Gegevens jaarverslag 2000 van sectieleiders

1. Een algemene beschrijving van het onderzoek van de sectie

8. Section Theoretical Evolutionary Biology

Section Chair: JAJ Metz

The section designs unifying frameworks as well as mathematical tools, for studying evolutionary and ecological problems, both on an a priori basis and in close co-operation with experimental groups. The theoretical research ranges from exploring the consequences of established biological theories to the construction of models for specific biological systems, the latter often with a view to develop data-analytical techniques.

http://wwwbio.leidenuniv.nl/~eew/G8/s1.html

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breng zonodig verbeteringen aan; vermijd/vervang jargon.

2. Een beschrijving van de voortgang van het onderzoek op het niveau van de projecten

Project 1 ***Ecological Dynamics***

Project leader: E Meelis

This project considers the dynamics of single species as well as processes involving the interaction between several species on ecological time scales. In one direction novel mathematical tools are developed for the translation from complex individual level causes to population dynamical consequences. In the other direction data analytical tools for dealing with observed ecological time series are developed, which increasingly account for the underlying individual level processes. The project includes various sub-projects:

Progress:

1.3 Branching process models

a: Book: a workshop has been organised at IIASA with several authors (Vladimir Vatutin, Mats Gyllenberg, myself and Peter Jagers). The chapters 1 to 6 have to a large extent been written, and parts of the final two chapters.

b: project with Vladimir Vatutin:

Haccou and Iwasa examined the branching process model in fluctuating environments for independently distributed numbers of offspring. They derived a method for simulating establishment probabilities and an approximation for the expected establishment probability.

From their simulation results it appears that, for independently distributed m_t and Poisson distributed offspring numbers, there is a positive auto-correlation between the extinction chances of invaders in successive reproduction periods. A major consequence of this is that spatial heterogeneity and dispersal is advantageous in such environments. Haccou and Iwasa conjectured that this result is more general but did not prove it.

We show that this is indeed true for independently distributed m_t, regardless of their distribution or the offspring distribution. Furthermore, we demonstrate that it is also true for positively auto-correlated m_t. However, as is demonstrated by an example, this is not necessarily true for environments with a negative auto-correlation between values of m_t. In environments where the m_t alternate between high and low values, the p_t are negatively correlated. From simulation results it appears that this also occurs in Markov-dependent environments with strong negative correlations. As a result, dispersal is not advantageous in such environments. We discuss these and other consequences for invasion strategies, biological control and metapopulation dynamics.

Project 8.2 ***ESS theory***

Project leader: P Haccou

In this project the step in the opposite direction, from population dynamics to properties of individuals, is made through the ESS route. In addition statistical methods are developed for analysing data on individuals in a manner useful for evolutionary theorising. The project includes various sub-projects:

Progress:

2.1: The model was generalised to diploid organisms and consequences for evolution of redundancy is being studied. We have started to examine the effects of cue reliability and environmental stochasticity on the

evolution of reaction norms. We conjecture (on the basis of previous work by Iwasa and Haccou) that more reliable cues in combination with large environmental variance lead to reaction norm evolution, whereas low reliability and low variance would promote the evolution of canalization.
2.4: The results have been extended to include cases where the reward remains higher than the costs. In that case there is no upper limit on the support of the distribution of persistence times in the favoured role.
A ms has been submitted (march 2001) to JTB.

Project 8.3 ***Adaptive Dynamics***
Project leader: JAJ Metz
This project considers evolutionary time-scales and the species level as well as between-species interaction. Our aim here is the construction of an overarching theory of phenotypic evolution, as a direct dynamical extension of the evolutionary statics of ESS theory. This theory also deals with co-evolution and with the treelike structure of character evolution through adaptive speciation. The project includes various sub-projects:
Progress:

3.8: August 2000 a PhD student, Joost Beltman, has been appointed on this project. A preliminary model has been formulated to study the effect of song learning and sexual imprinting on the initial evolution of brood parasitism. The model is being examined numerically and through simulations.

8.3.4. Evolution and development (F. Galis): The integration of developmental and evolutionary biology into a new field is having a major impact on the understanding of how development influences the direction and rate of evolution. We are studying how developmental processes constrain morphological evolution. In 1999/2000 we have continued to unravel the developmental constraints that keep the number of cervical vertebrae in mammals constant at seven by studying the association with medical problems in foetuses. In addition we have found evidence that the many global inductive interactions of the phylotypic stage are probably the cause of the remarkable conservation of this stage, including the conservation of the number of cervical vertebrae in mammals. A project was started on studying the evolutionary constraint on polydactyly. The subproject on the role of phenotypic plasticity and genetic assimilation in the process of adaptation and evolutionary change was continued.

Frans's input:
Project 8.3 Adaptive Dynamics
Main results:

1. For adaptive dynamics based on Lotka-Volterra community dynamics: Generalization of the invasion functions for arbitrary mutually different combinations of the residental phenotypic trait values. From this generalization necessary conditions, in terms of invasion fitnesses, are derived for the existence of interior attractors. Also, the generalization allows a continuously differentiable extension of the invasion function to the subsets of the full trait spaces where at most two residental traits are equal. This extension is a strong tool in the bifurcation analysis of evolutionary singular points.

2. Together with Stefan Geritz, Mats Gyllenberg, Kalle Parvinnen (all Turku, Finland): co-operation on invasion dynamics and attractor inheritance for discrete time community dynamics. (This is the discrete time analogon of the invasion-implies-fixation work for continuous time conmmunity dynamics.) The co-operation has resulted in a paper, Invasion Dynamics and Attractor Inheritance, S.A.H. Geritz, M. Gyllenberg, F.J.A. Jacobs, K. Parvinen, submitted to Journal of Mathematical Biology.

3. Together with Stefan Geritz, Eva Kisdi (both Turku, Finland): research on evolutionary cyclic patterns. The results have appeared as IIASA Interim Report IR-00-030: Red Queen Evolution by Cycles of Evolutionary Branching and Extinction, Eva Kisdi, Frans J. A. Jacobs, Stefan A. H. Geritz.

controleer de projectnaam, geef aan wie projectleider is; zorg voor een begrijpelijke projectbeschrijving; geef de wetenschappelijke vorderingen aan en maak daarbij gebruik van begrijpelijke, liefst zelfs aantrekkelijke taal; gebruik per project maximaal ½ A4 om de voortgang van het onderzoek te beschrijven.

3. Een overzicht van het in 2000 bij de sectie werkzame personeel (wordt geleverd door P&O)

4. Een overzicht van de research output in 2000, volgens de aangegeven indeling

geef aan welke promoties plaatsvonden
geef de lijst met publicaties, in 2000 verschenen in scientific journals en scientific reports
geef de lijst met books and book chapters
geef de lijst met professional publications
geef de lijst met editorial output

Chapman, LJ, **F Galis** and J Shinn. Phenotypic plasticity and the possible role of genetic assimilation: Hypoxia-induced trade-offs in the morphological traits of an African cichlid. Ecology Letters (2000) 3: 387-393.

Dieckmann, U, R Law, **JAJ Metz** (Eds). The Geometry of Ecological Interactions. Simplifying Spatial Complexity. Cambridge University Press. (2000). pp. xiv + 564.

Dijk, HFG van, L Brussaard, F Baerselman, TCM Brock, E van Donk, MA van der Gaag, CAM van Gestel, H de Heer, **N van der Hoeven**, FMW de Jong, AMA van der Linden, PCM van Noort, PA Oomen, A Stein, LEM Vet and PJM van Vliet. Veldonderzoek voor de toelating van gewasbeschermingsmiddelen. Mededelingenblad van de Koninklijke Nederlandse Planteziektekundige Vereniging 31 (2000): 136-139.

Dijk, HFG van, L Brussaard, A Stein, F Baerselman, H de Heer, TCM Brock, E van Donk, LEM Vet, MA van der Gaag, CAM van Gestel, **N van der Hoeven**, FMW de Jong, AMA van der Linden, PCM van Noort, PA Oomen and PJM van Vliet. Field research for the authorization of pesticides. Ecotoxicology 9 (2000): 377-381.

Galis, F and JJM van Alphen. How fast do Crossbills speciate? On assortative mating and vocalizations. Trends Ecol. Evol. (2000) 15: 357.

Kisdi, E, **FJA Jacobs** and Stefan AH Geritz. Red Queen Evolution by Cycles of Evolutionary Branching and Extinction. IIASA Interim Report IR-00-030. IIASA Studies in Adaptive Dynamics 43 (2000): 1-25.

Metz, JAJ, D Mollison and F van den Bosch. The Dynamics of Invasion Waves. pp. 482-512. In: U Dieckmann, R Law, **JAJ Metz** (Eds). The Geometry of Ecological Interactions. Simplifying Spatial Complexity. Cambridge University Press. (2000). 586pp.

Van Dooren, TJM. The evolutionary dynamics of direct phenotypic overdominance: emergence possible, loss probable. Evolution 54 (2000): 1899-1914.

Vos, P, **E Meelis** and WJ ter Keurs. A framework for the design of ecological monitoring programs as a tool for environmental and nature management. Environmental Monitoring and Assessment 61 (3) (2000): 317-344.

Vos, P, **E Meelis** en WJ ter Keurs. Second Opinion: Effecten van treingeluid op weidevogels. Een kritische analyse van het onderzoek van Alterra naar de invloed van treingeluid op de dichtheden van weidevogels. MiBi rapport 18 December 2000.

5. Een overzicht van de invited keynote addresses

Geef naam keynote speaker, titel lezing, bij gelegenheid van, plaats, land, datum
Neen alleen de echte belangrijke lezingen op!

Galis F *Why do almost all mammals have 7 cervical vertebrae? Developmental constraints, Hox genes and cancer.* University of Gainesville, Florida, USA, 11 January 2000.

Galis F *Why do we have 7 cervical vertebrae and why is the phylotypic stage conserved?* Harvard University and State University of New York at Stony Brook, USA, 12 and 14 April 2000.

Galis F *Why do we have 7 cervical vertebrae and why is the phylotypic stage conserved?*. Humboldt Universität Berlin, Germany, 28 November 2000.

Haccou P *Effects of parental survival on clutch size decisions in fluctuating environments.* Netherlands Institute of Ecology (Heteren), 28 November 2000.

Jacobs FJA *On The Mathematics Of Fixation In Phenotypic Trait Evolution.* Trends in Nonlinear Analysis, Heidelberg, Germany, 8 – 12 October 2000.

Metz JAJ *Adaptive Dynamics, Population Dynamics' Evolutionary Twist.* Innovationskolleg fuer Theoretische Biologie, Berlin, Germany, 12 -14 December 2000.

6. Een overzicht van lidmaatschappen van editorial and advisory boards

F. Galis
Member Editorial Board, Journal of Experimental Biology (Molecular Developmental Evolution)
Member Editorial Board, Molecular Developmental Evolution (J. exp. Zool.)
Member Editorial Board, Zoology, Analysis of complex systems.
Member of the Scientific Programme Committee of the 6th International Congress on Vertebrate Morphology (for Juli 2001 in Jena).
Voorzitter van de commissie Wetenschappelijke Bijeenkomsten (CWB)
Secretary of the Division of Developmental Evolutionary Biology of the Society of Integrative and Comparative Biology (SICB)

Regular Contributor for the new section 'Commentary' of Trends in Ecology and Evolution (TREE).

P. Haccou

J.A.J. Metz
Consultant Department of Mathematics, Utrecht University
Project Leader Adaptive Dynamics Network, Austria.
Member Steering Committee European Science Foundation Program Theoretical Biology of Adaptation
Member Editorial Board Acta Biotheoretica
Editor Evolutionary Ecology
Editor Cambridge Series: Adaptive Dynamics

E. Meelis
Treasurer of the Institute

schrap lidmaatschappen die in 2000 niet meer bestonden
vul aan met lidmaatschappen die in (de loop van) 2000 zijn ontstaan
corrigeer foutieve tekst

7. Een overzicht van de externally supported projects
(wordt geleverd door de FEA)

8. Een overzicht van door gasten gehouden lezingen binnen het EEW

17-20 February 2000, Gregory Wray, Duke University,
(Frietson)

29 August 2000, Yoh Iwasa, Department of Biology, Kyushu University, Japan. *Evolution of genomic imprinting and conflict between genes.*
(Patsy)

25 and 26 September 2000, Urs Schmidt-Ott, Max Planck Institute, Goettingen, Germany. *Evolution of developmental mechanisms: axis specification in dipteran insects.*

geef aan welke gastsprekers een voordracht voor het EEW hielden (datum, naam gastspreker, funktie gastspreker, instituut, plaats, land, titel voordracht)

9. Een overzicht van externe promotie-begeleiding

Haccou P. External Supervisor of Fabrizio Grieco, Heteren on behalf of Functional Ecology School

Van Dooren TJM. Supervisor of Ralf Gyselings (doctoral student, University of Antwerp)

10. Opgave van 1e en 2e fase onderwijsactiviteiten, w.o. aantal maanden begeleiding stagestudenten en aantal maanden begeleiding interne promovendi

Haccou P:
- ontwikkeling computer ondersteund onderwijs
- uren besteed aan de COO-component van het WP onderwijs: 700
- 1e fase:
  Wiskundige procesbeschrijving:
  college uren: 17
  practicum uren: 34
  aantal practicanten: 70
  tentamens: 7 x (waarvan 3 herkansingen, 4 gewone)
  aantal deelnemers: 70 (gewone, herkansingen: 10-20)
- 2e fase:
  interne promovendi:
  12(Yuri) + 5(Joost)

Jacobs FJA. Supervisor of Michiel Koster (stagestudent, 38 studiepunten)
Jacobs FJA. Supervisor of Evertjan van de Kaa (doctoraal student (Drs.))

Van Dooren TJM:
- Teaching of 1st year Statistics (Parts A and B): 14 hours lectures plus 12 hours exercise classes

Geef aan voor 1e fase:
- naam van het vak met aantal college-uren
- naam van het vak met aantal practicum-uren + aantal practicanten
- naam van vak(ken) met tentamen + aantal tentamendeelnemers
- naam cursus met cursusduur in weken en aantal cursisten
- aantal maanden begeleiding stagestudenten.

Geef aan voor 2e fase:
- aantal maanden begeleiding interne promovendi
- naam cursus met cursusduur in weken en aantal cursisten

11. Een overzicht van georganiseerde meetings

Haccou P: Branching process models, IIASA, Laxenburg, Austria, 25 September - 1 October 2000.

Metz JAJ: Workshop Integral Equation Formalisms for Physiologically Structured Populations, IIASA, Laxenburg, Austria, 4 8 September 2000, 4 participants: Odo Diekmann (Utrecht), Markus Kirkilionis (Heidelberg), Mats Gyllenberg (Turku) and **Hans Metz**.

Haccou P together with Peter Jagers (Gothenburg, Zweden): Workshop Branching processes and Biology: the ramifications of life and death, IIASA, Laxenburg, Austria, 26 - 29 September 2000. 6 participants: **Hans Metz**, Ulf Dieckmann (IIASA), Vladimir Vatutin (Moskou, Rusland), Mats Gyllenberg (Turku, Finland) and the organizers.

Robbers Y together with Andre de Roos (UvA) and JoseBorghans (UU): NVTB (Nederlandse Vereniging voor Theoretische Biology, Texel, The Netherlands, 3 - 4 February 2001.

geef aan welke (inter)nationale symposia en congressen (mede) georganiseerd zijn (titel, plaats, data, naam organisator, aantal deelnemers)

12. Een overzicht van maatschappelijke dienstverlening, w.o. lidmaatschappen externe besturen e.d.

P. Haccou.
Judging Committee ALW
NWO/ALW Grant Applications Judging Committee 'Ecology, Biodiversity and Evolution'.
EEW-Curriculum Committee
Educational Committee of the Functional Ecology School

N. van der Hoeven
Lid commissie "Bestrijdingsmiddelen en (semi)veldonderzoek" van de Gezondheidsraad.

E. Meelis
Secretary Study group Milieubeheer Leiden

J.A.J. Metz
Leader Project Adaptive Dynamics Network, IIASA, Austria (2 months sabbatical time)
Committee Non-linear Population dynamics, NWO Priority Program Nonlinear Systems
Curator LUF endowed chair Philosophy of Biology
Project Leader ADN + Curatorship

schrap lidmaatschappen die in 2000 niet meer bestonden
vul aan met lidmaatschappen die in (de loop van) 2000 zijn ontstaan
corrigeer foutieve tekst

13. Een overzicht van toegekende prijzen (distinctions)

geef aan welke wetenschappelijke prijzen of onderscheidingen in de wacht zijn gesleept (naam medewerker, naam prijs, doel prijs, waaruit bestaat de prijs, mening van de jury, datum en plaats van de uitreiking, naam van de uitreiker)

Odds and Ends:

Yuri Robbers en op 5-9 januari 2000 de "3rd Winter School on Population Dynamics" in Zeist bezocht.

Frans
jaarlijkse bijeenkomst Nederlandse Vereniging voor Theoretische Biologie,
Texel, Feb. 3-4 2000;
Adaptive Dynamics workshop, Budapest Hungary, May 1-5 2000;
Trends in Nonlinear Analysis Conference, Heidelberg Germany, Oct. 8-12 2000.

Hans Metz is op 23 en 24 oktober 2000 bij IIASA Laxenburg geweest om samen met Mous Sabelis, Ulf Dieckmann en Karl Sigmund te werken aan de redactie van een boek over "Virulence Management", te verschijnen bij Cambridge University Press.

Hans Metz is van 2 t/m 7 november 2000 in Laxenburg geweest voor een bij IIASA georganiseerde workshop in het kader van een formeel goedgekeurd uitwisselingsprogramma met Japan over theoretische oecologie en evolutiebiologie.

Op 1 en 2 december zijn Michel Doebeli (University of Britisch Columbia, Vancouver), Diethart Tautz (Universitaet Koeln), en Ulf Dieckmann bij de sectie Theoretische Evolutiebiologie op bezoek geweest om samen met **Hans Metz** te werken aan de redactie van een boek over "Adaptive Speciation" the verschijnen bij Cambridge University Press.