**Project title**

*Acoustic Monitoring of Avifauna: Bird Ecology Detection Using Microphone Arrays in Siberian Arctic Tundra*

**Summary**

**Background and Relevance**  
*Introduce your project, including the need you want to address. Tell us why the issue is important. Cite relevant literature, media coverage, or previous work where applicable (include citations in the Works Cited section below).*

Located at the top of northern hemisphere in Asia, Siberian arctic tundra is a heaven of many migratory birds (cite). Several permanent rivers flow into the Siberian tundra, creating wetlands and supporting birds with the food and the nesting locations they need during the breeding season. The tundra between the Yana and Kolyma rivers, the Indigirka Delta, is some of the most productive wetland areas in northeastern Russia (cite). The lower basin of Indigirka Delta serves as the breeding ground of critically endangered species, such as Siberian Crane and other 50-60 species (cite). Indigirka Delta tundra is said to have one of the greatest biome of the world.

Previous research had been done for investigating the birds around Indigirka Delta areas (cite), however, environmental restrictions prevented researcher to further understand the area. The Indigirka river channel will not open until May-June, and the tundra will not be clear of ice and snow until mid-June (cite). These two facts plus the lack of transportation limited the spatial and temporal scale of the avian studies can be achieved. Questions about phenology and species distributions, abundances are still keep unanswered. A long-term, wide spatial scale of bird monitoring is urgently desired in the area. Acoustic monitoring might be the solution.

Acoustic monitoring has been applied in diverse bioregions to study bird species distributions, abundances and even phenology (cite). The advantage of using acoustic monitoring is its remote and non-invasive characteristics. It has been shown the probability of detecting birds is higher when listening to audio recordings than during the field survey.

In 2019 summer, we proposed to set up the recorders in the tundra for monitoring bird population. We are especially interested in the following target species:

1. Siberian Crane: The rarest species breeding in tundra
2. Rough-legged Buzzard: wintering in south Asia, where people poison rats and mouse and cause the population decline.
3. Sandhill Crane: A competitor of the Siberian Crane
4. Tundra’s Swan: A competitor of the Siberian Crane
5. Ross’s Gull: Not yet well studied in Indigirka river
6. Jack Snipe: The nest hasn’t been found in Yakutia.

Located along the coast of the Eastern Siberian and Laptev Seas, this stretch of coastal subarctic tundra between the Yana and Kolyma Rivers is some of the most productive arctic tundra wetland areas in northeastern Russia.

The climate of the area is under the influence of both ocean and continental processes. The geology of the area is described as being within the Kimmerian folding zone of the Pacific Ocean Geosyncline (Nalivkin 1960). Rocks of the area are volcanic in origin and can be dated to the Cretaceous Period. Tectonically the area belongs to the East Siberian territory of Mesozoic folding. Quaternary sediments consist of layered loamy soils, sandy, and peat deposits (Goryachkin et al. 1994). Major river systems, from west to east, include the Yana, Khroma, Indigirka, Alazeya, and Kolyma rivers. The topography is flat and rolling tundra.

Vegetative characteristics of the region are typical for dwarf shrub arctic and typical tundra, but some sparse patches of larch forest are present along the southern border of the region. Permafrost underlies the entire region and plays a large role in landscape formation and botanical distribution. Common plant species include cotton grass (Eriophorum sp.), sedges (Carex sp.), dryas (Dryas punctata), willows (Salix sp.), crowberry (Empetrum sp.), cranberry (Vaccinium vitis-idea), and mosses.

**Biodiversity Features**  
These tundra regions are favored by numerous species of birds that migrate along Nearctic and Palearctic flyways to breed here. The large river deltas are some of the most important breeding areas and host between 40 and 60 breeding species each summer (Pearce et al., 1998b; Goryachkin et al., 1994). The area between the Yana and Indigirka rivers is the breeding ground for a large majority of the world’s population of Steller’s and spectacled eiders (Polysticta stelleri and Somateria fischeri) (Pearce et al. 1998a); both listed in the Red Data Books of Russia and listed as threatened on the U.S. Endangered Species List. Other characteristic birds for this region are red-throated loon (Gavia stellata), black brant (Branta bernicla), curlew sandpiper (Calidris ferruginea), sharp-tailed sandpiper (Calidris acuminata), broad-billed sandpiper (Limicola falcinellus), Ross’ gull (Rhodostethia rosea), ruff (Philomachus pugnax), willow ptarmigan (Lagopus lagopus), and snow bunting (Plectrophenax nivalis).

**Current Status**  
Coastal areas of the Kolyma River Delta, Indigirka River Delta, Khromskaya Bay, and the Yana River Delta are protected within existing reserves and within the Kytalyk Reserve, established in 1996 (25,000 km2). There is concern about the release of contaminants from mining operations further upstream that might harm the breeding areas for the birds of this tundra region, but quantitative data is lacking.

The coastal areas of this region are some of the least explored and mapped areas of the world. Even though data gathering projects have recorded information on more than 2000 different species of plants, invertebrates and fish, data coverage throughout the Siberian Arctic, especially in the eastern portions, are still fragmentary. The Siberian north coast area is among the least populated by humans in the world.

**Types and Severity of Threats**  
The northern coast of the Russian arctic is an attractive northern shipping route to connect European and Asian ports. Less than 60% of the length of the 11,400 nm Suez Canal, the route is generating increasing interest, especially since Russian arctic areas may hold reserves of oil, gas and other natural resources which could be exported by sea. While the International Northern Sea Route Programme has identified ecologically vulnerable areas along the NSR and concluded that areas of special importance to biodiversity and local indigenous peoples can largely be avoided, the Programme did identify 92 areas that are highly vulnerable to oil spills (INSROP, [www.fni.no/insrop](http://www.fni.no/insrop)). According Newell et al. (2000), gold mining and the operation of a tin combine on the Khroma River has destroyed fisheries and transformed habitat within this region.

**Justification of Ecoregion Delineation**  
This ecoregion is a narrow strip of tundra on the coast of the East Siberian Sea extending east of the Lena Delta to the marshy lowland at the mouth of the Kolyma River. Mapped ecoregion boundaries correspond to the montane and lowland tundra distributed between the Laptev and Chukote Seas in Kurnaev’s (1990) forest map of the USSR.

*###*

*Siberian Crane is one of the most important and rarest species in the Yakutia area (95% of the individual spent their summer time in Indeika tundra with the territories.) They migrate to Poyoung lake, China during winter and to the Russian tundra in Summer. Among 15 crane species in the world, Siberian Crane can be said as the most important species in Yakutia (indicator species? Keystone species?)*

*Currently, the number of Siberian is declining due to the construction of the dams around the Poyoung Lake (there summer habitat). Within 12 years, Siberian Crane was moved from threatened (1988) to critical endangered (2000) and now only 300 individuals left in the wild. One of the most important work is to track the population in their breeding habitat. The scientists in Academic of Russia is working on tracking the population of Siberian Crane but the work is really hard since it is hard to access to Arctic tundra and also the time is limited.*

*Siberian Crane is one species that representative of the inter country collaboration and we should work hard to track the population and work on preserve the species.*

**Goals and Objectives**

*What do you plan to accomplish with this project?*

*\*A goal is a simple, clear, and general statement of the desired outcomes; there may be more than one goal. The objectives should be derived from the goal statement, defining specific, measurable targets; please make clear to which goal the objectives are linked.*

*Monitoring the bird population in Indica river by audio recordings.*

*Understanding the conservation work has been done in Russian area.*

**Methodology Detail**

*Detail the methods you will use to complete your project and why these are the best methods. Note any special or unusual tools or techniques you plan to employ. List and describe the steps you will take to implement your approach, and provide a timeline for implementation. Indicate which populations, communities, and/or locations you will target with this project. If appropriate, specify the anticipated number of participants/subjects.*

**Methodology Justification**

*Explain why you believe the activities you have planned will achieve the result(s) you expect. Include any assumptions necessary for this project to succeed (e.g., critical relationships or external factors outside of your control).*

*Sergei is the person who studied the Siberian Crane for 27 years and visited Tundra every summer in Indica area locating the nests of Siberian Cranes.*

*I have visited the tundra in 2017 summer recording the bird sounds and understand the environment of tundra, limitations and restrictions. My personally know how to do audio processing and field recording. Audio research is a new import in Yakutia area but it is doable and will definitely help the scientists working in tundra.*

*Weather condition for recording systems:*

**Summary of Outputs and Results**

*Please describe all relevant outputs you expect to produce (e.g., data, new tool, new method, media). Describe the changes, if any, you expect to result from these outputs and specify who/what will benefit.*

**How do you plan to disseminate your results and to whom?**

**How will you evaluate your work and results?**

*Please list the indicators you will use to monitor progress toward your goal(s). Include current baselines and expected targets, if applicable.*

**External Capacity Development**  
*If applicable, please describe how your project contributes to the socioeconomic or professional development of local students, community members, collaborators, or other individuals through education, training, mentoring, or other methods.*

**Works Cited**

*As appropriate.*