

Projektrapport för forskningsprojekt finansierade
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THE SCANDINAVIAN BROWN BEAR RESEARCH PROJECT STATUS REPORT: 2018

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STATUS REPORT: 2018

The Scandinavian Brown Bear Research Project (SBP) is a long-term, individual-based project that conducts ecological research with a focus on research that is relevant to provide managers in Sweden and Norway with solid, scientifically based knowledge to meet present and future challenges presented by managing the population of brown bears. In our application for 2018-2020, we proposed to continue gathering and analyzing long-term individually-based data on bears with a main goal of following females from birth to death. The SBP worked in 4 ways concurrently: 1) research on population dynamics, life-history strategies, and general ecology using a dataset, over 30 years long, of individually marked bears (the base project) and; 2) management-relevant research. In addition, it; provided infrastructure and marked bears for 3) practical activities important for management, such as training and testing tracking dogs; and 4) associated research projects, such as veterinary and human physiology.

We proposed a 3-year long project with 7 different work packages for the research period but was granted funding for one for a total of 1 million SEK. We received additional comments from the Wildlife Committee in June 2018 and have also been in discussion about the future focus of the project during the Viltforskningsdagarna in September, with parts of the Committee. We have submitted an updated research proposal for 2019-2021 in September 2018 and we therefore here only report our results for 2018. The economy for 2018 will be reported separately in March 2019. Based on the suggestions from the Committee to focus on the interactions between bears and wolves, we have hired a postdoc for 2019 to work on this subject in collaboration with Skandulv.

During 2018, the SBP produced 39 publications; 24 international scientific papers, 3 PhD theses, 8 master's theses, 4 reports to management agencies.

Since 1984, the SBP has produced 686 publications; 266 international scientific papers, 23 books/book chapters, 22 proceedings papers, 35 PhD theses, 97 master's theses, 9 bachelor's theses, 146 reports to management agencies, and 91 popular articles. This makes the SBP the world's most productive carnivore research project, measured in scientific articles or PhD theses, and one of the most productive wildlife research projects worldwide.

Methods

We have continued with methods used since long time in the project, i.e., capturing female bears with a helicopter and following them from birth to death with GPS technology. The fieldwork is concentrated on females in central Sweden-southeastern Norway. Females receive GPS collars that take positions at least every 60 minutes, but more often in during some time periods. Our methods have been approved by the ethical committees in Sweden and Norway.

In order to maintain a sample size of marked bears that can allow us to measure the demographic consequences of changes in management within a reasonable time period, we have aimed to have radio-collars on 25 adult females at the end of each hunting season; the same level that the Yellowstone grizzly bear study has determined is necessary for the same reason. We capture most females the first time as yearlings with their mothers (the most cost-efficient method). Accounting for the time from yearling capture to adulthood and losses due to hunting, natural mortality and collar loss and failure, we need about 70 radio-marked bears in spring to maintain our sample size goal, based on rates of loss over the past several years. This will give us reliable estimates of important vital parameters, including age of first reproduction, litter size and litter interval, weight and size at each capture, and rates and causes of mortality by age. We take samples of hair, tissue, blood, etc. from captured bears and construct a pedigree from the genetic results. We also collect GPS and physiological data from the marked bears. The base project also counts the young of radiomarked mothers from a helicopter three times annually (before and after the mating season and before the hunt), documents berry availability (on plots), food habits (from scats), and den use.

Results for 2018

We have decided to list the relevant publications for 2018. These publications are available on the SBP website, www.bearproject.info. Because we did not receive the entire funding we applied for, we could not work on all the topics to the extent we had proposed.

Scientific papers

- Bischof R., C. Bonenfant, I. M. Rivrud, A. Zedrosser, A. Friebe, T. Coulson, A. Mysterud, and J. E. Swenson. 2018. Regulated hunting re-shapes the life history of brown bears. **Nature Ecology and Evolution** 2:116–123.
- Anijalg, P., S. Y. W. Ho, J. Davison, M. Keis, E. Tammeleht, K. Bobowik, I. L. Tumanov, A. P. Saveljev, E. A. Lyapunova, A. A. Vorobiev, N. I. Markov, A. P. Kryukov, I. Kojola, J. E. Swenson, S. B. Hagen, H. G. Eiken, L. Paule, and U. Saarma. 2018. Large-scale migrations of brown bears in Eurasia and to North America during the Late Pleistocene. **Journal of Biogeography** 45:394-405.
- Frank, S. C., M. Leclerc, F. Pelletier, F. Rosell, J. E. Swenson, R. Bischof, J. Kindberg, H. G. Eiken, S. B- Hagen, and A. Zedrosser. 2018. Sociodemographic factors modulate the spatial response of brown bears to vacancies created by hunting. **Journal of Animal Ecology** 87:247–258.
- Stenvinkel, P., J. Painer, M. Kuro-o, M. Lanaspa, W. Arnold, T. Ruf, P. G Shiels, and R. J. Johnson. 2018. Novel treatment strategies for chronic kidney disease: insights from the animal kingdom. **Nature Reviews** 14:265-284.
- Cattet, M., G. B. Stenhouse, D. M. Janz, L Kapronczai, A.Zedrosser, A. Söderberg, J. E. Swenson, and J. Boulanger. 2018. Can

- concentrations of steroid hormones in brown bear hair reveal age class? **Conservation Physiology** 6(1):coy001.
- Schregel, J., J. Remm, H. G. Eiken, J. E. Swenson, U. Saarma, and S. B. Hagen. 2018. Multi-level patterns in population genetics: Variogram series detects a hidden isolation-by-distance-dominated structure of Scandinavian brown bears *Ursus arctos*. **Methods in Ecology and Evolution** 9:1324-1334.
- Van de Walle, J., G. Pigeon, A. Zedrosser, J. E. Swenson, and F. Pelletier. 2018. Hunting regulation favors slow life histories in a large carnivore. **Nature Communications** 9:1100.
- Penteriani V., M. M. Delgado, M. Krofel, K. Jerina, A. Ordiz, F. Dalerum, A. Zarzo-Arias, and G. Bombieri. 2018. Evolutionary and ecological traps for brown bears *Ursus arctos* in human-modified landscapes. **Mammal Review**. 48:180–193.
- Kojola, I., V. Hallikainen, T. Helle, and J. E. Swenson. 2018. Can only poorer European countries afford large carnivores? **PLoS ONE** 13(4):e0194711.
- Støen, O.-G., A. Ordiz, V. Sahlén, J. M. Arnemo, S. Sæbø, G. Mattsing, M. Kristofferson, S. Brunberg, J. Kindberg, and J. E. Swenson. 2018. Brown bear (*Ursus arctos*) attacks resulting in human casualties in Scandinavia 1977-2016; management implications and recommendations. **PLoS ONE** 13(5): e0196876.
- Chanon, S., B. Chazarin, B. Toubhans, C. Durand, I. Chery, M. Robert, A. Vieille-Marchiset, J. E. Swenson, A. Zedrosser, A. L. Evans, S. Brunberg, J. M. Arnemo, G. Gauquelin-Koch, K. B. Storey, C. Simon, S. Blanc, F. Bertile, and E. Lefai. 2018. Proteolysis inhibition by hibernating bear serum leads to increased protein content in human muscle cells. **Scientific Reports** 8:5525.
- Arinell, K, S. Blanc, K. G. Welinder, O.-G. Støen, A. L. Evans, and O. Frøbert. 2018. Physical inactivity and platelet function in humans and brown bears. A comparative study. **Platelets** 29:87-90.
- Kleiner, J. D., R. C. Van Horn, J. E. Swenson, and S.M.J.G. Steyaert. 2018. Rub-tree selection by Andean bears in the Peruvian dry forest. **Ursus** 29:58-66.
- Moen, G. K., A. Ordiz, J. Kindberg, J. E. Swenson, J. Sundell, and O.-G. Støen. In press. Consistent behavioral reactions of brown bears to approaching humans in Fennoscandia. **Écoscience**
- Naves J., A. Ordiz, A. Fernández-Gil, V. Penteriani, M. M. Delgado, J. V. López-Bao, E. Revilla, and M. Delibes. 2018. Patterns of brown bear damages on apiaries and management recommendations in the Cantabrian Mountains, Spain. **PloS ONE** 13(11):e0206733.
- Lodberg-Holm H. K., H. W. Gelink, A. G. Hertel, J. E. Swenson, M. Domevscik, and S. M. J. G Steyaert. In press. A human-induced landscape of fear influences foraging behavior of brown bears. **Basic and Applied Ecology**
- Hertel, A. G., O. Langvall, J. E. Swenson, J. Kindberg, and A. Zedrosser. In press. Fluctuating mast production does not drive Scandinavian brown bear behavior. **Journal of Wildlife Management**

- Giroud, S., A. L. Evans, I. Chery, F. Bertile, G. Tascher, J. Bertrand-Michel, G. Gauquelin-Koch, J. M. Arnemo, J. E. Swenson, E. Lefai, S. Blanc, and C. Simon. 2018. Seasonal changes in eicosanoid metabolism in the brown bear. **Science of Nature** 105:58.
- Hertel, A.G., M. Leclerc, F. Pelletier, and A. Zedrosser. In press. Don't poke the bear: Can remote behaviour recordings be used to assess personality in elusive wildlife? **Animal Behaviour**
- Milleret, C., A. Ordiz, H. P. Andreassen, J. Kindberg, J. Månsson, A. Tallian, P. Wabakken, C. Wikenros, B. Zimmermann, J. E Swenson, and H. Sand. In press. Habitat segregation between brown bears and gray wolves in a human-dominated landscape. **Ecology and Evolution**
- Laske, T. G., A. L. Evans, J. M. Arnemo, T. L. Iles, M. A. Ditmer, O. Fröbert, D. L. Garshelis, and P. A. Iaizzo. 2018. Development and utilization of implantable cardiac monitors in free-ranging American black and Eurasian brown bears: system evolution and lessons learned. **Animal Biotelemetry** 6:13.
- Arnemo, J. M., B. Ytrehus, K. Madslie, J. Malmsten, S. Brunberg, P. Segerström, A. L. Evans, and J. E. Swenson. 2018. Long-term safety of intraperitoneal radio transmitter implants in brown bears (*Ursus arctos*). **Frontiers in Veterinary Science** 5:252.
- Pérez, A. S., A. Ordiz, H. Sand, J. E Swenson, P. Wabakken, C. Wikenros, B. Zimmermann, M. Åkesson, and C. Milleret. In press. No place like home? A test of the natal habitat-biased dispersal hypothesis in Scandinavian wolves. **Royal Society Open Science** 5:181379.
- Zarzo-Arias, A., M. del Mar Delgado, A. Ordiz, J. G. Díaz, D. Cañedo, M. A. González, C. Romo, Pablo V. García, G. Bombieri, C. Bettega, L. F. Russo, P. Cabral, Ricardo G. González, J. Martínez-Padilla, and V. Penteriani. 2018. Brown bear behaviour in human-modified landscapes: The case of the endangered Cantabrian population, NW Spain. **Global Ecology and Conservation** 16:e00499.

PhD theses

- Martin Leclerc. Université de Sherbrooke, Sherbrooke, Québec, Canada. PhD thesis. Conséquences écologiques et évolutives de la chasse chez l'ours brun (*Ursus arctos*) Scandinave.
- Karin Arinell. Örebro University, Örebro, Sweden. PhD thesis. Immobilization as a risk factor for arterial and venous thrombosis.
- Gro Kvelprud Moen. Norwegian University of Life Sciences, Ås. PhD thesis: Human-mediated effects on brown bear behavior and potential cascading effects.

MSc theses

- Matej Domevščík. Swedish University of Agricultural Sciences, Umeå. Master thesis: Resource distribution in disturbed landscapes – the effect of clearcutting on berry abundance and their use by brown bears.

- Tom Henning Linden. Norwegian University of Life Sciences, Ås. Master Thesis: The good, the bad, and the grizzly—assessing human impact on grizzly bears (*Ursus arctos*) at army cutworm moth (*Euxoa auxiliaris*) aggregation sites in the Shoshone National Forest, Wyoming.
- Jan Barilla. University College of Southeast Norway, Bø. Master Thesis: Selection of rubbing trees by brown bears in Slovakia.
- Luc Le Grand. Norwegian University of Life Sciences, Ås. Master Thesis: The behavioural and physiological response of Scandinavian brown bears to dog hunts and human encounters.
- Anne Mette Frøbert. Aalborg University. Master's Thesis: The hibernating Scandinavian brown bear; characterization of a potential regulator of hibernation physiology.
- Janine Rietz. University for Natural Resources and Applied Life Sciences, Vienna, Austria. Master thesis: Human impact on endozoochorous seed dispersal by Scandinavian brown bears.
- Svitlana Kudrenko. Norwegian University of Life Sciences, Ås. Master Thesis: Factors contributing to human injuries and fatalities inflicted by brown bears (*Ursus arctos*) in Russia, 1932-2017.
- Michal Haring. University of South-Eastern Norway and Žilina University, Tatranská Javorina, Slovakia. Master Thesis: Bear attacks on people in Slovakia, 2000-2016.

Reports

- Swenson, J. E. and J. Kindberg. 2018. The Scandinavian Brown Bear Research Project; final report 2015-2017. **Report 2018-1 from the Scandinavian Brown Bear Research Project.**
- Støen, O.-G, L. Le Grand, N. H. Thorsen, S. Sæbø, G. R. Rauset, J. M. Arnemo, B. Fuchs, A. L. Evans, D. Ahlquist, & R. Boström. 2018. Jaktforsøk på brunbjørn med hund - antall og hundetypens betydning for bjørnens fysiologi. **NINA (Norsk institutt for naturforskning) Rapport 1501.**
- Kindberg, J. och J. E. Swenson. 2018. Björnstammens storlek i Dalarnas och Gävleborgs län 2017. **Rapport 2018-2 från det Skandinaviska björnprojektet.**
- Kindberg, J. och J. E. Swenson. 2018. Björnstammens storlek i Sverige 2017. **Rapport 2018-3 från det Skandinaviska björnprojektet.**