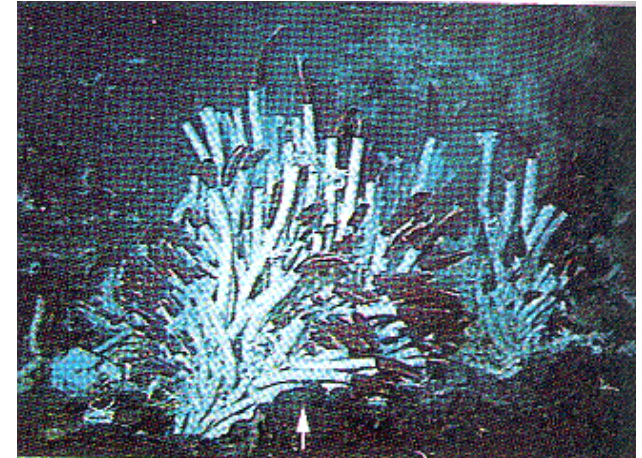


GENETIC RESOURCES OF THE DEEP SEA IN AREAS BEYOND NATIONAL JURISDICTION

Ecology, bioprospection, status of these genetic resources, and
technical options for access and benefit sharing regime



UNEP Short course
on biodiversity
17.-20.09.2007



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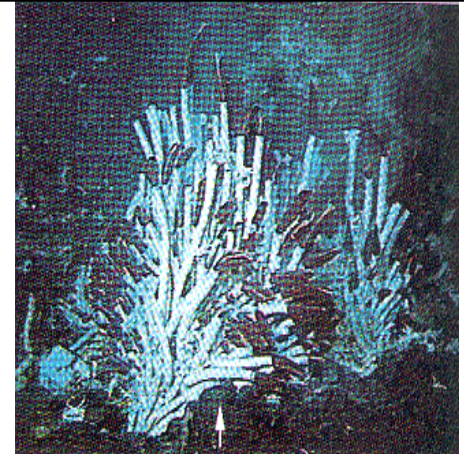
Isle of Vilm, 19.09.07



OUTLINE



- Introduction: political situation
- Ecosystems of the deep sea
- Commercial use and potential value of MGR
- Legal framework and status of marine genetic resources
 - UNCLOS (United Nations Convention on the Law of the Sea)
 - CBD (Convention on Biological Diversity)
- Key issues
- Proposals for a new international legal framework
- Next steps



INTRODUCTION



„There are ambiguities in the UNCLOS regime applying to bioprospecting that not only are likely to undermine efforts to manage biodiversity beyond national jurisdiction, they have the potential to lead to damaging conflicts among states”

(Prof. Mossop at the 2nd session of the meeting of experts on the emerging issues on the UNCLOS, 2006).



The present discussion

The status of genetic resources of the deep-sea beyond national jurisdiction

->focus of diplomatic discussions in these four international institutions:

- **CBD (Convention on Biological Diversity)**
- **ISBA (International Seabed Authority)**
- **United Nations Informal Consultative Process on the Law of the Sea (ICP)**
- **the annual debates of the United Nations General Assembly on Oceans and the Law of the Sea (UNGA)**



The present discussion

Three main issues:

- **Establishment of marine protected areas on the high seas**
- **Access and benefit sharing in relation to the genetic resources of the deep sea beyond national jurisdiction**
- **Regulation of mineral prospecting operations at hydrothermal vents on the high seas**



The present discussion

Three main issues:

- **Establishment of marine protected areas on the high seas**
 - **Access and benefit sharing in relation to the genetic resources of the deep sea beyond national jurisdiction**
 - **Regulation of mineral prospecting operations at hydrothermal vents on the high seas**
- > **At ICP-8 (June 2007): no overall agreement**
-> **At UNGA (2008): 2nd meeting of the Ad Hoc Working Group**



What are marine genetic resources?

Article 2 of the CBD defines them as **genetic material of actual or potential value. Genetic material is defined as any material of plant, animal, microbial or other origin containing functional units of heredity. Marine genetic resources are therefore plants, animals and microorganisms, and parts thereof containing functional units of heredity that are of actual or potential value. Above all there is currently no common definition of microorganisms.**

- **Scientific definitions describe microorganisms as organisms that are not visible to the human eye, and that include individual living cells of the domains of Bacteria and Archaea, as well as non-visible eukaryotes such as microscopic nematodes.**



What are marine genetic resources?

Within the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure, the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) of the WTO a wider range of categories of material have been accepted as microorganisms, including biological and genetic material derived from macroorganisms, such as tissue cultures and plasmids, as well as viruses, undifferentiated human, animal or plant cells, and protozoa.

- Under the Antarctic Treaty System the 1980 Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) is included which entered into force 1992. Article II(2) defines Antarctic marine living resources as “the population of fin fish, molluscs, crustaceans and all other species of living organisms.” Presumably molluscs and crustaceans associated with hydrothermal vents would fall within this definition, as would Bacteria and Archaea found at hydrothermal vents. This definition could be used for both, organisms around hydrothermal vents and other ecosystems at the seabed, falling under sedentary species or not, as well as all organism in the High Seas.



The richness of ecosystems in the deep-sea and their resources

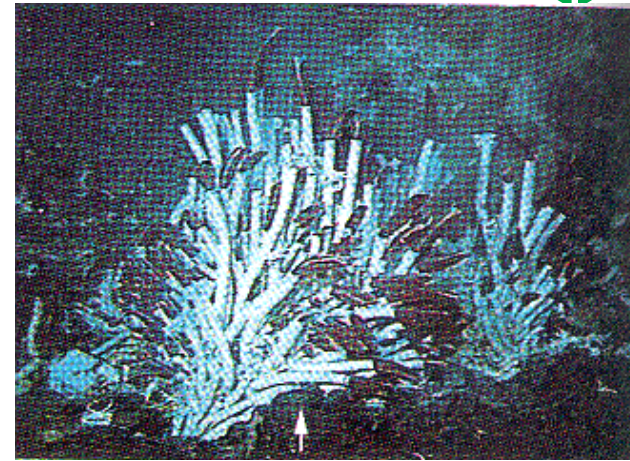
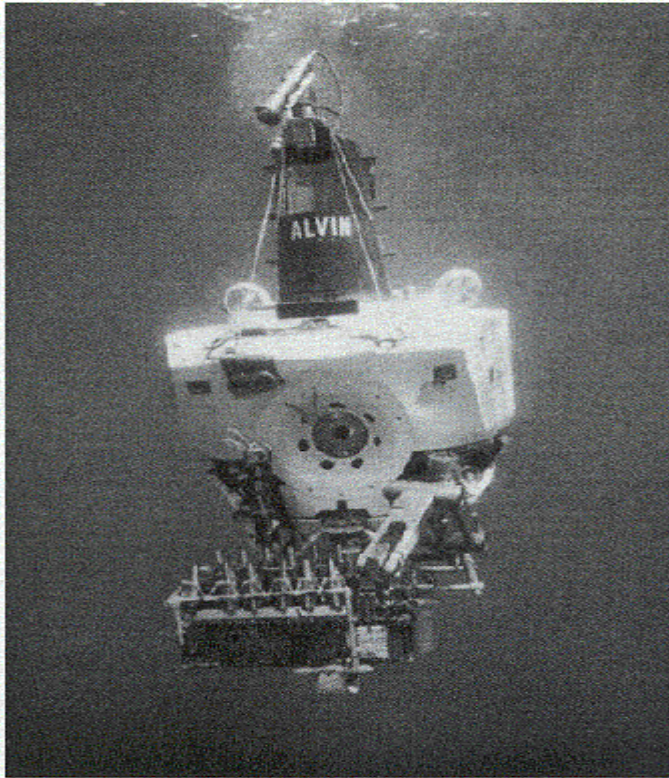


What is the deep sea?

- **ca. 65 % of the oceans are outside the 200 sm-Exclusive Economic**
- **Definition: the area beyond the edge of the continental shelf, greater than 200 m in depth, including the continental slopes, continental rises, and abyssal plains as well as topographic features such as seamounts, volcanic ridges and trenches (Butler and Koslow 2001)**
- **in 3000 m depth:**
 - **no light**
 - **food limited environment**
 - **pressure: 300 atm**
 - **temperature 1-2 °C**
 - **oxygen concentration near saturation**



Oasis of the deepsea



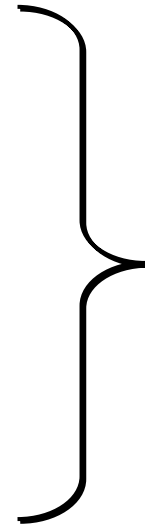
Research
submersible ALVIN



Several distinct ecosystems of the deep sea and their threats



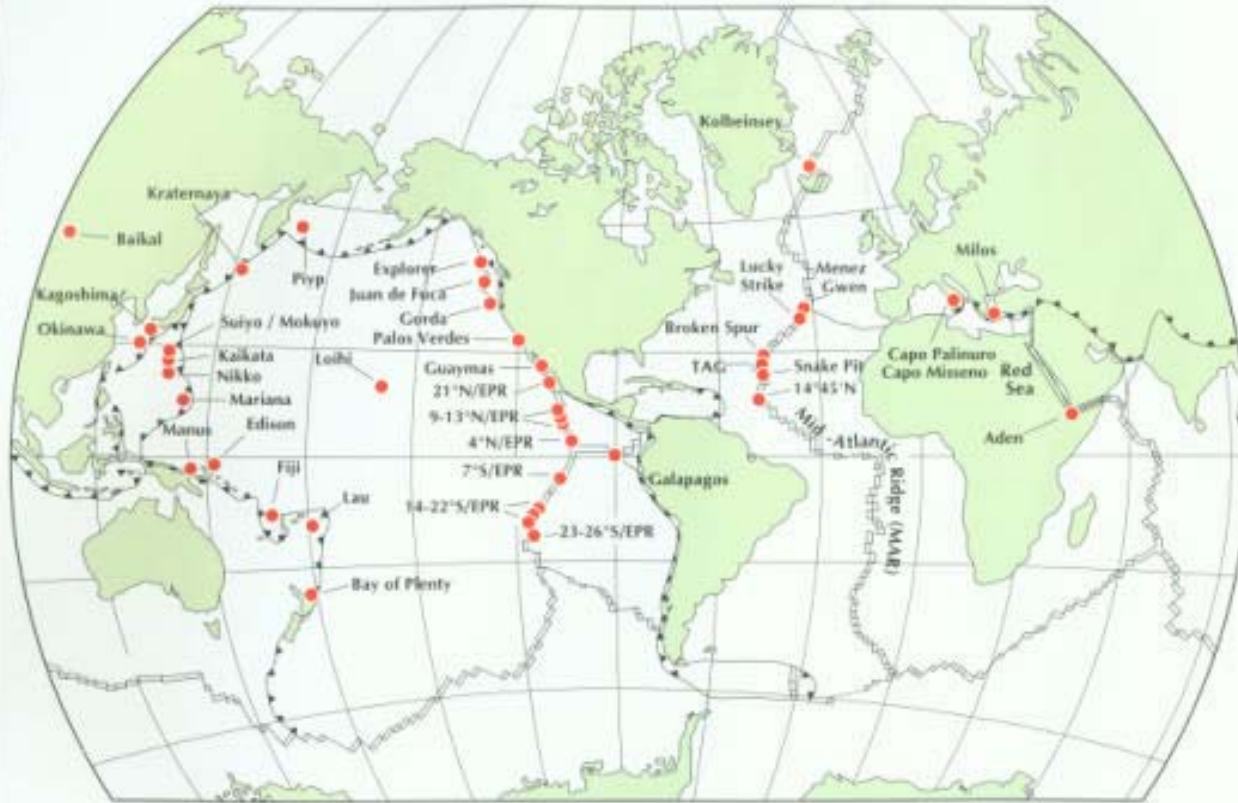
Hydrothermal vents
Cold Seeps
Seamounts
Cold water corals
Sponge reefs



- Home of unique genetic resources
- High levels of endemism and Biodiversity
- Sources of novel genetic resources with potential commercial application
- Vulnerable, because of slow growing and fragile condition



Global distribution of hydrothermal vents



Mid-Atlantic Ridge

Northeast Pacific

East Pacific Rise

Galapagos Spreading Center

Western Pacific

Global distribution of hydrothermal vents. (After Desbruyères, D. and Segonzac, M. (1998) Handbook of deep-sea hydrothermal vent fauna. Editions IFEMER, France 297 pp)



Hydrothermal vents environments

- Extreme for life
- Rapid temporal changes in the fluid properties
- Extreme gradients
- Very productive
- Dense communities of remarkable animals
- More than 500 new animal species; highly specialised and adapted to the extreme physio-chemical conditions (temperature and toxicity)
- Low diversity, but high endemism
- hosting one of the highest levels of animals abundance on earth





Genetic Diversity

- the base of the ecosystems: Bacteria and Archaea
- three phyla (92 % of vent fauna):
 - molluscs
 - arthropods
 - annelids
- 32 octopus and fish species
- giant clams, mussels, the giant tubeworm, crabs, sponges..





Commercial use and potential values of marine genetic resources



Bioprospection in the deep sea

Definiton:

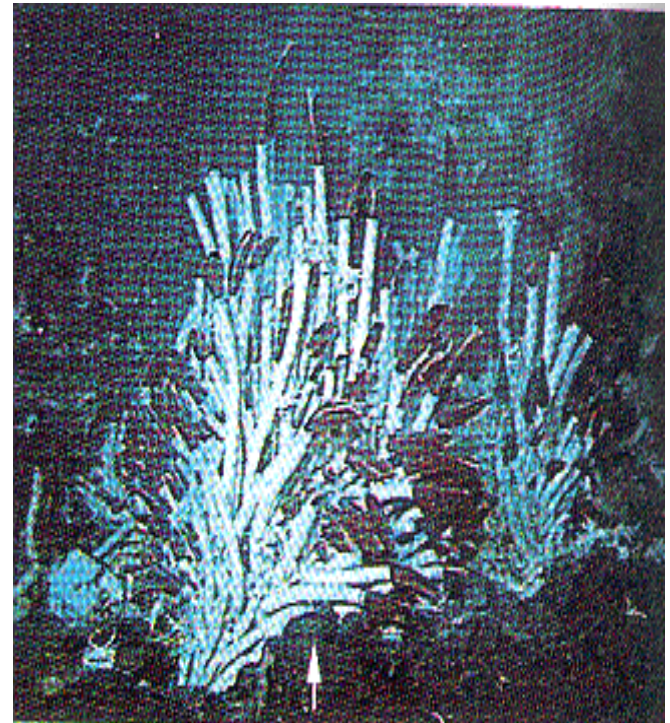
- An activity that involves the search of biodiversity for resources, be they genetic or biochemical or both, for use in purely scientific and/or commercial endeavours. (Jeffery 2002)
 - „The search for and sourcing of organisms from the natural environment with the purpose of extraction of compounds for further investigation of their potential for development in therapeutic or industrial applications.“ (Jones 1998: 5 Australasian Journal of Natural Resources Law and Policy 89)
- > Difficult to clearly distinguish between commercial and scientific activity





Kind of uses of extremophiles from the depth

- novel enzymes
- DNA polymerases
- microbial exo-polysaccharides
- Tubeworm colonies ->artificial blood





Commercial use of deep sea organism



Enormous potential for many different types of commercial application (health sector/industrial processes/bioremediation)

Patent Office Database reveals that compounds from deep sea genetic organism have been used as basis for

- ❶ Skin protection products (resistance to ultraviolet and heat exposure)
- ❷ Cancer fighting drugs
- ❸ Anti viral compounds
- ❹ Anti-allergy agents





Patents: a sign of commercial value

Patents:

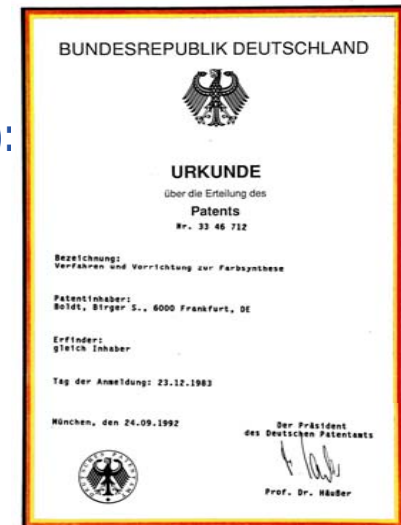
- importance in the commercialisation cycle
- governed by TRIPS (Trade Related Aspects of Intellectual Property Rights)
- due to IPRs: lack of transparency by collectors and in literature

Examples of patents

(involving MGR filed between 1973 and present):

- chemistry sector (53,5 %)
- pharmacology sector (32,2 %)
- Food sector (5,7%)
- Cosmetics sector (1,2 %)

Source: UNU, Johnston 2007





Potential values of marine biotechnology

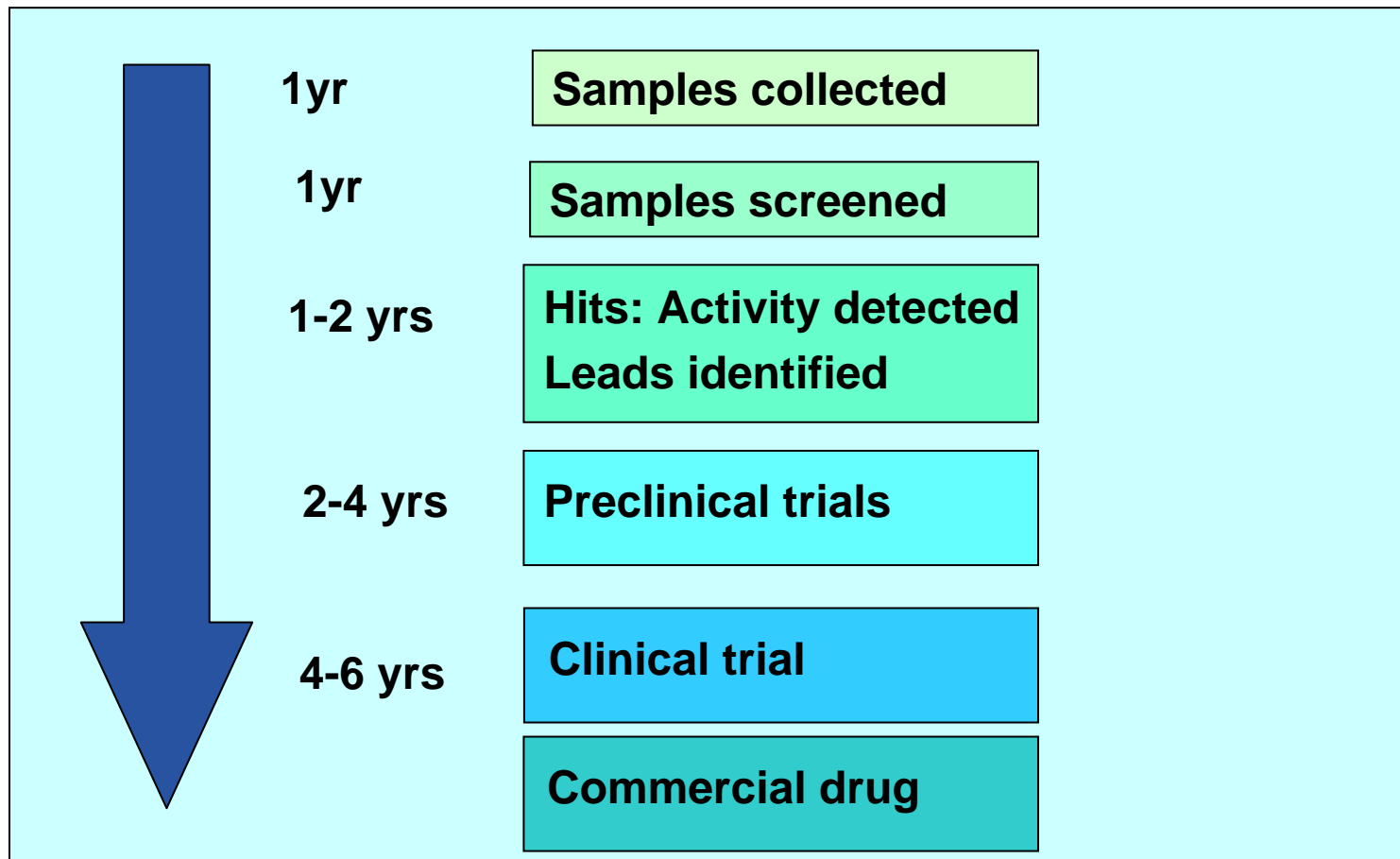
Following estimates:

- worldwide sales in 2000 of marine biotechnology-related products: US\$ 100 billion
annual profits from a compound derived from a sea sponge to treat herpes:
US\$ 50 million to US\$ 100 million
- value of anti-cancer agents from marine organisms: US\$ 1 billion a year
- Total US\$ 231 billion in 2005
- Cosmetics industry: estimated US\$150 million per year from deep sea hydrothermal vent source
- Enzyme market: \$US237 million for herpes treatment (2006)



The process of drug discovery

Process complicated, lengthy, expensive (US\$ 900 million)





Potential values of marine biotechnology

- At least 14 biotechnology and other companies involved and/or collaboration with research institutions
- These companies are mostly situated in North America and Europe
- 6 of these companies: sale products
- at least 37 patents have been granted



Bioprospecting

Questions that have arisen in the development of products include:

- How can ownership be properly acquired?
- What procedures need to be followed to ensure that the use is legitimate
- What if any approvals are necessary to ensure that the patent application is valid?
- Is benefit sharing required and if so with whom?



The legal framework



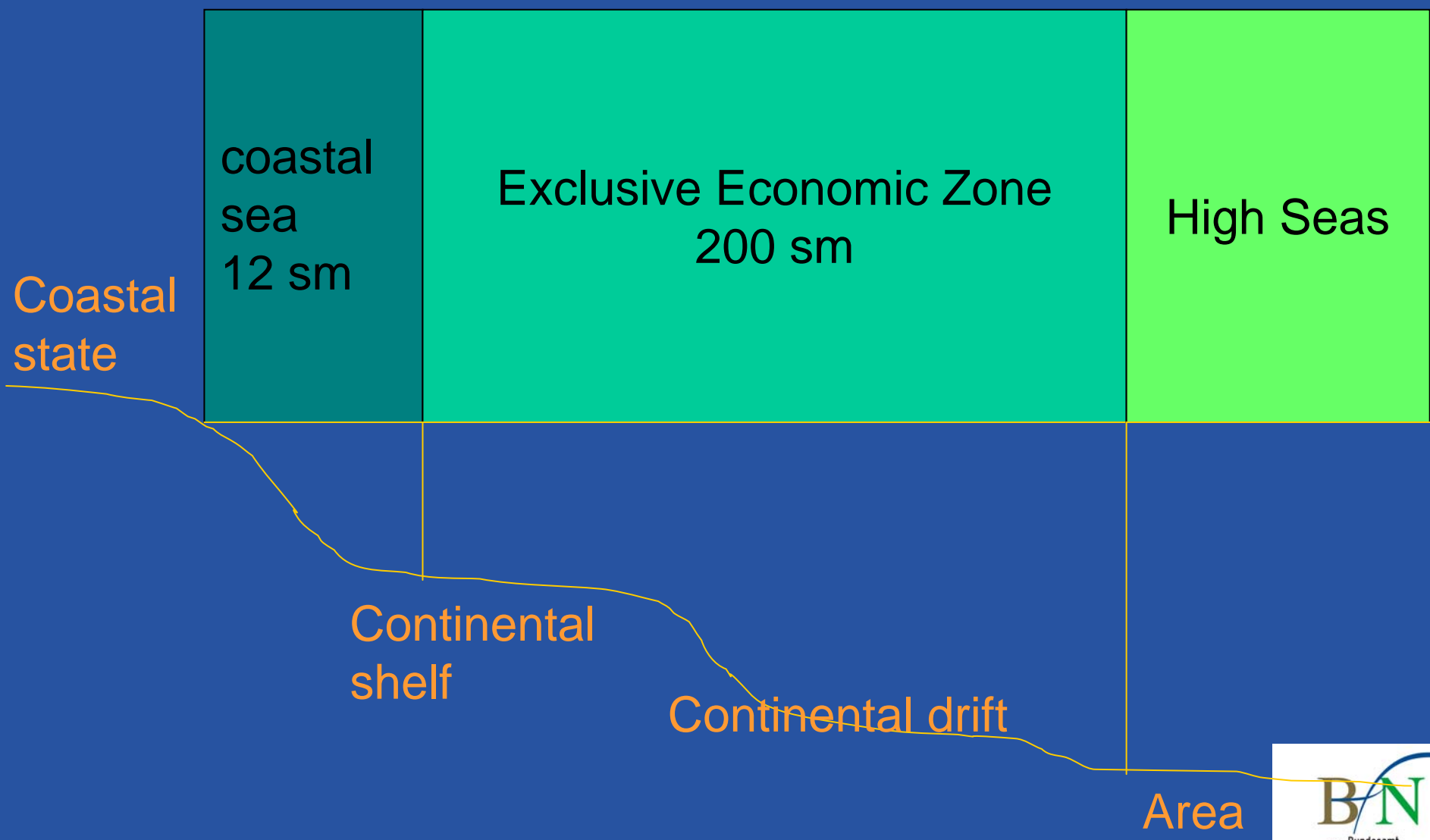
The international legal status of genetic resources in the Area

1. Convention on the Biological Diversity(CBD)
 - Art.4(a): No obligations concerning Access and Benefit Sharing (ABS) in areas beyond national jurisdiction
2. UN Convention of the Law of the Sea (UNCLOS)
 - Genetic resources are not addressed

Research and commercial interest have raised concerns, particularly among developing nations, about access to genetic resources, profits from exploitation and efforts to conserve these resources.

No Convention regulates directly the access to marine genetic resources in areas beyond national jurisdiction

→ **need of regulation!**





A North-South divide with respect to the status of MGRs in areas beyond national jurisdiction

Developed countries:

Access to living and genetic resources falls under high seas freedom, part VII, Art. 119 (living marine resources as fish and mammals)

➡ resources can be collected, explored and exploited by every governmental/private organisation

Developing countries:

Living and genetic resources of the area (seabed) fall under the common heritage of mankind, part XI, Art. 133

(„all solid, liquid or gaseous mineral resources in situ in the Area at or beneath the Seabed, including polymetallic nodules“)

➡ The international community have to participate at the benefits derived from the use of those resources



The common heritage principle

Art. 137 of UNCLOS:

- **No state shall claim or exercise sovereignty or sovereign rights over any part of the Area or its resources**
- **All rights in the resources of the Area are vested in mankind as a whole, on whose behalf the ISBA shall act.**
- **No state or natural or juridical person shall claim, acquire or exercise rights with respect to the minerals. Otherwise no such claim shall be recognized**



The need of regulation

Even if there is the decision to put deep sea genetic resources under the common heritage of mankind regime of UNCLOS there exists still no mechanism to regulate access and benefit sharing.



Key issues



Three main issues

- the distinction between pure marine scientific research (MSR) and bioprospecting
- the possibilities how sharing of benefits can be organized
- the role of patents and the disclosure of origin



Three main issues

Concerning

- the possibilities how sharing of benefits can be organized

Access and benefit sharing provisions:

- Permitted uses, including potential uses of genetic resources and their products or derivatives under the Material Transfer Agreement (e.g. Research, breeding, commercialisation)
- Statement for information and permission needs for a change of use than the original one intended at the time of access
- Statement on IPR provisions and related conditions
- Commitments to share monetary and non-monetary benefits



Bonn Guidelines

Non-monetary benefits: Sharing of research and development results, collaboration and cooperation; Participation in product development; Targeted training and capacity building; Admittance to ex situ facilities of genetic resources and databases; Joint ownership of IPRs

Monetary benefits: Access fee/fee per sample collected or acquired; Up-front payments; Payments of royalties; Milestone payments; License fee in case of commercialization; Special fee (trust fund etc.); Research funding; Joint ventures; Joint ownership of IPRs



Three main issues

Concerning

- the role of patents and the disclosure of origin

The conflict:

- TRIPS does not require disclosure of the place the biological species were collected
- Under the CBD exist some ways of disclosure.
To abide rules of access and to enable benefit sharing, the key issue is tracking of the (micro) biological resources:



Three main issues

- **the role of patents and the disclosure of origin**

Adjustments necessary in IPR law

- **Royalties/trust fund**
- **disclosure of resources of common interest**
- **Further example: Budapest Treaty**



Proposals for a new legal framework



Different options for a new legal Regime

● UNCLOS

Expansion of Part. XI (legal regime on mineral resources controlled by the International Seabed Authority (ISA) on living resources

● CBD

Protocol, Art. 28: Expansion of the Benefit-Sharing-Principle on marine genetic resources beyond the national jurisdiction.

● A new independent international agreement



A new Implementing Agreement

A new Implementing Agreement

- could fill the gap in the current regime
- clear rules necessary for the extraction and exploitation of deep sea genetic resources
- to ensure coordination, cooperation and compliance with the existing provisions
- for an effective management system (precautionary, sustainable and equitable)
- system must be flexible



A new Implementing Agreement

A new Implementing Agreement must also

- recognise areas beyond national jurisdiction as areas of scientific value for peaceful purposes, as well as a natural reserve that is part of the common heritage of humankind
- require environmental impact assessment (EIA) before approval of any bioprospecting activities planned to occur on the ocean floor or in the high seas
- encourage information and knowledge sharing on high seas biodiversity through a database of high seas species available to all
- establish a regime for benefit sharing
- require that duties on states, scientific institutions and companies to share the benefits arising from the utilisation of genetic resources are implemented in national legislation



Next steps



Next steps

- **Incorporate the UNCLOS provisions into national law**
- **Co-ordination of international institutions with jurisdiction over marine biodiversity**
- **States need to resolve legal inconsistencies and agree on principles that will apply to efforts to protect marine biodiversity across all activities -> Implementing Agreement**
- **Non-monetary benefits: capacity building, especially in the field of taxonomy, sharing of knowledge, technology transfer**
- **Governments could help companies to manage legal and commercial risks and attract investment by providing legal certainty for collection and reliable taxonomy**
- **Are monetary benefits helpful? Further study required**



Next steps

- **Developing a database on marine bioprospecting**
- **databases of arrangements on ABS**
merits of an international system for disclosure of the source or origin of genetic material
- **Populating the database**
- **Regular updating and maintenance**
- **Collaboration important**
- **A tiered system of self-regulation**
- **A seamount or group of seamounts about which a significant amount is known could serve as a test case for integrated management and first (non-monetary) ABS-regulations.**



Thank you !