



International Polar Year 2007-2008 The Netherlands (IPY•NL)



Coordinating project proposal

1f. Composition of the research group of the project (including subprojects)

Name and title	Specialization	Employment/Institute
Dr. M.J.J.E. Loonen	Arctic ecology, geese	Arctic Centre University of Groningen
Prof. Dr. T. Piersma	Animal ecology	Animal Ecology, University of Groningen
Prof. Dr. M. Klaassen	Bird migration, population dynamics	NIOO-KNAW
Dr. R.A.M. Fouchier	Virology, virus genetics	Dept. Virology, Erasmus Medical Centre
Prof. Dr. G. Dorrestein	Pathology, pathogen-host interaction	Veterinary Sciences, Utrecht University
Prof. Dr. J.A.P. Heesterbeek	Modelling infectious diseases	Theoretical Epidemiology, Utrecht University
Dr. B.S. Ebbinge	Goose Ecology	Alterra, Wageningen University
Dr. M. van Eerden	Wetland ecology	RIZA, Lelystad
Dr. H. van der Jeugd	Behavioural ecology	SOVON/Animal ecology, Univ. Groningen
Dr. N. van den Brink	Wildlife ecotoxicologist	Allterra, Wageningen University

And 29 researchers from 11 other countries (on 10 Jan 2006, probably still increasing, see website www.birdhealth.nl under join).

2. Populaire samenvatting van de coördinerende aanvraag (Nederlands)

(if granted, this description will be used for Dutch communication, also to non-specialists)

Hoe groot is de rol van ziektes en parasieten in de verspreiding en de grootte van dierpopulaties? Een besmetting kan dodelijk zijn, maar in de meeste gevallen wordt de infectie door het lichaam bestreden. Hoe groot zijn de verschillen tussen individuen in de snelheid en effectiviteit van deze bestrijding? We verwachten dat er veel variatie is. We verwachten dat dieren in sommige periodes kwetsbaarder zijn, dat de kans op infectie verschilt tussen gebieden en dat sommige ziektekiemen en parasieten moeilijker overleven in koude polaire streken. De structurerende rol van infecties is in de ecologie tot nu toe onderbelicht, maar kan van grote betekenis zijn als uitwisseling tussen populaties verandert bijvoorbeeld door klimaatsveranderingen of verlies van habitat. Voor dit onderzoek volgen we individueel geringde vogels, waarvan we eerst de aanwezigheid van ziektes en parasieten hebben gemeten en de werking van het immuunsysteem hebben getest. We gaan zoeken naar variatie tussen populaties en individuen en de effecten van vervuiling en klimaatverandering modelleren.

3a. Top 5 scientific publications of the applicants related to the coordinating project

1. **Loonen, M.J.J.E.**, Bruinzeel, L.W., Black, J.M. & Drent, R.H. 1999. The benefit of large broods in Barnacle geese: a study using natural and experimental manipulations. *J. Anim. Ecol.* 68: 753-768.
2. **Piersma, T.** 1997. Do global patterns of habitat use and migration strategies co-evolve with relative investments in immunocompetence due to spatial variation in parasite pressure? *Oikos* 80: 623-632.
3. **Klaassen, M.**, Lindström, Å., Meltofte, H. & Piersma, T. 2001. Arctic waders are no capital breeders. *Nature* 413: 794.
4. Munster, V.J., Wallensten, A., Baas, C., Rimmelzwaan, G.F., Schutten, M., Olsen, B., Osterhaus, A.D.M.E. & **Fouchier, R.A.M.** Mallards and highly pathogenic avian influenza ancestral viruses, Northern Europe. *Emerging Infectious Diseases* 11:1545-51 (2005).
5. Diekmann O. and **Heesterbeek J.A.P.** (2000) Mathematical epidemiology of infectious diseases: model building, analysis and interpretation. John Wiley & Sons.



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3b. Other relevant publications (max 1 page for publications, min 10 pts)

By the applying research group:

- Beekman, J.H., Nolet, B.A. & **Klaassen, M.** 2002. Skipping swans: differential use of migratory stopover sites in spring and autumn in relation to fuelling rates. *Ardea* 90(3):437-460.
- Brink, N.W. van den**, J.A. van Franeker, E.M. de Ruiter-Dijkman. 1998. Fluctuating concentrations of organochlorine pollutants during a breeding season in two Antarctic seabirds: Adélie penguin and southern fulmar. *Environmental Toxicology and Chemistry* 17: 702-709.
- Clausen, P., Nolet, B.A., Fox, A.D. & **Klaassen, M.** 2002. Long-distance endozoochorous dispersal of submerged macrophyte seeds by migratory waterbirds in northern Europe - a critical review of possibilities and limitations. *Acta Oecologica* 23: 191-203.
- Ebbinge, B.S.** & B. Spaans. 2002. How do Brent Geese (*Branta b. bernicla*) cope with evil? Complex relationships between predators and prey. *Journal für Ornithologie* 143: 33-42.
- Fouchier, R.A.M.**, Munster, V., Wallensten, A., Bestebroer, T.M., Herfst, S., Smith, D., Rimmelzwaan, G.F., Olsen, B., & Osterhaus, A.D.M.E. 2005a. Characterization of a novel influenza A virus hemagglutinin subtype (H16) obtained from black-headed gulls. *Journal of Virology* 79:2814-2822.
- Fouchier, R.A.M.**, Olsen, B., Bestebroer, T.M., Herfst, S., van der Kemp, L., Rimmelzwaan, G.F. & Osterhaus A.D.M.E. 2003a. Influenza A virus surveillance in wild birds in Northern Europe in 1999 and 2000. *Avian Diseases* 47: 857-860.
- Van Gerwe, T.J.W.M., A. Bouma, W.F. Jacobs-Reitsma, J. van den Broek, D. Klinkenberg, J.A. Stegeman & **J.A.P. Heesterbeek** (2005): Quantifying transmission of *Campylobacter* spp. among broilers. *Applied and Environmental Microbiology*, 71, 5765-5770.
- Graaf, A.J. van der, O.V. Lavrinenko, V. Elsakov, **M.R. van Eerden**, J. Stahl. 2004. *Polar biology* 27: 651-660.
- Hudson, P.J., Rizzolli, A., Grenfell, B.T., **J.A.P. Heesterbeek**, and Dobson, A.P. 2002: The ecology of wildlife diseases. Oxford University Press, Oxford.
- Jeugd, H.P. van der, K.B. Blaakmeer. 2001. Teenage love: the importance of trial liaisons, subadult plumage and early pairing in barnacle geese. *Animal behaviour* 62: 1075-1083.
- Kuiken, T., **Fouchier, R.A.M.**, Rimmelzwaan, G.F., & Osterhaus, A.D.M.E. 2003b. Emerging viral infections in a rapidly changing world. *Current Opinion in Biotechnology* 14:641-646.
- Loonen, M.J.J.E.**, K. Oosterbeek & **R.H. Drent** 1997. Density dependent effects on growth of young and final adult size in Barnacle Geese *Branta leucopsis*. *Ardea* 85: 177-192.
- Mendes, L., **T. Piersma**, M. Lecoq, B. Spaans and R.E. Ricklefs. 2005. Disease-limited distributions? Contrasts in the prevalence of avian malaria in shorebird species using marine and freshwater habitats. *Oikos* 109: 396-404.
- Mendes, L., **T. Piersma**, D. Hasselquist, K.D. Matson and R.E. Ricklefs. 2006. Variation in the innate and acquired arms of the immune system among five shorebird species. *J. Exp. Biol.* 209: 284-291.
- Nolet, B.A., Bevan, R.M., **Klaassen, M.**, Langevoord, O. & Van der Heijden, Y.G.J.T. 2002. Habitat switching by Bewick's swans: maximisation of average long-term energy gain? *Journal of Animal Ecology* 71: 979-993.
- Olsen, B., Munster, V.J., Wallensten, A., Waldenström, J., Osterhaus, A.D.M.E., & **Fouchier, R.A.M.** 2006. Global patterns of influenza A virus in wild birds. *Science* (in press)
- Piersma, T.**, A. Lindström, R.H. Drent, I. Tulp, J. Jukema, R.I.G. Morrison, J. Reneerkens, H. Schekkerman and G.H. Visser. 2003. High daily energy expenditure of incubating shorebirds on High Arctic tundra: a circumpolar study. *Funct. Ecol.* 17: 356-362.
- Piersma, T.** 2002. Energetic bottlenecks and other design constraints in avian annual cycles. *Integr. Comp. Biol.* 42: 51-67.
- Stahl J., Tolsma P.H., **Loonen M.J.J.E.** & Drent R.H. (2000) Subordinates explore but dominants profit: resource competition in high arctic barnacle goose flocks. *Animal behaviour* 61: 257-264.

Other references with respect to the coordinating application:

- Grenfell B.T., W. Amos, P. Arneberg, O.N. Bjørnstad, J.V. Greenman, J. Harwood, P. Lanfranchi, A.R. McLean, R.A. Norman, A.F. Read & A. Skorping. 2002. Chapter 9: Visions for future research in wildlife epidemiology. In: Hudson P.J., A. Rizzoli, B.T. Grenfell, J.A.P. Heesterbeek & A.P. Dobson (eds) *The Ecology of Wildlife Diseases*. Oxford University Press.



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4. Detailed description research area and research plan of the coordinating project

(max 2 pages, min 10 pts, including figures)

(Including coherence and coordination between different subprojects)

In short, the aim of the project is:

1. Study geographic variation in infections, parasite loads, viral prevalence, immune system functioning
2. Study the effects of infections, parasites, viruses and immune response on fitness parameters and energetics of individually marked birds
3. Link the observed trends to pathogen-host (or parasite-host) interaction, dynamics of the pool of pathogens and pollution levels.
4. Modelling future scenario's of geographic variation and relating the findings to climate change, nature management and human health.

Healthy individuals are able to optimize resource use, survival and reproduction. Health of an individual will be under constant attack. Animals have developed immunological, physiological and behavioural strategies to battle these attacks from pathogens, parasites and/or pollution on their health. This battle for health is the main theme of the study.

Individually marked birds are the subject of this study. They can be studied over their life time in the wild. Health of marked individuals can be correlated with present and future fitness. Experimental manipulations will quantify the consequences of specific attacks on health and will determine cause and effect in the correlations.

Ecological immunology is a fast developing field, with beautiful examples of individual and species differences in immune response. Population size and distribution is structured by pathogens, parasites and pollution. Their fitness effect is the result of a complex interaction in an evolution of the struggle for survival. Most of the Arctic breeding birds are highly migratory. Therefore spatial and temporal variation between populations and individuals is an important focus of the study.

The polar regions are of special interest for this study. These areas are considered to have relatively low levels of pathogens, parasites and pollution. Migratory birds linking temperate regions with the Arctic are potential vectors of diseases as shown by the recent spread of the West Nile Virus and Avian Influenza: diseases which are threatening domestic animals and humans. With a changing arctic due to climate change and pollution, more knowledge is needed on how animals cope with attacks on their health and how this will further influence the dynamics and spread of these diseases.

In the IPY, we will classify the occurrence of pathogens, antibodies, parasites and pollution levels in individually marked wild birds in the Arctic and through international partners in the Antarctic. We will study the immune system by running tests on blood samples or by challenging the individuals and monitor the production of antibodies. Fitness of the birds is measured directly by this sampling together with reproductive output or body condition, but also on the longer term by survival parameters. Health can be monitored over time when the individual is repeatedly seen or caught. Finally we will model temporal and spatial variation and relate our findings to climate change, nature management, environmental degradation by human action and human health.

The project involves ecologists, biologists, veterinarians virologists and modellers. The project needs field workers for sampling birds and measure fitness, analysis capacity to run all tests and scientific interaction between participants to explain the pathogen-host interaction and geographical variation. It will involve and thus benefit from long-term projects, during which birds have already been ringed and their fitness.

IPY-funding is organised per nation and funding might not be possible in a special IPY-program for many of the international partners. The Netherlands harbours major scientific players in the various fields of expertise on which BIRDHEALTH is built and a strong core group in the Netherlands will give



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a boost to the international cooperation. The program BIRDHEALTH in the Netherlands is divided in four subprojects, each with a specific focus and a requested position.

Core of the study and of vital importance to all other subprojects is the postdoc (a), which will play an important role in organizing the fieldwork and the international cooperation. This project focuses on geographic variation in infections, parasites, viruses and immune system functioning. The other three projects have each there specific focus on ecological immunology (b), avian influenza (c) and modelling (d). The first three projects link with field work on fitness of ringed birds, which has already a history of many years. The fourth (theoretical) project will greatly benefit from the expertise in the other sub-projects during model development, parameterization and testing but also identify subjects requiring particular attention in empirical studies

5. Timetable of the coordinating project and working programme

- 2006 Filling in the program and network details and having the first workshop
Themes: align international focus, secure funding for field parties and analysis; standardizing measurements and develop a field protocol, determine priority field sites and auxiliary sites, preparing databases for monitoring the flow of samples and combining the results.
- 2007 Capacity building: training people, planning field sampling, planning analyses
Field season, focussing on establishing correlations and determining geographical variation
Outreach: involving students
- 2008 Analyses, refocus, second workshop
Field season, focussing on filling gaps and experimentation to establish cause and effect, collecting more fitness data on sampled individuals.
Outreach: involve press and film makers to show the field work
- 2009 Analyses, publication of results in scientific journals, bringing it all together in a book.
Outreach: dissemination of results to stakeholders and the general public, also in countries where the research hgas been conducted.
- 2010 Finalising the project, feedback to Ph.D. students

6. Affiliation with (inter)national research programmes

(This should include an explicit description of existing and planned cooperation)

The project is an international project IPY, with research groups joining from various countries, but also with specific expertise (see the project website www.birdhealth.nl under join). It has clear links with other IPY-projects focussing on fitness of birds, pollution (175: COPOL), biodiversity an human health. Cooperation with other IPY projects will be used for access to study sites (11: Arctic Wolves, 72: ArcDiv, 133: CBMP).

It fits in international monitoring programs for avian influenza (Novaflu and Nivarec) and links with research programs supported by CAFF (biodiversity) and AMAP (pollution), both working groups of the Arctic Council, for which the Netherlands has an observer status. The project is officially fully endorsed by both the International IPY Committee and the working group CAFF (Conservation of Arctic Flora and Fauna).

PRISM-II *Partners for Water* is an international program co-funded by the Ministry of Transport, Public Works and Water which plans a field expedition to the Pechora delta in Russia and supports a local Russian initiative for capacity building of Nenetskiy Zapovednik (www.prism-pechora.nl).

Expertise from previous projects on migratory birds will be used and/or re-vitalized:

Organisation	Where	Funded by
Wader StudyGroup	Dickson, Russia	Ministry of Agriculture, Nature and Food Quality
RIZA	Pechora	Ministry of Transport, Public Works and Water
NIOO	Pechora, White Sea	NWO, KNAW
Alterra	Taymir	Ministry of Agriculture, Nature and Food Quality
University of Groningen	Zackenbergl, Greenland	Netherlands Arctic Program



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University of Groningen
University of Groningen
Erasmus Medical Center
Erasmus Medical Center
Erasmus Medical Center

Longyearbyen, Spitsbergen
Ny-Ålesund, Spitsbergen
Netherlands
Netherlands, Sweden
Netherlands, Sweden

EU-5th framework FRAGILE
Netherlands Arctic Program
Ministry of Agriculture
EU-5th framework NOVAFLU
EU DG-SANCO

7. Societal significance

Motivation of the relevant policy aspects, such as:

- Political / societal significance in a national and international context
- Urgency for international and/or national policy

(These are important for the evaluation of the proposal, because of the funding by several ministries.)

Wild birds form the natural reservoir for low pathogenic avian influenza virus, and are thought to form a risk for spreading a highly pathogenic form from Asia to Europe. In addition, the spread of a virulent form of the west nile virus across North-America has also shown the link between migratory birds, pathogen pools and animal and human health. Since the first draft of this proposal, political and societal interest in issues covered by BIRDHEALTH has boomed. So far the focus has been mainly on the life threats to farm animals and humans. BIRDHEALTH wants to study the effects on wild birds but will also provide crucial information on pool size of pathogens and chances of transmission. All this not only for these viruses but for a wide variety of pathogens and parasites. The results and analysis are placed in relation to global warming and pollution, both issues which have a high profile in politics and society, especially in relation with both poles.

The Netherlands is observer to the Arctic Council and member of the Antarctic Treaty System. With this project the Netherlands will contribute to the goals of these organisations in a field of research with a typical Dutch expertise.

Most Arctic breeding bird populations are migratory birds, crossing international borders and wintering in temperate regions like the Netherlands. Their well-being is linked with nature management in several countries. The Dutch government has invested in international nature conservation, science and education along these migratory routes and BIRDHEALTH fits in this previous investment. We will specifically invest in partnerships with Russia through Dutch partners (MoU 2005), to create geographical balance in our circumpolar approach.

This program has also a direct link to biodiversity. Pathogens, parasites and viruses belong to a category of life, which we often try to exterminate. They are rarely listed in lists as part of global biodiversity. They are listed as threats for (wild) animals and thus can have an effect on biodiversity especially when the immune response fails due to pollution.

The IPY is an international initiative with a high profile in international news and publications. The Netherlands did not contribute to the previous IPY, which has delayed our membership to the Antarctic Treaty System for several years and required additional investments in Antarctic science. BIRDHEALTH will be active on both poles on many locations and in international cooperation. It will need the involvement of local people and new students. It will form a framework for scientific cooperation with a strong appeal to the general public. It will link health safety for humans and animals, climate change, sustainable development, environmental issues and nature conservation in an integrative way.

The integration of various disciplines over the whole scope of the topics within this project is a big challenge. The plan is feasible because it is based on existing contacts of Dutch scientists. It provides a framework to continue ecological polar research even after the IPY. To meet the goals and to align the international cooperation, it is essential that the program is rooted firmly in the Dutch funding of the IPY. Many other countries will only contribute by sampling. The four subprojects make it possible that the program evolves beyond the level of monitoring to new scientific insights.

9a. Requested budget from ALW



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		2006	2007	2008	2009	2010
Research costs (k€)						
	Education, Outreach & Communication			25		
	Coordination*	6.6	6.4	5	1.5	0.5

* Costs for coordination can only be requested if coordinating main applicant is lead contact of the related IPY "Full proposal". Other costs must be specified in the applications for the subprojects.

9b. Explanation and/or remarks to the proposed budget for coordination costs.

- 2006 Bringing together international partners (workshop), aligning projects
- 2007 Training field assistants and deploy field sampling equipment
- 2008 International discussion and contact (workshop), outreach activities, analysis
- 2009 Outreach
- 2010 Contact with partners

Explanation to the proposed budget for education, outreach and communication

A symposium **Avian Flyways: Connecting Temperate and Arctic** in 2008: 25 k€

We intend to improve and reinforce international scientific cooperation by convening a symposium in late 2008 drawing together partners from a number of IPY initiatives and other Arctic programmes. The rich biodiversity of the Arctic vertebrate fauna depends on the breeding bird assemblage, the grand majority of them long-distance migrants. The sustainability of biodiversity in the northern regions thus depends on the integrity of both breeding and wintering habitats as well as the connecting flyways. Recent research has identified the crucial significance of stopover sites for avian migrants, especially sites used prior to breeding. Intensive studies on marked individuals including detailed work on resource use are being pursued as part of the IPY projects and it is our intention to bring the researchers together to assemble a synthesis under the title **Avian Flyways: Connecting Temperate and Arctic**. This topic is at the heart of several research teams concentrating on swans, geese and waders (shorebirds) breeding in Arctic Canada, Greenland, Spitsbergen and Arctic Russia. A number of these teams are already united in the Canadian IPY initiative WOLVES coordinated by Gauthier, and others participate in three IPY initiatives for the Netherlands IPY contribution and there are links to the IPY of Denmark Sweden and Norway as well. It is emphatically not our goal to synthesize the total work package of any one of these IPY units, but rather to gather together new insights on the specific topic of flyway ecology which has until very recently been the Cinderella of migration research.

The urgency of doing this now is that *climate change* (that is causing a mismatch between onset of resource peak times and migratory timing) together with increased human interference through *changed land use* along the flyway poses a threat to the sustainability of the migratory system. An added dimension is the potential role these flyways might play in the dissemination of avian influenza. We feel that a rigorous scientific review will serve both to stimulate further research as well as providing a solid basis for appropriate management. The symposium will be convened by Bakker, Piersma and Loonen from Groningen University, Klaassen (NIO/University of Utrecht) and Gauthier (Université Laval) and thus covers both the resource base and avian ecology. We are aiming at publication in a series produced by Cambridge University Press. Two emeritus professors both still active in Arctic research and between them drawing on fifty season's expeditionary work have agreed to assist in the editorial process (Jefferies at Toronto University and Drent at Groningen University). There are expressions on intent to participate from fifteen Arctic research team leaders so far. It is emphatically the goal to unite both the young researchers embarking for the first time in Arctic work with the team leaders from the initiatives centred at Bylot (73° N) Greenland (74°) Spitsbergen (77-80°) and the Pechora, Russia (68°).



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Rationale of timing, Budget

The timing in 2008 allows full use of the first two field seasons of the IPY investigators (ten PhD and Postdoc appointments envisaged under auspices of three national programmes). We apply for 25 thousand Euro from the Netherlands IPY (conforming to the budgetary ruling concerning the Netherlands Arctic Program NAP call in recent years).

10. Financial assistance for *coordination* from (an)other source(s)

NAP 2006/2007: Field work for a pilot project, main focus Spitsbergen 2007 during summer

Interdepartementaal Polair Overleg: grant to the Arctic Centre for coordinating Dutch research, for running a field station on Spitsbergen and for representation within e.g. CAFF (Conservation Arctic Flora and Fauna www.caff.is)

We will try to get specific money to involve Russian scientists and indigenous people, and to support their efforts to contribute to BIRDHEALTH from earmarked governmental money and private sponsoring (oil and gas industry).

The international project is co-lead by dr. S.A. Hanssen from the University of Tromsø, Norway. Norway is one of the countries which also will make a substantial contribution to the IPY. We hope that he can play a coordinator role too.

Several partners will financially contribute to the proposed symposium. The contribution from Canada IPY WOLVES (Gauthier, Jefferies et al) already includes travel funds for their team to attend our gathering. Both Spitsbergen and Pechora projects supported from the Netherlands are linked with this initiative (see submission WOLVES). Additional funding is being requested from the Norwegian IPY programme (submission 15 March 2006) and the British Ecological Society (for publication). Van Eerden from the Netherlands Ministry of Transport as spokesman for the Partners in WaterPechora Project is also seeking support for our venture.

11. Relation research program university, large institutions, research schools, etc.

The Arctic Centre of the University of Groningen is representing the Dutch science community in a number of international arctic science forums, financed by the government. Nationally, it aims to be a hub and facilitator for polar science and education.

Within the University of Groningen there are also other research groups with histories in Arctic (Animal Ecology) and Antarctic (Marine Biology) research which are presently combining their strength into a virtual centre of polar ecology and education.

The ecological research groups of the University of Groningen participate in the Centre for Ecological and Evolutionary Studies (CEES) and are part of the research school Functional Ecology.

The department of Virology at Erasmus Medical Center houses the WHO-affiliated Dutch National Influenza Center and is an international reference laboratory for a variety of viruses. The department is active in the WHO Working Group on Influenza Research at the Human/Animal Interface and is part of the research school Molecular Medicine.

Dutch members of the research group of this project have also established links via national societies as the Netherlands Ecological Society (NECOV), the Netherlands Ornithologist's Union (NOU) and the Dutch Society for Wildlife Health (DSWH).

(No signatures required for electronic submission)
