze the body composition of male (M) and female (F) kits at pelting. Animals originated from the seventh generation of lines selected for high (H) and low (L) feed efficiency. Body measurements included body weight, carcass weight, skin length, weight of pelt including fat, and weight of pelt after fleshing. This analysis concentrates on body weight and pelt weight after fleshing and fat. Allometric analysis of growth in traits relative to body weight was done in the four groups (H-M, H-F, L-M, and L-F). In this analysis, no effect due to selection lines was observed. Pelt weight has the same growth coefficient in males and females but with different intercepts. Weight of fat relative to body weight differed in both growth coefficient and intercept between males and females.

Scientifur, Vol. 24, 4, 2000 Proceedings of the VIIth International Scientific Congress in Fur Animal Production, Vol. III-B, 65-67

Effects of Genetic Selection for Domestic Behaviour on Hormonal Control of Reproduction in the Silver Fox

Ludmila V. Osadchuk.

To establish genetic and physiological mechanisms of the early evolution of domestic animals, a model of silver fox domestication was developed at our institute by long-term selection for a lack of aggression and fear towards man (domestic behaviour). The aim of this presentation is to show changes in the gonadal function of domesticated foxes. The levels and the in vitro production of reproductive hormones (testosterone, oestradiol and progesterone) were measured. Additionally sperm production, potential fertility, embryonic mortality and reproductive behaviour were assessed. Our study has shown a time shift of the annual rhythm of ovarian activity and a depressed relationship between photoperiod and endogenous hormonal cycles in domesticated foxes. Domesticated vixens were also more resistant to the detrimental effects of

the artificial photoperiods on hormonal secretion and fertility. The shorter period of testicular activity, lower sperm production and sexual activity was found in domesticated males. Selection also reduced sexual and increased agonistic behaviour in domesticated males during bisexual encounters. The study of fetal development indicated heterochrony in the pituitary-testicular axis in domesticated animals. In conclusion, selection for domestic behaviour can bring about a considerable destabilization of the gonadal function for a short period of time.

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Genetic Trends in Population of Pastel Fox

Andrzej Jakubczak, Danuta D•browska, Gra•fyna Je•fewska, Stanisław Socha, Grzegorz Zi•ba

Studies were carried out on fur animal breeding farm in Jeziory Wielkie near Poznań. Females of common fox with a total of 4155 pastel offspring were investigated for the period from 1978 to 1997. Efficiency of the breeding was evaluated by the following traits: litter size at birth, and weaning as well as an individual index of external conformation traits (including body size and fur colour and quality). Genetic trends were estimated using a BLUP method with a multitrait animal model. For all investigated traits, with exception of litter size at birth, a tendency toward increase was found during the years under investigation. This shows the breeding strategy was well conceived in this herd.

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Genetics of Kit Growth and Maternal Weight Changes during Lactation in Mink

B.K. Hansen & P. Berg.

The objective of this study was to establish whether genetic variation for early growth of kits and weight changes of the dam during lactation exists, and to describe the genetic correlation between these traits. Three selection lines of the Scanblack colour type

were established in 1996. The selection criteria were litter size (line 1), growth of kits caused, by the kit growth capacity (line 2), or by maternal ability to induce growth (line 3) in kits. Altogether, records of 5977 kits from 758 litters were included. The genetic variance of single traits and the genetic correlations between traits were estimated using REML under an Animal Model. A low amount of genetic variance was detected for kit growth capacity ($h^2_d \approx 0.09$). An intermediate genetic variance was detected for maternal ability ($h^2_m \approx 0.22$) to induce growth in kits and for dam weight changes from first to fourth week post partum ($h^2_d \approx 0.36$) and a favourable genetic correlation between maternal effect on kit body weight and dam weight changes from 1 to 4 weeks post partum ($r_{md} = 0.54$). However, the corresponding genetic correlation between maternal effect on kit body weight and dam weight changes from fourth week until weaning was negative ($r_{md} = -0.25$).

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Penetration of Red Hairs in the Coat of Silver Foxes

Dag Inge Våge, Elin B. Stavdal & Helge Klungland

Recently, two major genes regulating pigmentation have been identified in the fox (*Vulpes vulpes*). While the standard silver fox is caused by a genomic deletion in the agouti gene, a substitution mutation in a gene called extension is found in the Alaska silver fox. Given two alleles in two separate loci, nine different genotypes could be realised. Five out of these have a silver fox phenotype, and look almost identical. It has been speculated that some of these five genotypes are more prone to develop red hairs in the otherwise black coat. Due to problems with the identification of the different genotypes, this has not been investigated systematically. In the present study, DNA-based genotyping has been used to test a possible association between specific genotypes and the presence of red hairs.

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Selection Scheme and Genetic Improvement of Orylag® for Fur Production

R.G. Thébault, D. Allain, H. de Rochambeau and J.L. Vrillon

Orylag® is a new fur derived from the Rex rabbit by genetic improvement of coat characteristics. It was obtained at INRA in 1990 from a closed original population of 200 animals bearing the Rex gene, managed in separate families and mainly selected on the absence of guard hair in order to obtain a fur only composed of undercoat. Other fur quality parameters were then introduced and animals are now selected on several criteria: body weight at 8 weeks of age, hair length, fur compactness, and 5 fur scores: bristliness, fur priming, extension of the agouti band, intensity and homogeneity of fur colour. The whole *Orylag®* fur production, which is genetically derived from the INRA population, is increasing (80,000 pelts in 2000) and marketed within a vertically integrated organisation controlled by producers. A description of the selection scheme is given and genetic parameters of the different fur traits are discussed.

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The Influence of Heterozygosity for “Black crystal” Mutation on Cranial Size and Shape in Mink

Kharlamova A.V., Faleev V.I., Trapezev O.V.

Twenty-two cranial measurements of two genotypes of American mink were carried out. One genotype is standard, or “wild type” – a nonmutant animal with dark-brown colour of fur. The other genotype is heterozygous for semidominant autosomal mutation “*Black crystal*” (*Cr*), which changes the fur colour and has a negative effect on reproduction. Heterozygosity for “*Black crystal*” leads to a significant increase of width and height of the brain, as reflected in the cranium. Length parameters not only of the cranium, but also those of body length have a tendency to decrease. Body weight is higher in heterozygotes. Heterozygosity for “*Black crystal*” mutation changed the skull ratio toward more brachycephalic. Statistical significance of data