RETROSPECTIVE ON RESEARCH LICENSING IN THE NWT

Forty years of research: 1974-2013

Aurora Research Institute
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Executive Summary

The Head Office of the Aurora Research Institute (ARI) is located in Inuvik, Northwest Territories. All research in the NWT requires a Scientific Research Licence from ARI, with the exception of wildlife, archaeological, or fisheries research. The Aurora Research Institute maintains records of licences issued dating back more than half a century. For the 50 year anniversary of the Inuvik location, ARI prepared this retrospective of research undertaken between 1974 and 2013, the years for which licensing information is available.

The retrospective includes an assessment of research locations over two decades, and the general topic of research (for example, if the research was a health sciences, social science, traditional knowledge, or physical or biological science project). The retrospective also includes an assessment of the Principle Investigators of the research, such as where their home institutions are located and what these institutions are, and their gender. The retrospective also examines research funding. Finally, ethical review and the logistics of licence application and issue are examined. The retrospective includes general "snapshot" overviews of the 40 years, and examines trends through time where applicable.

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List of Acronyms

Acronym	Definition
ARI	Aurora Research Institute
EIS	Environmental Impact Statement
MGP	Mackenzie Gas Project. A large proposed pipeline (and gas field) development. Environmental assessment for the project ramped up in the early 2000s.
NGO	Non-governmental organization
NSERC	Natural Sciences and Engineering Research Council of Canada, Canada's federal funding agency for university-based research and training in the natural sciences and engineering.
NWT	Northwest Territories
PI	Principle Investigator
POLAR	On-line application system for obtaining a research licence
SSHRC	Social Sciences and Humanities Research Council of Canada. Federal research funding agency that promotes and supports postsecondary-based research and training in the humanities and social sciences.
TK	Traditional knowledge, and related terms traditional ecological knowledge, local knowledge.

1. Introduction

All research undertaken within the Northwest Territories (NWT) must be licensed. Most studies receive a Scientific Research Licence through the Aurora Research Institute (ARI).[1] Wildlife studies and archaeological studies have separate review and licensing processes through other government departments. To obtain a Scientific Research Licence, a researcher must complete an application describing their research activities and submit this application to ARI. The researcher is also directed to contact appropriate community and regional organizations for feedback about their project. Once received by ARI, the application is sent to community organizations in the region(s) of the research for review and feedback. When a licence is issued, it is valid for a given calendar year. At the end of each year, the research team must submit a summary of that year's work. These summaries are compiled and made available to everybody in the NWT in the annual *Compendium of Research*.

In 2014, ARI celebrated its 50th Anniversary of conducting and licensing research in the Inuvik Region. This retrospective includes overview and trend information from 40 years of research licences, including:

- What are the trends in research discipline?
- Who is funding research?
- Who conducted the research, and where are they from?
- Where is the field work?
- How many community organizations are being notified about research?
- What are the timelines of the research application process?
- How is ethical review being conducted?

Research licence information is available in several digital formats (see Appendix 1 for database and spreadsheet information). Prior to mid-2005, research applications were made in paper to the licensing office. Currently, detailed information on research licences is gathered directly from researchers in the application process through an on-line application form. Licence applications are reviewed by ARI, and when complete, are forwarded to community organizations for review. Information gathered and maintained by ARI about each licence was, in the earlier decades, less comprehensive. Today, however, the information is very detailed and complex. The increasing amount of information collected has allowed for increasingly complex questions to be explored using the data. As such, some aspects of the retrospective do not cover the full 40 year period.

[1] Licenses for research exclusively in what is now Nunavut were not included in the retrospective.

2. Annual trends in licensing

ARI issued a total of 3977 licences between 1974-2013. The average number of licences issued per year was 99, with a range of 29-203.

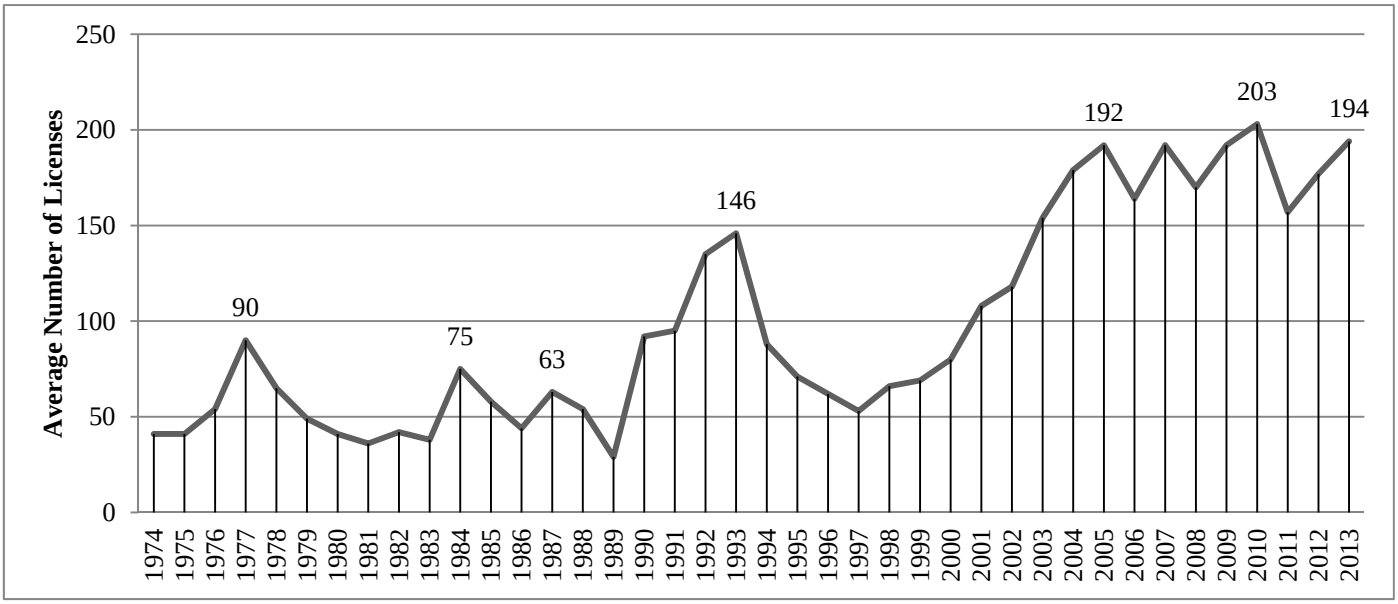


FIGURE 1. NUMBER OF LICENCES BY YEAR

Although overall the trend was towards more licences issued per year, there were several interesting peaks. There was a peak in research licensing in late 1970s, and early 1990s, and lesser peaks in the early and late 1980s. In the early 2000s, the numbers rose to current levels and have remained high. The spike in the early 2000s correlated somewhat with an increase in research for the Mackenzie Gas Project (MGP, see ARI 2011 for a full discussion on MGP licensing). However, the continued high average number of research licences issued after the research for the Mackenzie Gas Project dwindled in the mid-2000s suggests that non-MGP research in the NWT has increased.

3. Trends in month licence was issued

The number of licences issued by ARI every month was not steady throughout the year. The monthly average varied from around three in December to around 19 in June (Figure 2).

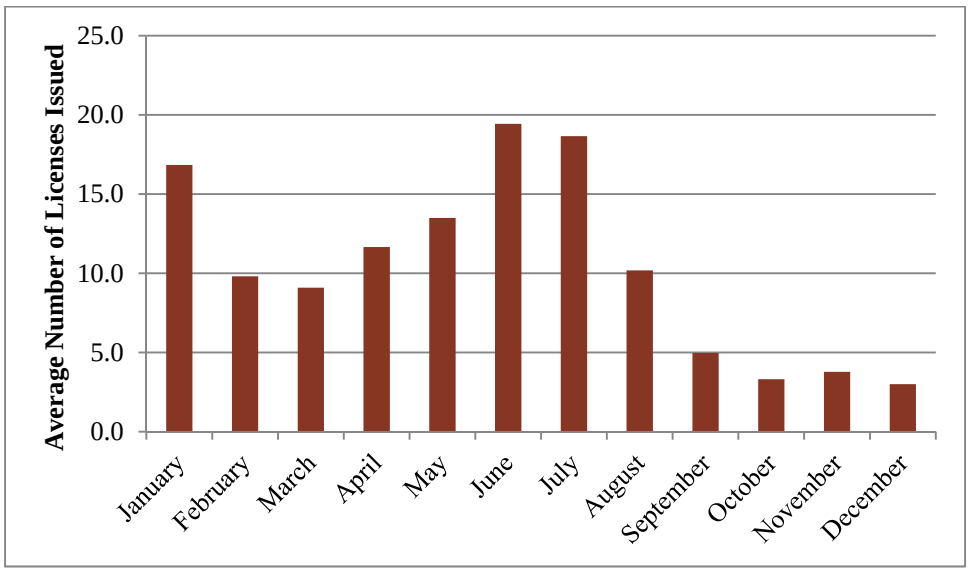


FIGURE 2. AVERAGE LICENCE COUNT BY MONTH ISSUED 1980-2013[2]

Additionally, the monthly average of licences issued was not consistent between 1974 and 2014. Figure 3 shows the number of licences issued per month on average in 1981-82, 1991-92, 2001-02, and 2011-12.[3]

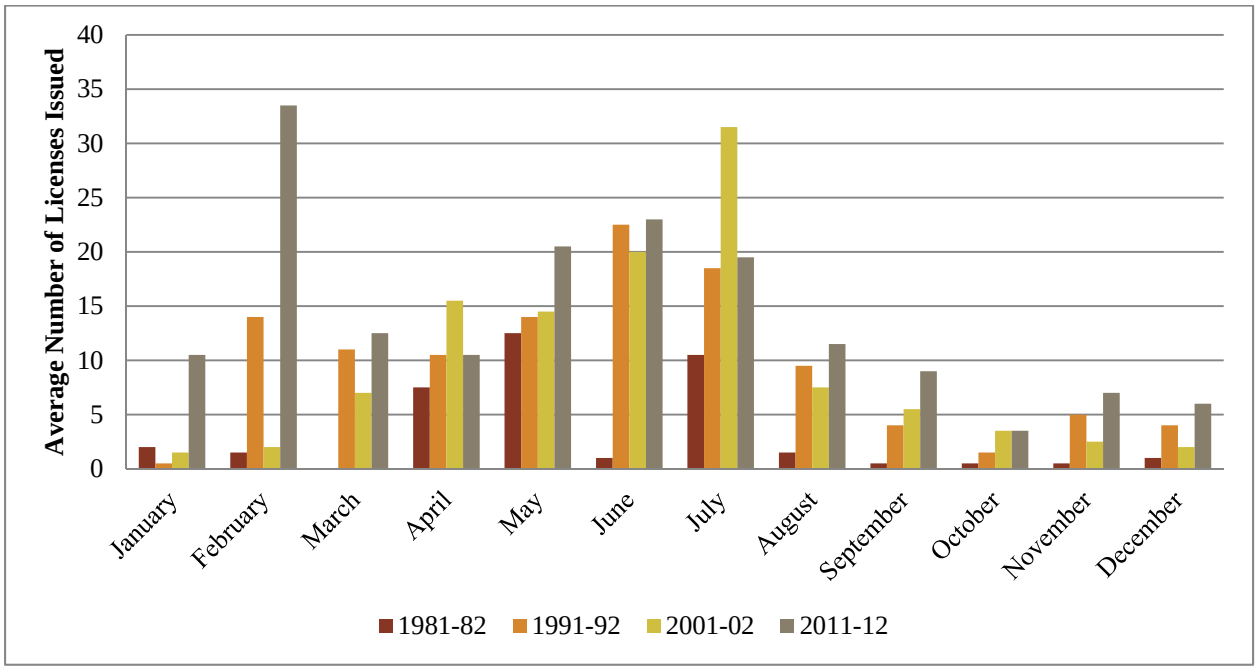


FIGURE 3. AVERAGE LICENCE COUNT BY MONTH ISSUED, COMPARISON OF 1981-82; 1991-92; 2001-02; 2011-12

[2] Average figures from 1980 to 2013, 1983 and 1986 not included.
[3] These years were selected for the four-decade review as data for 1980 is incomplete, and 1983 is unavailable.

In the early 1980s, the majority of licences were issued between April and July. In the early 1990s, licence issuance was spread more evenly between February to August. In the early 2000s, many more licences were issued in the time between April and July. Most recently, in 2011-12, many licences are issued in February. Another lesser peak occurs in June, and the fewest are issued in the fall and early winter. The large number of licence issued in recent years in January/February compared to previous years relates to a simplified renewal process introduced in 2009. All but two of the 45 licences issued in February 2011 were renewals (no licences were issued in January 2011). Of the 21 licences issued in January 2012 and the 22 issued in February, all but eight were renewals. Overall, the lightest months for licence issuance more recently were September, October, and December.

4. Trends in time between date of application and date of issue

Licences granted between 2005-2013 have both the date of application and the date of issue recorded.[4] The number of days between application and issue of licences has remained relatively steady. Figure 4 shows the average time between application and issue with one standard deviation.

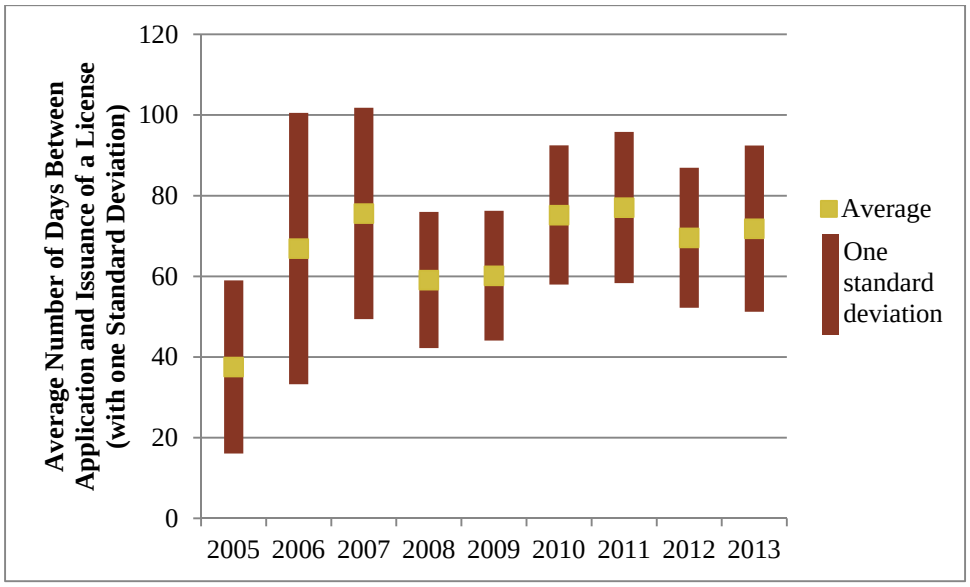


FIGURE 4. TIME BETWEEN DATE OF APPLICATION AND DATE OF ISSUE IN DAYS (AVERAGE AND SD), 2005-2013

As noted in the introduction, a licence is issued for a calendar year. At the end of the calendar year, if an application is still out for review, it is typically cancelled. For example, a licence applied for in October 2011 for work to be conducted in 2011 would be cancelled at the end of 2011 if the requirements to complete and issue the licence were still outstanding. There are very

[4] See Appendix 2 for further information about data.

rare exceptions to this rule. There were some extreme outliers in the time between date of application and date of issue. One hundred and six licences were issued after more than four months. Only four projects were issued after a year, and a single project took over a year and a half between application and issue.

The projects with the greatest time between application and issue (over a half a year) were from all areas of the NWT. They were from all disciplines, although they were more often traditional knowledge or social science projects. The reasons for the long time between application and issuance were project-specific, but included: researchers applying long before other requirements were in place, topic sensitivity, outside (*i.e*. ethics review) processes, projects getting bumped from one year to another for other reasons, and researcher-specific personal issues.

4.1. Seasonal differences in application-to-issue date timelines

Applications submitted in the early summer had the shortest average time between application and issue (Figure 5). The quick turnover timelines in June and July are attributable, in part, to applications that were submitted later than recommended. At that point, researchers typically take a more active role in seeking feedback from community organizations to obtain their licence and access the field for their projects. Licences applied for in October and November tended to have a longer time between application and issue.

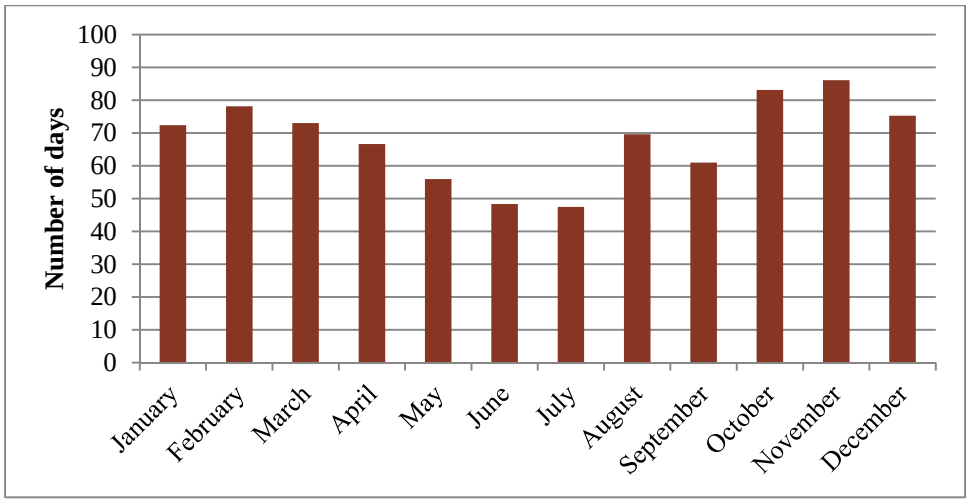


FIGURE 5. AVERAGE TIME BETWEEN APPLICATION DATE AND ISSUE DATE IN DAYS BY MONTH, 2005-2013

5. Trends in organization/affiliation of Principle Investigator

In most licences since 1980, the PI's affiliation was recorded. These were assigned to a category:

- **Aboriginal/Inuit Organization**
- **Federal Government** (*Including federal museums, government tags also include crown corporations*)
- **Industry** (*Including both development organizations and research contractors, except where it was specifically noted "on contract to [government or other organization]. This will cause some overlap between industry and other categories*)
- **Non-profit**
- **Other** (*Including provincial government organizations, hospitals, research centres other than non-profits, non-Aboriginal boards, professional associations, self-directed, church*)
- **Territorial Government**
- **University** (*Including institutes within universities, ARI, research chair programs, and colleges*)
- **US Government***
- **Yukon Government***

**For the purposes of this retrospective, the US Government and Yukon Government, both of which had small numbers, were included with "Other."*

The affiliation of the PI had a complex trend over the time period where affiliation is included in the data (1980 to present). In the absolute count (Figure 6), the number of University-affiliated projects grew substantially over the years, with a few noticeable peaks (early 1980s and early 1990s – it would appear that academic-led projects account for the majority of the spike in licences in the early 1980s, and share the 1990s spike with federal government-led projects). However, when compared as a percentage (Figure 7), academic-led projects varied wildly, and trended lower in percentage of total projects despite the increase in absolute numbers. Industry-led projects spiked around the time of the Mackenzie Gas Project environmental assessment and related research (after 2000). Although the percentage of academic projects declined around this time, academic projects continued to grow in absolute numbers. Federal government-led projects spiked in the early 1980s, and then leveled off with a minor upward trend in overall numbers just prior to the mid-2000s, where they have since plateaued. All other types of research affiliations have remained quite low, generally less than 10% each across the 34 years of available data.

Trends in organization/affiliation of Principle Investigator

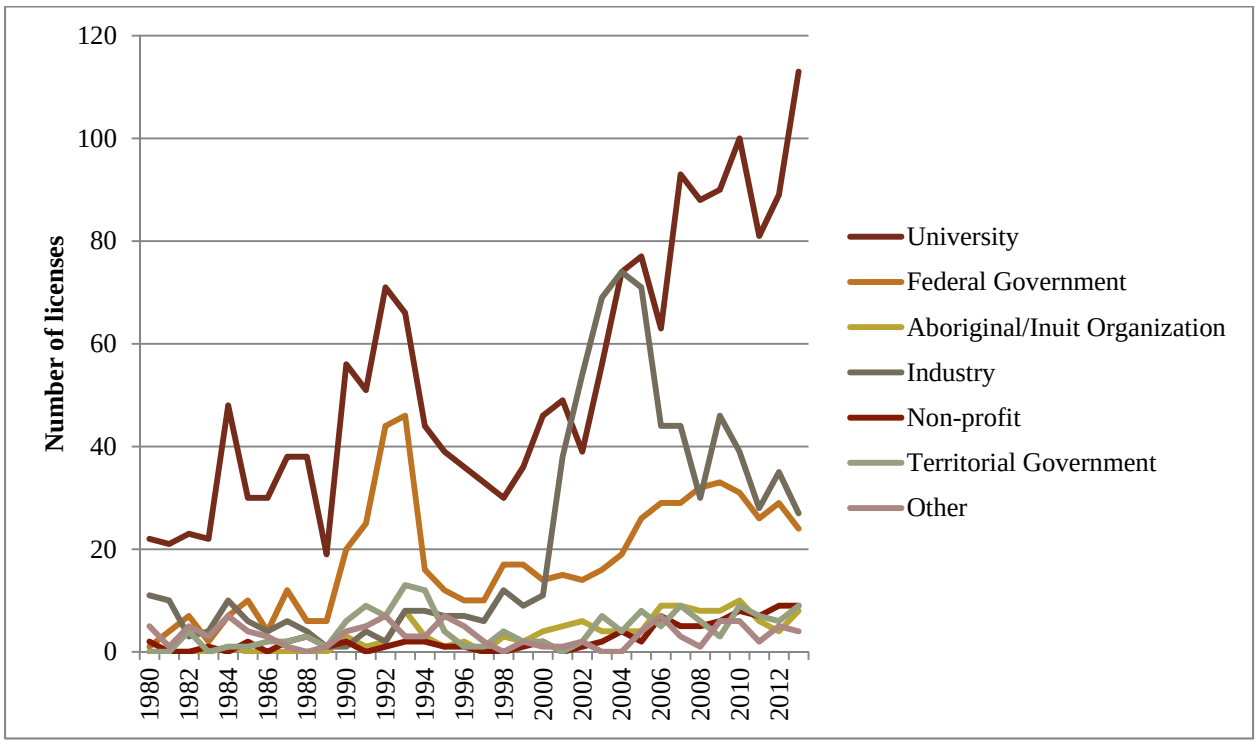


FIGURE 6. LICENCE COUNT BY AFFILIATION OF PRINCIPLE RESEARCHER, 1980-2013

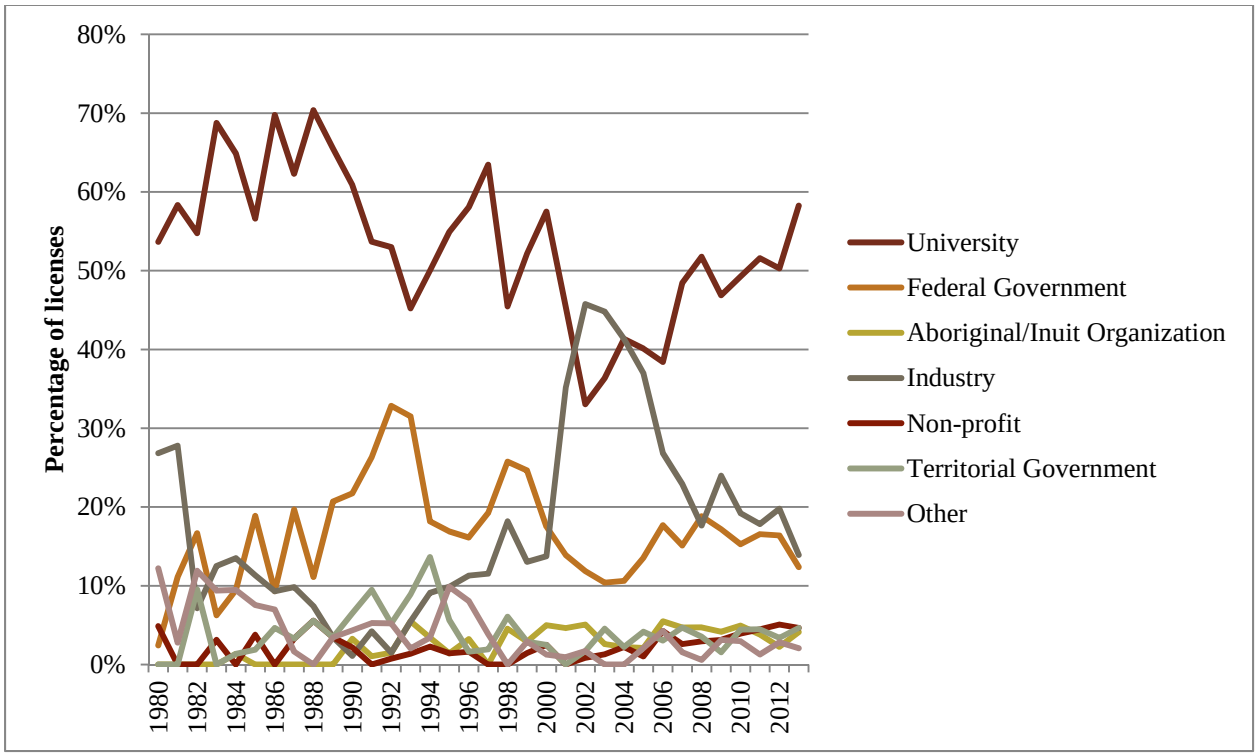


FIGURE 7. PERCENTAGE OF LICENCES BY AFFILIATION OF PRINCIPLE RESEARCHER, 1980-2013

6. Trends in research funding

Project funding information was included on many projects from 1980-2013, with the exception of the years 1983 and 1986. Three different types of funding information were used in this retrospective (Table 1).

TABLE 1. FUNDING INFORMATION USED IN RETROSPECTIVE

Column	Type of information	Date range available
Funding Source	Narrative description of funding source, often with specific funding organization (For example: NSERC, charitable grant organization, scholarship, name of industry proponent)	1980-2013 (Unavailable in 1983, 1986, reduced availability in 2007-2013, inconsistent in mid-late 80s)
Researcher-Selected Funding Category	Selection by research licence applicant from short list referring to most "relevant" support for the research project (see discussion below). Includes: Government, Self/Private, NGO, Industry, Other.	Mid 2006-2013 (Almost all licences in the date range have this information)
Retrospective Funding Category (manually assigned)	Funding category assigned manually for the purposes of this retrospective referring, generally, to most important cash support for project. May also refer to most important in-kind support, or outside cash support if the applying organization is also supporting – this is unclear. Includes: Aboriginal/Inuit Organization, Federal, Industry, Non-Profit, Other, Territorial, University, Unknown.	Depending on availability of **Funding Source**, and to a lesser extent, **Researcher-Selected Funding Category**. The more broad selections of the **Researcher-Selected Funding Category** could be assigned a more specific **Funding Category (manual)** only if appropriate contextual information was also available.

6.1. Retrospective funding category

Available funding information for each project was categorized into a Retrospective funding category manually, similar to the categories used the 10 year retrospective[5] (ARI 2011). The process of cataloguing funding sources was not as clear-cut as assigning a type of affiliation to the PI, as many funding sources were ambiguous, leading to some limitations with this assessment. For example, federal funding sources could have been be a direct contribution from a federal government department, or through a granting agency such as NSERC and SSHRC.

[5] US Government funding, a category used in the previous retrospective, was lumped into 'other' for the purposes of this retrospective.

However, federal funds were also likely the source of some "University" funding, and University scholarships may also overlap with Non-Profit grants if the University is administering such a program. Additionally, multiple funding sources were often listed, and only the first (*assumed to be the most important*) was used to categorize the project's funding. The specific manual categorization was most useful between 1980-2006 (slightly less so from 2006-2009). After 2006, and especially after 2009, there were many blanks in the manual categorization system.

- **Aboriginal/Inuit Organization** (*Including community/regional governance, Aboriginal co-management*)
- **Federal** (*Including SSHRC, NSERC, and Network of Centres of Excellence Program, federal crown corporations*[6])
- **Industry** (*Including Aboriginal joint ventures or community-owned industry*)
- **Non-Profit** (*Including charitable foundations and citizen's organizations*)
- **Other** (*Including organizations funded by multiple types of sources [i.e. federal/territorial or university/federal], provincial, Yukon, US, or international government sources, provincial crown corporations, professional organizations, 'self'*)[7]
- **Territorial** (*Including territorial crown corporations*)
- **University** (*Including associations of universities*[8])
- **Unknown** (*Used when funding source was included but was unclear. Blanks were left blank.*)

The following figures show the trends in these funding categories between 1980 and 2013. Federal government funding was the most important source of research funding for licenced projects in the NWT. Federal funds were the main support for between 36 to 80% of projects, and for 22 of the 32 years shown in the graph below, federal funding was the main support for more than 50% of the projects that year. In the early 1980s, and again during the MGP years, Industry-funded projects were also common. From the late 1980s to around 2000, projects funded by "Other" sources were numerous. This category included a broad variety of different sources, such as non-NWT territorial or provincial government sources, professional organizations, and others (see bullet points above). All other funders (Aboriginal/Inuit Organization, Non-Profit, Territorial, and University) generally funded less than 10% each of licenced projects in the NWT.

[6] If the funding source was indicated to be the general "Government" category, then the affiliation of the Principle Investigator and project description was used to determine territorial *vs.* federal (or in the case of international funding, "other") where possible. Otherwise, "Government" was assigned as Unknown. Occasionally, wording in the project description would allow for an assignation of funding category. Contaminants and fisheries "government"-funded research were tagged as federally funded.
[7] Including, for example, Arctic Contaminants Action Program of the Arctic Council, Action Canada.
[8] Including, for example, ACUNS.

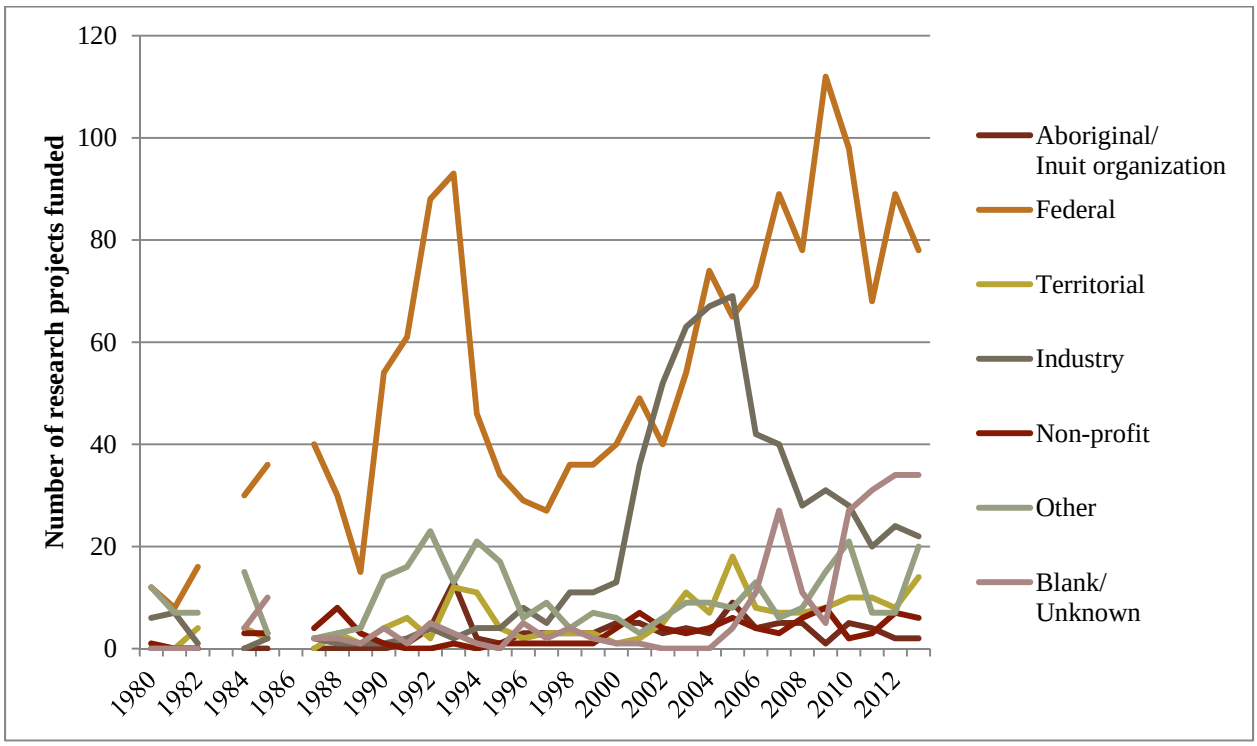


FIGURE 8. LICENCE COUNT BY RETROSPECTIVE FUNDING CATEGORY 1980-2013

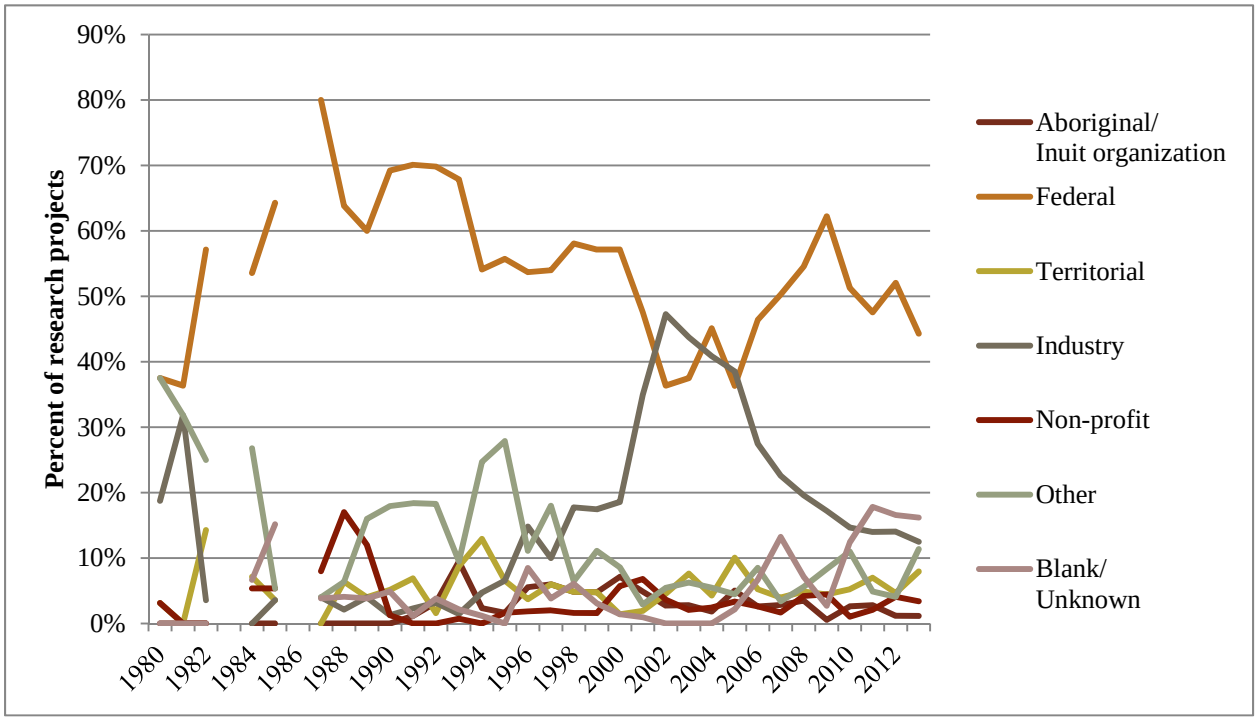


FIGURE 9. PERCENTAGE OF LICENCES BY RETROSPECTIVE FUNDING CATEGORY 1980-2013

6.2. Researcher-Selected Funding Category

Within the automated on-line application program, POLAR, for licences starting midway through 2006, applicants were requested to select a broad category of funding with the following instructions: "Choose the category in which the majority of your funding originates. If multiple categories apply, choose the most relevant."

- Government
- Self/Private
- NGO
- Industry
- Other

These categories were slightly different than the retrospective categories (fewer categories), and they did not necessarily match the "Funding Source" entered by the applicant, nor allow for a retrospective category to be identified. The reasons for the discrepancies in the data are not clear, but likely relate to the applicant having an alternate interpretation of the terms used in this category than the ones used for the retrospective. A theoretical scenario is described below.

TABLE 2. FUNDING CATEGORIES FOR EXAMPLE PROJECT

	Example entry: professor with large in-kind contribution and small cash grant to project
Funding Source	NSERC *Got small NSERC grant to cover expenses, professor enters "NSERC" into text box on line*
Researcher-Selected Funding Category	Self/Private *Possible reasons include:* *1. The professor understands that NSERC grant to be 'Self/Private' as it is in his name.* *2. Because the majority of the project expenses are covered by in-kind contribution – the professors salary, office space, University equipment, etc., the professor selects the "Self/Private" tag.* *3. Other reason.*
Retrospective Funding Category	Federal *Because the cash contribution was a federal funding source, the category "Federal" was assigned for the purposes of the retrospective only, and doesn't exist in the original database*

A researcher-selected funding category was included with at least 99% of all licences between 2007-2013. The government category was by far the most important funding category during 2007-2013. Around two-thirds of all research was funded by government sources (58-72%). The next most common funding was Industry, which was close to the remaining categories of Other, Self/Private, and NGO.

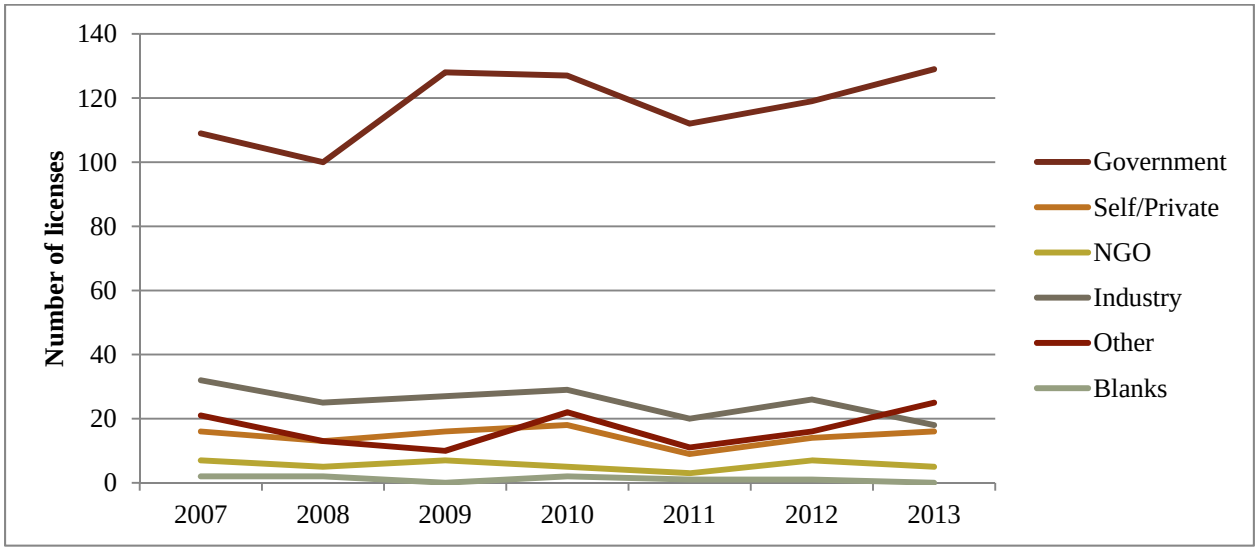
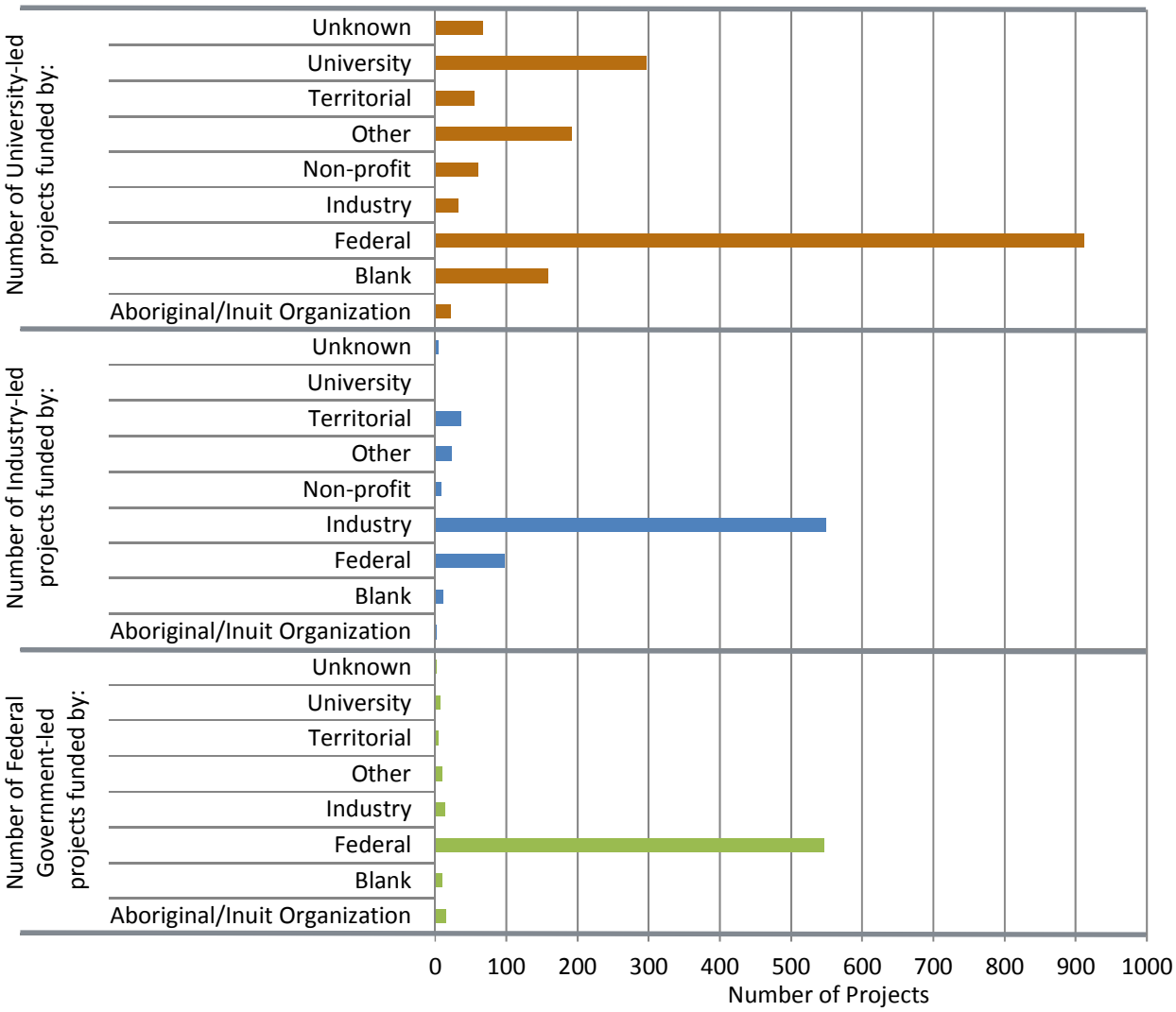


FIGURE 10. LICENCE COUNT BY RESEARCHER-SELECTED FUNDING CATEGORY 2007-2013

The following bar graph shows the breakdown of types of funding accessed for University-led, federal government-led, and industry-led projects.[9] University-led projects were as likely to be funded through federal government sources (51%) than all other sources combined (49%). Significant numbers of University-led projects were also funded *via* University funding, Other funding, and Unknown funding. Industry-led project were, unsurprisingly, very likely to be funded by industry sources (75%). The only other funding source for industry-led projects which tops 10% of total projects funded was federal funding (13%). Federal government-led projects were much, much more likely to be funded through federal sources than any other (89%).

[9] A project is considered "University-led" if the principle investigator's affiliation is "University", and so on.



**Horizontal labels are retrospective funding source.*

FIGURE 11. LICENCE COUNT BY FUNDING SOURCE: UNIVERSITY-LED, INDUSTRY-LED AND FEDERAL GOVERNMENT-LED PROJECTS, 1980-2013.

7. Principle Investigators

A total of 1852 Principle Investigators (PIs) were granted research licences over the last 40 years. Twenty projects did not have a recorded Principle Investigator (PI). This was an average of about two licences per PI, ranging from one to 93. Most PIs, almost two-thirds, obtained only a single licence (see Table 3). In other words, about two-thirds of all licenced projects were led by researchers who only worked in the NWT once.

TABLE 3. NUMBER OF LICENCES BY PRINCIPLE INVESTIGATOR

Total number of licences obtained	Number of PIs	Percentage
1	1161	63%
2	335	18%
3	142	8%
4	67	4%
5	34	2%
6+	116	6%

The spread of years where a PI held licences ranged from one year (occasionally a PI had multiple licences in a single year) to 37 years. When multiple licences were obtained by a PI, they might have been in consecutive years (such as when a research returns for a multi-year project or comes back yearly for different projects) or there might be gaps. Sometimes, the gaps were many years in length.

The number of years a researcher held a licence represents, generally, the number of years they continued to work in the NWT. Filtering out single-year licence holders, about a third of multi-year PIs held licences for just two years, and another third for six or more years. Figure 12 shows the breakdown of the number of years researchers acted as PIs in the NWT based on the spread between their first and last licences issued.

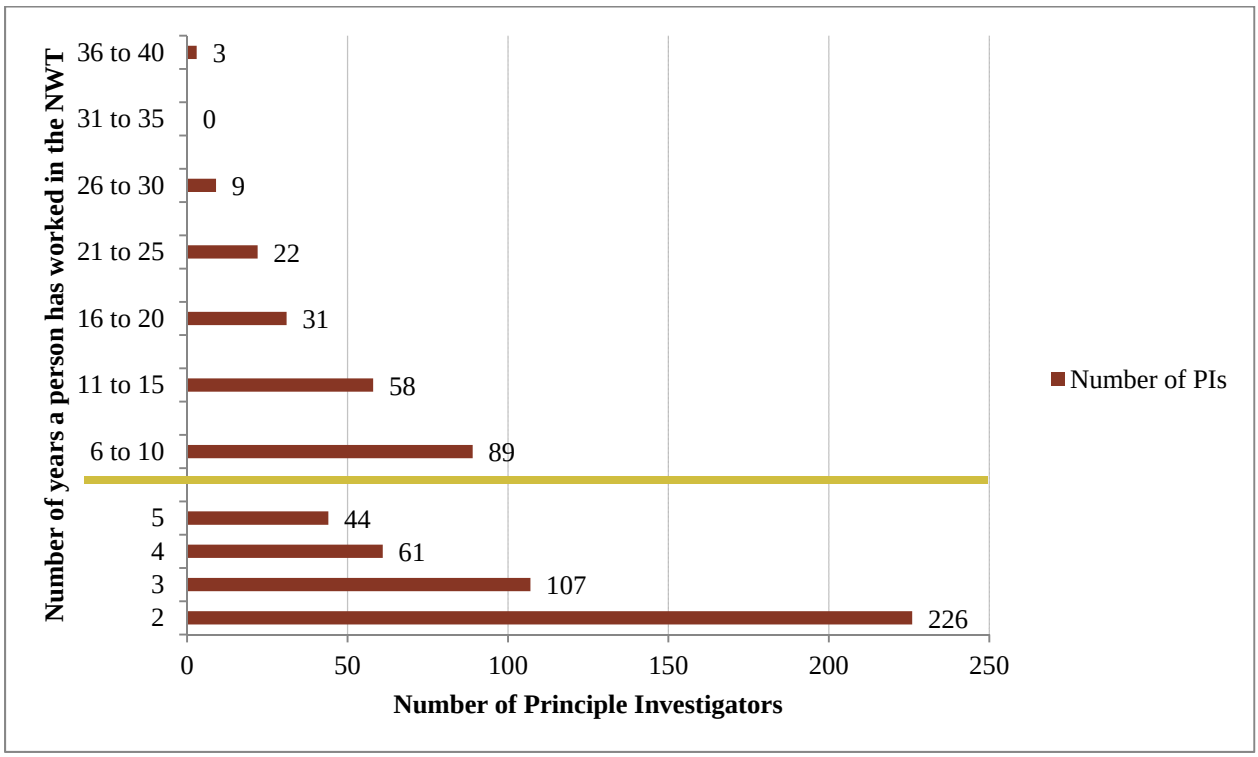


FIGURE 12. NUMBER OF YEARS PRINCIPLE INVESTIGATORS (PIS) CONDUCT RESEARCH IN THE NWT AS SHOWN BY SPREAD OF YEARS BETWEEN FIRST AND LAST LICENCES ISSUED.

7.1. Principle Investigators with 15 or more licences

Although most researchers led only a single research project, a small group of PIs held a large number of licences each. The following 17 PIs had 15 or more licences each. Most of the researchers in this group were male researchers (15 of 17), and researchers working in physical sciences (13/17). The remaining researchers worked in biological sciences. Some worked in multiple disciplines: physical, biological, engineering, and contaminants. None were health or social science researchers. Twelve were self-reported PhDs. Five focused exclusively on the Inuvialuit Settlement Region or Inuvialuit plus Gwich'in Settlement Area, although all 17 worked in the Inuvialuit region at least once. Four focussed on the 'Mackenzie Valley' regions (Inuvialuit Settlement Region, Gwich'in Settlement Area, Sahtú Settlement Area, and Dehcho Region – see Figure 30 for a map of these regions). The North and South Slave regions appear to be underrepresented as destinations for long-term researchers.

TABLE 4. PRINCIPLE INVESTIGATORS WITH MORE THAN 15 LICENCES, 1974-2013

Principle Investigator	Number of licences	Earliest licence	Latest licence	Spread of years
Dr. Chris Burn	28	1987	2013	27
Affiliation: Department of Geography, **UBC**; then **Carleton University**. Projects: Physical sciences, studying: frost heaves, snow, ground ice, permafrost, pingos, ice wedges, ground temperatures, wind, and climate change. Regions: Mainly Inuvialuit Settlement Region, some Gwich'in Settlement Area.				
Dr. Michael English	19	1978	2013	36
Affiliation: Cold Regions Research Centre, **Wilfrid Laurier University** Projects: Physical science. Hydrology, geomorphology, sediments, water levels, water chemistry, snowpack, soil nutrients Regions: North Slave, South Slave				
Dr. Marlene Evans	31	1992	2013	22
Affiliation: National Hydrology Research Institute, **Northern River Basin Study**, then **Environment Canada** - National Water Research Institute Projects: Physical science, biology, and contaminants. Slave River, metals and organic contaminants, aquatic studies, fish Regions: All of the NWT				
Dr. Hugh French	15	1975	1997	23
Affiliation: **University of Ottawa** Projects: Physical science. Terrain disturbance, geomorphology, drainage, ground ice, permafrost, erosion, drilling, palaoenvironmental studies Regions: Mainly Inuvialuit Settlement Region, one also Gwich'in Settlement Area				
Larry Graburn	27	2003	2006	4
Affiliation: **ColtKBR** (industry) Projects: Physical science, engineering. Geotechnical and hydrological studies relating to Environmental Impact Assessment: Mackenzie Gas Project. Regions: Inuvialuit Settlement Region, Gwich'in Settlement Area, Sahtú Settlement Area, Dehcho Region.				
Dr. G. Peter Kershaw	39	1977	2012	36
Affiliation: Department of Geography, **University of Alberta** Projects: Biology. Reclamation/disturbance, forestry, environmental effects, tundra studies, Regions: Mainly Sahtú Settlement Area, one in Inuvialuit Settlement Region.				
Dr. Steve Kokelj	22	1999	2013	15
Affiliation: **Carleton University**, then **Indian and Northern Affairs Canada**, then **Government of Northwest Territories**. Projects: Physical science. Permafrost, ground ice, development effects, Regions: Inuvialuit Settlement Region, Gwich'in Settlement Area.				
Dr. Lance Lesack	19	1993	2010	17
Affiliation: Department of Geography, **Simon Fraser University** Projects: Physical science. Lake biogeochemistry, hydrology Regions: Inuvialuit Settlement Region, Gwich'in Settlement Area				
Dr. Phillip Marsh	26	1990	2013	24

Affiliation: National Hydrology Research Institute, **Environment Canada** Projects: Physical science. Snow accumulation and melt, hydrology, water chemistry, permafrost Regions: Inuvialuit Settlement Region, Gwich'in Settlement Area				
Dr. Humfrey Melling	15	1985	2010	26
Affiliation: Institute of Ocean Sciences, **Department of Fisheries and Oceans** Projects: Physical science. Beaufort Sea ice motion, thickness. Marine hazards. Regions: Inuvialuit Settlement Region				
Dr. Scott Dallimore	15	1989	2013	25
Affiliation: **Geological Survey of Canada** Projects: Physical science. Permafrost and shallow gas, coastal research, gas hydrate research. Regions: Inuvialuit Settlement Region, Gwich'in Settlement Area				
Mark Nixon	15	1990	2004	15
Affiliation: **Geological Survey of Canada** Projects: Physical Science. Active Layer Monitoring Network (permafrost). Regions: Inuvialuit Settlement Region, Gwich'in Settlement Area, Sahtú Settlement Area, Dehcho Region.				
Dr. Akira Osawa	22	1987	2013	27
Affiliation: **Forestry and Forest Products Research Institute**, then **Ryukoku University**, then Graduate School of Agriculture, **Kyoto University**, Japan. Projects: Biology. Forestry, self-thinning, jack pine, carbon dynamics, boreal forests. Regions: Mainly South Slave, one in Inuvialuit Settlement Region and two in Gwich'in Settlement Area.				
Andrew Povey	93	2002	2005	4
Affiliation: Mackenzie Project Environment Group, **AMEC Americas Ltd**., Earth and Environmental Division (Industry) Projects: Biology, TK, Engineering. Terrestrial and TK studies, Mackenzie Gas Project. Regions: Inuvialuit Settlement Region, Gwich'in Settlement Area, Sahtú Settlement Area, Dehcho Region.				
David Sherstone	16	1974	1993	20
Affiliation: **Inuvik Scientific Resource Centre**, then **Science Institute of the NWT** Projects: Physical science. River ice, sea ice, glaciers, hydrology, flooding Regions: All of the NWT				
Dr. Ross Wein	17	1984	2003	20
Affiliation: **University of New Brunswick**, then **University of Guelph**, then Department of Forest Science, **University of Alberta** Projects: Biology, physical science. Forest fire, disturbance, drought resistance, carbon, climate change, driftwood Regions: Inuvialuit Settlement Region, Gwich'in Settlement Area, South Slave, Dehcho Region				
Annika Trimble	15	2009	2013	5
Affiliation: **Aurora Research Institute** Projects: Physical Science, some engineering and biology. Seeds, wind energy, solar irradiance. Regions: Inuvialuit Settlement Region, Gwich'in Settlement Area, North Slave, Dehcho Region.				

7.2. Trends in gender of Principle Investigator by year and discipline

Although the gender of PIs was not gathered specifically, it was generally able to be assigned to most PIs.[10] The majority of research in the NWT was led by a male PI – 2484 of 3665 licences (68%). There was a greater number of licences issued to researchers without an assignable gender in the 1970s and into the 1980s (Figure 13). A linear trend line does show an increasing presence of female PIs in the years with more complete data, post-1995.

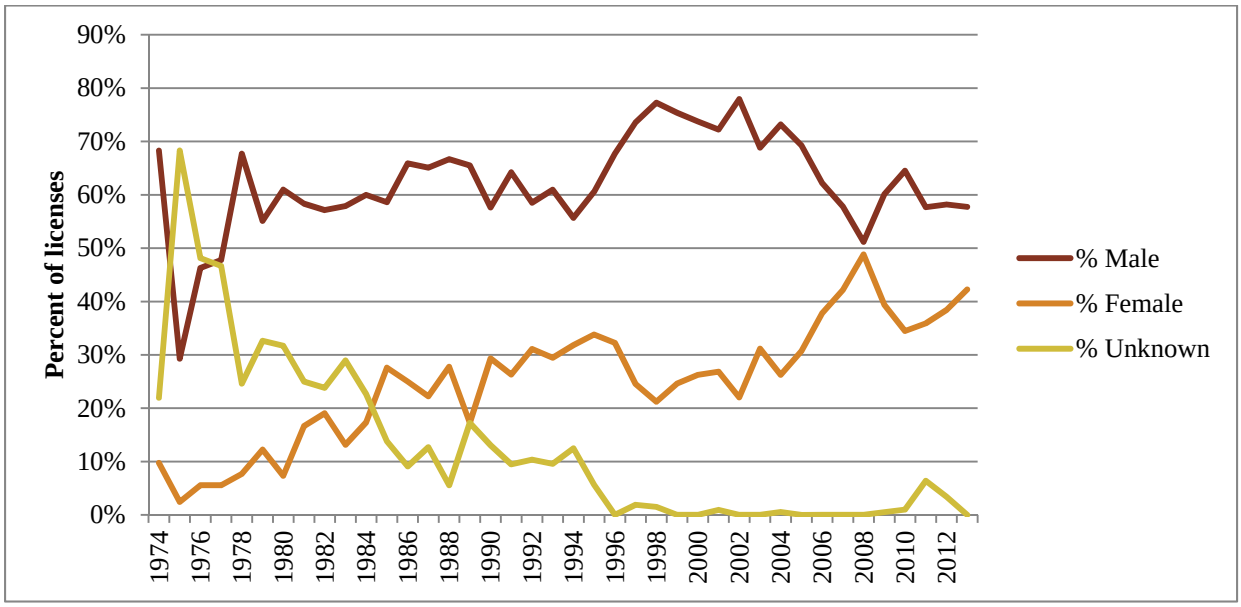


FIGURE 13. TREND IN GENDER OF PRINCIPLE INVESTIGATOR, 1974-2013

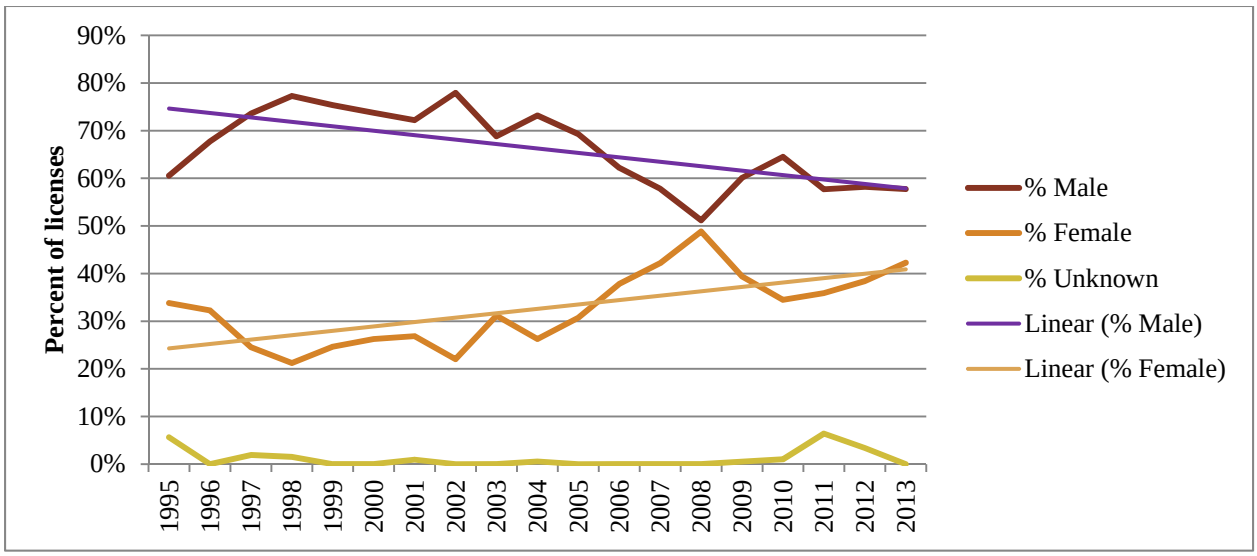


FIGURE 14. TREND IN GENDER OF PRINCIPLE INVESTIGATOR WITH TREND LINE, 1995-2013

[10] See Appendix 2 for further information.

The greatest disparity in gender of PI can be seen in the physical sciences and biology, where male PIs vastly outnumbered female PIs. Female PIs were slightly more common over the 40 years of the retrospective in health and social science projects. A chart showing the breakdown between disciplines from the first decade of the retrospective (1974-1983, Figure 15) and last decade (2004-2013, Figure 16) are included below. The charts differ in particular in biological sciences, and lesser but still noticeable trends in health and social sciences.

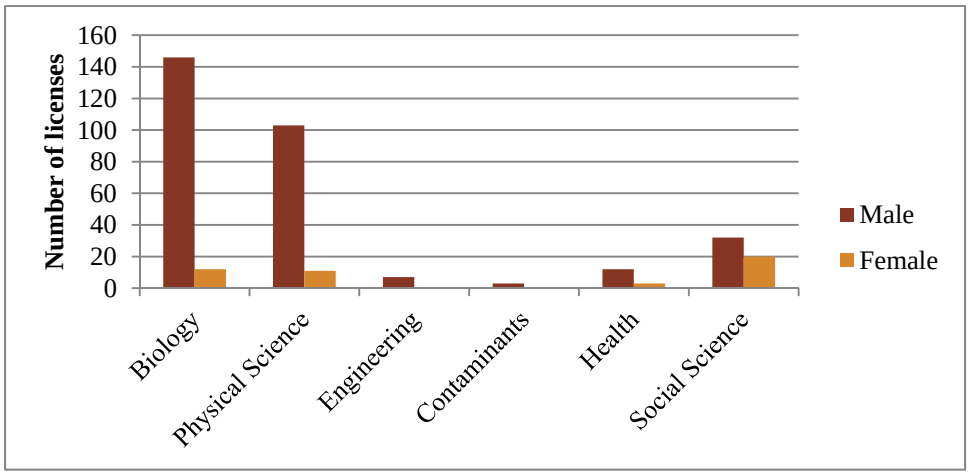


FIGURE 15. GENDER OF PRINCIPLE INVESTIGATOR BY DISCIPLINE, 1974-1983

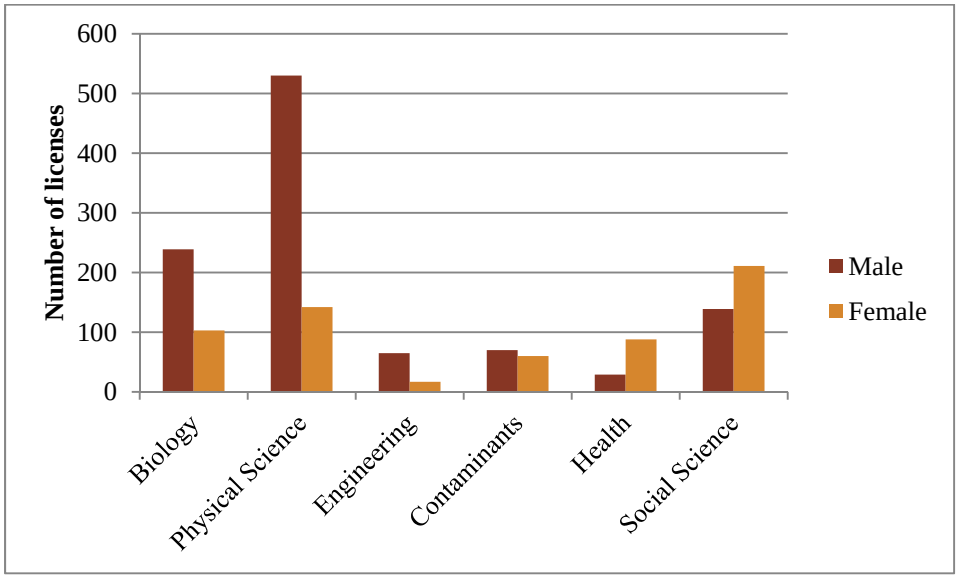


FIGURE 16. GENDER OF PRINCIPLE INVESTIGATOR BY DISCIPLINE, 2004-2013

8. Trends in applicant origin

Researchers working in the NWT have come from across the northern hemisphere. The city, province/state, and country of origin of the PI has been tracked consistently since 1996 (although data is also available for 1983, 1986, and 1987, included in the maps below).

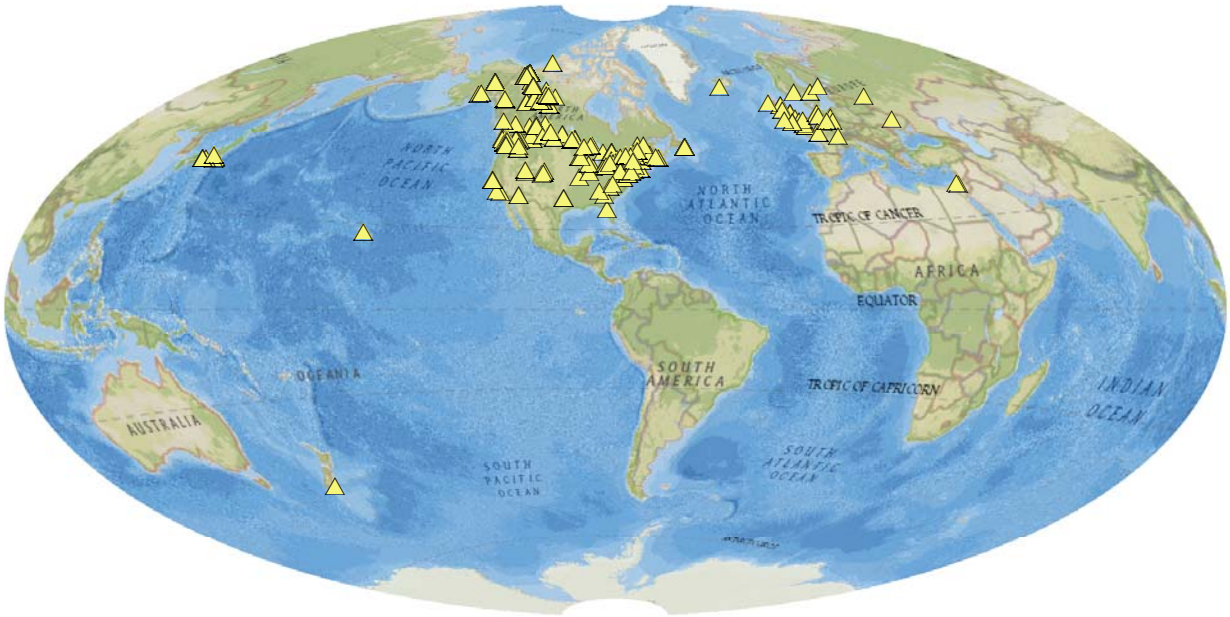


FIGURE 17. LOCATION OF ORIGIN OF PRINCIPLE INVESTIGATOR, 1983, 1986-7, AND 1996-2013

The number of PIs from various locations is shown in a series of maps with proportional symbols below. The larger the symbol, the greater the number of licences issued PIs from that location. Out of the 2612 licences with a location for the PI, the largest number of licences (390) were issued to Calgary, Alberta-based researchers. In descending order, the next most common places of origin were: Yellowknife (371 licences), Ottawa, Ontario (254 licences), and Edmonton, Alberta (252 licences).

Researchers from across the NWT, including the Arctic Archipelago, were issued about a quarter (23%) of all licences. The majority of licences were issued to researchers in the capital city of Yellowknife and administrative centre of Inuvik (371 and 132 respectively, of 598 total NWT licences). Less than 10% of NWT licences were from smaller centres (Figure 18).[11] As noted above, researchers from Calgary and Edmonton were also issued a quarter of all licences. Researchers from other western cities were also strongly represented (Saskatoon, Winnipeg,

[11] A single license was issued to a New Zealand researcher, which is not included in this map series.

Vancouver, and Victoria, Figure 19). Almost 10% of all licences were issued to Ottawa researchers. Other Ontario and Quebec researchers also had a strong presence in NWT research, including Quebec City, Montreal, Kingston, Toronto, Mississauga, and Kitchener (Figure 20). Finally, American researchers from across the continental US (and Hawaii, not shown; and Alaska, shown in Figure 18) obtained licences to conduct research in the NWT (Figure 21).

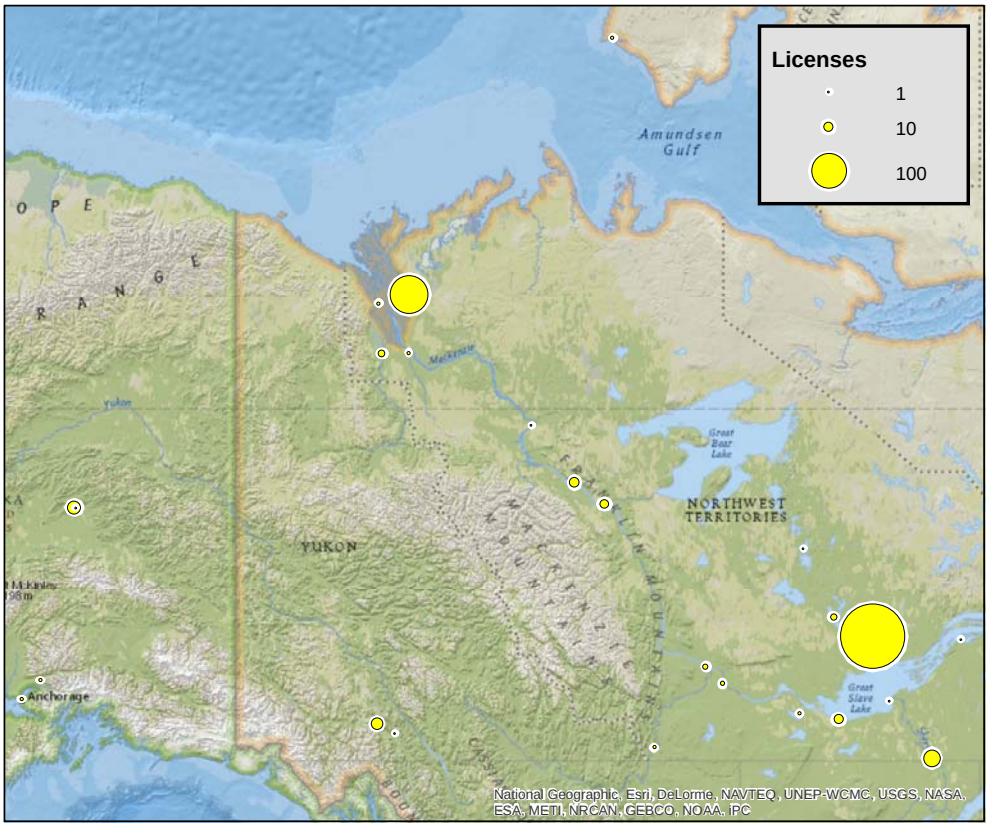


FIGURE 18. LOCATION OF ORIGIN OF PRINCIPLE INVESTIGATOR, NORTHWEST TERRITORIES, YUKON, AND ALASKA.

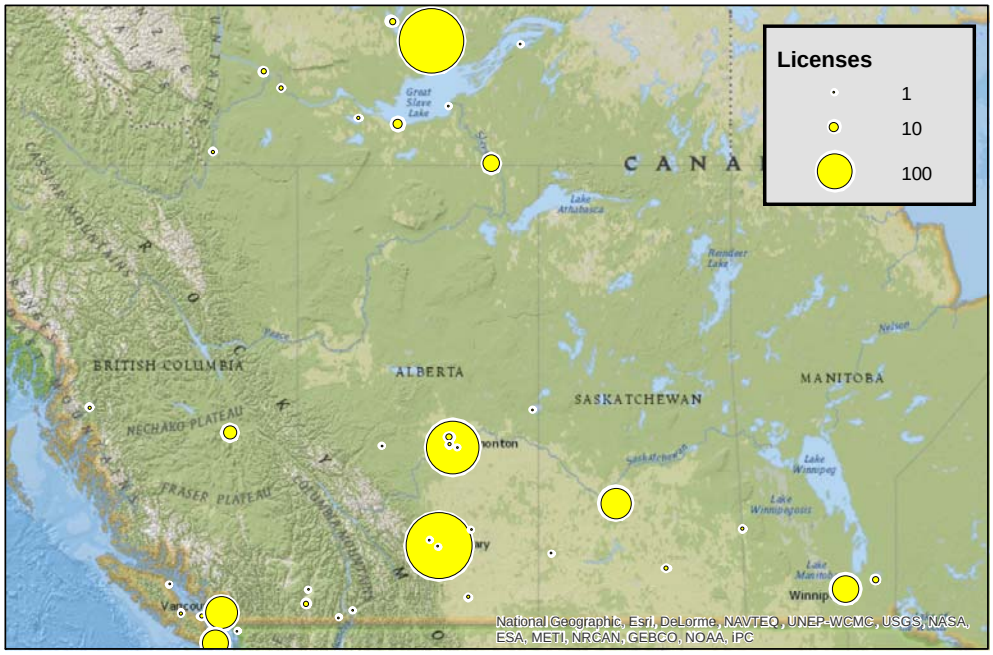


FIGURE 19. LOCATION OF ORIGIN OF PRINCIPLE INVESTIGATOR, WESTERN PROVINCES.

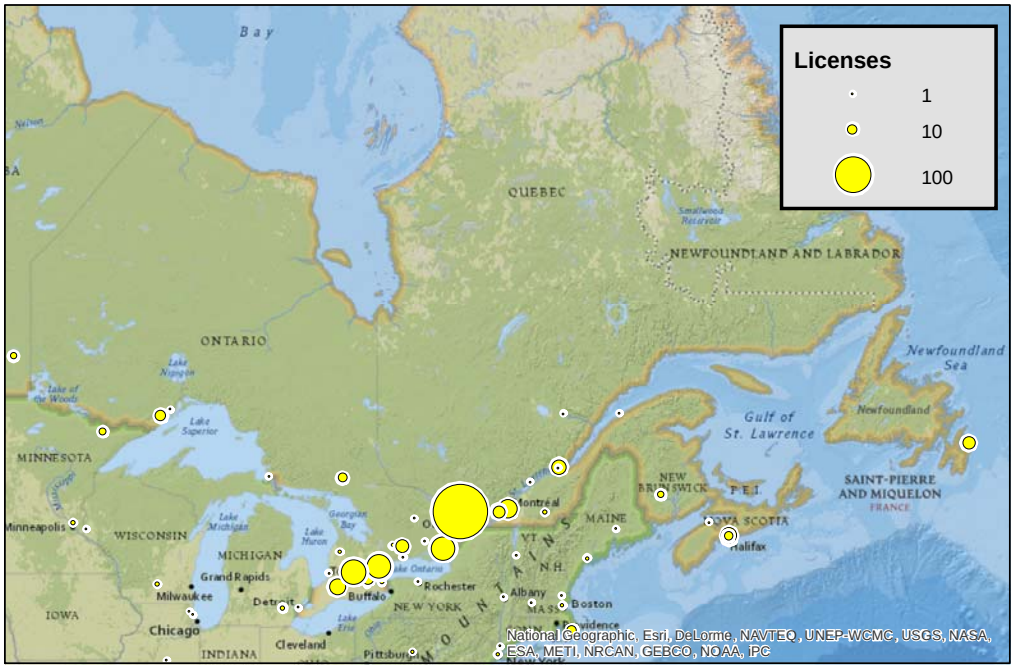


FIGURE 20. LOCATION OF ORIGIN OF PRINCIPLE INVESTIGATOR, ONTARIO, QUEBEC, MARITIME PROVINCES.

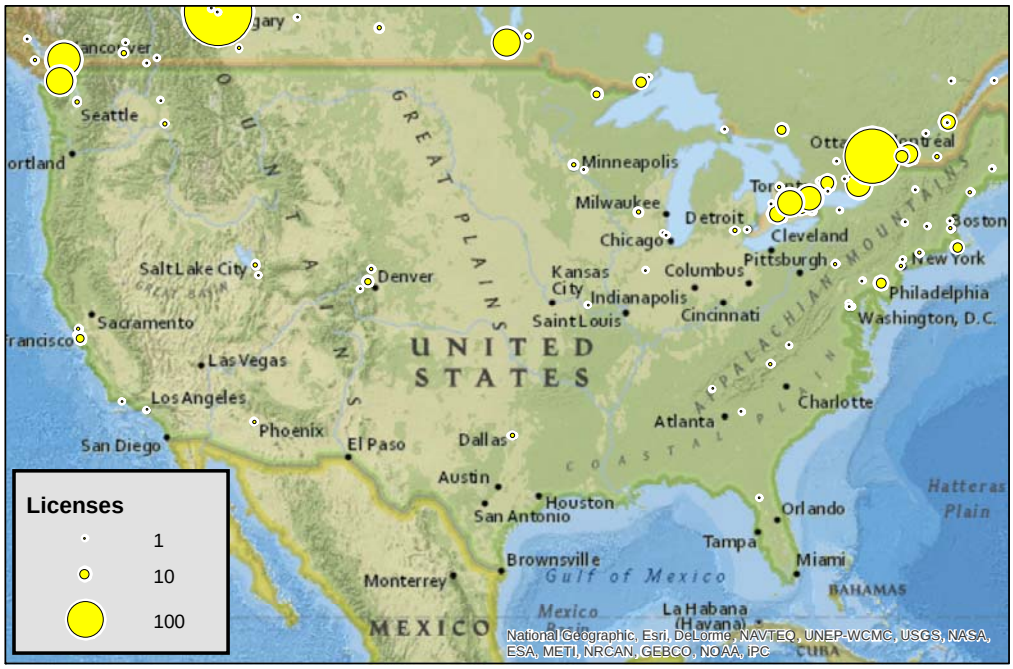


FIGURE 21. LOCATION OF ORIGIN OF PRINCIPLE INVESTIGATOR, UNITED STATES.

Though much smaller in numbers than Canadian researchers, researchers from the United Kingdom, Europe, Russia, and Israel have conducted licenced research in the NWT (Figure 22). Japanese researchers obtained 20 licences (Figure 23).

FIGURE 22. PROPORTIONAL SYMBOL LOCATION OF ORIGIN OF PRINCIPLE INVESTIGATOR, EUROPE AND MIDDLE EAST.

FIGURE 23. PROPORTIONAL SYMBOL LOCATION OF ORIGIN OF PRINCIPLE INVESTIGATOR, JAPAN.

9. Trends in research discipline

All research licences were categorized to a broad discipline: engineering, contaminants, traditional knowledge, health, social science, biology, or physical science. From 1974-2013, physical science projects were the most numerous, followed by social science and health. Engineering, contaminants, TK, and health each were less than 10% of the total. The majority of projects were categorized to only a single discipline (and the current on-line application system constrains applicants to a single choice). There were, however, a small number (261) of projects which have more than one assigned discipline.[12]

[12] There were many multi-disciplinary research projects undertaken, although this information was not captured.

TABLE 5. LICENCES BY DISCIPLINE[13]

Type	Number	Percent of total
Engineering	139	4%
Contaminants	191	5%
TK	216	5%
Health	221	6%
Social Science	800	20%
Biology	1068	27%
Physical Science	1619	41%

The trend over the last 40 years in research discipline was dynamic. Figure 24 and Figure 25 show the count and percentage of licences from each discipline. Biology and physical science (and to a much lesser degree, social science) had the most research licences by count, especially in the period between 1974 and the early 2000s, when physical science projects became more numerous. Biology programs dropped dramatically in number and percentage in the last decade, and social science and physical science trended upwards. There was a spike in contaminants research in the early 1990s, and dual lesser spikes of Engineering and TK research in the early/mid 2000s, likely associated with the Mackenzie Gas Project.

[13] Numbers will not add up to 3961, nor will percentages add up to 100, due to the 262 projects with more than one discipline.

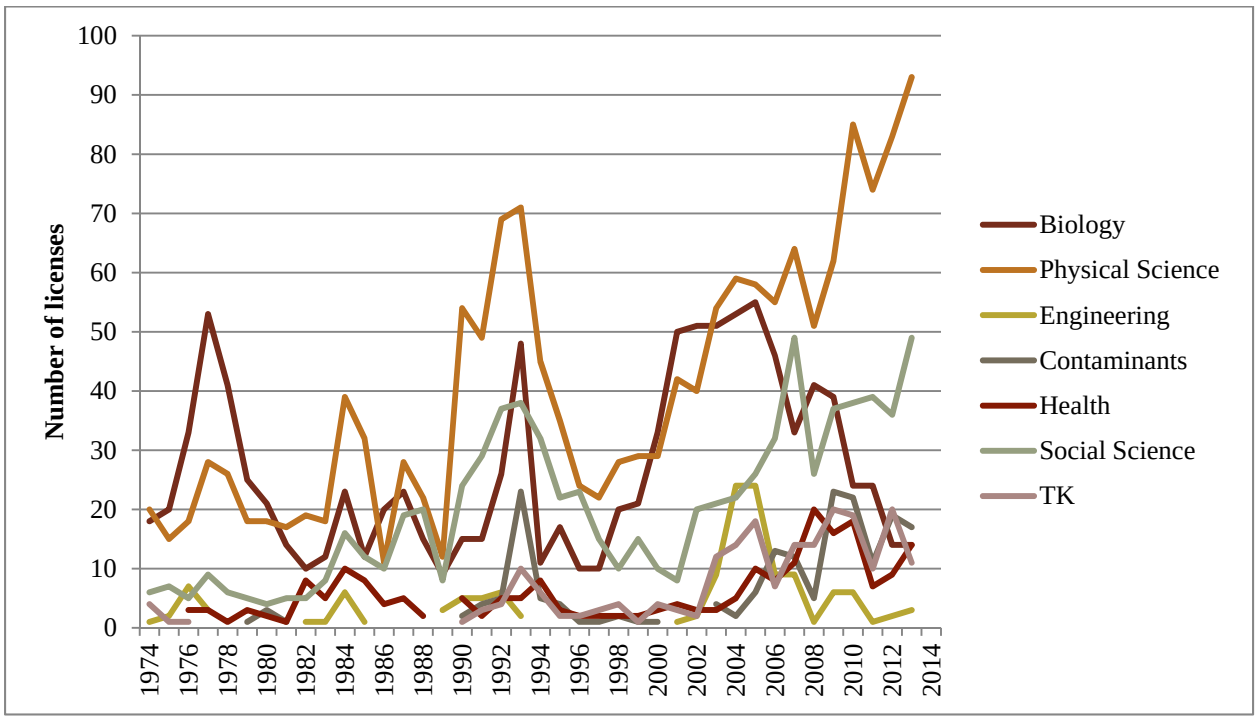


FIGURE 24. TRENDS IN RESEARCH DISCIPLINE BY NUMBER OF LICENCES, 1974-2013

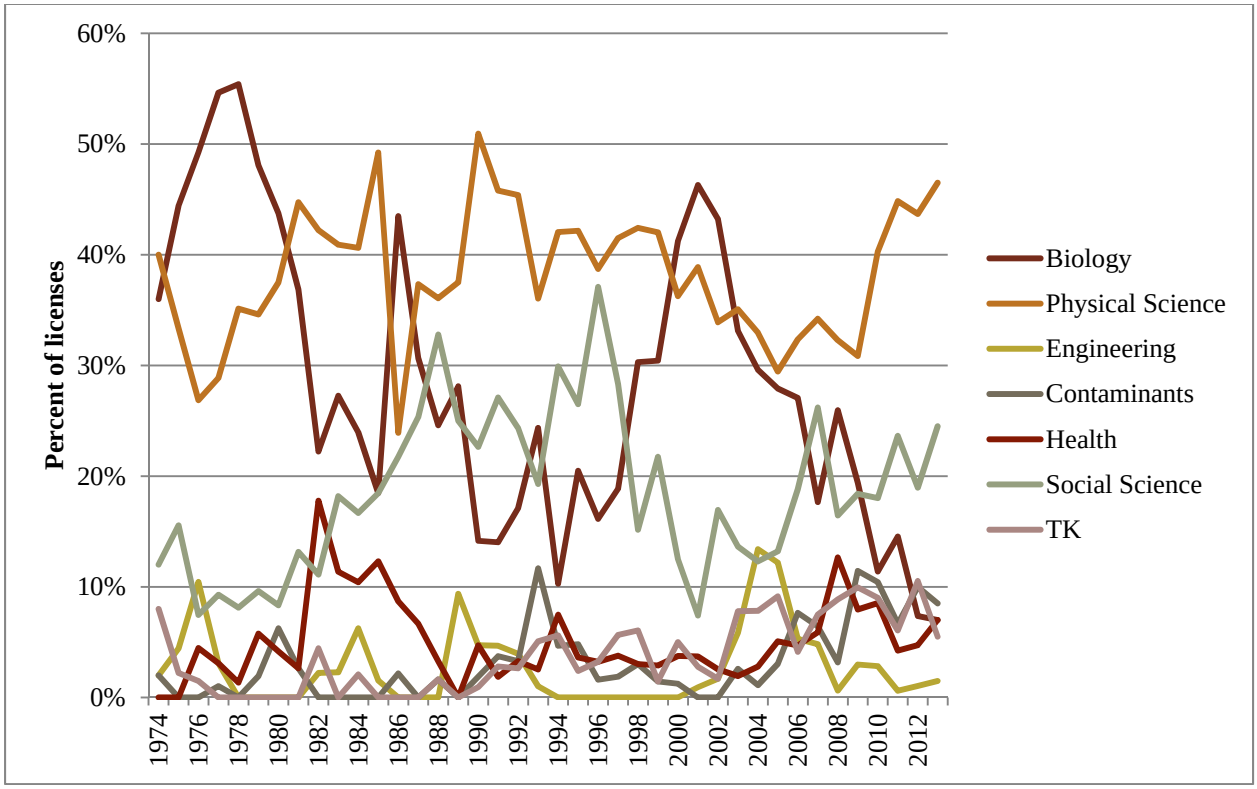


FIGURE 25. TRENDS IN RESEARCH DISCIPLINE BY PERCENT, 1974-2013

10. Trends in number of organizations contacted

As noted in the introduction, the scientific research licensing process includes the requirement for the researcher to consult with appropriate community and regional organizations about their research. The current process was instituted at the request of Aboriginal organizations, and as a means to implement the NWT Scientists Act from 1974. Although licence applicants are encouraged and expected to contact various community and other organizations prior to applying for a licence, ARI sends licence applications to all appropriate community and regional organizations for review and to seek feedback. In addition, ARI sends licence applications to a smaller number of organizations to notify them of research, without seeking feedback.

Starting in 1988, there was a count available on the number of organizations the ARI contacted during the licensing process. In recent years, this count included organization from which feedback is sought, as well as organizations who receive a copy of the licence as a notification. The average number of organizations contacted from 1988-2013 is 6.8. As shown in Figure 26, there is an increase in the average number of organizations contacted/notified since the early 1990s.

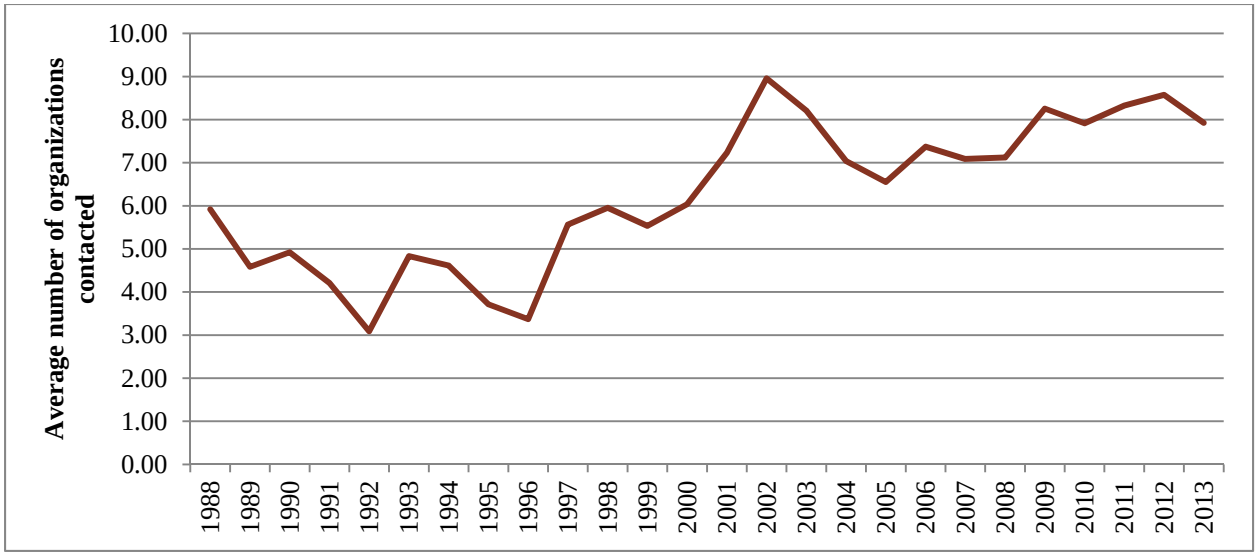


FIGURE 26. TRENDS IN AVERAGE NUMBER OF ORGANIZATIONS CONTACTED 1988-2013

Although multi-region research declined in both absolute count and percentage of research (see Figure 31 and Figure 32), it appears that multi-region research was at least part of the reason why

the number of organizations contacted has increased. Between 2000 and 2009, 12.2 organizations on average were contacted for multi-region research, which is noticeably higher than the average. Between 2010-2013, the average fell slightly to 11.9. Earlier multi-region research had near-average numbers of organizations contacted (in the 1990s, the average was 5.6, over the single-region 1990s average of 4.3).

There were 86 projects with more than 20 organizations contacted. Of these, 71 are multi-region. Ten of these projects were biology projects, 21 were physical science, five were engineering, 11 were health projects, 31 were social science, and 11 were traditional knowledge projects. Considering that social science projects constitute a smaller portion of research projects in general (20% compared to physical science projects at 41%), in the NWT, they were over-represented in this sub-set. Social science projects in this group tended to have numerous community organizations and government departments, and health and school boards on the contact list.

ARI has also sought a small number of new organizations to be a part of the review and feedback process for licence applications, especially as internet connectivity has increased and become more accessible in some communities. This includes, for example, several school and health boards where appropriate.

Different disciplines appear to have a different number of organizations contacted. For the full 40 years, traditional knowledge studies were the highest number at 7.7 on average. Contaminants projects had the lowest number at around 5.9.

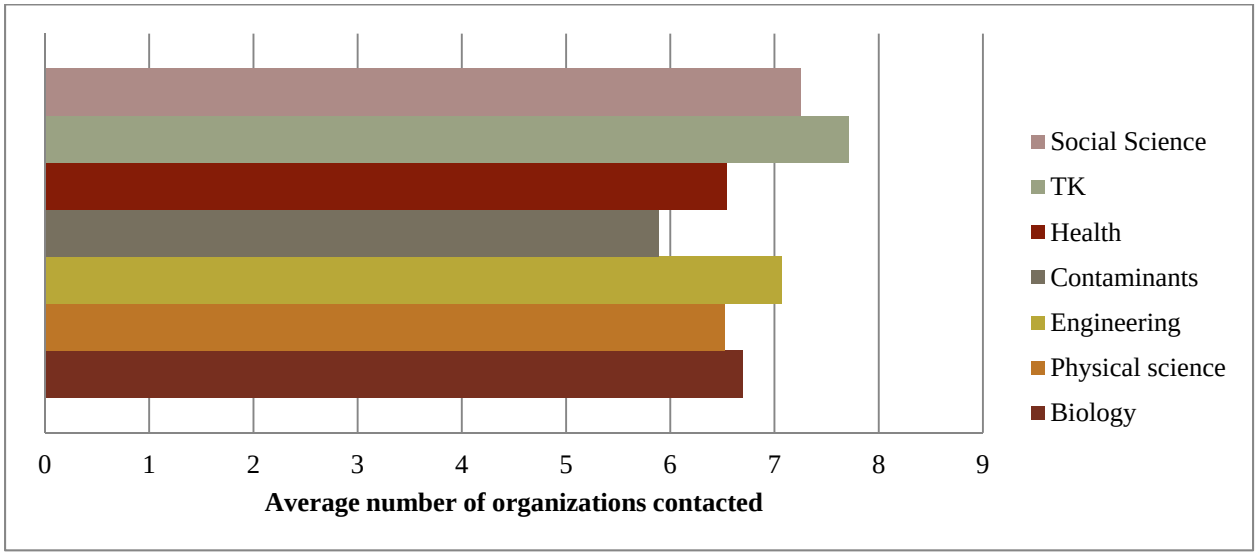


FIGURE 27. AVERAGE NUMBER OF ORGANIZATIONS CONTACTED BY DISCIPLINE 1988-2013

The figures for the decade 2004-2013 were quite different. Social science had the greatest number of organizations contacted on average at 8.9, and health projects the least at 5.9.

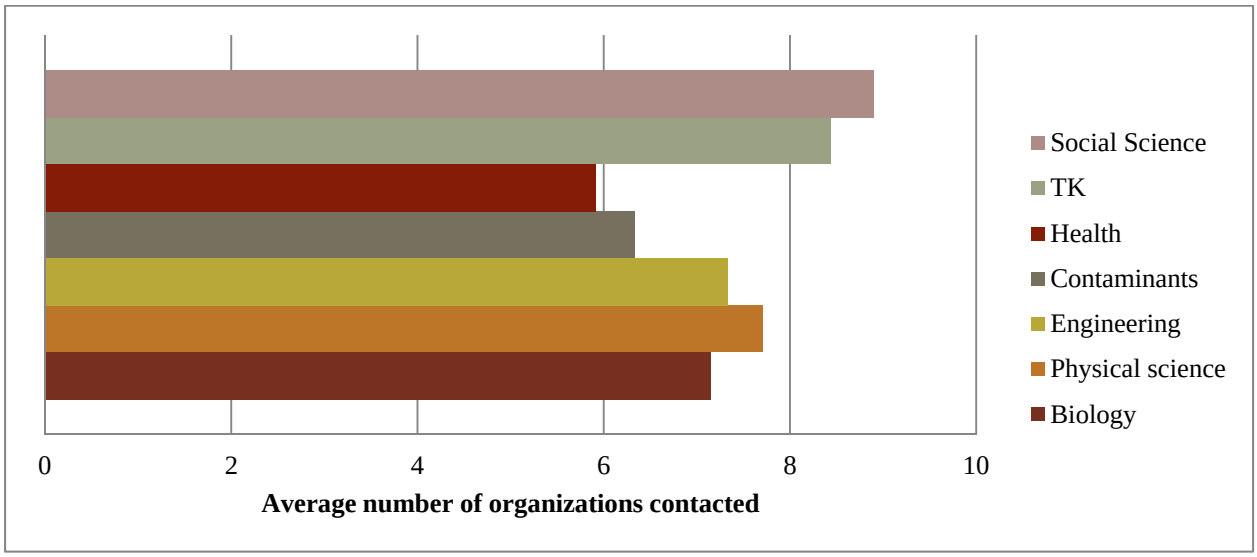


FIGURE 28. AVERAGE NUMBER OF ORGANIZATIONS CONTACTED BY DISCIPLINE 2004-2013

11.Trends in ethical review

Licences for research involving human subjects are required to have ethical review and approval by a Research Ethics Board or Institutional Review Board. The Aurora College's Ethics Review Board can be used by researchers applying for a research licence who are not affiliated with another university or institution.

Data on Ethics Review of research projects was collected starting in 2005. Between 2005-2013, 564 projects included ethical review, of a total of 1641 projects (34%). The majority of ethical reviews (about 75%) were undertaken through universities. The remaining 25% were shared equally by the Aurora College's Ethics Review Board, and "other" (including government departments, Aboriginal/Inuit organizations, and unknown).

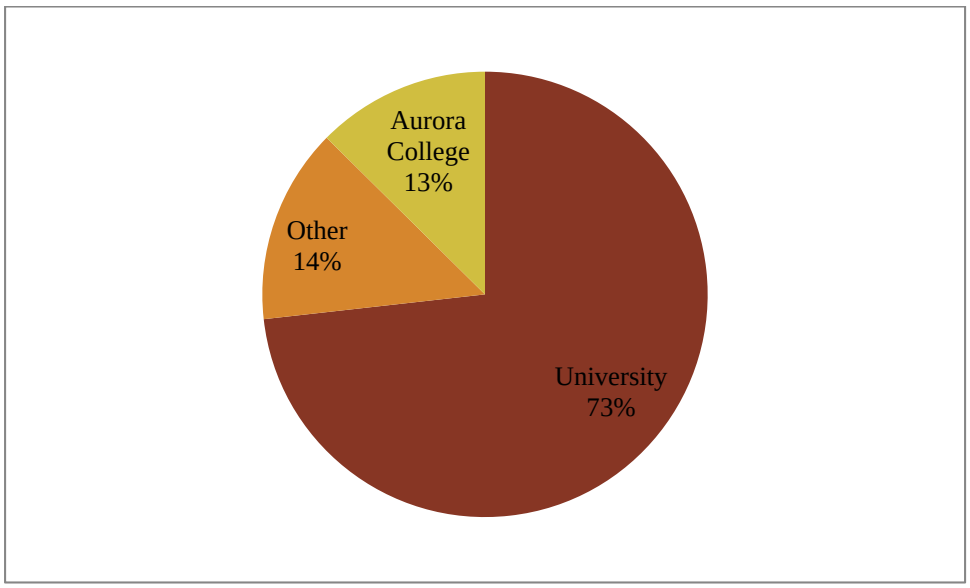


FIGURE 29. ETHICS REVIEW ORGANIZATIONS, 2005-2013.

12. Trends in region of work and single vs. multi-region research

The location of field work for every research licence between 1974 and 2013 was catalogued to one or more of the six political regions making up the NWT.

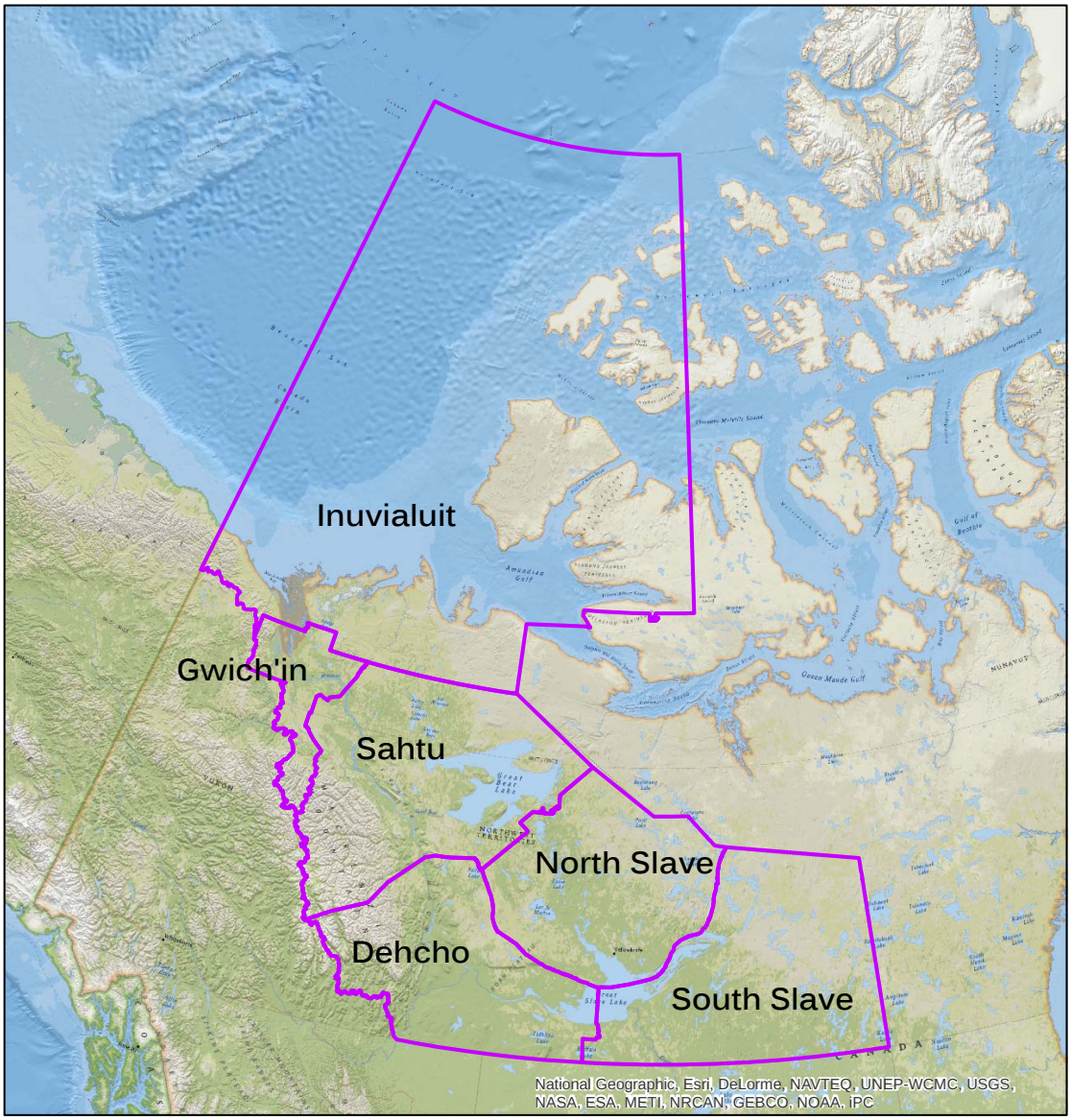


FIGURE 30. REGIONS OF THE NWT USED FOR LICENSING

For example, a project may include work in only the Inuvialuit Settlement Region, or may include work in the South Slave, North Slave, and Dehcho Region. In every year except one, more projects are single-area than multiple area. In a single year (1983) there is an equal number of single-area projects and multi-area projects.

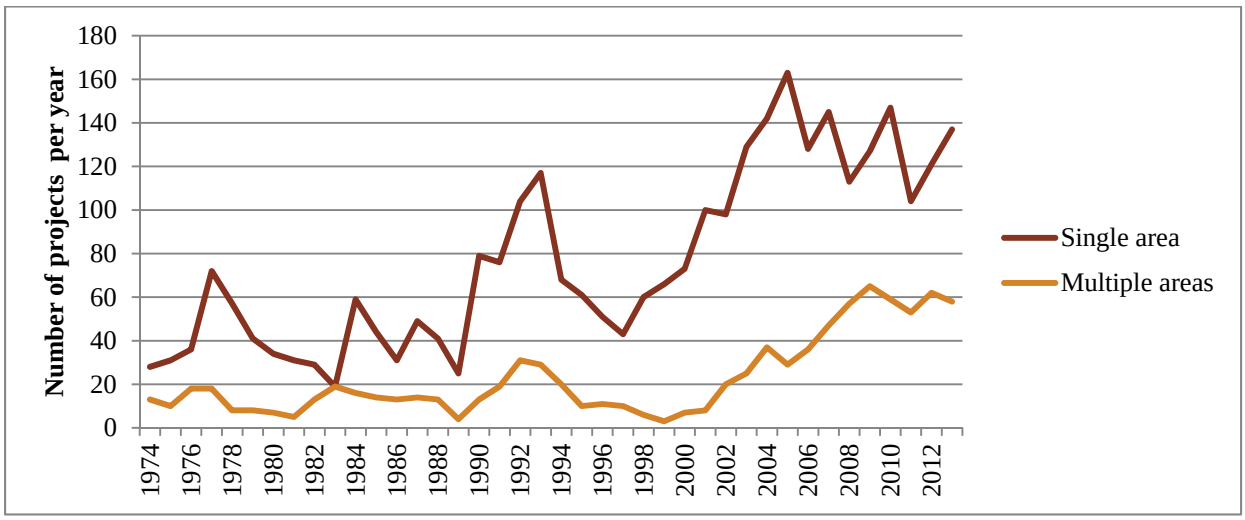


FIGURE 31. TRENDS IN SINGLE-REGION AND MULTI-REGION PROJECTS, 1974-2013

Figure 31 (above) shows to total number of projects every year which were single region and the total number of projects which included work in multiple regions, and shows an increase in both types of projects. Figure 32 (below) shows the percentage of single-area and multi-area projects, and shows that overall, multi-area projects are decreasing in proportion to single-area projects, quite steadily, since about 2000.

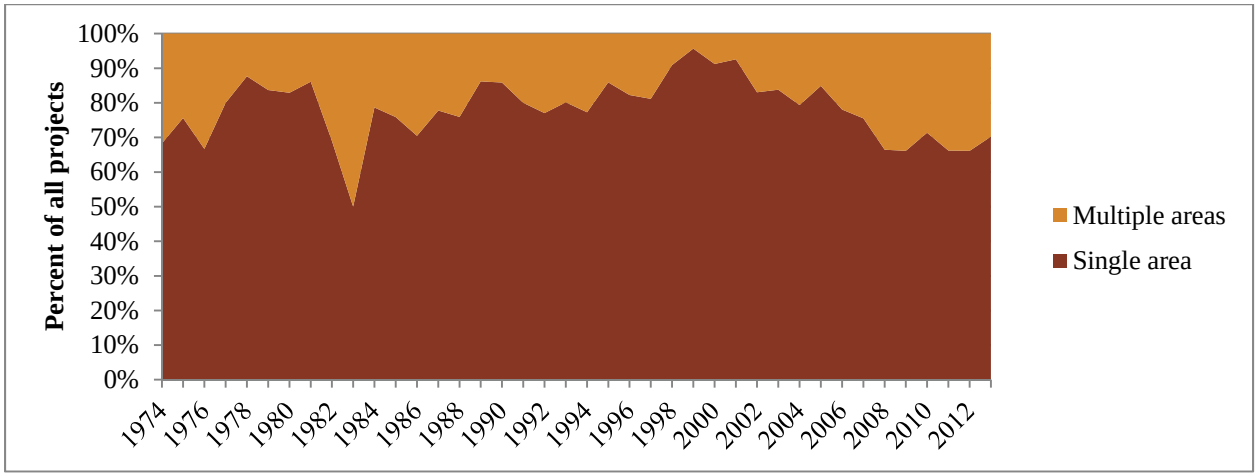


FIGURE 32. TRENDS IN SINGLE-REGION AND MULTI-REGION PROJECTS, 1974-2013 (PERCENT)

A project may occur in one, two, three, four, five, or six regions. The following figure is a line graph showing the number of projects in each region. Note that many projects contributed to the count of more than one region.

Trends in region of work and single vs. multi-region research

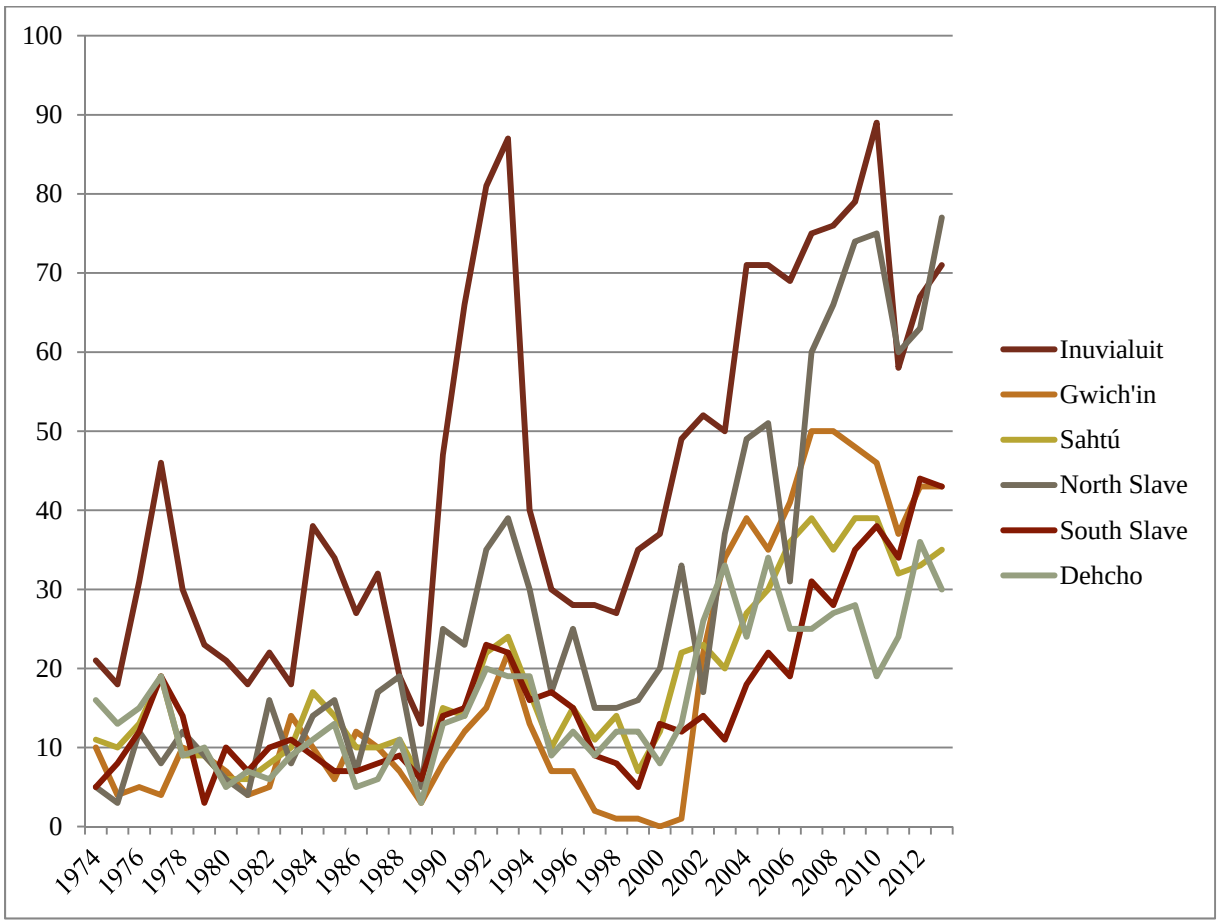


FIGURE 33. TRENDS IN REGION OF PROJECTS, 1974-2013 (COUNT, ANY SINGLE PROJECT MAY BE COUNTED MULTIPLE TIMES)

The following table shows a count of all research projects in each area over the 40 year period, again with the caveat that many (multi-region) projects will be counted more than once.

TABLE 6. NUMBER AND PERCENT OF PROJECTS BY REGION, 1974-2013

Region	Number of projects with a component in this region	Percent of total projects[14]
Dehcho Region	649	16%
South Slave	651	16%
Gwich'in Settlement Area	697	17%
Sahtú Settlement Area	740	19%
North Slave	1114	28%
Inuvialuit Settlement Region	1794	45%

[14] Will not add up to 100 due to multi-region projects.

The Inuvialuit Settlement Region was very strongly represented in research licences. Indeed, nearly half of all research projects in the NWT (45%) were either wholly or partly within the Inuvialuit Settlement Region. The inclusion of the Arctic Archipelago and Beaufort Sea/Arctic Ocean within the Inuvialuit Settlement Region may play a role, along with perhaps other unique biophysical, development-related, and social features of the region. The Inuvialuit Settlement Region was followed distantly by the North Slave region. The Sahtú Settlement Area, Gwich'in Settlement Area, South Slave, and Dehcho Region all had less than 20% of research projects either wholly or partly within their borders.

13.Trends in field work location

The following maps show the density of field work in each region, loosely by decade (1991-2001, 2002-2013). The increasing intensity or depth of purple colour demonstrates an increasing intensity of field work. Generally, field work locations were provided by researchers on license applications and mapped by ARI.

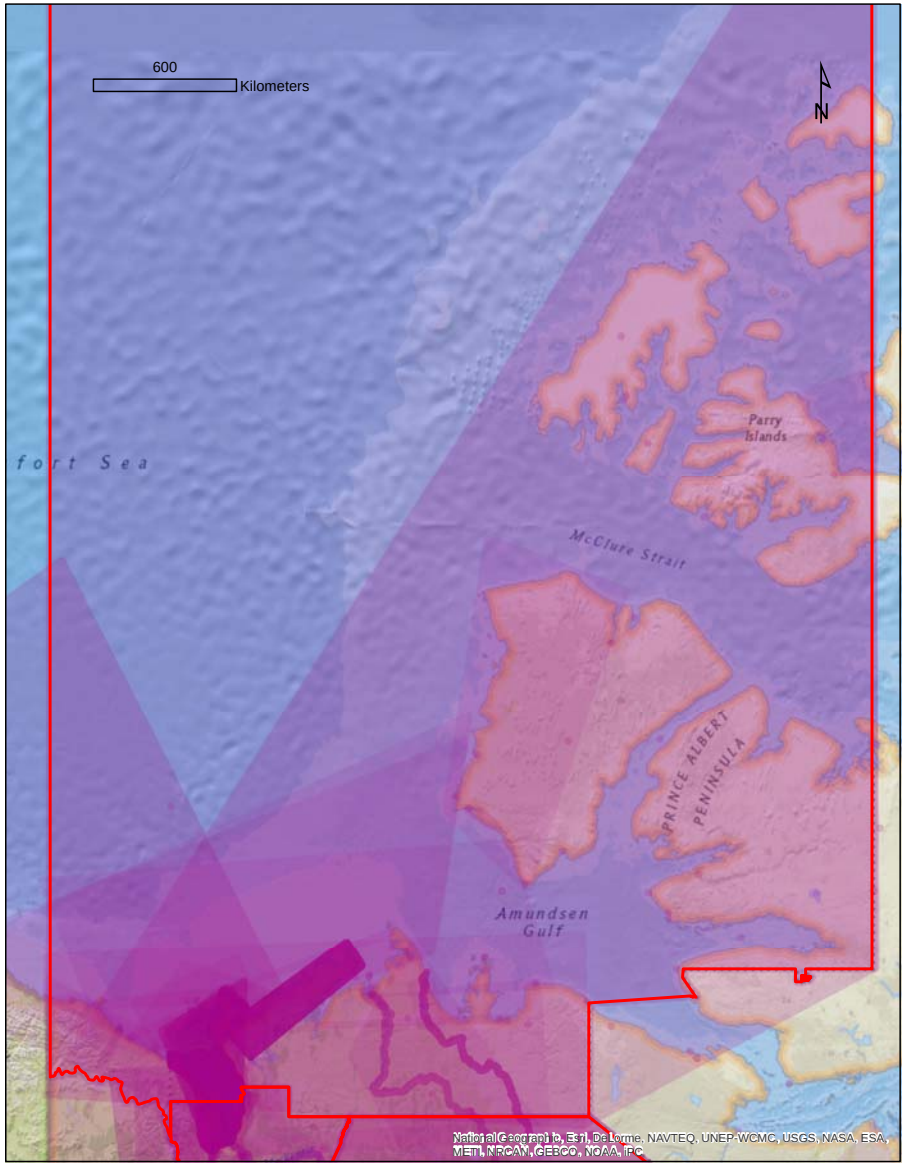


FIGURE 34. FIELD WORK LOCATIONS, INUVIALUIT SETTLEMENT REGION, 1991-2001.

FIGURE 35. FIELD WORK LOCATIONS, INUVIALUIT SETTLEMENT REGION (PALER TO SHOW CONCENTRATIONS), 2002-2013.

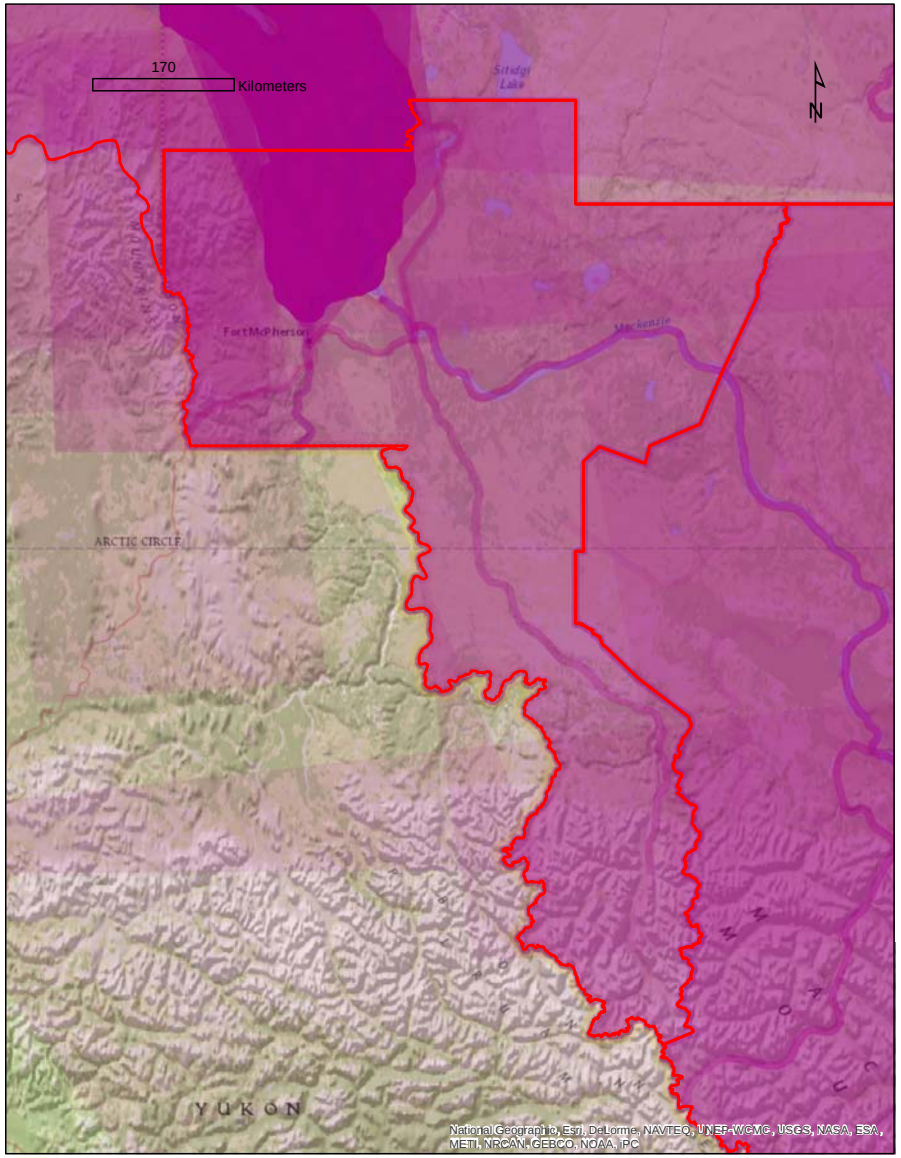


FIGURE 36. FIELD WORK LOCATIONS, GWICH'IN SETTLEMENT AREA, 1991-2001.

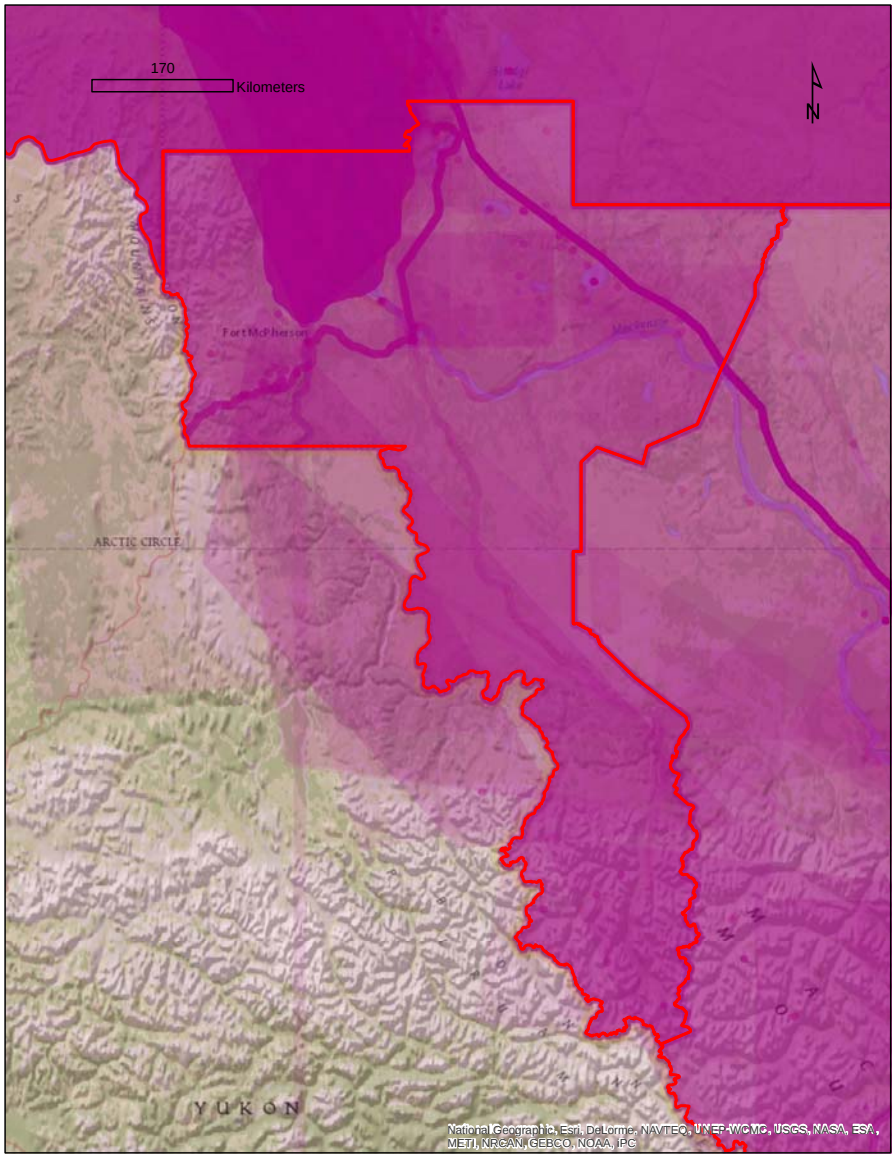


FIGURE 37. FIELD WORK LOCATIONS, GWICH'IN SETTLEMENT AREA, 2002-2013.

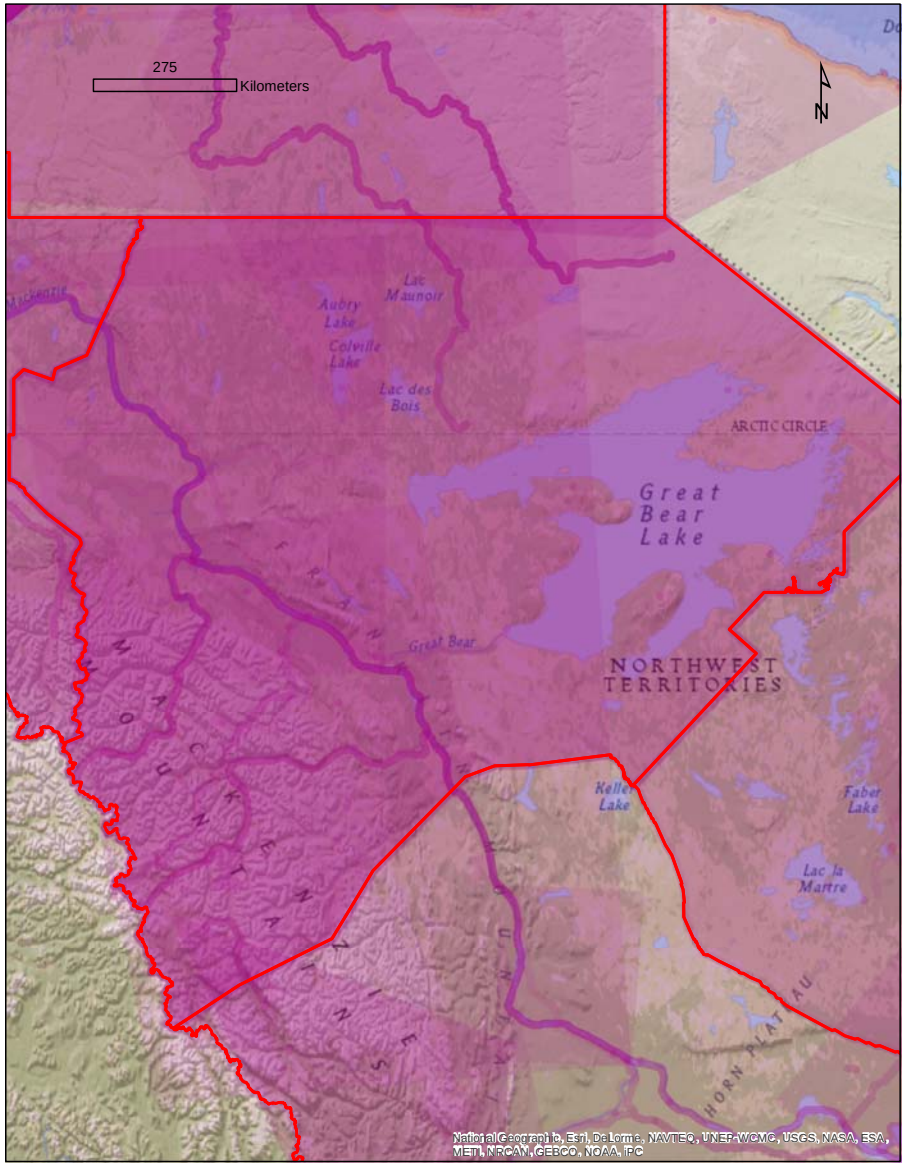


FIGURE 38. FIELD WORK LOCATIONS, SAHTÚ SETTLEMENT AREA, 1991-2001.

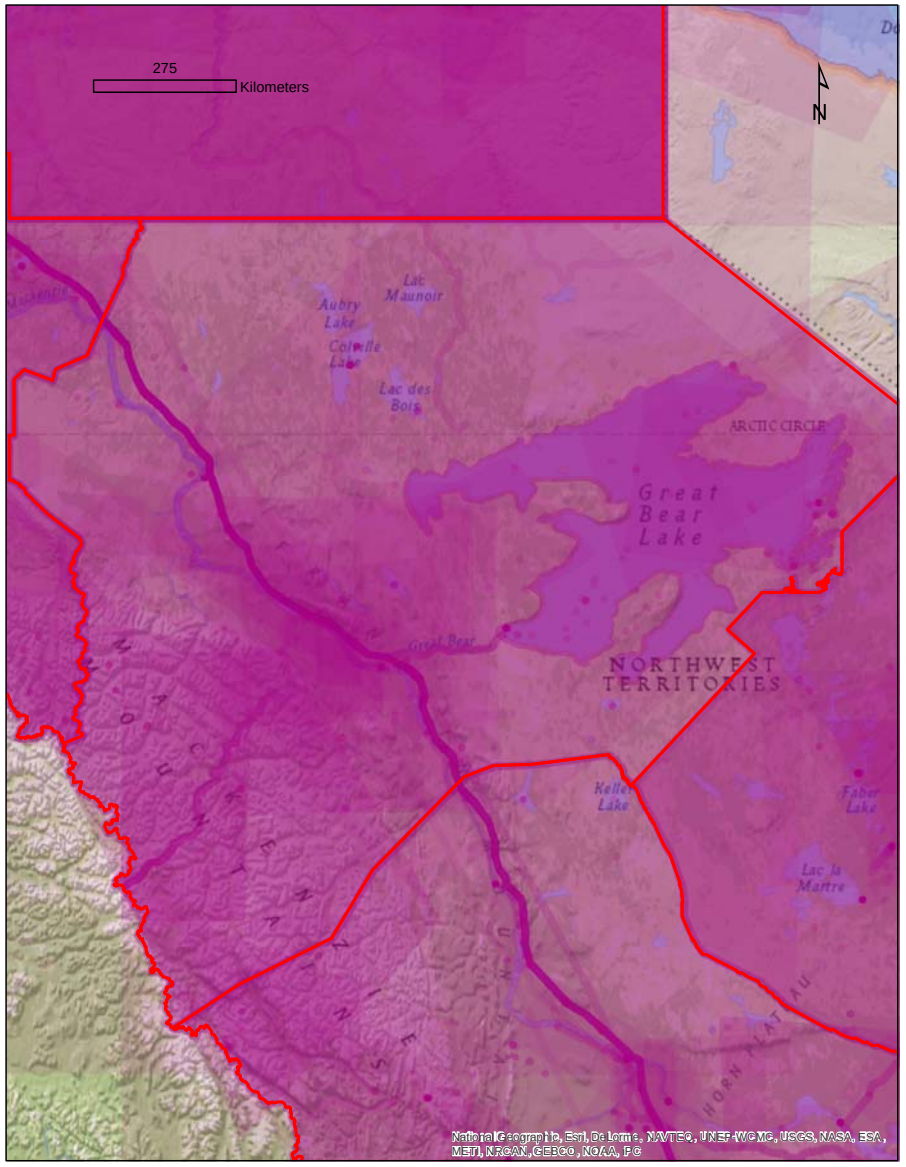


FIGURE 39. FIELD WORK LOCATIONS, SAHTÚ SETTLEMENT AREA, 2002-2013.

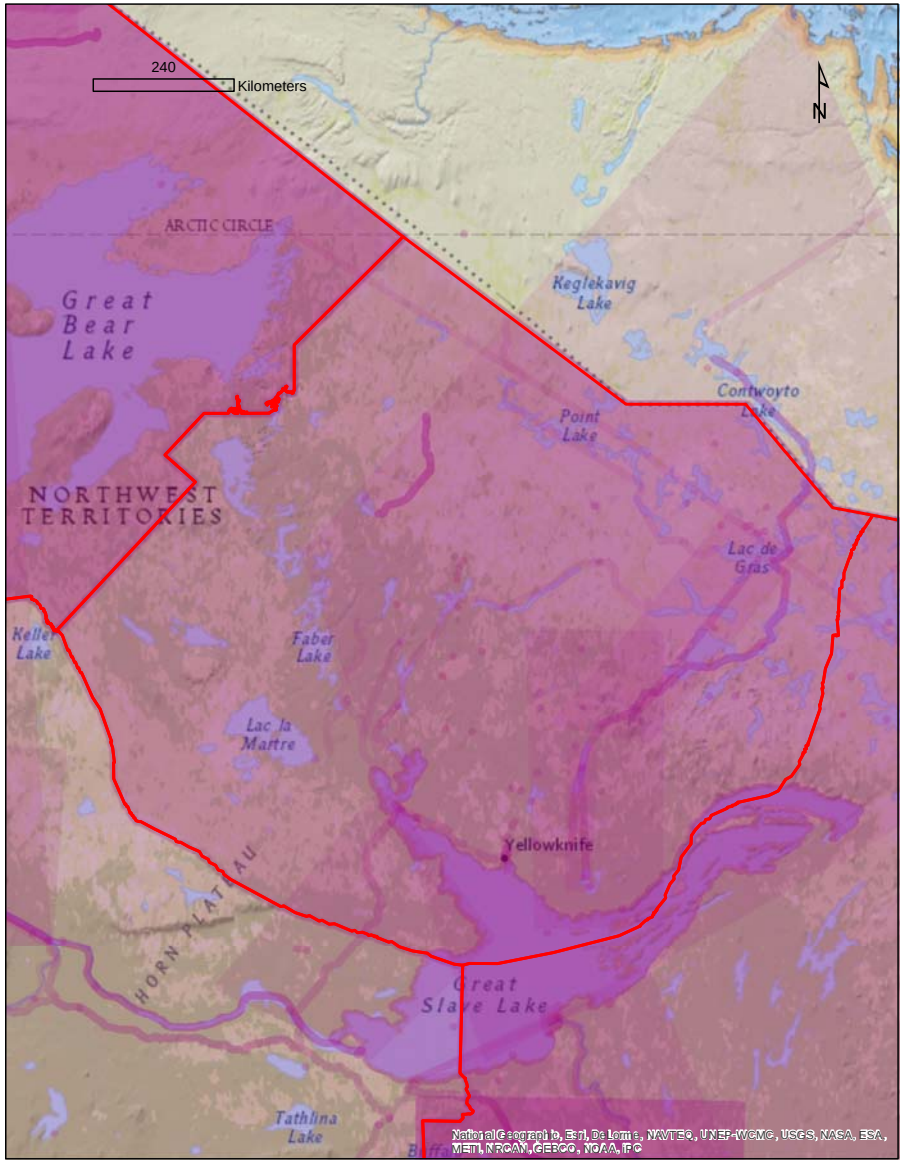


FIGURE 40. FIELD WORK LOCATIONS, NORTH SLAVE AREA, 1991-2001.

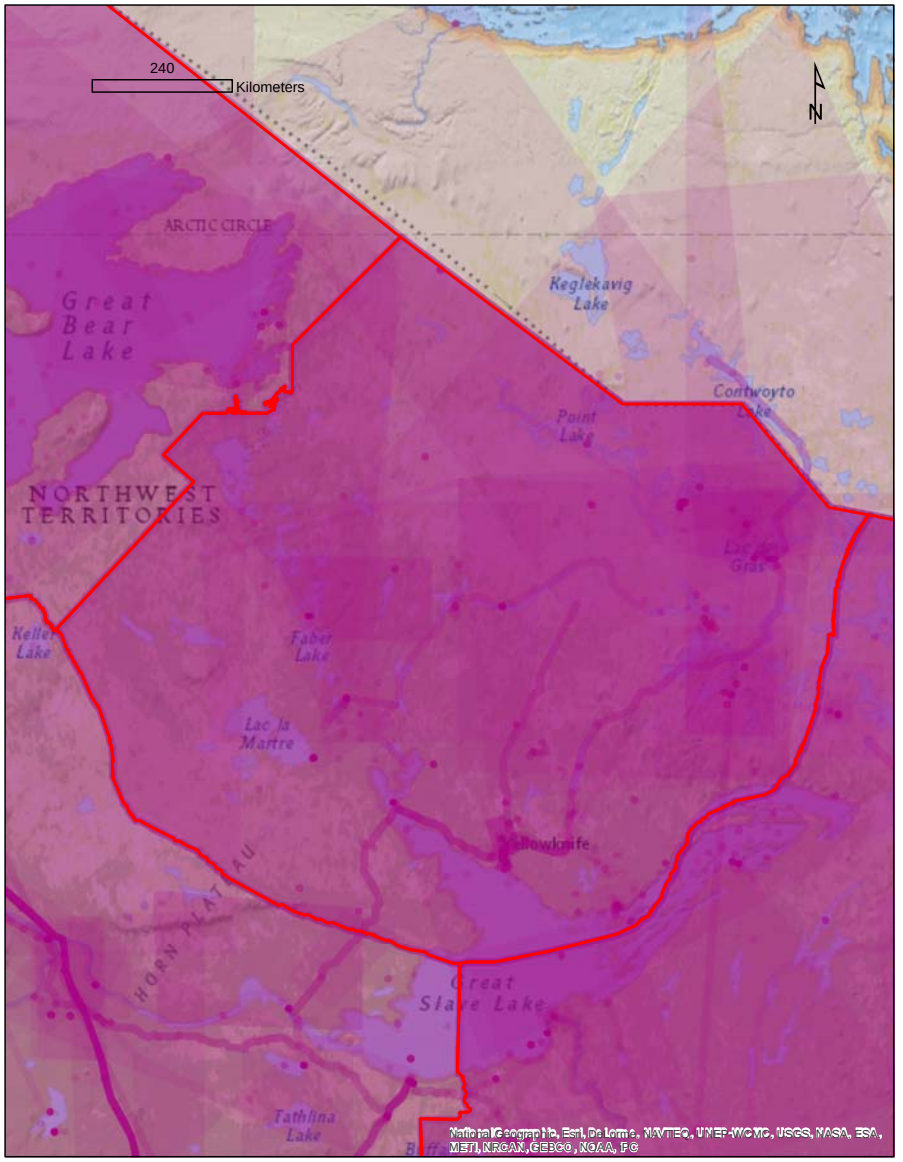


FIGURE 41. FIELD WORK LOCATIONS, NORTH SLAVE REGION, 2002-2013.

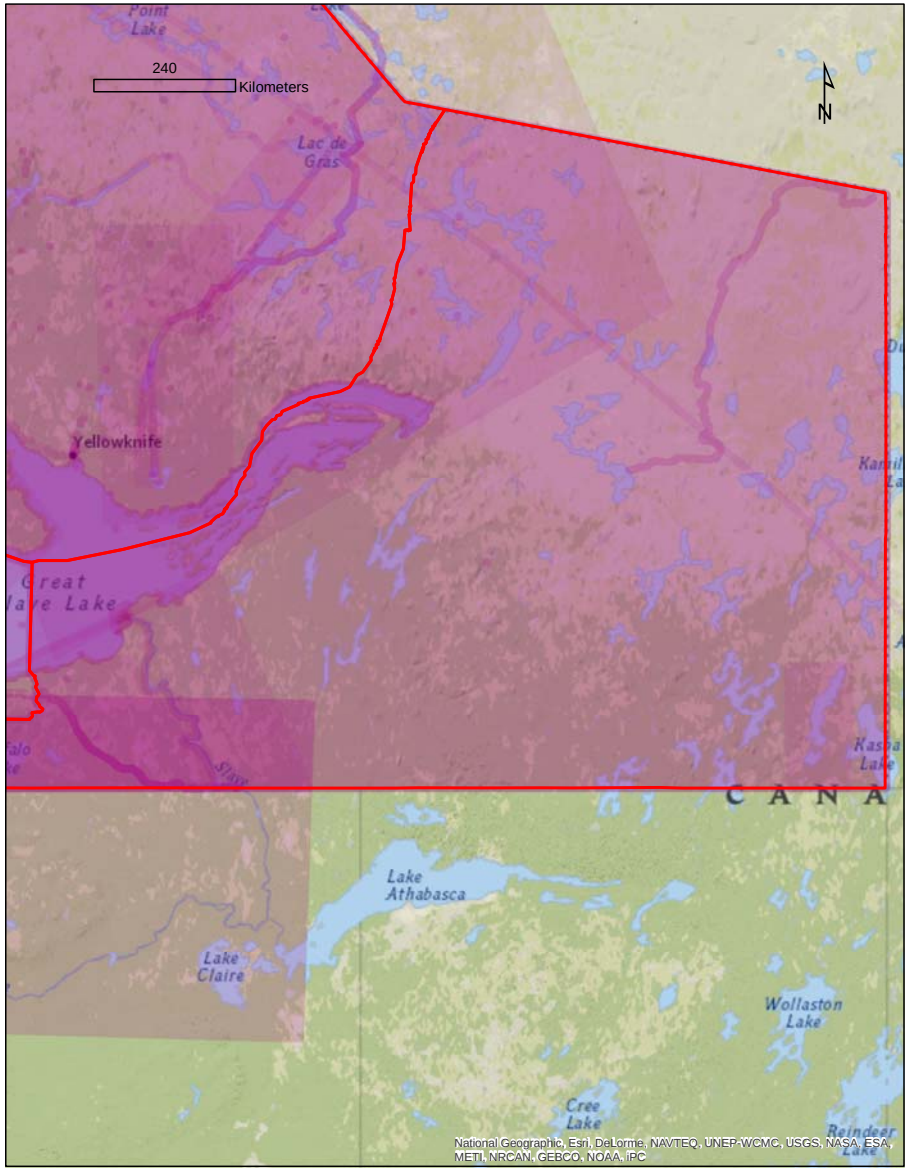


FIGURE 42. FIELD WORK LOCATIONS, SOUTH SLAVE AREA, 1991-2001.

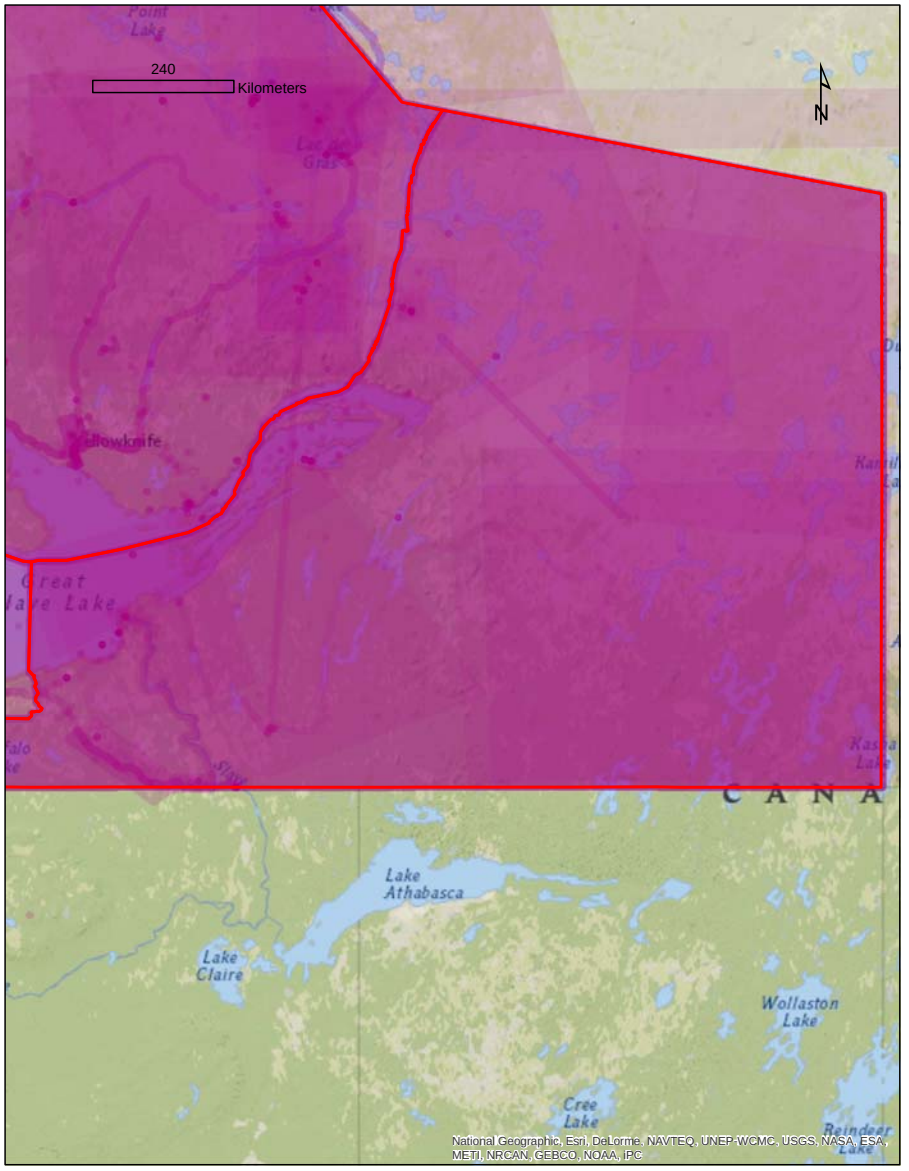


FIGURE 43. FIELD WORK LOCATIONS, SOUTH SLAVE REGION, 2002-2013.

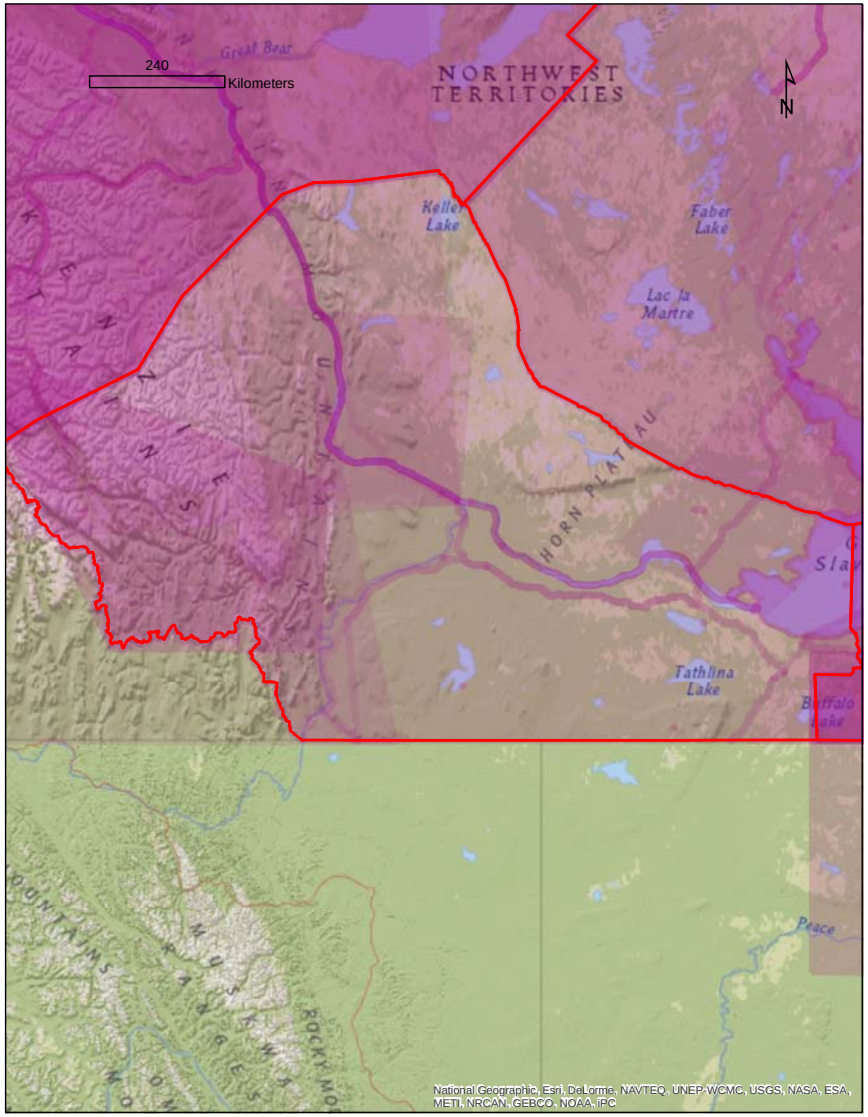


FIGURE 44. FIELD WORK LOCATIONS, DEHCHO REGION, 1991-2001.

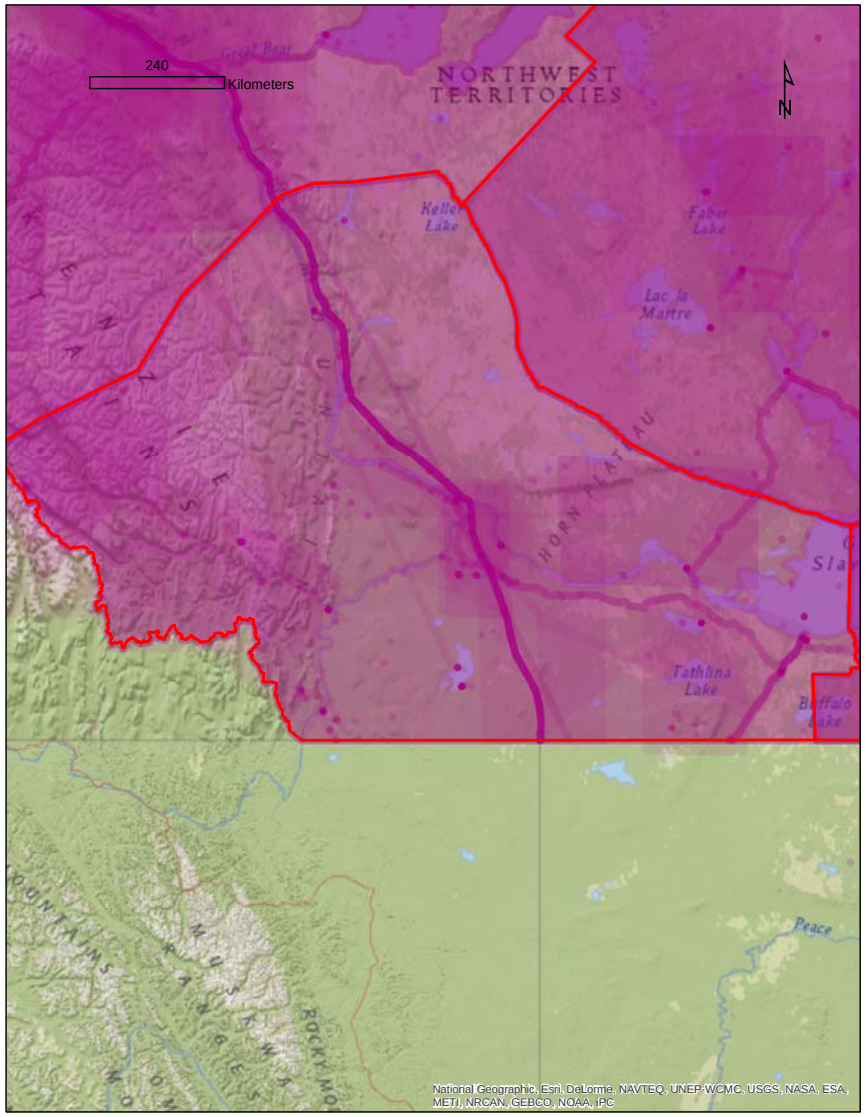


FIGURE 45. FIELD WORK LOCATIONS, DEHCHO REGION, 2002-2013.

In the Inuvialuit Settlement Region, research in the 1990s focussed on the Mackenzie Delta and the Arctic Coast towards Tuktoyaktuk. The linear north-south shapes are rivers and surrounding areas, which were the subject of various research projects such as contaminant introduction to the Arctic, lemming research, and plant research.[15] Research in the 2000s was much more broadly distributed. There was still a concentration in the Mackenzie Delta, although the ocean areas were much more the focus of research. The route of the Mackenzie Gas Project was also a focus of research.

In the Gwich'in Settlement Area, the Mackenzie Delta was an important geographic focus of research in the 1990s and 2000s. The Mackenzie and Peel rivers, and to a lesser extent, the Arctic Red River, were also the focus of research. The Dempster highway was a research focus in the 2000s. As in the Inuvialuit Settlement Area, the whole GSA received more research attention in the 2000s.

In the 1990s in the Sahtú Settlement Area, rivers were a focus of research as well, including the Mackenzie, Anderson, Horton, Mountain, and Keele rivers. Rivers remained a focus in the 2000s, and Great Bear Lake and Great Bear River were also more frequently researched. There was more research in general across the Sahtú Settlement Area over this period.

In the North Slave and South Slave regions, the Great Slave Lake, various rivers, and the Tibbit-Contwoyto Road were the focus of research in the 1990s. The area around the Slave River was also a research focus. In the 2000s, there was a greater density of research across the North Slave and broadly distributed across the South Slave. In the 2000s, highways in the North Slave and Dehcho Region were more often the focus of research activity. The Mackenzie River is the greatest focus of research in the Dehcho Region in the 1990s. Other rivers attracted research in the 2000s, along with roads and numerous small research locations in the Mackenzie Mountains, around lakes, and in communities.

[15] The prevalence of river features is also related to how geography is assigned in the database to research projects. If a project happened in proximity to a river, that project would be assigned the river's shape.

References

Aurora Research Institute

2011 Retrospective on Research Licensing in the Northwest Territories 2000-2009. Inuvik: Aurora Research Institute and Canadian Arctic Research Licensing Initiative (CARLI). Available via: http://nwtresearch.com/sites/default/files/retrospective-on-research-licensing-in-the-nwt-2000-2009.pdf

Appendix 1: Assumptions and information about data analysis

1.1 General information

All licence data was merged (i.e. from 1974 to 2013). Duplicate entries from overlap in database formats were removed. The amount and type of information available for each licences increases over the years, which affected the types of questions that can be answered for earlier vs. later decades. Some information was back-filled manually where possible, for earlier licences.

Licence information was provided in three general formats. There was an increasing amount of information gathered over the years.

1. Comma separated text spreadsheets of licence information between 1974-1996,
2. "Approach" database, from licences between 1996 and 2009,
3. "POLAR" database, from licences between 2005 and 2013.

The early spreadsheets and Approach data were entered manually by the licensing office. POLAR has a web interface, and researchers fill out their applications themselves.

The online POLAR application system and database improved ARI's means of getting applications to community organizations for feedback. This in turn increased the amount of time these organizations have to review applications.

1.2 Trends in gender of Principle Investigator by year and discipline

Gender was assigned to PIs based on salutation, name, and pronoun use in public information. In some cases, no name was available, and in some cases, it was not clear. Although this system is very basic and will miss some of the nuances of gender affiliations and gender non-specific names, it was still considered of interest here.

1.3 Trends in time between date of application and date of issue

The number of days was calculated using Microsoft Excel's DAYS360 function, which uses a 30 day month.