

Greenland's new legislation on commercial and research-related use of biological resources: implications for the International Polar Year and later

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ABSTRACT. New possibilities for economic development have been identified by the Greenland Home Rule Government in recent years. One of these is the potential for development of biotechnology based on Greenland's biodiversity. To ensure that Greenland shares in benefits derived from the exploitation of these resources the Home Rule Parliament recently enacted legislation on commercial and research-related use of biological resources that is premised on rights recognised by the 1992 Convention on Biological Diversity. This legislation represents the first law in an Arctic jurisdiction specifically to create a mechanism for access and benefit sharing in relation to Arctic genetic resources. The main area of research and commercial interest so far relates to potential developments in biotechnology from the microbial diversity of ikaite tufa columns located in the Ikka Fjord in southwest Greenland. The legislation seeks to provide a mechanism for regulating access to such biological resources and a means for Greenland to share in the potential benefits that may come from scientific research on them and subsequent commercialisation. Much research in Greenland now falls within the scope of this legislation. The purpose of this article is to explain the provisions of the legislation to the polar research community as well as to review its implications for research in the International Polar Year and later. The legislation imposes many new obligations on researchers in Greenland including obligations to obtain survey licences, obligations on reporting and the regulation of publication of scientific research. Commercially focussed research is also tightly regulated with a particular emphasis on patent rights. However, many aspects of the legislation are uncertain and it is unclear how much of the legislation will be implemented in practice.

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Introduction

In 1979, Greenland obtained Home Rule or autonomy within the Danish realm. For most people in Greenland it is widely understood that continued autonomy depends on economic development (Lyck 1989). In order to enhance this autonomy, Greenland seeks to broaden its economy beyond a limited base which is heavily dependant on transfers from the Danish state and fisheries. Fishing, for example, provides some 93% of Greenland's exports relying heavily on two species, prawns and Greenland halibut (Statistics Greenland 2005). A number of new economic possibilities have been identified by the Home Rule Government in recent years. These new opportunities include expanded mineral resource and oil exploitation, tourism, as well as the potential for the export of ice and water, niche food and beverage markets (such as boutique beers and vodka), and involvement

in the international biotechnology industry (Greenland Department of Industry 2007).

It is the latter of these new economic possibilities that is the focus of this article. In particular it considers the recently enacted legislation on commercial and research-related use of biological resources (the biological resources legislation). This was enacted by the Home Rule Parliament on 20 November 2006 and it entered into force on 1 December 2006 (Greenland, Home Rule Parliament 2006b). The Bill, as presented to Parliament, was not amended by that body. The legislation potentially applies to a wide range of scientific research activities in Greenland during the International Polar Year (IPY) and later. The purpose of this article is to disseminate information in relation to this new law to the broader polar research community. The paper begins by giving an overview of the origins of the legislation including some brief comments on the nature and scale of the emerging interest in the biotechnology potential of Greenland's biodiversity. The paper then continues to outline the key provisions of the legislation before concluding with a brief examination of unresolved questions surrounding the implementation of the legislation and its implications for research in Greenland during the IPY and later.

Background to the legislation

The new era of 'genome enabled' biology in polar regions offers new possibilities across a wide range of scientific disciplines including systematics, microbiology, ecology, evolutionary biology, physiology, biochemistry and

molecular biology (National Research Council 2001). The exotic organisms of polar ecosystems are ideal candidates for genomic analysis and have excited commercial interest in their potential for novel developments in biotechnology (Clark and others 2004). Much of the focus to date has been on Antarctica. A number of recent studies (for example Lohan and Johnston 2005; Hemmings and Rogan-Finnemore 2005) have highlighted the potential for new developments in biotechnology that is offered by Antarctica. More recent data on trends in patents granted in relation to biotechnology based on research in relation to Antarctic genetic resources shows that this interest continues unabated. A report tabled at the XXXth Antarctic Treaty Consultative Meeting in New Delhi, India noted that a search of European and United States patent databases revealed that for the period 2004–2006, a further 20 patents had been granted in relation to inventions utilising Antarctic genetic resources (UNU-IAS 2007). These 20 patents are in addition to those identified in previous studies such as those noted above (UNU-IAS 2007).

Relatively little attention has been given to developments in the Arctic region despite evidence of interest in countries such as Norway and Finland, as well as in Greenland (Leary 2007a). While debate is continuing with respect to how issues associated with bioprospecting and biotechnology in Antarctica should be handled, legislative regimes which deal with these issues are emerging in a number of Arctic jurisdictions. For example, Norway is in the process of developing legislation on access to genetic material as well as legislation on the utilisation of marine organisms that will apply to the Norwegian high north. This legislation is a component of Norwegian government policy to develop its marine biotechnology industry (Leary 2007a).

In the case of Finland the exploitation of Arctic genetic resources is currently unregulated. However, a review of that situation commenced in October 2004 with the establishment of a working group under the Finnish Advisory Board on Genetic Resources, and consideration of possible options for regulation and the preparation of draft legislation is underway (Finland, Ministry of Environment 2006).

While development of legislative and policy regimes in these jurisdictions is continuing, Greenland's biological resources legislation represents the first law in an Arctic jurisdiction specifically to create a mechanism for access and benefit sharing in relation to Arctic genetic resources.

Greenland is the sovereign territory of Denmark, or perhaps more correctly following the implementation of home rule in 1979, Greenland is an autonomous 'distinct community . . . within the framework' of the Danish realm (Denmark 1978). While technically responsibility for fulfilling international obligations under treaties such as the 1992 Convention on Biological Diversity (CBD) lies with Denmark, because of the constitutional structure of Greenland Home Rule, as a practical matter much of the

actual implementation of these treaties falls to the Home Rule Government.

Under the Danish legislation granting home rule to Greenland the Danish state transferred legislative powers in a range of areas to the Greenland Home Rule Parliament. Pursuant to the Home Rule Act 1978 (Denmark 1978), the home rule authorities exercise legislative and executive powers with respect to several areas including:

- Fishing, hunting, agriculture and reindeer breeding;
- Conservation;
- Legislation governing trade and competition, including legislation on restaurant and hotel business, regulations governing alcoholic beverages, and regulations governing closing hours of shops;
- Other matters relating to trade, including state-conducted fishing and production; support and development of economic activities; and
- Protection of the environment.

Arguably the constitutional competence of the Home Rule Parliament to pass the biological resources legislation lies in one or more of these heads of power. The legislation in part relates to issues of trade, support and development of economic activities, and to a lesser extent protection of the environment and conservation. Certainly there has been no objection from Denmark with respect to the competence of the Home Rule Parliament to enact this legislation.

While the constitutional competence of the Home Rule government to enact this legislation may be clear, whether the level of biotechnology industry interest in Greenland's biodiversity warrants such legislation is less clear. At best it is reasonable to say that industry interest is exploratory only in nature and, in part, this interest has been a response to emerging interest in the development of biotechnology from Antarctica (P. Andersson, personal communication, 2007).

The main area of research interest so far relates to potential developments in biotechnology from the microbial diversity of ikaite tufa columns located in the Ikka Fjord in southwest Greenland (61°11'N; 48°01'W). The Ikka Fjord is an old glacier valley created during the last ice age some 8–10,000 years ago (Aarup 2006). Water seeping through crevices in surrounding mountains, rich in carbonate, bi-carbonate and sodium, trickles out from submarine springs and, upon meeting the surrounding seawater in the fjords, forms the ikaite tufa columns (Aarup 2006). The Ikka Fjord contains a low temperature alkaline environment which contains a range of psychrophilic alkaliphiles (Stougaard and others 2002). To date most alkaliphilic microorganisms have been isolated from environments influenced by industrial activities such as cement production, mining operations, food processing and sewage plants and are rarely found in nature (Stougaard and others 2002). The ikaite tufa columns of the Ikka Fjord contain distinct microbial communities that are different from other known alkaline or polar environments and are therefore, unique (Schmidt

and others 2006). Microbial communities in alkaline environments have been subject to considerable study recently with respect to the possible biotechnological and industrial applications of alkaliphilic enzymes (Schmidt and others 2006).

The explanatory memorandum to the Bill that ultimately became the bioresources legislation highlights that the potential for exploitation of the ikaite columns is the main initial area of focus for developments in biotechnology. Thus it observed:

The ikaite columns are interesting from a basic research perspective. They are found in an environment that provides unique growth conditions for different microorganisms. This makes them potentially interesting for biotech enterprises that see industrial application potential in the microorganisms found on the ikaite columns. It is assessed that Greenland may benefit from these activities.

Despite requests from companies interested in exploiting these resources the Home Rule Government decided that licences were not to be granted for utilisation of such resources until a legal basis was in place to govern their exploitation (A. Olsen, personal communication, 2007).

At least three companies, two Danish and one Spanish, are known to have expressed interest in research and development with respect to the biotechnology potential of Greenland's biodiversity. One of the first companies was Arla Foods which is a Danish company with interests in milk based products in Sweden, the United Kingdom, Saudi Arabia, Argentina, Brazil, Poland, USA and Canada (Arla Foods 2007). Arla Foods was a formal participant in a project with Danish researchers on 'extremophilic microorganisms and enzymes'. Arla Foods were interested in both temperature stable enzymes and cold-active enzymes for various dairy processes. Recently, the company has confirmed its interest in another project which will aim to develop new peptides using milk proteins cleaved with cold-active proteases from Arctic microorganisms (P. Stougaard, personal communication, 2007).

Another company with interest in this area is Bioneer A/S that has established a collection of extremophilic microorganisms from Greenland. Bioneer A/S is an independent, research-based service company involved in research and development in the broad fields of biomedicine, biomedical technology and biotechnology. The collection of extremophilic microorganisms held by Bioneer currently serves as a screening source of new enzyme candidates for customers within the broad fields of medical research, biotechnology and food technology (Bioneer 2007).

While the unique microbial biodiversity of the ikaite tufa columns of the Ikka Fjord have been the main focus of research and commercial interest this is not the only area with potential for commercial development, outside traditional forms of exploitation such as hunting and fishing. One area worth noting relates to the potential of secondary compounds from arctic plants such as arctic angelica for developments in pharmaceuticals and fine

chemicals (P. Mølgaard, personal communication, 2007). Such research is not without precedent, for example in Iceland, Sagamedica ehf has developed nutraceutical or herbal medicines based on arctic angelica which it currently markets (Sagamedica 2007). Angelica is a medicinal plant that has been used to treat illness in Iceland and in other parts of Scandinavia since Viking times. Products marketed by Sagamedica are supposedly efficacious in treating symptoms of a number of ailments including coughs, colds and sore throats, as well as some symptoms associated with prostate cancer (Sagamedica 2007). Another research project worth noting is work that has been undertaken by Danish researchers on the potential for using seaweed from Greenland fjords as fodder for sheep (Nordic Seaweed Project 2004).

An overview of the legislation

The following overview of the legislation is based on unofficial English translations of the explanatory notes to the Bill for the biological resources legislation that were provided to the author by the Home Rule Government, unless otherwise referenced (Greenland, Home Rule Parliament 2006a). While these translations were carried out for the Home Rule Government by a professional translation agency, the translation is unofficial and the Danish version of the legislation should be consulted for official or legal purposes.

Before being enacted drafts of the legislation went through several rounds of consultation with a range of stakeholders. These included companies and entities with potential interest in developing biotechnology in Greenland including Greenland Venture A/S (the main company utilised by the Home Rule Government to encourage investment in, and exports from, Greenland); Bioneer A/S; the Danish Royal Veterinary and Agricultural University; the law firm Gorrissen Federspiel Kierkegaard; Grønlands Turist-og Erhvervselskab A/S (Greenland's tourism and business society); Grønlands Arbejdsgiverforening (Greenland's employers' organisation); and Greenland and Danish government agencies including the Bureau of Minerals and Petroleum, the Bureau of Corporate Governance, the Ministry of Culture, Education, Research and the Church, the Ministry for Environment and Nature, the Department of Foreign Affairs, the Department of Taxation, the Ministry of Finance, and the Department of Industry.

After this first round of consultation a revised Bill was circulated for comment to the same entities as well as to the Danish Forest and Nature Agency, the ATI fisheries industry school in Maniitsoq, the Inuili food school and the Greenland Institute of Natural Resources. After these two rounds of consultation the Bill was enacted in its current form (Greenland, Home Rule Parliament 2006b).

Purpose and scope of the legislation and key definitions

Referring to the CBD, Section 1 of the Act lists four main aims as follows: (1) exploring biological resources

in accordance with the CBD; (2) utilising research results to create commercial value; (3) ensuring that Greenland gets a fair share of the value created on the basis of biological resources; and (4) utilising biological resources in a manner appropriate for the environment and nature. The explanatory notes to the Bill explain that the concept of ‘exploring’ biological resources suggests that the Act seeks to facilitate the survey and mapping of Greenland’s biological diversity with a view to discovering new and unknown biological resources, and that known biological resources should be explored with a view to finding new and different ways to use them. The focus of the legislation is therefore on the ultimate commercial utilisation of Greenland’s biological resources. As the explanatory notes to the Bill make clear: ‘It is deemed most appropriate to realize this by giving the Greenland government a direct or indirect controlling influence on such commercialisation’ (Greenland, Home Rule Parliament 2006a).

In addition, another main focus of the legislation is to develop Greenland’s own knowledge base in relation to its biodiversity. At a later date it is hoped that trade schools and colleges in Greenland, such as the ATI fisheries school in Maniitsoq might come to have a role in the systematic compilation of such data.

In order to give effect to the aims of the legislation it applies to a very broad range of activities. Thus Section 2(1) provides that the Act applies to

- 1 All forms of commercial and research-related acquisition, collection, receipt, use and export of biological resources.
- 2 Publication of survey and research results as well as patenting of biological resources.
- 3 Other commercial use as well as products extracted from or produced on the basis of biological resources.

Examples of activities covered by Section 2(1) given in the explanatory notes to the Bill include the collection of plants and animals as well as taking samples of ice cores, ikaite columns, soil, sediment and marine ice samples. Potentially this means that the legislation applies to most forms of scientific research in Greenland in relation to biological resources, but it also potentially extends to the broad fields of geology, agronomy and oceanography to name but a few where biological resources may inadvertently be sampled, although that is not the main focus of research.

However, Section 2(4) also provides a mechanism for applications by researchers for an exemption from the legislation for specific research purposes. The explanatory notes to the Bill suggest that this provision allows for dispensation for specific research purposes and may be granted to individual projects as well as to specific institutions. One example given in the explanatory memorandum to the Bill is in the case that the main objective of the research is not the acquisition, collection, use and export of biological resources, but rather that this takes place as a by-product of the research activities. It is not clear

how widely such an exemption will be granted especially given one of the main goals of the legislation is to increase the knowledge base in relation to Greenland’s biological resources. Like many of the provisions of this legislation, it is not yet clear how this provision will operate in practice, and thus it is not clear what type of research might be exempted under this provision.

It is worth noting that there are a number of other exceptions provided for in Section 2. Thus the legislation does not apply to ‘human biological resources’ and to general and non-technological utilisation of natural resources, such as traditional hunting, fishing and agriculture or collection of plants etc. for decoration or consumption. As the explanatory notes to the Bill explain, this means that the legislation does not apply to so called ‘private collection and use of biological resources’ that is collection and use for one’s own personal purposes with no subsequent professional intentions. Examples given in the explanatory memorandum include picking flowers or collecting stones for decoration at home, and picking spices, herbs, tea and plant oils used for personal consumption.

The legislation potentially therefore applies beyond just commercial focused biotechnology research and development although with several exceptions as noted above. Similarly because of the way the legislation is structured, it could extend beyond activities that may typically take place in the field to include activities associated with the publication of research results by scientists, as well as to commercial research and development, and ultimately patents and product marketing. While many countries have developed or are in the process of developing similar legislation in accordance with the CBD, the Greenland regime is perhaps the broadest of any of the regimes developed in the world, especially having regard to the very strict regulation it places on scientific research.

Essential to the understanding of the broad scope of the legislation are the key definitions used throughout the legislation as set out in Section 3. For present purposes the two most significant definitions are the definitions of ‘Biological resources’ and ‘Commercial utilisation’. ‘Biological resources’ are defined as ‘all kinds of genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity’.

This definition mirrors the definition of biological resources contained in Article 2 of the CBD. It has been suggested that by using the term ‘Biological resources’ the scope of operation of the legislation is much wider than that of the CBD. Thus the explanatory notes to the Bill stated that the

point of departure of the Bill is the [CBD]’s definition of biological resources and not just genetic resources, cf. Section 3, in order to give the Bill a wider scope. However, the [CBD] only regulates access to genetic resources. The scope of this Bill thus builds upon the Convention’s principles of commercial utilisation-not

just for genetic resources, but also for a wider area, namely biological resources (Greenland, Home Rule Parliament 2006a).

But given that the definition of biological resources in the legislation mirrors the definition contained in the CBD, it is difficult to see what the semantic difference is between the two concepts in the context of the legislation. Especially having regard to the fact at a simplistic level it is possible to say that all biological resources by definition also contain genetic resources that is genes and DNA.

The explanatory notes to the Bill shed some light on the legislator's intention here.

The Bill covers biological resources and not just genetic resources in order to avoid the unfortunate limitation that could lead to Greenland missing out on considerable licence income. The concept of 'genetic resources' is especially used in connection with industrial enzymes, as they are normally coded for a single gene, which means the fundamental unit and commercialisable [sic] resource is a gene that can be isolated, characterized and developed biotechnologically [sic].

The pharmaceutical and biomedicine industries mainly operate in an entirely different way. Typically, an enterprise developing pharmaceuticals will screen a large number of extracts from different organisms for biological activity. The active substance is isolated and characterised, and in this connection, the molecular structure of the active substance is determined and, finally, new commercial pharmaceuticals are synthesised chemically. The reason for this is that biologically active substances are very often coded by many genes that may be difficult to isolate and develop through biotechnology, while a practicable and more affordable solution is to synthesise the substances chemically. There are a number of examples of recent medical drugs and drug leads developed from extracts of biological resources without genes or genetic resources having been involved. In order for Greenland to get a part of the benefit available for the pharmaceutical industry, this Bill uses the term 'biological resources' instead of 'genetic resources' (Greenland, Home Rule Parliament 2006a).

As the explanatory notes suggest, the legislators clearly intended that the legislation should extend to include so called 'derivatives' that is semi-synthesised or totally synthesised compounds based on structures discovered from studying genetic resources (ten Kate and Laird 1999). However, by merely adopting the definition of 'genetic resources' from the CBD and re-naming the same as 'biological resources' it is unclear whether in fact derivatives are included in the scope of the legislation. The better interpretation appears to be that they are not. The potential benefits to Greenland are thereby greatly diminished.

The other key definition worth noting is 'commercial utilisation' which is defined as meaning: 'production or resale of products or knowledge based on biolo-

gical resources and commercialization of patent rights covering biological resources or based on biological resources'.

This appears to be a very broad definition. Arguably the rights asserted by this provision seem to go far beyond what was originally intended by the provisions of the CBD. The CBD recognises a number of key concepts. For present purposes the key provisions of the CBD of relevance are Article 3 and Article 15. Article 3 in part explicitly recognises the sovereign right of states to exploit their own resources pursuant to their own environmental policies. Article 15 recognises the right of states to determine access to genetic resources on mutually agreed terms as well as the right to share in the benefits of their commercialisation. What is unclear and is an issue of significant debate is how far states (or in the case of Greenland autonomous regions within states) can claim rights to control the use of knowledge associated with such resources or patent rights. Certainly there has been considerable debate as to the relationship between rights recognised under the CBD and patent rights. There is definitely a significant 'missing link' between the regime recognised by the CBD and other international regimes such as the Agreement on Trade-Related Aspects of Intellectual Property Rights or TRIPS (Leary 2007b). Although there is a range of views on these issues it is arguable that the definition of 'commercial utilisation' contained in this legislation stretches the boundaries, if not going beyond the rights recognised by the CBD. Having said that, however, as a matter of international law outside the CBD it is certainly open to a state (or in Greenland's case an autonomous region within a state) to legislate as it sees fit provided its constitutional competence allows it to do so. But this question is made even more problematic by the uncertainty surrounding patent law in Greenland, a matter that is discussed in more detail below.

Survey licences

Under Section 6 of the legislation any acquisition, collection or survey of biological resources in connection with research or with a view to possible subsequent commercial utilisation will require a survey licence. Curiously Section 6(2) of the legislation provides as follows. 'The survey licence shall be subject to the applicant complying with the regulations on commercial utilisation of genetic resources laid down in the [CBD] and respecting Greenland's rights to biological resources'.

It is unclear what this provision means. The CBD does not contain any 'regulations' *per se* related to commercial utilisation other than the general provisions of Article 3 and 15 of the CBD referred to above. The CBD is a framework treaty only and which sets out only general principles. The explanatory notes to the Bill do not shed any light on the meaning of this provision referring only to the fact that rights to control access to biological resources are recognised by the CBD. This is one further aspect of the legislation that may be clarified by later regulations under the Act.

Under Section 6(3) survey licences are granted without commercialisation rights. The terms of the licences will be on terms imposed by the Greenland government including in particular, terms stipulating that collection must be carried out so that the environment and nature suffer the least possible damage; the geographical area of collection; methods to be used in connection with collection of biological resources; reporting obligations; and transfer of rights to the Greenland government or the utilisation enterprise, if the licensee itself does not wish to utilise commercially knowledge obtained on the basis of the survey licence. Pursuant to Section 6(7) changes in use or application including changes in collection methods, places or types of biological resources will require a new survey licence. Survey licences will be for a limited period and will lapse if not renewed.

Finally it is worth noting the tight control the Home Rule Government seeks to maintain over the results of any such research. Thus Section 6(10) of the legislation provides: 'Any kind of transfer to or communication to a third party of the survey licence, all or parts of the survey materials or survey results shall be subject to advance approval by the Greenland government'.

The explanatory notes to the Bill indicate that transfer or communication of the survey licence, survey materials and results includes sale and cost-free transfer.

At a minimum, these provisions could be interpreted to mean that scientists would not be free to share or publish their results or indeed to share biological samples collected with their colleagues in the research community without first obtaining prior permission from the Home Rule Government. On face value this might act as a disincentive to research because the need to obtain several approvals would interfere with the normal scholarly processes such as peer review. Whether such an absurd outcome will actually occur in practice is unclear.

Commercial utilisation of Greenland's biological resources

Part 2 of the legislation provides that Greenland's rights to biological resources shall be managed by one or more 'utilisation enterprises' and the Greenland government is authorised to arrange this. Under Section 4 of the legislation a utilisation enterprise may be granted the exclusive right to manage such rights commercially for a period of up to ten years. This period may be extended for additional periods of up to ten years provided agreed performance targets are met during the period. The utilisation enterprise may also be authorised to utilise biological resources commercially and to sell commercial licences on behalf of Greenland.

It is anticipated that the utilisation enterprise will be the primary vehicle through which Greenland's biological resources are developed and exploited. It is anticipated that the Greenland government would hold a controlling interest via majority ownership of shares in the utilisation

enterprise. Current proposals are that the initial utilisation enterprise might be established via non-cash contributions from the Greenland government with exclusive rights to sell commercial licences on commercial terms for utilisation of a limited area of biological resources (A. Olsen, personal communication, 2007). The explanatory notes to the Bill indicate that the Home Rule Government would like to see a biotechnology company contribute its collection of already collected microorganisms from environmental niches in Greenland. The Greenland government is currently in negotiations with Bioneer A/S with a view to that company contributing its rights in relation to the extensive collection of Greenlandic microorganisms mentioned above to the proposed utilisation enterprise. The final structure of the proposed utilisation enterprise will be reflected in an agreement by shareholders as well as in further regulations that have yet to be passed.

Negotiations for the creation of such a utilisation enterprise, tentatively known as Nuna Biotech are still continuing. One of the major stumbling blocks may be the availability of sufficient capital to fund the company's start up operations. The explanatory notes to the Bill indicate that the Greenland government wishes to rely on Danish and foreign capital for the start up. But given the speculative nature of such a venture it may be that significant capital contributions from government may be required.

Assuming that a utilisation enterprise is eventually created, then the explanatory notes to the Bill indicate that in its original form it is proposed that the utilisation enterprise would include a sales unit which would take care of the sale of commercial licences, and a biotechnology laboratory. The laboratory would be established in Greenland for the purposes of collection of samples and systematisation and cultivation thereof. The required knowledge and technology for this would be transferred from what is referred to as a 'biotech enterprise' that would establish operations in Greenland or through strategic partnerships with interested companies and organisations within the international biotechnology sector (A. Olsen, personal communication, 2007)

One of the main tasks of the utilisation enterprise would be to market Greenland's biodiversity and its genetic resources internationally as a unique source of new product opportunities within a wide range of markets, such as pharmaceutical and biotechnology industries, food ingredients and industrial enzymes. Key to understanding the control of the utilisation enterprise over the commercial utilisation of Greenland's biological resources are the provisions of Section 10. Section 10 provides that commercial utilisation and survey results from biological resources can only be undertaken with a commercial licence issued by the utilisation enterprise. Section 3(4) of the legislation defines 'commercial licence' as 'a licence that grants rights to commercial utilisation of biological resources and survey results based on biological resources'.

Section 10(3) provides that detailed terms of a commercial licence would then be set out in private-law agreements with applicants. A fee will be payable for such a commercial licence and this will be calculated on the basis of factors such as the duration, scope and expected financial return on the licence.

Reporting obligations

As is common with regulation of scientific research in many jurisdictions, the Greenland legislation imposes reporting obligations on holders of survey and commercial licences. Thus holders of such licences must submit annual reports on work undertaken pursuant to such licences, as well as copies of published articles and notify any commercial utilisation pursuant to the provisions of Section 12(1). This information will then be passed on by the Greenland government to specially selected knowledge centres and to the utilisation enterprise. A similar reporting obligation applies where a research project ceases before completion of research and includes an obligation to give reasons for ceasing research. Under Section 12(3), if the Greenland government is of the view that reports do not contain sufficient information then the government is empowered to require that more information be provided.

Under Section 8, any person involved in publication or other communication of survey results based on the biological resources of Greenland is obliged to inform the Greenland government of the publication no later than the time of publication. Copies of written publications that deal with biological resources must be submitted to the Greenland government. The Greenland government will then pass on details of publications and survey results to the commercial utilisation enterprise.

It is worth noting that Section 8 stresses that 'any person involved in publication' is required to notify the Home Rule Government 'unless said person knows for sure that the Greenland government has already been informed'. This places an onus on every person involved in publication presumably including co-authors and publishers to make sure that the Home Rule Government has been advised that publication is forthcoming. It will be very important for each of these people to verify this for themselves, especially given the potential penalties that may apply for non-compliance. These penalties are examined in detail below.

Any such publications must also acknowledge that the material originates in Greenland. The same provision also requires that publication and other disclosure 'must be effected with due respect for Greenland's rights to biological resources and in accordance with the provisions of the [CBD]'. Again it is unclear exactly what this provision requires because the CBD has no specific provisions related to publication and disclosure apart from general provisions dealing with research and training, and public education and awareness and exchange of research results in accordance with Articles 12, 13 and 17 respectively of the CBD.

Patents

The legislation contains a number of provisions relating to patents and Greenland's biological resources. The explanatory memorandum to the Bill emphasises that the legislation targets activities directly or indirectly aimed at financial return using survey results or parts thereof, based on biological resources or rights to such resources, and that a patent application of itself would not be regarded as commercial utilisation. In contrast sub-licensing or sale of intellectual property rights to a third party would be regarded as commercial utilisation.

Section 9 of the legislation deals with reporting obligations in relation to patent applications. Section 9(1) provides as follows.

- 1 Any holder of a survey licence applying for a patent for an invention made in connection with or on the basis of a survey licence shall be subject to a duty of information to the Greenland government regarding the patent. This duty of information entails that a copy of the patent application must be submitted to the Greenland government no later than in connection with the patent application itself. The Greenland government may lay down more detailed regulations regarding said duty of information.
- 2 The Greenland government shall inform the utilization enterprise of who intends to apply for patents for results so that the utilization enterprise may contact potential applicants for commercial licences.

Thus, while a commercial licence is not required to take out a patent, there is nonetheless an obligation to notify the Home Rule Government of such an application. These provisions are all the more interesting when read in conjunction the provisions of Section 10(3). As noted above Section 10(3) provides for the Greenland government or the utilisation enterprise to enter into private-law agreements that define the terms of a commercial licence. But in addition to this, Section 10(3) also provides for similar private-law agreements to be entered into with patent owners 'regarding terms of commercial utilisation of a patent'.

Implicit in all of these provisions is that the Home Rule Government will seek to receive benefits from the utilisation of patents. However, the legislative basis for this has not been clearly spelt out either in the biological resources legislation or any other Home Rule legislation. The position with respect to patents is also unclear because of uncertainty surrounding the extent to which Denmark's patent legislation applies to Greenland. In addition given that most patents would probably be granted outside Denmark, it is unclear how Home Rule measures to derive benefits from patents would be enforceable in relation to patents granted in other jurisdictions. Further clarification of these issues is clearly needed.

Penalties for non compliance

The legislation imposes criminal penalties for non-compliance with its provisions. Thus under Section 16,

a fine will be payable for the following.

Any acquisition, collection or survey of biological resources without a survey licence;

Any type of transfer of a survey licence to a third person without prior approval;

Any transfer of all or parts of survey materials or survey results to a third person without prior approval;

Any commercial utilisation of biological resources or survey results from such resources without a commercial licence;

Any failure to notify the Greenland government of publication or other communication of survey results or parts thereof;

Any failure to provide written copies of publications that deal with biological resources or based on such resources;

Any failure to provide annual reports as required by a survey licence or a commercial licence;

Any failure to comply with terms laid down in a survey licence and or a commercial licence.

Fines will be payable by individual researchers and by the research organisations and or companies for whom they work. Further details in relation to fines will be spelt out in yet to be enacted regulations under the Act.

Implications for scientific research in Greenland in the International Polar Year and later

Of the 416 consortia prepared for and endorsed for the IPY, 123 of these relate to research in, around and concerning Greenland. This research will involve at least 3000 researchers from more than 50 countries (Denmark 2007). Outside Antarctica, Greenland is one of the main locations for scientific research during the IPY.

As outlined above, the new biological resources legislation in Greenland may apply *prima facie* to much of this research. In summary the net effect of this legislation is that many scientists working in Greenland either indirectly or directly with biological resources will need to consider whether the provisions of the new legislation potentially applies to their research. If it does, at a minimum such researchers will now be required either to apply for exemption from the legislation or to obtain survey licences for field work carried out in Greenland. Those who obtain a survey licence will have to report on their research and provide copies of all publications and reports relating to their research to the Home Rule Government. All publications and reports resulting from such research must now include a number of references to the rights of Greenland under the CBD. This must, at a minimum, include reference to the fact that any biological resources, the subject of the research, originated in Greenland and that access to biological resources has taken place with prior consent.

The majority of scientific research in Greenland may not ultimately lead to any commercial benefit. However, these obligations potentially apply to all scientists active in Greenland during the IPY and later, regardless of

whether or not the research may ultimately have commercial applications.

As the legislation has only just been enacted and much remains to be clarified as to how it will be implemented, it is not yet clear how onerous these obligations will be for the scientific community. The Greenland government is conscious of concerns that have been expressed by the scientific community with respect to the impact of this legislation and has expressed a desire to minimise the impact on research, while at the same time ensuring Greenland does have the mechanisms in place to benefit from this research and its subsequent commercialisation. To that end it will ensure that all applications for survey licences and other permits for research purposes are to be processed adopting a 'one-door principle' (A. Olsen, personal communication, 2007). That is to say applications for survey licences are only to be submitted once to the Department of Industry that will then liaise with relevant departments to ensure appropriate licences and permits are issued (A. Olsen personal communication, 2007). The details for this process are still being developed. The Home Rule Government contemplates that a subsequent executive order will lay down more detailed regulations on how the Department of Industry will co-ordinate with other departments, including specific time limits for licences and permits to be issued. In addition, because there may be a lack of capacity within Greenland to deal with issues raised by individual applications from time to time the Home Rule Government may engage consultants to provide special expert advice as required.

In general terms, however, the Home Rule Government has expressed a desire to ensure that the new licensing system does not act as a disincentive to scientific research in Greenland. Thus as the explanatory memorandum to the Bill observes.

The application procedure for survey licences cannot be so administratively complicated that it discourages research institutions from applying for a survey licence. It should be kept in mind that research institutions do not have the same administrative staff available for the preparation of applications as do professional enterprises. Applications for survey licences should therefore not be unnecessarily burdensome for the applicant as to administration. Therefore, a survey licence may be granted for an individual project or for research institutions as a general survey licence (Greenland, Home Rule Parliament 2006a).

In addition, given the more detailed regulation that applies to commercialisation of such research, researchers will now also need to be very conscious of when their research may have commercial possibilities. Knowing exactly when scientific research becomes commercially focused may not always be easy to determine. But researchers will need to have this in mind as recipients of a survey licence will be contacted at a later stage to follow up whether biological resources are being utilised commercially. No doubt part of this follow up could involve cross checking to see whether all approvals for

transfer of biological resources and or survey licences and commercial licences have in fact been granted.

On a more practical level the Greenland government faces great difficulty in enforcing these requirements. Given the vast size of Greenland and the fact that much research occurs in very remote and isolated places the government may simply never know that research is taking place. In part, learning more about the research that is taking place is one of the objectives of the legislation. Through analysis of the information provided by researchers the Home Rule Government hopes to build its knowledge base on Greenland's biodiversity and its potential for commercial exploitation (A. Olsen, personal communication, 2007)

One aspect that appears unclear so far is the likely consequences for the environment of a new form of exploitation of Greenland's biodiversity. The explanatory notes to the Bill suggest that utilisation must be carried out in accordance with the 'sustainability principle'. Yet there is no clear definition of what this means in the legislation. Nor is it clear what mechanisms the Greenland government intends to put in place to achieve this. However, the memorandum to the Bill does indicate that tracking the environmental impact is one reason why applications for survey licences will contain details of the location of research and collection methods for samples. Quite apart from that it is unclear to what extent 'sustainability' will really be implemented in practice.

Legislative statements in relation to 'sustainability' must be viewed with some scepticism given Greenland's record to date on managing its biodiversity in a sustainable manner. Much criticism has been levelled at Greenland in recent years in relation to the management of its biodiversity and its particular lax enforcement of its existing environmental and nature protection laws (Hansen 2002). While non-governmental organisations like the WWF have recognised that Greenland has made some progress in the sustainable management of biodiversity, there still appears to be significant deficiencies in the legislative and management framework for such management in Greenland beyond this recently enacted legislation (WWF 2005). In this context therefore the creation of a legislative mechanism to facilitate increased exploitation of Greenland's biodiversity needs to be approached with caution.

Conclusion

Given its isolation, pristine environment, and unique biodiversity, it is no surprise that Greenland, like Antarctica is the focus of a considerable amount of scientific research. Likewise as the unique biodiversity of Greenland is slowly studied and understood it should also be no surprise that it also offers exciting possibilities for new developments in biotechnology. In enacting the biological resources legislation the Home Rule Government is responding to the emergence of a new economic opportunity for Greenland. But in the process, a new framework for

managing scientific research in Greenland during the IPY and later has also been created. As the legislation is relatively new, it is too early to say how successful (or unsuccessful) it will be in both promoting the development of Greenland's biotechnology potential, while at the same time not putting a brake on future scientific research. Many questions remain on how the legislation will be implemented in practice.

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References

- Aarup, C. 2006. Identification of biofilm-producing bacteria in ikaite tufa columns, Unpublished Masters thesis, Royal Veterinary and Agriculture University, Denmark.
- Arla Foods. 2007. URL <http://www.arlafoods.com>
- Bioneer A/S. 2007. URL: <http://www.bioneer.dk>
- Clark, M., A. Clarke, C. Cockell, P. Convey, H. Detrich, K. Fraser, I. Johnston, B. Methe, A. Murray, L. Peck, K. Römisch, and A. Rogers. 2004. Antarctic genomics. *Comparative and Functional Genomics* 5:230–238.
- Denmark. 1978. The Greenland Home Rule Act, 1978. (Act No. 577, 29 November 1978).
- Denmark. 2007. International Polar Year, 2007. IPY in Greenland. URL: <http://www.ipy.dk/greenland.htm>
- Finland, Ministry of Environment. 2006. Geenivarojen saatavuutta ja hyötyjen jakoa koskevien Bonnin ohjeiden kansallinen toimeenpano [Bonn guidelines on access to genetic resources and benefit sharing: national conduct of the Bonn guidelines in Finland]. Helsinki.
- Greenland, Department of Industry. 2007. Invest in Greenland. URL: <http://www.greenlandexpo.com>
- Greenland, Home Rule Parliament. 2006a. Explanatory memorandum to a Bill for legislation on commercial and research-related use of biological resources (EM 2006/49, 7 August 2006).
- Greenland, Home Rule Parliament. 2006b. Commercial and research-related use of biological resources. (Act No.20, 20 November 2006 unofficial English translation).
- Hansen, K. 2002. *A farewell to Greenland's wildlife*. Copenhagen: Gads Forlag.
- Hemmings, A., and M. Rogan-Finnemore (editors). 2005. *Antarctic bioprospecting*. Christchurch: University of Canterbury.

- Leary, D. 2007a. Lessons from the arctic: the power of the Arctic to shape environmental governance in the Antarctic. Rovaniemi. (Paper presented at the conference Knowledge and Power in the Arctic, 15–18 April 2007).
- Leary, D. 2007b. *International law and the genetic resources of the deep sea*. Leiden/Boston: Martinus Nijhoff.
- Lohan, D., and S. Johnston. 2005. *Bioprospecting in Antarctica*. Tokyo: United Nations University-Institute of Advanced Studies.
- Lyck, L. 1989. Greenland: ten years of home rule. *Polar Record* 25(155): 343–346.
- National Research Council of the National Academies. 2003. *Frontiers in polar biology in the genomic era*. Washington, DC: The National Academies Press.
- Nordic Seaweed Project. 2004. URL: <http://www.bi.ku.dk/seaweed/english.asp>
- Sagamedica ehf. 2007. Sagamedica products. URL: <http://www.sagamedica.com>
- Schmidt, M., A. Prieme, and P. Stougaard. 2006. Bacterial diversity in permanently cold and alkaline ikaite columns from Greenland. *Extremophiles* 10: 551–562.
- Schmidt, M., A. Prieme, and P. Stougaard. 2007. *Ar-sukibacterium ikkense* gen. nov., sp. nov., a novel alkaliphilic enzyme-producing proteobacterium isolated from a cold and alkaline environment in Greenland. *Systematic and Applied Microbiology* 30: 197–201.
- Statistics Greenland. 2005. Greenland in figures 2005. URL: <http://www.statgreen.gl>
- Stougaard, P., F. Jørgensen, M. Johnson, and O. Hansen. 2002. Microbial diversity in ikaite tufa columns: an alkaline cold ecological niche in Greenland. *Environmental Microbiology* 4(8): 487–493.
- ten Kate, K., and S. Laird. 1999. *The commercial use of biodiversity. Access to genetic resources and benefit-sharing*. London: Earthscan Publications.
- UNU-IAS (United Nations University-Institute of Advanced Studies). 2007. Biological prospecting in Antarctica: review, update and proposed tool to support a way forward. New Delhi: Antarctic Treaty Consultative Meeting XXX (IP 67).
- WWF. 2005. *The big four-an update on Greenland's efforts with regard to species conservation and nature protection*. Copenhagen: WWF Denmark