Fisheries and Oceans Canada | Pêches et Océans Canada

Procurement Hub – Fredericton
301 Bishop Drive
Fredericton, NB E3C 2M6

26 April 2023

30004170

TITLE: Whole genome sequencing for Arctic killer whale population substructure and trends.

1. **Advance Contract Award Notice (ACAN)**

   An ACAN is a public notice indicating to the supplier community that a department or agency intends to award a contract for goods, services or construction to a pre-identified supplier, thereby allowing other suppliers to signal their interest in bidding, by submitting a statement of capabilities. If no supplier submits a statement of capabilities that meets the requirements set out in the ACAN, on or before the closing date stated in the ACAN, the contracting officer may then proceed with the award to the pre-identified supplier.

2. **Definition of the requirement:**

   The Department of Fisheries and Oceans Canada has a requirement to conduct whole genome sequencing analysis for Arctic killer whale population substructure and trends. DFO's planned killer whale research over the next three years has been developed largely in response to increasing concern about the impacts of killer whale predation, as well as formal requests for advice on potential management options from several Inuit communities. DFO needs to address knowledge gaps concerning ECA killer whale demography using genetics and photographic-identification studies to quantify Arctic killer whale abundance trends (e.g., how many are there, and are they increasing in number?) and characterize population structure (e.g., do killer whales observed in different areas belong to the same or different populations?). This research falls in line with DFO's EAFM approach, providing data on killer whales to allow for incorporation of potential predator impacts on a number of prey management stocks (e.g., belugas in Cumberland Sound, where killer whales have a rapidly emerging presence in recent years).

   The work will involve the following:

   The overall objective of the contract is to use whole genome sequencing (WGS) analysis of killer whale samples collected from the Canadian Arctic. Specific objectives include:

- Genomics-based evaluation of population structure and potential presence of multiple Designatable Units for evaluation of conservation status.
- Genomics-based models of demographic history of killer whales in the Northwest Atlantic/Arctic.
- Genetic variation across environmental gradients as evidence of local adaptation to Arctic conditions (via whole-genome analysis);

Scope of Work:

- Data quality control
    - Filter out indels, low-quality sites, non-biallelic sites
    - Determine and filter out sex-linked scaffolds
    - SNP filters for minor allele frequency, Hardy-Weinberg equilibrium, and linkage disequilibrium pruning
- Population structure
    - Principal component analysis, and ancestral admixture with sparse non-negative matrix factorization (sNMF) algorithms
    - Genomic differentiation estimates through pairwise fixation indices.
    - Runs of homozygosity, genetic diversity metrics
- Demographic history:
    - Reconstruct changes in effective population size over time using Sequentially Markovian Coalescent (SMC++) analyses
    - Estimate contemporary effective population size
- Environmental gradients:
    - Genome scans through multiple methods (e.g., sNMF, latent factor mixed models (LFMM)) to identify loci under selection
    - Quantify species compositional allelic turnover along environmental gradients through gradient forest analyses
- Epigenetics:
    - Genome scans through multiple methods (e.g., sNMF, LFMM) to identify epigenetic loci under selection
- Summary reports of all data analyses (methods) and results

3. Applicability of the trade agreement(s) to the procurement

This procurement is subject to the following trade agreement(s):

- *Canada-Korea Free Trade Agreement*
- *Canadian Free Trade Agreement*
- *Canada-Chile Free Trade Agreement*
- *Canada-Columbia Free Trade Agreement*
- *Canada-Honduras Free Trade Agreement*
- *Canada-Panama Free Trade Agreement*

4. Criteria for assessment of the Statement of Capabilities (Minimum Essential Requirements)

Any interested supplier must demonstrate by way of a statement of capabilities that it meets the following requirements:

- The proposed resource must have a minimum of 10 years of experience in genomic and epigenomic research and a PhD degree in biological sciences
- Access to lab space suited for epigenetics lab work and the ability to troubleshoot low quality samples
- Extensive computing experience with Slurm Workload Manager and R packages required for analysis of genomic data
- Experience with sequence read mapping and processing, analyses in population genomics, detecting signatures of selection, and genotype-environment associations, genomic offsets
- Experience in whale research
- Experience with climate change biology and species range shifts
- Experience in scientific writing for manuscripts and reports

5. Justification for the Pre-Identified Supplier

Colin Garroway's lab at the University of Manitoba is experienced in the field of genomics, and has experience processing whole genome data for killer whales that is necessary for this contract work. There are no alternative sources of supply for the same or equivalent support. The genetics/genomics processing experience of the proposed vendor (Garroway lab) gives them unique experience and expertise relevant to the type of analysis. The Garroway lab curates a database of >50 killer whale genomes sampled in and around the eastern Canadian Arctic. They have developed quality assurance protocols associated with killer whale genome mapping and single nucleotide polymorphism identification and data analysis. Critically, adding additional genomic samples to these already existing data will increase the power and precision with which we can address new questions associated with adaptive change in the Arctic. Through additional work on whale population genomics in the region the Garroway lab has generated 100s of additional whole genomes for Arctic (bowhead, narwhal, beluga) and subarctic whales (pilot whale, sperm whale). Interactions between these two groups of species will be critical for understanding the consequences of climate change and killer whales in the Arctic. Access to these as of yet unpublished data and additional expertise will contribute substantially to project success.

6. Government Contracts Regulations Exception(s)

The following exception(s) to the *Government Contracts Regulations* is (are) invoked for this procurement under subsection 6 (d) only one person is capable of performing the work.

7. Period of the proposed contract or delivery date

The proposed contract is for a period of two years, from date of contract award to March 31st, 2025.

8. Cost estimate of the proposed contract:

The estimated value of the contract, is $130,000.00 CAD x (GST/HST extra).

9. Name and address of the pre-identified supplier:

Colin Garroway, 66 Chancellors Cir, Winnipeg, MB R3T 2N2

10. Suppliers' right to submit a statement of capabilities

Suppliers who consider themselves fully qualified and available to provide the goods, services or construction services described in the ACAN may submit a statement of capabilities in writing to the contact person identified in this notice on or before the closing date of this notice. The statement of capabilities must clearly demonstrate how the supplier meets the advertised requirements.

11. Closing date for a submission of a statement of capabilities

The closing date and time for accepting statements of capabilities is May 11th, 2023 at 2:00 p.m AST

12. Inquiries and submission of statements of capabilities

Inquiries and statements of capabilities are to be directed to:

Marie-Carmen Sedji – Contracting Officer
301 Bishop Drive Fredericton, NB E3C 2M6.
Telephone:506-478-7358
Email: DFOtenders-soumissionsMPO@dfo-mpo.gc.ca