Poster Session 1 – Population Dynamics

44 The effect of habitat connectivity on colonisation of forest fragments with rodents

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Habitat fragmentation through anthropogenic modification/urbanisation can have an impact on the distribution and population abundance of the small mammal fauna. Increased fragmentation and the presence of landscape elements that block distribution may minimise recolonization of suitable habitat by small mammals after the population crash phase. This is relevant as the human population expands and requires more and more space, which increases fragmentation. We determined the degree of connectivity of habitat fragments in north-west Germany formally by allocating permeability values to the habitat structures present at landscape scale. These data were related to surveys of the colonisation of forest fragments by rodents to assess relationships between fragmentation and repopulation after rodent outbreaks. Such information is not only important for the assessment of land use effects but can also contribute to a better understanding of processes driving population dynamics in rodent species prone to outbreaks such as bank voles (*Myodes glareolus*). In addition, risk related to rodent-borne diseases can be considered. First results are presented and discussed.

Poster Session 1 – Population Dynamics

45 Recent information on population status of *Meriones dahli* that is close to extinction in the Middle East

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Meriones dahli is psammophilic (living in sand) inhabiting ecologically dispersed areas and suitable habitats are fragmented. This rodent is distributed in a small area spread over the northern skirts of Mount Ararat on the borders of Igdir province in Turkey. Abu jail (*Calligonum polygonoides*) is found in the desert ecosystem where the plant is dominant, and *Meriones dahli* lives in the burrows dug into the bottom of the Abu jail plant. In the mid-1980s, the global population size was estimated to be 5,000-6,000 individuals. The information about the *Meriones dahli* population seems to consist of scattered records, but there is a steady decline in populations according to the information available. Within the scope of the study, the counting method used in the species action plan was used in determining the population size. Considering that it is breeding 3 times a year according to the literature data, about 10 days after the first frying season, field trials were initiated and 100 Sherman type traps were used during the landing (5 consecutive days). The mark-recapture method was used according to the transect method and the traps were spread homogeneously over the whole area starting from the point locations given in the literature records, leaving a 10 m gap between the traps. At the end of the study, a total of 4 individuals were caught and 1 of them was juvenile, 1 was female and 2 were males. The cause of the sudden decline in the population is observed as habitat disposal, material intake, construction activities and excessive grazing. Some suggestions have been made to prevent this decline: protecting the area immediately; suggesting the selection of alternate areas by the Municipality of Aralık as a garbage area; organization of training activities in the towns and villages of muhtars, schools and settlements in Aralık, especially raising awareness of shepherds; field type information displayed on signboard and warning plate.

Poster Session 1 – Population Dynamics

46 Recent bamboo flowering in Chittagong Hill Tracts of Bangladesh: anticipating new rodent outbreaks

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Rodent outbreaks resultant from bamboo flowering is a real phenomenon that damages farmer crops in parts of the world particularly Chittagong Hill Tracts (CHT) of Bangladesh, Mizoram in India and Chin State of Myanmar. In 2006 *Melocanna* bamboo flowered in CHT and severe food shortage was reported of that regions until 2011. Recently *Dendrocalamus longispathus* (Kurz) and *Denrocalamus giganteus* (Munro) have flowered in CHT where farmers are predicting a new rodent outbreaks due to bamboo flowering. Following the bamboo flowering, six community meetings were organized in different places to understand the timing of bamboo flowering and magnitude of bamboo flowering. The farmers reported that bamboo flowering started in January and may produce seeds in May-June. Previous research suggests that timing of bamboo flowering and seeding coincided with the increase of the rodent population and damage and crops loss. Effective monitoring of bamboo seeding as well as early awareness of the rural people about the increase of rodent population with the use of appropriate technology like community trapping, trap barriers system might avoid crops loss and damage to household belongings by the rodents. Government and non-government institutions along with rodent experts need to take immediate measures to avoid food shortages and associate risks derived from rodent outbreaks in CHT.

Poster Session 1 – Population Dynamics

47 Trophic niche partitioning by small mammals in forest environments. Influence of food types and availability, measured using stable isotope analysis in hair

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We analysed the carbon and nitrogen isotopic composition in hair from 173 rodent individuals (12 field mice, 122 yellow-necked mice and 39 bank voles). They were caught on four 0,5 ha transects, each consisting of 100 traps controlled twice a day for five days, located in different forest environments: wet alder forest, coniferous forest, deciduous forest dominated by hornbeam and lime and a habitat dominated by planted pine with understory typical for a coniferous forest. 147 samples of potential rodent food were collected on all transects and their isotopic composition was analysed. Due to differences in humidity and fertility of the study sites, we found large differences in the isotopic composition of the isotopic "background" (nitrogen and carbon isotopes of primary producers). This indicates the importance of using isotopic data on food and consumer from exactly the same habitat in this type of study. In the deciduous forest male yellow-necked mice consume more animal prey than females, indicated by higher δ15N values. We found no other sex-dependent differences in isotopic niches. Rodents from the coniferous forest had the largest isotopic niches, and this study site was also the one with the lowest rodent density. On the other hand, individuals from the alder forest differed least in isotopic composition, despite having the highest density of all study sites. This indicates a limitation of population dynamics by resource availability rather than pressure from predators. Analyses of the isotopic mixing polygons suggest that a food source with higher δ15N values than plant material has not been taken into account. This is probably insects and other soil invertebrates. Samples from this organisms will be collected and analysed before the presentation of this results.

Poster Session 1 – Population Dynamics

48 Population size and distribution of Norway rat, *Rattus norvegicus*, in the sewer system of Barcelona (Spain)

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Urban rat population size in cities is usually unknown and cannot be considered when elaborating rat surveillance and control programs in municipalities. The Agència de Salut Pública de Barcelona, in the framework of the rodent surveillance and control program carried out in the city, started, in 2016, a project that included a study to determine the urban rat population size and to model its distribution in Barcelona. It was performed from December 2016 to November 2017 mainly in the accessible sewer system of the city, where rat densities are the highest and the Norway rat is present. Rats were censed with kill traps in 63 sewer sections (90 m long each). In each section, 30 traps were placed and checked daily during four consecutive nights. Several environmental factors, potentially related to rat abundance, were calculated for each section to determine which combination of them explained better the rat abundances found. Considering only those factors whose data could be obtained for the entire city, the result was a formula containing the amount of food establishments, the human population size, the streets' width and the canopy surface. With that information, a SIG model was elaborated to predict the rat abundance in all the accessible sewer system of Barcelona. In some areas the prediction matches closely with the abundance of citizen complaints for rats, but in general terms there is no correlation between them. This study provides, for the first time, the Norway rat population size in the accessible sewer system in Barcelona, which is estimated at 106,739 ± 37,884 individuals. Additionally, it provides information about their distribution in the city. The results of this study will modulate the rodent surveillance and control program in Barcelona. If the study is replicated in the future, it will allow for tracking the population dynamics in the city.

Poster Session 1 – Population Dynamics

49 Rodent population dynamics: multimodality amplified by climatic fluctuations

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A mathematical model aimed at describing rodent population dynamics is proposed. The model takes into account the population age structure and density-dependent regulation of birth rate. It is revealed multimodality in the model proposed. This phenomenon consists in the existence of various dynamic modes under the same values of parameters, a transition to these modes determined by the initial conditions. In particular three modes: for example 1-, 3- and 4-cycles alternatively appear, which is noteworthy because both three-year and four-year cycles as well as fluctuations disappearance are observed in rodent populations. We proposed multimodality identification approach in real population. It is based on the model parameter estimates obtained for survey and the observation data of population dynamics. Modeling of the real bank vole population dynamics (*Myodes glareolus*) shows the model trajectory describes well enough the dynamics tendency but weakly captures the real values of the population size peaks. To improve the approximation quality a climatic factor was included in the model. This model study showed climatic factor influence leads to a change in form of dynamic mode attraction basins or model parameter values. As a result the population size is shifting from some mode attraction basin to the attraction basin of another one. In other words population dynamics can be described by the following scheme. In the current year with certain climatic conditions the population develops and tends to a stable mode. Next year with different climatic conditions this mode cannot be achieved or does not exist and the population adapting to new conditions tends to another stable mode. In particular the real dynamics of the bank vole can be represented by a sequence of alternating transients that give fluctuations with 3-, 6-, 7- or 14-year period under constant climatic conditions. This work is partially supported by the Russian Foundation for Basic Research (Project no. 18-04-00073) and the Fundamental Research Complex Program "Far East" (Project no. 18-5-051).

Poster Session 1 – Population Dynamics

50 Drivers of *Microtus arvalis* population dynamics : lessons from a 17 year time series

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Common vole population dynamics appear to be strongly correlated to landscape configuration. In comparing time series of vole populations in various regions of France, Delattre et al. (1992) reported a variety of patterns, ranging from low density populations prone to local extinction in intensively tilled homogeneous agricultural landscapes, to multi-annual large-amplitude variations of population densities in permanent grassland landscapes. These observations support the Trophic ROMPA (Ratio of optimal to marginal patch habitat) Integrated Model (TRIM) outlined by Lidicker (2000), which combines the exploitation ecosystems hypothesis (Oksanen and Oksanen 2000) with the effect of spatial arrangements of habitats on vole dispersal and predator communities. In landscape of high productivity and large proportion of optimal habitat Lidicker (2000) TRIM and Delattre et al. (1992) conceptual models predict that (1) vole population dynamics will be driven mostly by extrinsic rather than by intrinsic factors. In practice, population dynamic features, except for seasonality (reproduction stop in winter) should not be driven by reproduction variation; (2) population peaks will last longer and at the extreme tend to produce larger amplitude fluctuations with only seasonal variation and no cyclicity. In this presentation, we consider a 17 year (1979-1996) time series of *Microtus arvalis* population fluctuation in eastern France, in a landscape where the ratio of permanent grassland in farmland is near 100%. We show that: (1) large multiannual population variation (> 5 years) and long (multi-annual) high density peaks (hundreds ind./ha) can be observed with no delayed density dependence (thus no cyclicity); (2) meteorological conditions have a delayed and direct impact on reproduction parameters but not on population dynamics and (3) population declines in spring and summer are not explained by reproduction variation, hence explained by mortality increase. This corroborates Lidicker and Delattre's models and indicates that the drivers of population dynamics might be a combination of predation/disease/social stress. To isolate or weigh each of these factors is however virtually impossible yet for methodological reasons.

Poster Session 1 – Population Dynamics

51 Population dynamics, breeding pattern and home ranges of rodent species in fallow lands of Mukwe Constituency, Kavango-East Region, Namibia

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Rodents have a very important role in ecosystems; they act as bio-indicators of environmental conditions because of their rapid turnover and ability to invade disturbed areas. In addition, some rodents are agricultural pests in rural communities causing crop damage and food shortage across Africa as well contribute to the spread of zoonotic diseases. Rodent species show spatial and temporal patterns in numbers, often linked to environmental factors. The main aim of the study was to determine the population abundance, breeding patterns, species diversity and home range sizes of rodents in Mukwe Constituency, Kavango-East Region (Namibia). The capture-mark-recapture method was carried out over a period of two years in two (labelled DVA and DVB) 70 x 70 m grids (49 Sherman traps each). The rodent species composition in Diyogha Village Grid A (DVA) was: *Mastomys natalensis* (28.6%), *Gerbilliscus leucogaster* (49%), *Saccostomus campestris* (18.6%), *Steatomys pratensis* (0.7%) and other species (2.4%) and for Diyogha Village Grid B (DVB): *Mastomys natalensis* (12.6%), *Gerbilliscus leucogaster* (72.6%), *Saccostomus campestris* (13.7%) and *Steatomys pratensis* (1.1%). All three dominant species showed a significant temporal variation within grids: *Mastomys natalensis* (t = 2.6672; P < 0.05), *Saccostomus campestris* (t = 3.2925; P<0.05) and *Gerbilliscus leucogaster* (t = 4.6728, P<0.05). Although most species seems to breed during the wet season, *Gerbilliscus leucogaster* showed breeding signs in the dry season. Most captured animals were adults, while sub-adults and juveniles were rarely present. Sex ratio did not differ significantly from the 1:1 ratio. Home range overlap was found within and between species, indicating that animals are not territorial.

Poster Session 1 – Population Dynamics

52 Estimating the absolute abundance of rodents and their mammalian predators from camera traps in the southern Yukon, Canada

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Camera trapping has been used largely to determine presence or absence of large vertebrates, and the question of whether it can ever be used to estimate absolute abundance is an open one. We will report on 6 years of research in the southwest Yukon, Canada, to determine if camera images can reflect absolute abundance of mice, voles, red squirrels and snowshoe hares. For these smaller vertebrates the answer is yes. We have now embarked on a larger question of whether cameras can detect and census larger vertebrates in the boreal forests of the Kluane Lake area, Yukon. We have deployed remote cameras on game trails year-round to capture images of all vertebrates including bears, bison, wolves, wolverine, coyotes, lynx and marten and we report on progress here. We are doubtful that we can recognize individuals of most of these species for standard mark-recapture estimates. We are testing new methods of determining density of unmarked animals with camera trap photos. Many of these predator species fluctuate in numbers dramatically in response to the 10-year hare cycle, but others are more stable. The eyes of cameras may be an important technique to provide data 24/7 on the state of this boreal forest ecosystem under rapidly shifting climate in northwestern Canada.

Poster Session 1 – Population Dynamics

53 Regulation of reproduction in Brandt's voles

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Seasonal breeding is a universal strategy in many animals living in non-tropical regions. Brandt's vole (*Lasiopodomys brandtii*) is a small, non-hibernating, herbivorous, and social rodent that is mainly distributed in the grasslands and steppes of China, the Republic of Mongolia, and the Baikal Lake region of Russia. Brandt's voles show striking seasonal breeding and only breed from spring to autumn, which caused dramatically annual fluctuation of their population. By a four-year investigation, we demonstrated the annually photoperiod-synchronized reproductive activity of wild Brandt's vole population. Male adult voles displayed a strict seasonal rhythm of gonadal mass with the precise annual peak around summer solstice. Cooperatively, hypothalamus genes, Dio2, Rfrp-3, Kiss-1 and GnRH, predictively initiation of reproductive inhibition occurred in the best stage of breeding season by response to ambient condition, possibly including photoperiodic signal and variation of temperature and food supply. After long term domestication, inhibition of gonadal development of juveniles gradually disappeared in non-breeding season while the photoperiod response was still retained. These results indicate that the photoperiod response is only a predictive indecisive mechanism. Limited by short life span, an age-dependent reproductive strategy divergence occurred in the main breeding season: overwintered voles could keep reproductive activity across the season, while most of newborn males inhibited the development of gonadal gland except few born in early breeding season. In the wild population, male biased dispersal is a key mechanism of inbreeding-avoidance while it facilitated the reproduction of early born voles, which was testified by completely inhibiting of reproductive activity of newborn voles when overwintered voles were coexisted in the semi-natural enclosure.

Poster Session 1 – Population Dynamics

54 Species composition and community structure of small pest rodents (*Muridae*) in cultivated and fallow fields in maize growing areas in Eastern Uganda

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A capture-mark-recapture study was undertaken in eastern Uganda for three years to establish species composition and community structure of small rodents and their population dynamics in a maize associated cropping system. The study was conducted in two fallow field mosaic habitats that were dominated by *Lantana camara* and other perennial and annual grasses and shrubs (CMR 2 and CMR 4) and cropped fields that initially were planted with maize but subsequently rotated with other seasonal crops (CMR 1 and CMR 3). Ten species were recovered with *Mastomys natalensis*\f "S" being the most dominant species (58,6%), *Muscus* spp. (16%) *Aethomys* spp (7.4%)*Lemniscomys barbarous* (5.2%) *Lophoromys* spp. (4.4%), *Arvicanthis niloticus* (0.9%), *Gerbilliscus* spp. (0.1%), *Graphiurus* sp.(0.1%), *Steatomys* spp. (0.1%), *Grammomys* sp. (0.1%). Spatial variation in small rodent population abundance was highly significant ($F_{3,859.5}=4.706$, $P<0.004$). Using Turkeys (HSD) test, CMR2 showed the highest abundance (26±3 animals/0.5 ha) which significantly differed from other grids. The lowest abundance was recorded in CMR1 (13±3 animals/0.5 ha). The pattern of the individual species variation did not follow similar trends and were very variable and non-significant except for *Mastomys natalensis*. Temporal variation in terms of weather seasons showed significant differences in total small rodent population abundance ($F_{3,721.598}=3.859$, $P=0.012$). The post hoc comparison of treatment means showed higher abundances in the yearly second wet season (Wet 2), with 24 animals/0.5 ha) significantly different from other seasons. The yearly first dry season (Dry 1) displayed the lowest trap catches (12 animals/0.5). There were also year-to-year changes in species population density and generally, with highest population peaks occurring in 2015 compared with year's 2016 and 2017.The study findings provide insights into the species diversity of important small rodent pest species found associated in maize farming systems in eastern Uganda and form basis for design of an appropriate ecologically sound management strategy.

Poster Session 1 – Population Dynamics

55 Population fluctuation and breeding patterns of multimammate mouse, *Mastomys natalensis* (Smith 1834), in maize associated cropping system in Eastern Uganda

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Multimammate mice (*Mastomys natalensis*) continue to constrain farmers efforts towards obtaining optimum outputs from cereal crops production in sub-Saharan Africa through their pre and post-harvest damage they inflict. They are by far the most involved species in most rodent outbreaks reported in the region and once they occur, often they result into crop damage and may cause heavy losses. This study thus aimed at establishing the population dynamics and breeding patterns of *Mastomys natalensis* in maize associated cropping systems Eastern Uganda. The population of the multimammate mouse varied significantly ($F_{10,0.705} = 7.838$, $P<0.0001$) with months. The highest population peaks were recovered in the second rain season (September to October) but specifically in October 2015, where 73 animals/0.5 ha and 66 animals/0.5 ha were captured in fallow and maize fields respectively. Also, *Mastomys natalensis* was observed to be sexually active throughout the year in the study area, with some breeding peaks noted towards end of first rainy season towards maize harvesting stage (May- July). This suggests that breeding is constantly occurring but with an increase during maize harvesting periods. The higher population abundance recorded in September to October is an indication of a buildup population from breeding in previous months. In conclusion higher population abundances of multimammate mice in both habitats were observed to be driven by rainfall patterns but peaking in the second yearly season. This could be as a result of continued population build up from first rainy season which is followed by a short dry period and then another second rainy season. This phenomenon played a role in providing food and vegetation cover which allowed continuous breeding and survival thus population peaking in October. It is therefore advisable that control should be initiated in the first planting season to break the buildup of populations to higher numbers.

Poster Session 1 – Population Dynamics

56 Probability of bank vole and red vole hybridization in different geographical localities

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The overlapping area of closely related bank vole (*Myodes glareolus*) and red vole (*Myodes rutilus*) is very wide and conditions of their coexistence differ a lot within this territory. Besides, the bank vole is rapidly spreading to the east and to the north extending this area. Ancient hybridization between bank and red voles was found recently: one of the *Myodes glareolus* genetic lineages has mitochondrial DNA similar to that of the *Myodes rutilus*. To test the hypothesis that hybridization could occur in the absence of conspecific males we conducted the following experiments. 19 groups of voles were maintained in outdoor enclosures 120 m^2 in size. All experiments lasted not less than two months. Each group contained two bank vole females, two red vole females and four bank vole males. This way we simulated the conditions that promote hybridization in mixed populations of *Myodes glareolus* and *Myodes rutilus*. 9 groups contained animals trapped in western Siberia where population density of these species is similar and where bank vole appeared not so long ago. 10 other groups contained voles trapped in Valday Hills. It is the south-western point of the overlapping area and the border of red vole area. The bank vole is a numerous species there while red vole is a stenotopic one mosaically living in dark coniferous forest. Peculiarities of interspecific relations in two kinds of groups occurred to differ from each other as well as the reproduction success of red vole females. 10 out of 18 red vole females in western Siberia groups bore hybrids. In Valday Hills groups only one red vole female out of 20 had a litter. Thus voles existing under conditions which enable them to hybridize (low density of one of the species) have got specific adaptations holding back the hybridization.

Poster Session 1 – Population Dynamics

57 Development and evaluation of a genome-wide SNP panel for invasive ship rats (*Rattus rattus*) in New Zealand

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Single nucleotide polymorphisms (SNPs) have become the marker of choice in molecular ecology because they offer a variety of advantages over microsatellite markers in genetic studies: SNPs are highly abundant throughout the genome, allow higher throughput and are less error prone to amplification and scoring mistakes, enabling standardization across laboratories. This makes SNPs powerful markers for studying the evolutionary history of populations, demography, genetic variation and kindship. Ship rats count as the most ferocious invasive species in New Zealand, posing the biggest threat to many endemic species, especially on small near-shore islands, which are important breeding grounds for many seabird species. Previous ship rat studies in New Zealand have been carried out utilising solely mitochondrial or microsatellite markers, because currently no SNP markers are available for ship rats in public databases. In this study, a first SNP maker panel was developed for ship rats in New Zealand with the aim of utilising the SNP panel for pest management, studying the genetic structure and population dynamics of this invasive species. Upon initial discovery of ~72 million variants from paired-end sequencing reads of a single ship rat individual in reference to the *Rattus norvegicus* genome, a reductive filtering workflow allowed selection of 300 high-quality SNP markers. This SNP marker panel was subsequently tested by performing MassARRAY genotyping of 65 ship rat samples, representing a wide geographical distribution of individuals across New Zealand, to remove markers under ascertainment bias. This final verification step provided a set of informative SNPs and first results will be presented. Utilization of a SNP panel for genetic evaluation and implementation in future conservation management projects will provide another level of information, increase accuracy of population structure and invasion histories, while allowing higher throughput with lower costs.

Poster Session 1 – Population Dynamics

58 Frequency of acorn mast years can act as a potential driver of rodent population and phenotype characteristic

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Scientific research studying population fluctuation of rodents generated an abundance of factors influencing patterns in rodents abundance (e.g. climatic factors, local weather, intensity of acorn production or competition). Whilst studies have shown that a rodent population is dominantly influenced by the quality and quantity of acorn production, the effect of the frequency of acorn mast years on the demographic and phenotype characteristics of rodent populations are understudied. The structure of our data allowed us to divide it into two parts (i.e. first part included irregular spread of acorn mast years, the second part included time series where the acorn production occurred almost at every year). The first part contains six-year time series (2002 – 2007), and the second part contains four-year time series (2009-2012). In this study we evaluate the influence of frequency of acorn mast years on the relationship between environmental factors (biotic and abiotic) and phenotypic characteristics of two species of rodents (*Apodemus flavicollis* and *Apodemus sylvaticus*) in Central Europe. The results of the generalized linear model provide evidence that rodents influenced by irregular spread of acorn mast years were more affected by abiotic and biotic conditions than rodents influenced by the steady occurrence of mast years. In addition, by compering the median value of body length by Wilcoxon test we can conclude that individuals influenced by the steady occurrence of mast years were significantly larger than individuals influenced by irregular spread of acorn mast years.

Poster Session 1 – Population Dynamics

59 Kinship analysis revealed reproductive success skewed toward overwintered Brandt's voles in semi-natural enclosures

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Age structure and seasonality influence the population fluctuation of small rodents. Age determines body weight and social experience, while seasonality regulates the duration of breeding season and sexual maturity of newborn offspring. Therefore, reproductive success and skew usually occur in different age groups. Brandt's vole (*Lasiopodomys brandtii*) is a social, short lifespan, and seasonal breeding small rodent with a dramatic seasonal population fluctuation. However, it is still not clear about reproductive skew in this species. In present study, we studied the kinship in semi-natural enclosure populations by microsatellite maker based on genotyping, analyzed the reproductive skew between genders and between overwintered and newborn voles, and monitored variation of male reproductive activity by testing fecal testosterone levels around the year. Our results showed that the majority of overwintered voles had reproductive success along with striking increase of the population size in three enclosures; and all biological fathers and 77.8% biological mothers were overwintered voles and they have all and 87% offspring, respectively. Compared to overwintered voles, reproductive skews were significantly higher in potential overwintered and newborn parents, implying the possible reproductive suppression of newborn voles from dominant overwintered voles. Moreover, both heavier body weight and higher testosterone levels of overwintered males supported their potential social status in the population. Therefore, our study provided some new evidence for reproductive skew and differentiation of postnatal gonadal development patterns of different age groups in Brandt's vole.

Poster Session 1 – Population Dynamics

60 House mouse population dynamics and impacts on invertebrates in the absence of other mammals

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Mesopredator and competitor release can lead to population increases of invasive house mice after larger introduced mammals are controlled or eradicated. In New Zealand, mammal-resistant fences have enabled multi-species eradications of pest mammals to protect indigenous species. When house mice are the only mammals remaining in these biodiversity sanctuaries, they may reach high population density, with potential consequences for their indigenous prey. We studied mouse populations and their invertebrate prey in the absence of other mammals for 5 years. We compared two forest sites within independent mammal-resistant fences. The sites had contrasting levels of mouse management, reversed half-way through the study. At site Q, mice reached 30-46/ha seasonally, then were eradicated. At site M, mice were initially undetectable but increased during the study to 23/ha. Ground-dwelling invertebrates common in mouse diet increased in numbers at site Q and declined at site M; site differences in these 5-year temporal trends were significant. Results were consistent for beetles, spiders and weta (large flightless orthopterans) in pitfall traps; beetles, spiders and caterpillars (lepidopteran larvae) in leaf litter; weta tracks in ink tunnels; earthworms in litter and soil. Beetle and earthworm species richness and beetle and weta body sizes followed similar temporal trends. The highest mouse densities were similar to estimates in New Zealand forests after mass seeding (masting) events, but lower than in another sanctuary and on some islands lacking larger terrestrial mammals. With no competition or predation from other mammals, food limitation may have prevented further growth of these mouse populations. The significant impacts of mice on invertebrate numbers and community composition may affect ecosystem processes including the supply of food for indigenous birds. However, their effects on indigenous vertebrates are likely small compared with the combined impacts of the many successfully removed mammalian predators and browsers.

Poster Session 1 – Population Dynamics

61 Impacts of non-monotonic interactions on population and community dynamics

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Species interaction is often assumed to be monotonically-related to population density, but in nature species interaction is often non-monotonic, e.g., in seed-rodent dispersal system, rodents impose both positive and negative impacts on plant seeds, largely depending upon the seed and rodent abundances. Yet the impacts of non-monotonic interactions on population and community dynamics are largely unknown. This presentation will briefly review previous studies on this subject, and present our recent modeling results. We demonstrate that for four kinds of non-monotonous interactions shift signs to negative or neutral interactions at high population density stabilizes ecological networks, while non-monotonous interactions shift signs to positive interactions at high population density destabilize networks. Further analyses showed that dome-shaped non-monotonic interactions performed better in maintaining both high persistence and biomass or biomass flow in more complex networks, but resulted in larger variations of species biomass. These results suggest cooperation or mutualism among antagonists may be important in maintaining stable and complex ecological networks.