National Seminar on

Biodiversity Regime Emerging Challenges and Opportunities

22 May 2008

Organized by

Central Marine Fisheries Research Institute
Mangalore Research Centre
Bolar, Mangalore - 575 001

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The Context

Conservation of diversity of flora and fauna of the Earth had been in the agenda of environmentally conscious individuals and organizations for several decades. Since the Convention on Biological Diversity (CBD) in 1992 at the Earth Summit in Rio de Janeiro, 'Biological Diversity' has become a catchword.

As per the obligations as a party to the Convention, India has introduced its domestic legal regime by enacting the Biological Diversity Act in 2002. The provisions of this Act, CBD and the rules of Trade Related Intellectual Property Rights (TRIPS) has rendered the issues pertaining to biological diversity a serious subject of study and debate.

Biological diversity is no more a topic of biology alone as it has acquired various dimensions. There are a multitude of challenges to be tackled regarding Biodiversity resources. At the same time, several opportunities are also emerging in the field of studies, research, advocacy, trade, IPR etc. In order to fully exploit the emerging opportunities, we need to sensitize, create awareness and educate the people, especially the young generation, about the various issues. This Seminar is conceived with that objective. It could not have been appropriate on any other day than the 22nd May 2008 when the International Biodiversity Day is observed all over the world.

Respecting the importance of the subject, Central Marine Fisheries Research Institute (CMFRI) had established a dedicated division for Marine Biodiversity. Mangalore Research Centre of CMFRI had done some commendable work in the area of Marine Biodiversity. It is rightly felt to convene a seminar on such an important topic at Mangalore, especially for the benefit of the people of Karnataka.

Themes

The seminar will address the state of affairs in biodiversity regimes with presentation on the following broad areas by invited speakers. In addition, there will be some poster presentations on relevant aspects.

- Biodiversity -Current Scenario
- Karnataka Marine Biodiversity
- Legal Regimes of Biodiversity
- Trade related Issues of Biodiversity
- Biotechnology and Biodiversity: Challenges and Opportunities
- Climate Change and Biodiversity
- Challenges for Communities
- Career Opportunities in Biodiversity

Participation

The seminar is open for teachers of colleges and senior students who contemplate further studies and career in biodiversity related subjects. The environmental NGOs and other stakeholders engaged in biodiversity related activities also can benefit by participation in the Seminar. Participation is restricted to about 50 members only and registration will be on a first-come-first basis. Organizational sponsorship is preferred (maximum two participants from a college or organization) There is no fee for participation. Participants have to make their own arrangements to reach the venue and no travel expenses will be paid.

Venue : S.N. Siddiquie Auditorium, Geological Survey of India,
Pandeshwar, Mangalore- 575001
Time : 9:30 AM to 5:30 PM

Advisory Committee

National Advisors

Dr. S. Ayyappan, Deputy Director General, ICAR, New Delhi
Dr. Mohan Joseph Modayil, Member, ASRB, New Delhi
Dr. P.A. Aziz, Director, Salim Ali Centre for Ornithology and Natural History, Coimbatore
Dr. K. Vekataraman, Member Secretary, National Biodiversity Authority, Chennai
Prof. Madhav Gadgil, Emeritus Scientist, Agharkar Research Institute, Pune
Shri. Ashish Kothari, Kalpavriksh, Pune
Prof. M.K. Ramesh, CEERA, NLSIU, Bangalore

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Dr. E. Vivekanandan, Head, DFD, CMFRI, Kochi
Dr. E. V. Radhakrishnan, Head, CFD, CMFRI, Kochi
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Dr. G. Gopakumar, Head, MCD, RC of CMFRI, Mandapam

Local Advisors

Prof. Y. Basavaraju, Dean, College of Fisheries, KVASFU, Mangalore
Prof. K. R. Sridhar, Chairman, Dept. of PG Studies & Research in Biosciences, Mangalore University
Shri. Millo Tago, IFS, Conservator & CEO, Bannerghatta Biological Park, Bangalore
Shri. V.K.K. Kalluraya, DDG, Geological Survey of India, Mangalore
Shri. Veerappa Gowda, Director of Fisheries, Bangalore
Shri. Suresh Kumar, Deputy Director of Fisheries, Mangalore

Organizing Committee

Chairman
Dr. A. P. Dinesh Babu, Scientist-in-Charge, RC of CMFRI, Mangalore

Members
Dr. N. Ramachandran
Dr. V.S. Kakati
Dr. Sujitha Thomas
Smt. Geetha Sasikumar
Dr. P.S. Swathilekshmi
Dr. Miriam Paul Sriram

Kindly submit your Registration Form in time to

Dr. K. Vijayakumaran
Senior Scientist
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OPENING REMARKS

The IDEA

Let me begin with the idea of the seminar. At the end I wish to speak on the power of idea. The idea of the seminar is only 29 days old and 39 thousand rupees poor. The idea of the seminar came to me when I was at NLSIU in Bangalore during the third week of April. I was reading Biodiversity related law when the biodiversity day, 22^{nd} of May, came to my notice. The rest is now in the domain of history.

MRC of CMFRI

At Mangalore Research Centre of CMFRI, till recently, we were silent workers. Being silent has got its own drawbacks. Say, when people and media talk about ***Netrani Island*** and its biodiversity, nobody mention about CMFRI or **Dr. P.U. Zacharia** who led the team of scientists to study the marine biodiversity of Karnataka. We are now **out of the silent mode** and wish to legitimately claim our space among the stakeholders. In this process, we would come up with many outreach programmes in near future.

LIMITATIONS

There was constraint of **funds and time and space**. We had to compromise a lot on many things. The idea was realized by the wholehearted **support of our Director, my colleagues** and you. The credit of success of the seminar belongs to all of you. I assume complete responsibility for any flaw in the conduct of the programme.

WHY BIODIVERSITY REGIME

The important aspect which I want to stress at this point is about the legal implications of Biodiversity Regime. Whether you like it or not, India is a party to CBD. We have an obligation to the international community under 'access and benefit sharing (ABS)' of our biological diversity and traditional knowledge. The equations of ABS can be drawn clearly if we are able to value our wealth properly. Our knowledge will enhance and strengthen our bargaining power. **We are already in the game. If we want to win, we should know thoroughly the rules of the game.**

SCOPE

Biodiversity is no more a subject of biology it has become an interdisciplinary topic. Our intention is to give a **glimpse of some of the facets of the emerging biodiversity regime**. The topics are selected to focus on important areas of Biodiversity Regime. We hope there will be a lot of interaction from the august audience. This is only a beginning. We have succeeded in coming together, now we can think of working together. **Our aim should be to protect our resources and fight against bio-piracy and intellectual colonialism**.

OBJECTIVE

We want to sensitize the participants on the emerging issues of Biodiversity Regime. **We want to disturb you from your comfort zone**. We want to initiate a new stream of thought process. Generate new ideas; CBD was an only an idea some two decades ago. Do not drop ideas. Discuss with your peer and explore how to make it materialize. **The power of idea** is so great that I urge all of you, especially the young people, who are assembled here to pursue every idea you get. Make our nation stronger in protecting our valuable resources and legitimate rights**. In the emerging Biodiversity Regime we cannot afford even a minute degree of complacence.**

Dr. K. Vijayakumaran
Convener
Seminar on Biodiversity Regime

National Seminar on

Biodiversity Regime: Emerging Challenges and Opportunities

PROGRAMME

REGISTRATION: **08.30- 09.30 Hrs**

INAUGRAL SESSION: **09.30-10.30 Hrs**

Opening Remarks:	**Dr. K. Vijayakumaran**, Convener, Seminar on Biodiversity Regime.
Welcome:	**Dr. A.P. Dineshbabu**, Scientist-in-Charge, R C of CMFRI, Mangalore.
Inauguration:	**Dr. N.G.K. Pillai**, Director, CMFRI
CD Release:	**Dr. N.G. K. Pillai**, Director, CMFRI
Felicitations:	**Dr. H. Sivananda Murthy**, Director of Extension, Karnataka Veterinary, Animal Science and Fisheries University, Bidar.
	Dr. B.R. Venkatesh, Director, Geological Survey of India, Mangalore.
Vote of Thanks:	**Dr. P.S. Swathilekshmi**, Scientist, R C of CMFRI, Mangalore.
National Anthem	

TECHNICAL SESSION: **11.00-17.30 Hrs**

11.00-11.30 Hrs **Legal Regime of Biodiversity**

Dr. B. K. Ravindra
Principal, S D M Law College, Mangalore

11.30-12.10 Hrs **Plant and Animal Biodiversity in Ayurveda**

Dr. T. Sridhara Bairy
Head, Dept. of *Dravya Guna*, S D M College of Ayurveda, Udyavara, Udupi

12.15–12.50 Hrs **The Valuation of Marine Biodiversity in India**

Dr. Ramachandra Bhatta
Head, Dept. of Fisheries Economics, College of Fisheries, Mangalore

12.50-13.20 Hrs **Climate Change and Biodiversity**

Dr. E. Vivekanandan
Head, Demersal Fisheries Division, Central Marine Fisheries Research Institute

LUNCH BREAK: 13.3 0-14.3 0

14.30-15.00 Hrs **Marine Biodiversity of Karnataka**

Dr. P. U. Zacharia,
Senior Scientist, RC of Central Marine Fisheries Research Institute, Tuticorin

15.00-15.30Hrs **Biotechnology and Biodiversity – Challenges and Opportunities**

Dr. K. K. Vijayan,
Head, Marine Biotechnology Division, Central Marine Fisheries Research Institute

15.30- 16.00 Hrs **Role of Bioinformatics in Biodiversity Research:**

Dr. Santhosh J. Eapen
Senior Scientist, Bioinformatics Division, Indian Institute of Spices Research, Calicut

16.00- 16.30 Hrs **Trade Related Issues in Biodiversity**

Dr. K.S. Mohamed
Head, Molluscan Fisheries Division, Central Marine Fisheries Research Institute

16.30- 17.00 Hrs **Biodiversity Regime Challenges and Opportunities**

Dr. K. Vijayakumaran
Senior Scientist, RC of Central Marine Fisheries Research Institute, Mangalore

17.00-17.30 Hrs **Concluding Remarks, Summing up, Recommendations**

Dr. N.G.K. Pillai
Director, CMFRI

Dr. S. M. Siva Praksh
Professor, College of Fisheries, Mangalore

Dr. K. Vijayakumaran
Convener

Silent Prayer

We take a moment to visualize all the wonderful creations of nature and the diverse life forms and bless them with our whole heart.

We remember that every life form is intimately linked to us by the common evolutionary path and the common organic structure we share.

Then we seek the blessings of the supreme power which manifests in the various forms and forces of nature by observing silence for one minute.

Legal Regime of Biodiversity

Dr. B. K. Ravindra .M.A., LL.M., Ph.D
Principal & Chairman,
S.D.M. Law College & Centre for PG Studies in Law
Mangalore.

Introduction:

- Today implementation of the Biodiversity Act is in full swing.
- NBA is granting approvals for accessing biological resources even in those areas where there are no Biodiversity Management committee, which denies mandatory public consultation needed before approval is granted.
- 17 State Biodiversity Boards are established with little or no representation of the communities. (M.P. Karnataka and Sikkim have also prepared their state level rules)
- Samples of agreements to be entered between parties for access of biodiversity have been prepared and special Govt. committees have been constituted on specific topics, such as threatened species.

- **Local communities started mobilizing against the provisions and practices of the Act and issues and concerns were discussed on 17 & 18 May 2007 at Bir, Himachal Pradesh for Northern region states.**

- **The Campaign was initiated in 2004 and several people traveled to Delhi to express their displeasure and submitted memorandum to Ministry of Environment and Forests (MOEF). Bir meeting was entitled as Biodiversity Regulation legality and Reality.**

- **Bir Meeting confirmed the fact that local people must have a say in determining how best their local land crops are to be managed.**

- It was urged that C.B.D. principle of national sovereignty, by which India claimed a right to its independent management of its biodiversity within the global framework must further come down to community sovereignty for truly making local decisions on resources and for application of local know-how.

- It was stressed that merely understanding the provisions of law without corresponding attention to implementation is ridiculous.

- Access to biodiversity and clearance to the use of biological resources are becoming predominant in the legal regime.

- **Today all environmental regulations suffer from this malaise in India the state simply equates regulation with process for providing clearances. so, there must be a debate on this issue.**
- **Without this nuance public voice the environment will continue to be degraded, natural habitats will be lost, biodiversity sacrificed and peoples livelihood put at risk.**
- **Every year on 5th June Environmental day is celebrated, holding numerous celebrations like awareness programmes and the work undertaken by Governmental and NGO's to safeguard Environment.**
- **Civil Society's are keen to publicize what they have done for the protection of biodiversity.**

Biological Diversity Act

- **Access to biological resources for research and for commercial utilization including Intellectual property Rights was an unregulated domain until the biodiversity Act was passed - 2002.**
- **The Act was a felt necessity because of biopiracy and biosafe trade as well as to check illegal access to natural resources and also the theft of traditional knowledge.**
- **Then the necessity to have legislation came because India had become a signatory to Bio diversity convention.**
- **The object of the Act was to conserve biodiversity, the sustainable use of biological resources and equity sharing benefits from the use of resources.**

- **An Institutional structure for the implementation of the Act was laid down that is NBA established at Chennai, State Biodiversity Boards, Biodiversity Management committees formed at Panchayat and district councils.**

- **Foreign countries wishing to access India's biodiversity and associated traditional knowledge for research and commercial utilization would need to apply before NBA who will review the application and hold consultation with the Biodiversity Management committee for granting approval.**

- **Indian entities are only required to submit, their application to state Biodiversity Board for sanctioning of applications.**

Protection-Diluted

- **When the Act was notified there was mixed responses Environmentalists were unhappy over the actual provisions of the Act.**

- **Special privilege granted to Indian companies raised doubts, and concerns, was regarding the Act that it has practically sanctioned intellectual property rights in biodiversity by outlining a process.**

- **The extremely limited role of the local communities in the decision making process was not appreciated.**

- **In the year 2004, the Ministry for Environmental Forests (MOEF) showed complete disrespect to the role communities can play with reference to conservation of biodiversity.**

- **The rule of the Ministry stated that BMC is documenting the Biodiversity and traditional knowledge through peoples Biodiversity registrars (PBR) as a result communities become mere data provides for PBR's.**

- **The Original intent of the law was thwarted as the law created only a mechanism that regulated the use of biological resources and even this regulation was drafted in favour of industry with no regard to local communities.**

- **The interesting part is that though the Act says that the communities are conservers and preservers of biodiversity, the rules delineating the provisions of the Act limit the power and function of the very same communities to only documentation of resources and knowledge with no legal provision to control.**

- **Biological diversity has no single standard definition**

- **A simple definition of biodiversity covers genes, species and eco- systems of a region.**

- **Genetic diversity refers to the varieties of genes within species.**

- **Species diversity encompasses the variety of living organisms- plants, animals and other forms of life existing in a region or the entire biological spectrum on earth.**

- **Biodiversity found on earth today is the result of 3.5. billion years of evolution. Until the emergence of humans, the earth supported more biodiversity then in any other period in geological history.**

- After the advent of humans, biodiversity has begun a rapid decline with one species after another suffering extinction.

- The loss of biodiversity often reduces the productivity of ecosystems, thereby shrinking nature’s basket of goods and services, from which we constantly draw and further destabilizes eco systems and weakens their ability to deal with natural disasters such as floods, droughts and hurricanes, and with human caused stresses such as pollution and climate change.

Economic Values of Biodiversity

- Biodiversity offers several direct and indirect economic benefits to human kind.
- Firstly on it depends the stability of the biosphere, which in turn leads to the stability of climate, water regime, soil fertility, quality of air and overall health of the biosphere.
- Secondly, biodiversity is the source from which human race depends for food, fodder, fuel, fiber shelter, medicines and raw materials for industrial goods.
- Biodiversity is the biological capital our planet and it forms the foundation upon which human civilization is built.

Important economic commodities that biodiversity supplies to human kind are

- Biodiversity provides food: Crops, livestock, forestry and fish.
- Biodiversity has a role in medication. Wild plant species have been used for medicinal purposes since before the beginning of recorded history. For example quinine comes from cinchona tree, (to treat malaria) digital is from the foxglove plant (chronic heart trouble), and morphine from the puppy plant (pain relief).
- National Cancer Institute estimates that 70% of the promising anti-cancer drugs come from plants in the tropical rain forests. Animals also play a role in particular in research. It is estimated that out of 2,50,000 known plant species only 5000/- have been researched for possible medical applications.

Industry:

For example fibres for clothing ,wood for shelter and warmth. Biodiversity may be a source of energy. (such as biomass) other industrial products are oils, lubricants, perfumes, fragrances, dyes, paper , latexes rubber, waxes, resins ,corks, can all be derived from various plant species. Animals can also be used as a mode of transport.

Tourism and Recreation:

Biodiversity is a source of economical wealth for many areas, such as parks and forests, where wild nature and animals are a source of beauty and joy for many people. Ecotourism in particular, is a growing outdoor recreational activity.

Bio diversity Profile in India.

- India is the seventh largest country in the world and Asia's second largest nation with an area of 3,287,263 km^2
- India has a land frontier of some 15,200 km and a coastline of 7,516 km and India is one of the top twelve mega diversity countries and has two of the total eighteen biodiversity hot spots in the biodiversity rich areas of the western gates and eastern Himalayas.
- According to Ministry of Environment and Forest Report, the country is estimated to have over 49,219 plant species and 81,251 animals representing 12.5% of the world's flora and its fauna.
- High incidence of endemism and occurrence of several endemic centre are characteristic feature of India's biodiversity .Among plants species, endemism is estimated at 33%.
- To protect the biodiversity , India has got 89 national perks, 497 wildlife sanctuaries, covering an area of 1.56 lakh km^2 and 27 Tiger reserves with an area of 37,761 km^2.

A Walk through history

- Concern for environment is constant in history heightened concern about environmental destruction and loss of species and ecosystems in the seventies led to concerted action.
- In 1972, the united Nations conference on the Human – Environment (Stockholm) resolved to establish the united Nations Environment programme.

International Concern over depleting biodiversity:

- The International communities concern about the unprecedented loss of biological diversity emerged at the U.N. conference on the Human Environment held in Stockholm in 1972.
- The debate was whether environmental protection and economic development are consistent with each other or antithetical.

To quote Late Smt. Indira Gandhi

"On the one hand the rich look askance at our continuing poverty on the other they warn us against their own methods . We do not wish to impoverish the environment any further and yet we cannot for a moment forget the grim poverty of large numbers of people. Are not poverty and Need the greatest polluters? For instance , unless we are in a position to provide employment and purchasing power for the daily necessities of the tribal people and those who live in or around jungles , we cannot prevent them from combining the forest for food and livelihood, from poaching and firm despoiling the vegetation. When they themselves feel deprived, how can we urge the preservation of animals?. How can we speak to those who live in villages or slums about keeping the oceans, the rivers and air clean when their own lives are contaminated at the source? The environment cannot be improved in conditions of poverty, Nor can poverty be eradicated without the use of science and technology"

- **The world commission on Environment and Development concluded that economic development must become less ecologically destructive. In its report it observed “Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs”. It called for “a new era of environmentally sound economic development”. ”Sustainable development” became the theme of the United Nations conference on Environmental Development (UNCED)**

- **In 20 years between Stockholm and Rio-summit various international conventions were promulgated for conservation of the earth’s species but all have fundamentally failed.**

- **In 1990, the U.N Environment programme began the first of seven negotiating sessions whose objective was to produce an international treaty on the conservation of biological diversity signed by 153 nations and the European community.**

Goal of convention on Biological Diversity

- Conservation of biodiversity
- Sustainable use of the components of biodiversity
- Sharing the benefits arising from the commercial and other utilization of genetic resources is a fair and equitable way.
- Convention is a land mark in International law as it recognizes the conservation of biological diversity as "a common concern of human kind" and is an integral part of the development process.
- Convention reminds decision makers that natural reserves are not infinite assets and sets out new philosophy of the present century of sustainable use.
- Convention offers decision makers guidance based on the precautionary principle that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize threat conservation will bring significant environmental economic and social benefits in return.

- **Main issues covered under the convention are:**

- **Measures and incentives for the conservation and sustainable use of biological diversity.**
- **Regulated access to genetic resources.**
- **Access to and transfer of technology including biotechnology**
- **Technical and scientific operation.**
- **Impact assessment.**
- **Education and public awareness**
- **Provision of financial resources.**
- **National reporting on efforts to implement treaty commitments.**
- **Under the convention governments are required to conserve, as well as sustainable use of biodiversity and frame national biodiversity strategies and action plans and integrate these into broader national plans for environment and development.**

The commitments in the treaty are:

- **Identifying and monitoring the important components of biological diversity that need to be conserved and used sustainably**
- **Establishing protected areas to consume biological diversity**
- **Rehabilitating and restoring degraded eco-systems and promoting the recovery of threatened species in collaboration with local communities.**
- **Respecting preserving and maintaining traditional knowledge of the sustainable use of biological diversity with the involvement of indigenous peoples and local communities.**
- **Promoting public participation, particularly when it comes to assessing the environmental impacts of development projects that threaten biological diversity.**
- **Educating people and raising awareness about the importance of biological diversity and the need to conserve it.**

To quote Kofi Annan,

- “Biological diversity is essential for human existence and has crucial role to play in sustainable development and the eradication of poverty. Biodiversity provides millions of people with livelihoods, helps us to ensure food security and is a rich source of both traditional medicines and modern pharmaceuticals”

India signed the convention on Biological Diversity on 5th June 1982 and it came in the form of an Act on 2nd December 2002.

- The main object of the CBD are:
- Conservation of biological diversity
- Sustainable use of its components
- Fair and equitable sharing of benefits arising out of utilization of genetic resources
- To respect and protect knowledge of local comities related to biodiversity protection and rehabilitation of threatened species involvement of institutions of self government in the implementation of the Act through promotion of committees

  – In order to safeguard the interests of the local people the Act creates certain exceptions. they are,
    - Free access to biological resources to use within India for any purpose other then commercial use.
    - Use of biological resources by vaidyas and hakims.
    - Free access to India citizen within the country for research purposes.

- **The Act porpose to have National Biodiversity Authority, State Biodiversity Board and Biodiversity Management Committees.**

- **National Biodiversity deals with matters relating to requests for access by foreign individuals institutions or companies, and all matters relating to transfer of results of research to any foreigner of imposition of terms and conditions to secure equitable sharing of benefits and approval for seeking any form of Intellectual property rights in or outside India for an invention based on research.**

- **State Biodiversity Board will deal with matters relating to access by Indians for commercial purposes and restrict any activity which violates the objectives of conservation sustainable use and equitable sharing of benefits.**

- **Biodiversity management committees will be set up institutions of self government in their respective areas for conservation, sustainable use, documentation of biodiversity and chronicling of knowledge relating to biodiversity.**

- Biodiversity funds at central, state and local levels are setup. The monetary benefit reserved as fees, and royalties by approval of national biodiversity fund. The fund will be made use of for conservation and development of areas from where resources have been accessed.

- Traditional Knowledge is proposed to be protected. State Government should notify National Heritage Sites which are important from the standpoint of biodiversity, in consultation with local self governments

- The Act acts like a double edged knife which has the potential to stifle development as well as take away the livelihood of millions and on the other hand, it has the potential to take India to reach new economic heights with sound ecological balance and improve the per capita income of the 'poor Indians' and improve their standard of living.

Benefit claimers
Means person or group of persons who are:

- **The conservers of biological resources, their by products.**
- **Creators and holders of knowledge and information relating to the use of such biological resources**
- **Innovations and practice associated with such use and application.**
- **Creators and holders of knowledge**
- **It includes only those persons who created or held the knowledge because of their customs or traditions which is not restricted to what is already present but also what may be created or learnt in future because of their customs and traditions . This so because today it is possible for an outsider to get hold of any knowledge by various means and once he gets hold of the knowledge he should not qualify as a benefit claimer under this Act.**

- **Innovations and practices associated with such use and application:**
- **Whether a person innovating on an already existing knowledge of use and application of a biological resource is eligible to be a benefit claimer under this Act?**
- **This is to be decided on a case to case basis .For example, if a particular plant is known to be used to relieve pain and a study of plant reveals that the plant can also be used for some other purpose, say for instance, To cure cancer should the person making this finding be eligible to be a benefit claimer under this Act? The answer should be 'yes' for more than one reason.**
- **Firstly if such a person were eligible to be a benefit claimer there would be an incentive for this person to disclose his finding since there is a benefit.**
- **Secondly a method to transfer a part of this benefit to the original holders of knowledge can be made out thereby benefiting the original holders also.**

- **Biological Diversity: means the variability among living organisms from all sources including *inter alia* terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part this includes within species, between species and of ecosystems.**

- **Biological Resources: means plants animals and microorganisms or parts thereof their genetic material and by products(excluding value added products) with actual or potential use or value but does not include human genetic material.**

EFFECT OF THE DEFINITION ON THE HERBAL BIOTECH AND OTHER SUCH INDUSTRIES:

- The Act is set to affect a large variety of industry which uses plants, animals or micro organisms occurring naturally in the environment that uses them to manufacture products or uses then in the process of manufacturing products. To name a few industry are, herbal drug industry, bio tech industry, aromatic oil industry etc.

- The effect of this wide definition in such that even if certain plants are grown by the industry for the purpose of making drugs, they will have to seek the approval of the Authority or the Board unless exempted.

- India has a large industry manufacturing herbal medicines and aromatic oils and they cultivate the raw materials for making drugs and aromatic oil, which are sold commercially and this Act would make it mandatory for these industries to seek approval from the Authority or the Board as the case may be.

- **Commercial Utilization: mean and uses of biological resources for commercial utilization. Examples of commercial utilization are specifically provided, as uses to make drugs, industrial enzymes, food flavours, fragrance, cosmetics, colours extracts and genes used for improving crops and live stock through genetic intervention.**

- **The exclusionary part of the definition finds place for traditional and conventional practices in breeding, agriculture, horticulture, poultry, dairy farming, animal husbandry or bee keeping.**

- **Local Bodies: means institutions of self-government like the Panchayats and municipalities within the meaning of Article 243 B and 243 Q of India.**

- **Value Added products: mean products that may contain portions or extracts of plants and animals in unrecognizable and physically inseparable form.**

Thank You!

THE VALUATION OF MARINE BIODIVERSITY IN INDIA

Ramachandra Bhatta
Professor and Head of the Division
(Division of Fisheries Sciences)
College of Fisheries, Mangalore 575 002

Broad issues of valuation of marine biodiversity

- **Why marine biodiversity valuation is different from valuation of other environmental resources?**
- **What are the contexts or scope of valuation?**
- **Different valuation approaches**
- **How can we make use of these valuation results**?

Similarities and dissimilarities

- Presence of non-market goods and opportunity costs
- Potential for benefit transfer application
- Resource pricing
- Issues of geographic scale.

Uniqueness of Marine Biodiversity

- **Resources are fugitive**
- **Nature of uses**
- **Open access**
- **Public good nature**

Scope and Purpose of Valuation

- Impact analysis: an assessment of the damages inflicted on the resource system from a specific event (e.g. oil spills)
- Partial valuation
- Total Valuation

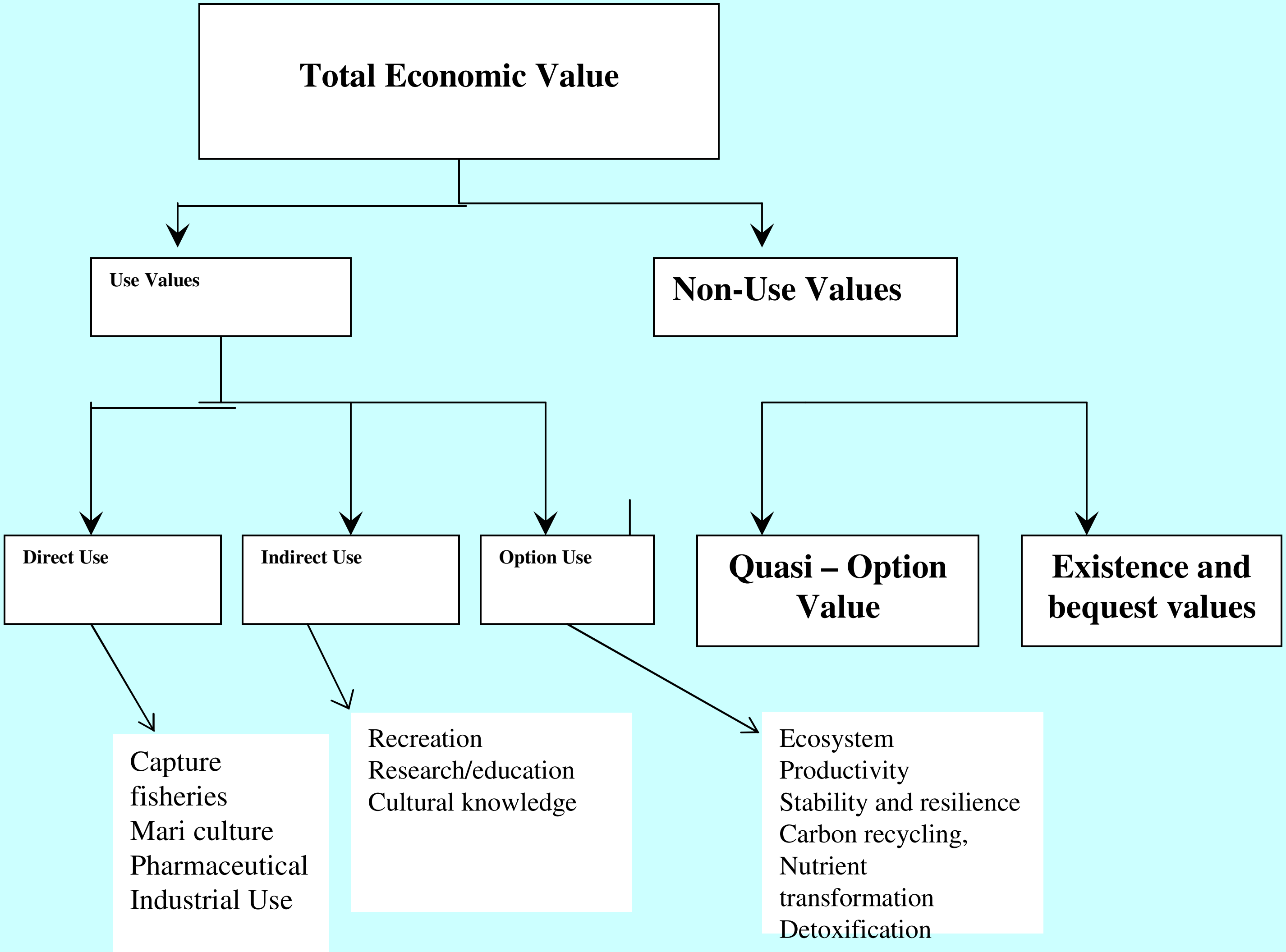
Sources of Benefits from Marine Biodiversity

- Biodiversity and productivity (seasonal and time diversity in species)
- “Sampling competition” effect
- There is also a Complementarity in resource use. Different species are able to occupy different regions of the ecosystem.
- Biodiversity and stability
- Biodiversity and global material cycling
- Nutrient and organic matter transformation
- Source of tourism, recreation and entertainment

Cultural values and future scientific values

- Basis of many cultures.
- Cultural information regarding the habits of marine animals and ecosystem forms a center piece of traditional societies
- Enrich body of scientific knowledge

Economic Contribution of Marine Biodiversity



BRIEF DESCRIPTION OF THE MARINE BIODIVERSITY OF INDIA

- The coastal and estuarine ecosystem
- Inter-tidal Ecosystem
- The coral reef ecosystem
- Deep sea fishery ecosystem

Use values of Coastal Resources

Uses

- Extraction (Sand mining)
- Water extraction
- Recreation
- Agriculture(Cultivation)
- Aquaculture Development

Military Uses Harbours and ports

Transport, housing and pipelines

Transport, housing

Impacts

- Erosion
- Lower water tables and salt water intrusion
- Damage vegetation and encourage blowouts
- Fertilizer use and changes in the species mix
- Salt water intrusion, loss of biodiversity, reduction of the productivity
- Erosion due to increased traffic and decline in the fishery
- resources (Seabird project),
- Disturbance to ecosystem

Marine Ecosystem and Marine Biodiversity

Estimating the direct use values

- **In the case of marine ecosystem it could be viewed as "factories" generating fisheries and other consumptive and non-consumptive products and services.**
- **The contribution of the richness of biodiversity to the ability of an ecosystem in producing different use and non-use values.**
- **We are comparing the economic values of biodiversity-rich and –poor marine ecosystems, but not the total value of any one given marine ecosystem.**
- **Biodiversity as the *joint dissimilarity* of a set of species. Dissimilarities are based upon the differences between species, known as *distances,* in genetic, behavioral, morphological, or other characteristics relevant to management or valued by society.**
- **First by defining a set of characteristics of a benchmark species and then adding up the distances of characteristics of all individual species in an ecosystem. Obviously, the higher the *distance* value, the richer the biodiversity of that system.**

Contribution of biodiversity to commercial fisheries
Modified bioeconomic model

$$\dot{X} = g(X, B) - H(E, B)$$

where
X is the fishery stock, H is the fishery production function, E is usual fishery inputs, and the B is the distance variable representing biodiversity richness

WHAT IS CONTINGENT VALUATION?

- To assess the value of non market public goods such as environmental quality.

Approaches

1. Single bound
2. Double bound
3. Finite no. of bounds
4. Open ended question

Commonly used method

Double bound Multinomial Logit model

SINGLE AND DOUBLE BOUND LOGIT MODELS

SINGLE BOUND

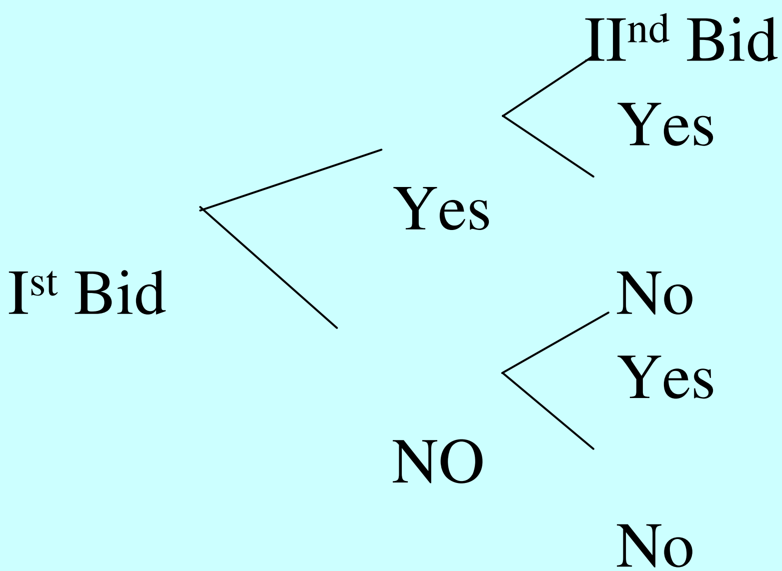
Yes

I^{st} Bid

No

$$Y_{i1} \begin{cases} 1 & \text{if yes for the } i^{th} \text{ individual} \\ 0 & \text{if no for the } i^{th} \text{ individual} \end{cases}$$

DOUBLE BOUND



Percentage of sampled household willing to pay and not willing to pay (Professional wise)

GROUP	Total samples	WTP	Percentage of WTP	Not-WTP	Percentage of not-WTP
Industry & Business	163	122	74.85	41	25.15
Fishing & Farming	93	60	64.52	33	35.48
Fishery related business	53	27	50.94	26	49.06
Workers	21	11	52.38	10	47.62
Non working group	70	45	64.29	25	35.71
Government Officials	100	56	56.00	44	44.00
Over all	500	321	64.20	179	35.80

Sampled households and their Willingness to pay (Professional wise)

GROUP	No. of samples willingness to pay	Percentage households willing to pay 2 times of WTP	Maximum amount of 2 times of WTP	Average amount of 2 times of WTP
Industry & Business	122	53.28	5000	1508
Fishing & Farming	60	18.03	1000	488
Fishery related business	27	11.48	1000	558
Workers	11	0.82	500	500
Non working group	45	12.30	2000	1067
Government Officials	56	20.49	4000	1140
Over all	321	64.20	2250	877

Sampled house holds Willingness to pay at least half of the amount (Professional wise group)

GROUP	Sampled households not willing to pay	% of households willing to pay 1/2 times of not-WTP	Maximum amount willing to pay ½ times among not WTP	Average of ½ times of non-WTP
Industry & Business	41	7.32	1000	542
Fishing & Farming	33	18.18	250	150
Fishery related business	26	11.54	125	125
Workers	10	10	125	125
Non working group	25	8	1000	563
Government Officials	44	15.91	1000	688
Over all	179	35.8	583	366

Percentage of sampled household willing to pay and not willing to pay (Income wise)

Income class	Sampled house holds	Percentage of WTP	Percentage of non-WTP
<20,000	106	55.66	44.34
20,000-39,000	105	56.19	43.81
40,000-59,000	72	63.89	36.11
60,000-79,000	47	78.72	21.28
80,000-99,000	42	61.91	38.10
>100000	128	72.66	27.34
OVER ALL	500	64	36

Sampled households and their Willingness to pay (Income wise)

GROUP	No. of samples in WTP	Percentage of households willing to pay 2 times of WTP	Maximum amount of 2 times of WTP	Average amount of 2 times of WTP
< 20,000	59	35.59	1000	464.29
20,000-39,000	59	28.81	1000	529.41
40,000-59,000	46	34.78	2000	750
60,000-79,000	37	54.05	2000	725
80,000-99,000	26	50	2000	1192.31
> 1,00,000	93	54.84	5000	1842.59

Sampled households Willingness to pay at least half of the amount (Income wise)

GROUP	Sampled house holds not willing to pay	% households willing to pay 1/2 times of sampled not-WTP	Maximum amount willing to pay ½ times among not WTP	Average of ½ times of non-WTP
< 20,000	47	14.89	250	142.86
20,000-39,000	46	6.52	1000	416.67
40,000-59,000	26	15.38	1000	437.52
60,000-79,000	9	-	-	-
80,000-99,000	16	12.5	1000	750
> 100000	35	11.42	1000	656.25
Over all	179	11.17	708	401

WTP amount obtained using double bound logit model

Parameter estimate	Double bound approach	WTP (Rs.)	WTP (using truncated mean) (Rs.)
α	-2.5927	508	522
β	0.0051		

Major reasons for WTP

Reasons	No.	Per cent
Total Response	304	
For future generation	66	21.7
Fishing community	18	5.9
Own use	10	3.3
Sustainability of fishery resources	11	3.6
- For future generation - Own use	17	5.6
-Fishing community -Sustainability of fishery resources	8	2.6
- For future generation - Fishing community	12	3.9

Major reasons for not willing to pay for conservation of coastal biodiversity

Reason for Not willing to pay	Samples	Percentage
The cost is too high	7	3.91
Polluters should pay	27	15.08
Don't trust the government	8	4.47
Already paying enough taxes	13	7.26
Environment is clean enough	2	1.12
Not enough income to pay	27	15.08


04/12/2006


04/12/2006

Conclusions

- The coastal resources provide many non-market benefits which are undermined during the process of developmental and industrial projects.
- The impact analysis and compensation methods do not recognize the non-market benefits.
- The results of the empirical study conducted in coastal Karnataka shows that the per capita willingness to pay was Rs. 522 per year in the form additional taxes for the preservation of coastal environment.


Thank You

Impact of Climate Change on Marine Biodiversity

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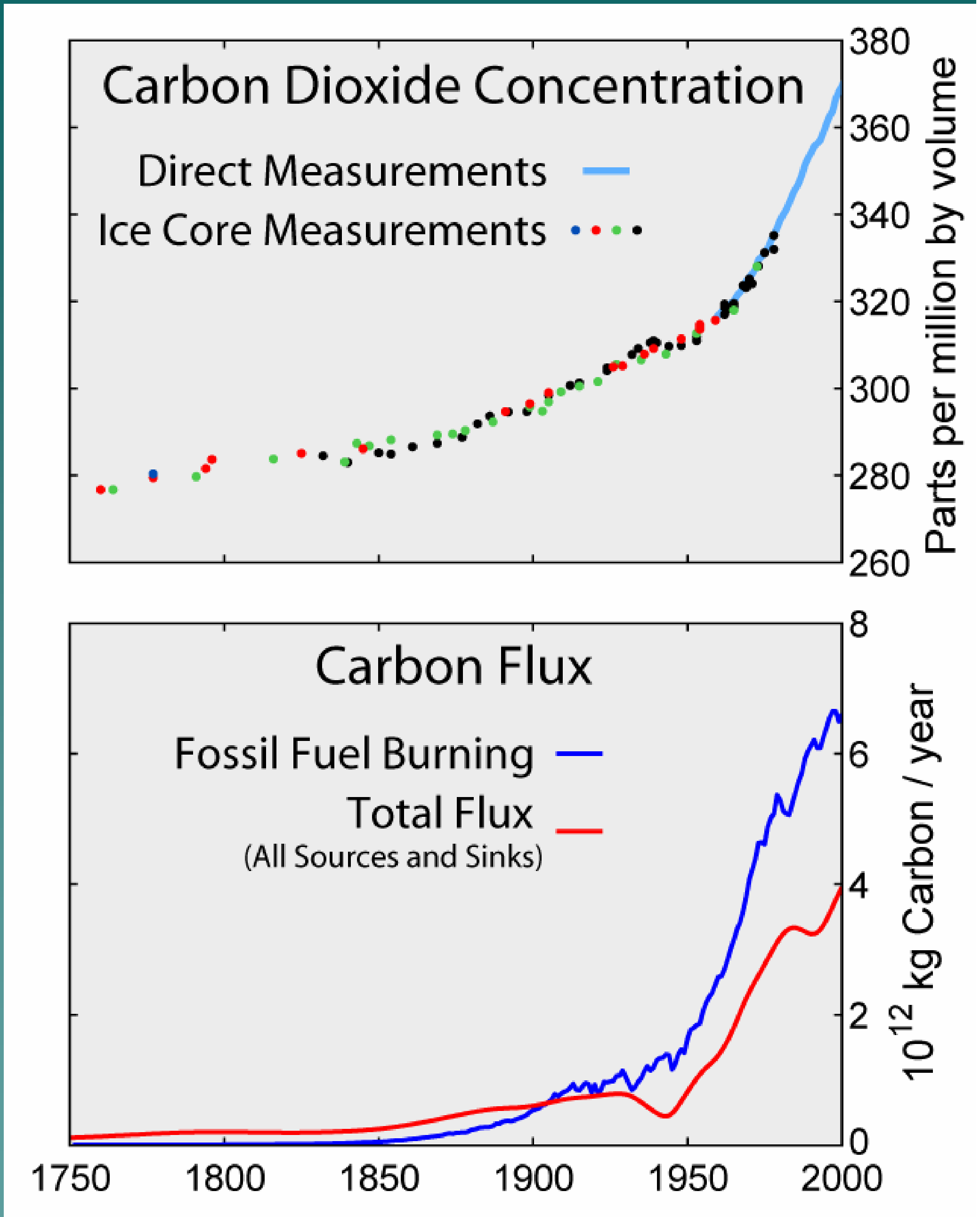
Central Marine Fisheries Research Institute
Kochi 682 018

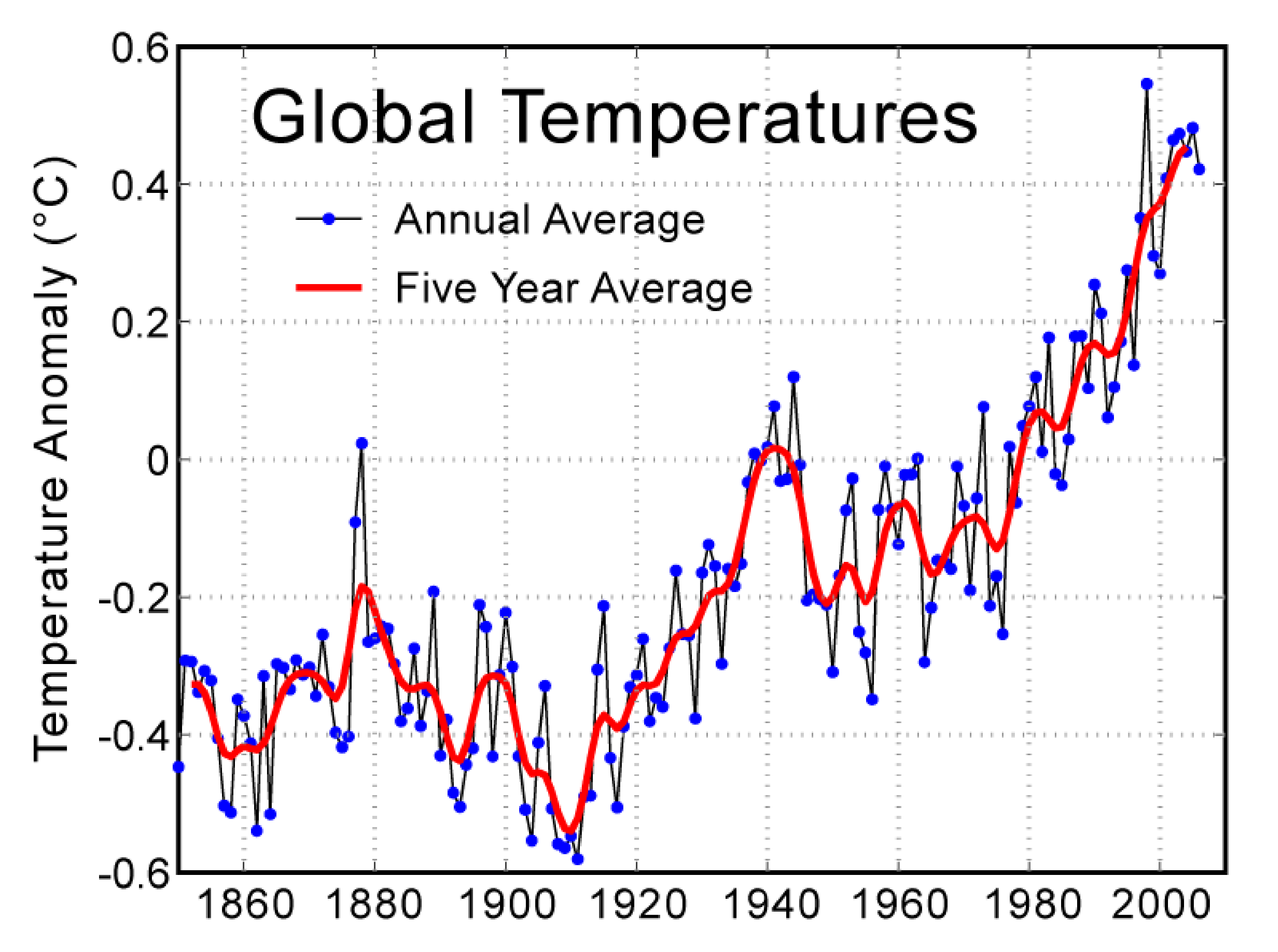
Causal factor for climate change

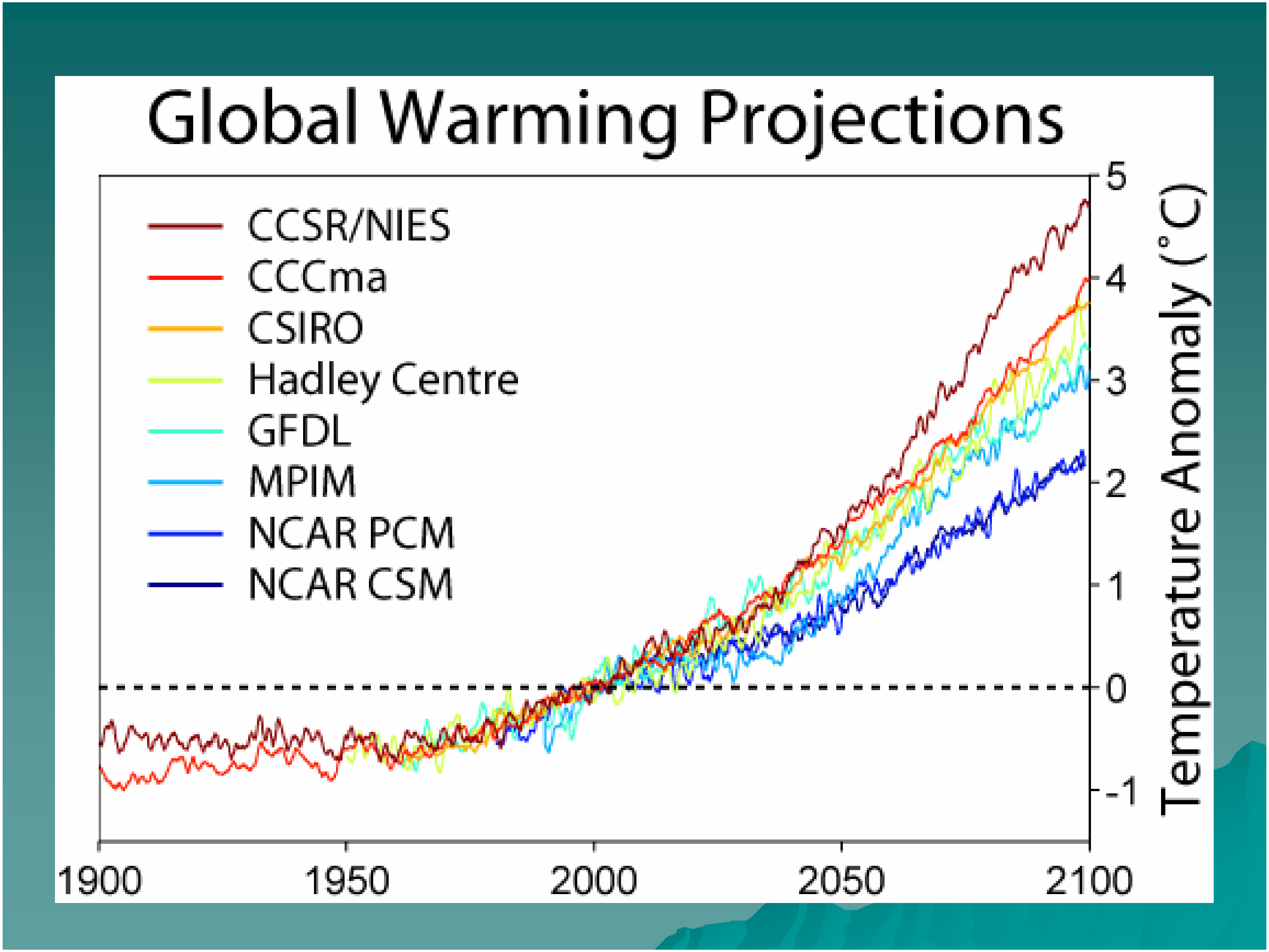
- CO_2 emission in the atmosphere has increased from 275 ppm in 1750 to 383 ppm in 2005.
- At the present trend, it may reach 450 ppm by 2030.
- Co_2 concentration of 550 ppm may be irreversible, and is threshold for several life processes.



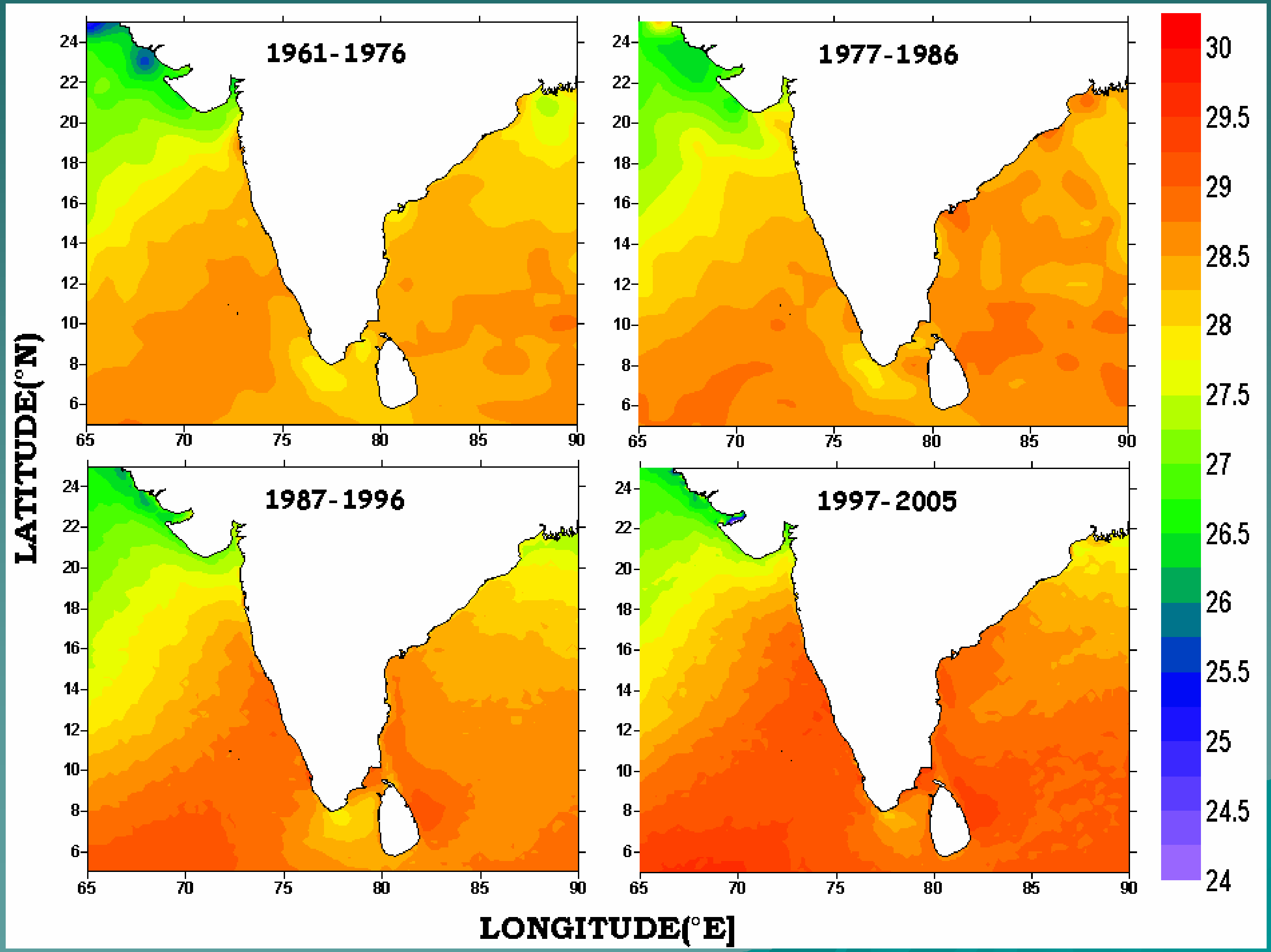
Climate Change in the Oceans: *Rise in Sea Temperature*

- The global average air temperature rose 0.74°C during the 100 year period ending in 2005.
- If the trend continues, the atmospheric temperature will increase by 2.2 to 4.8° C by 2100.
- Seawater mean temperature increased 0.06° C in the last 50 years.
- Increase is not even: upper 300 m of the oceans increased by 0.31° C.
- The mean sea surface temperature in the Indian Seas warmed by 0.2° C in the last 45 years.


Global Temperatures
Annual Average
Five Year Average
Temperature Anomaly (°C)
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
1860
1880
1900
1920
1940
1960
1980
2000


Global Warming Projections
CCSR/NIES
CCCma
CSIRO
Hadley Centre
GFDL
MPIM
NCAR PCM
NCAR CSM
Temperature Anomaly (°C)
5
4
3
2
1
0
-1
1900
1950
2000
2050
2100

Rise in Sea Surface Temperature in the Indian Seas



Climate Change in the Oceans: *Rise in Acidity*

- When CO_2 enters the oceans, it reacts with seawater to form carbonic acid, producing hydrogen ions, which cause the acidity of the seawater to increase.
- In the last 250 years, the concentration of H+ ions in seawater has increased by 30%, equating to a fall in pH by 0.1 unit.
- Continued rises in the concentration of atmospheric CO2 will lead to a global surface water pH reduction of up to 0.4 units by 2100.

Climate Change in the Oceans: *Rise in Sea Level*

- Sea level will increase due to seawater warming, which causes thermal expansion of ocean water (responsible for 70% of the increase); and melting of glaciers and ice sheets of polar regions (30% of the increase)
- Sea level is expected to rise by 9 to 30 cm by 2050 and by 30 to 90 cm by 2100.
- A 25 cm rise would displace large number of people from the Ganges delta, and drown Maldives.

Effects of climate on biodiversity

What do we mean by loss of biodiversity?

- species extinction
- stock extinction
- change in (relative) abundance
- changes in distribution

These changes may sound trivial, but…

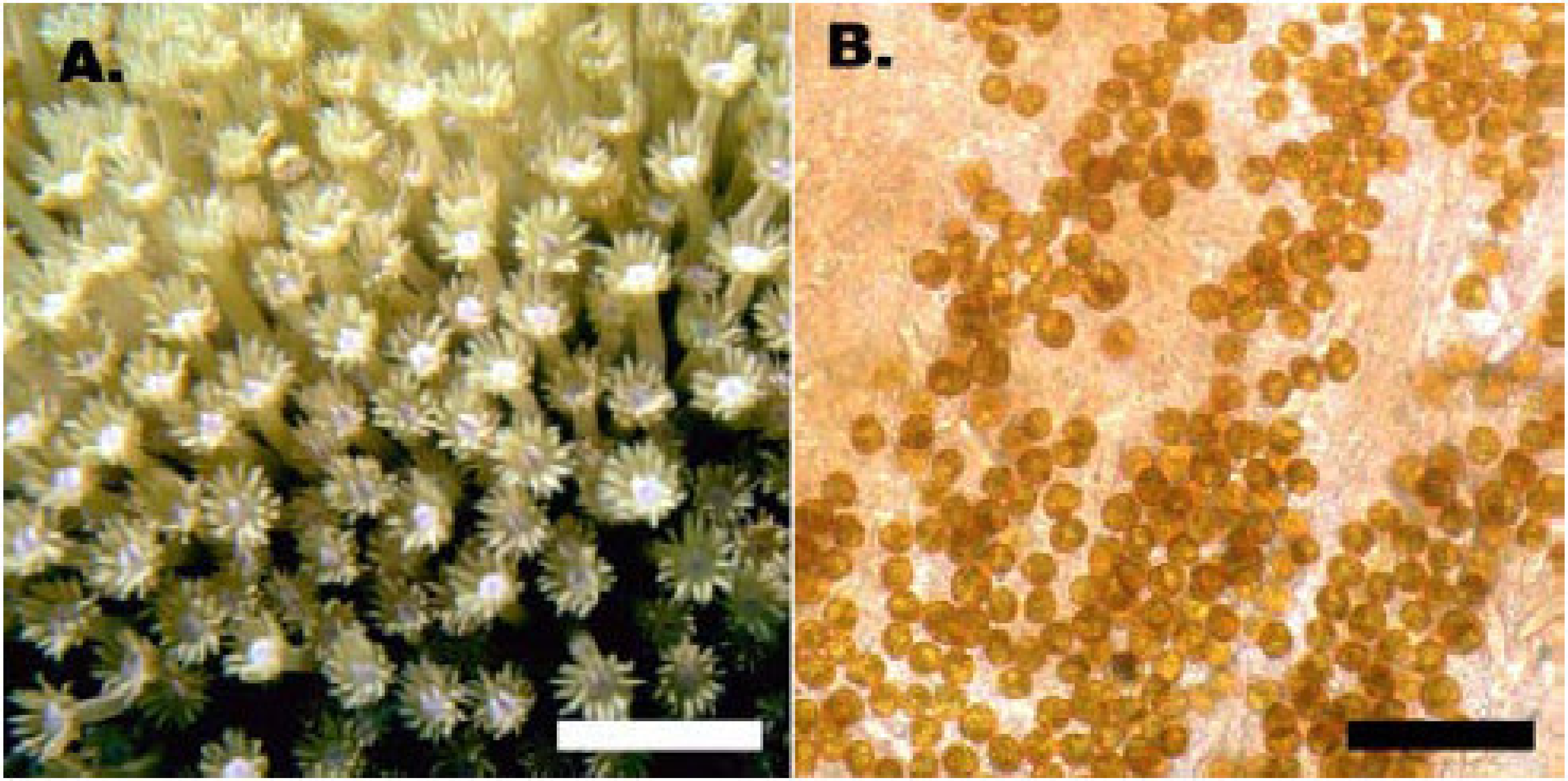
- Marine invertebrates are among the organisms most sensitive to CO_2 accumulation, especially those with a hypometabolic mode of life and heavily calcified.
- Echinoderms, crustaceans and molluscs are found to be very sensitive to acidity.
- Early life stages with an incomplete development of physiological capacities may be the most sensitive. Thereby, reduced reproductive success may be one of the key effect of climate change.
- The main impact of fluctuating climate on intertidal ecosystems would be through changes in sea level and temperature, and exposure to warmer environment during low tide.

Immediate effect is on the CORALS

Coral Bleaching

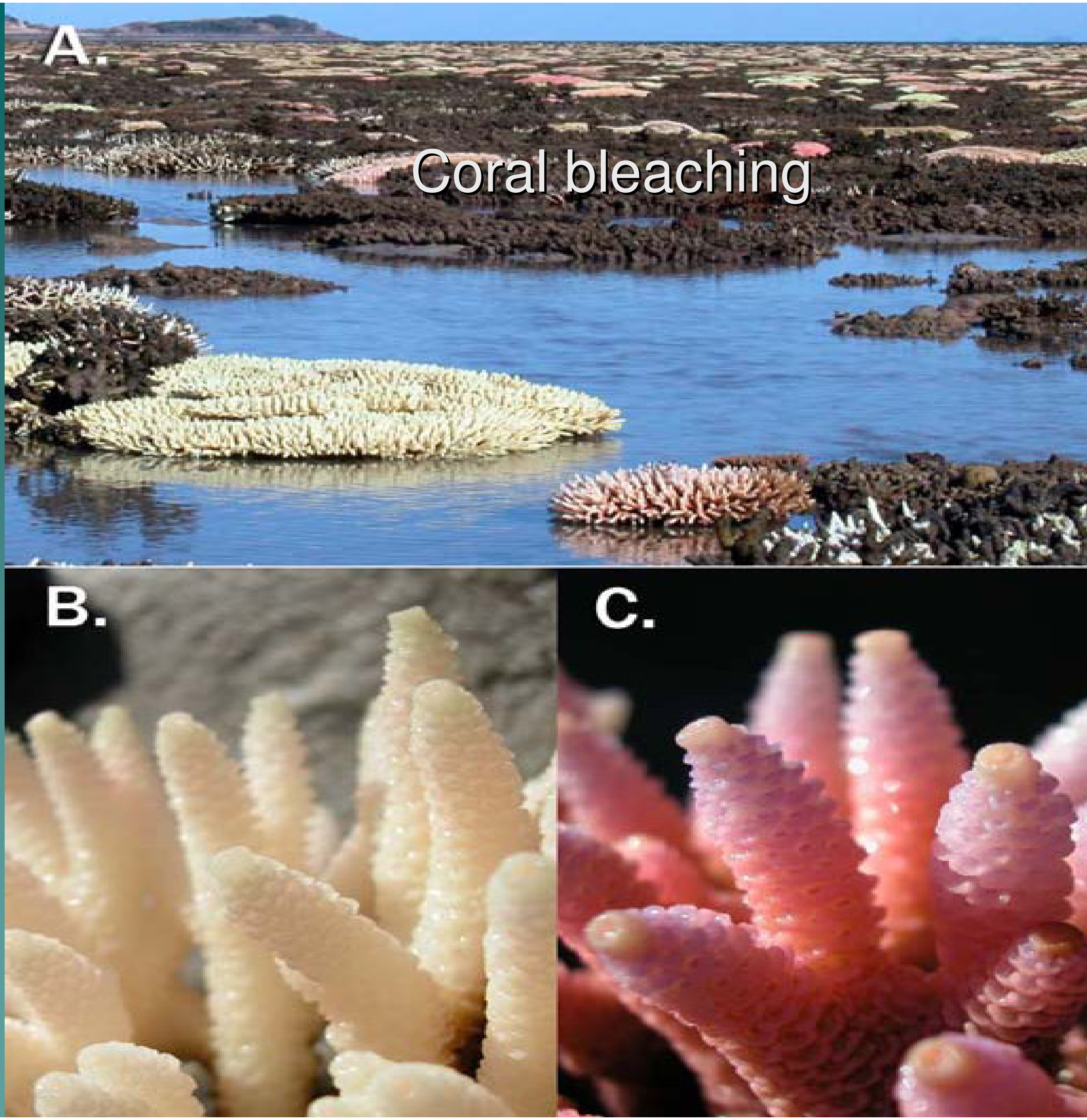
- Coral bleaching results when the symbiotic zooxanthellae (single-celled algae) are expelled from the host coral organisms due to stress; may lead to mortality of corals depending upon the intensity of bleaching

Polyps Zooxanthellae



Causes of Coral Bleaching

Factors	Mechanism	Effects
Acidification	Lowering of pH and carbonate ion concentration	Calcification rates reduce
Temperature	Sea surface temperature increase due to greenhouse effect	Coral bleaching
Sea level	Rise in sea level because of warming	Coastal flooding, input of sediments
Storm	Increase in storm frequency & intensity	Species decline or shift
Dust	Iron dust enhances phytoplankton and macroalgal growth; transport of pathogens	Light penetration decrease, macroalgae compete with corals for space


A.
Coral bleaching
B.
C.

Projected demise of coral reefs in the Indian Seas

Region	Decline starts	Remnant
Andaman	2030 - 2040	2050 - 2060
Nicobar	2020 - 2030	2050 - 2060
Lakshadweep	2020 - 2030	2030 - 2040
Gulf of Mannar	2030 - 2040	2050 - 2060
Gulf of Kachchh	2030 - 2040	2060 - 2070

Vulnerability of sea turtles

- Olive ridley mass-nest along the Orissa coast during December – March every year (3 to 6 lakh turtles nest in a year).
- Sex of hatchlings determined by soil temperature at the time of incubation.
- Those hatching out at < 27^{o}C are males; at > 27^{o}C are females.

Climate and Fisheries

1. Climate affects fisheries
2. Climate affects biodiversity
3. Fisheries affect biodiversity

- *Fishing has a bigger effect on biodiversity than does climate change*
- *Our time series of changes in fish populations mainly come from fisheries*

Changes in Distribution and Phenology

- *Category 1: Shift in latitudinal distribution*
- *Category 2: Extension of distributional boundary*
- *Category 3: No shift/extension of boundary, but change in biomass*
- *Category 4: Shift in depth of occurrence*
- *Category 5: Spatial shift in spawning*
- *Category 6: Temporal shift in spawning*

Distributional Changes

- With warming of the sea, the fish is able to find temperature to its preference in the northern latitudes and eastern longitudes, thereby extending the distributional boundaries and establishing fisheries in larger coastal areas.
- It is expected that the abundance may increase along Gujarat and West Bengal coasts in the coming years assuming further increase in sea temperature.
- These distributional shifts are expected to result in drastic changes in species mix and ecosystem structures and functions.
- Will this trend pave the way for species replacement?

Phenological changes

- The phenology of species, *i. e.*, the sequence and timing of events – growth, maturation, reproduction – in their life cycle, is affected.
- The peak spawning season of threadfin breams off Chennai is found to shift from warmer months of April & May towards relatively cooler months of January & February
- The shift in the timings of maturation and reproduction may cause mismatches between the production of planktonic propagules in one part, and the usual patterns of coastal circulation or the availability of appropriate food items in the other.

IUCN: 1998 Red Data Book

Extinct: Species not located in the wild for the last 50 years

Endangered: Taxa in danger of extinction & survival unlikely if causal factors continue operating

Vulnerable: Likely to move into endangered category in the near future

- Over fishing
- Extensive destruction of habitat
- Environmental disturbance

Rare: Taxa not at present endangered or vulnerable but at risk

Existing CITES criteria for listing in Appendix I

1. Small population size (< 5,000 individuals)
2. Restricted area of distribution ($10,000\ km^2$)
3. Decline in numbers
4. Likely to satisfy one of 1-3 within the next 5 years

There are severe limitations of the existing CITES listing criteria and guidelines if applied to exploited fish stocks

There may be several misses and numerous false alarms

Life history characteristics are very important

Greatest relevance to the risk of extinction is population resilience;

ability to rebound after perturbations;

ability to sustain exploitation

Small population size (< 5,000 individuals)

- applicable to sessile and low productivity species;

- for exploited fish stocks, the number of individuals associated with the risk of extinction could range from <1000 (e.g. low productivity species) to > 1 million (e.g. highly productive small pelagics)

Restricted area of distribution (10,000 km^2)

- applicable for certain reef fish, sessile species;

- but is too large to protect several small pelagics, invertebrates including corals

- no numeric guideline is universally applicable

Historical decline if any, in area of distribution should be used

Analysis should be on a case-by-case basis

Decline in numbers

Population decline criterion is the most widely applicable for exploited fish stocks

Historical extent of decline should be considered

5% - 30% decline from the reference baseline is appropriate for listing

Productivity is a complex function of fecundity, growth rate, natural mortality, age at maturity and longevity.

More productive species have greater ability to rebound from low numbers; they can take advantage of situations

Low productive species, if depleted, spend longer periods at low population size; they are exposed to greater risk to depensatory factors

CONCLUSION

- CLIMATE CHANGE IS A DEPENSATORY FACTOR THAT EXACERBATES THE CURRENT THREATS TO BIODIVERSITY.
- MANAGING BIODIVERSITY WILL BECOME FAR MORE CONTENTIOUS BECAUSE THE FAUNA AND FLORA WILL CHANGE IN UNEXPECTED WAYS.
- The ability to preserve marine biodiversity will rest on a mechanistic understanding of the interactions between global change events and localized disturbances.

THANK YOU

Marine and coastal aquatic biodiversity of Karnataka

Dr. P.U. Zacharia

Central Marine Fisheries Research Institute,
Mangalore Research Centre

Karnataka State

- Karnataka State has a 300 km long coastline and is a frontline state in marine fisheries development.
- Historically known as the 'mackerel coast', it has a continental shelf area of 25,000 km^2.
- About 80% of the shelf area lies between 0 and 72 m depth.
- Its contribution to the total marine fish production of the country has varied from 6 to 14 % annually.

Geo-location of sampling sites

Grid No	Inter-tidal	Lat (^oN)	Long (^oE)	Code
G1	Mangalore	12.99889	74.79389	**IT1**
G2	Mulki	13.02917	74.78861	**IT2**
G3	Malpe	13.36556	74.6975	**IT3**
G4	Kundapura	13.60778	74.67611	**IT4**
G5	Baindur	13.87333	74.61528	**IT5**
G6	Murdeshwar	14.09806	74.49083	**IT6**
G7	Kumta	14.43778	74.38583	**IT7**
G8	Ankola	14.65889	74.28306	**IT8**
G9	Karwar	14.88889	74.10278	**IT9**
	Estuary			
G1	Netravati-Gurupur	12.83972	74.82889	**E1**
G2	Mulki	13.07361	74.78222	**E2**
G3	Swarna-Sita	13.33972	74.71056	**E3**
G4	Chakra-Haladi-Kollur	13.64306	74.65861	**E4**
G5	Vankatapur	13.98333	74.56167	**E5**
G7	Saravati-Badgani	14.28139	74.44333	**E6**
G8	Aganashini	14.50056	74.31528	**E7**
G9	Kali	14.80444	74.12000	**E8**

Geo-location of sampling sites..contd

	Sea/sub tidal			
G1	Mangalore	12.92000	74.80111	**S1**
G2	Mulki	13.70111	74.76889	**S2**
G3	Malpe	13.33972	74.70889	**S3**
G4	Kundapura	13.63278	74.13500	**S4**
G5	Baindur	13.98417	74.56167	**S5**
G6	Murdeshwar	14.08861	74.33389	**S6**
G7	Kumta	14.29861	74.38500	**S7**
G8	Ankola	14.50694	74.31639	**S8**
G9	Karwar	14.73361	74.01556	**S9**
	Island			
G3	St.Mary's	13.38194	74.68250	**IS1**
G6	Netrani	14.01500	74.33278	**IS2**
G8	Kukre	14.70611	74.24583	**IS3**
G9	Devgad	14.82250	74.06444	**IS4**
G9	Kurmagad	14.84833	74.10111	**IS5**

Sampling methods

- The entire coastal water is divided into nine equal sampling grids of 0.15^{o} staring from south to north.
- From each grid flora and fauna were collected to cover the intertidal, subtidal, estuarine and island ecosystems using the standard sampling procedures.
- The latitude and longitude of the sampling stations were fixed using GPS.
- Specimens were identified up to species level using standard procedure.
- Microscopic specimens were identified with the help of light microscope. Photo micrographs of important specimens were taken using digital camera.

Flora

- **Total of 62 phytoplankton species were observed and out of which 5 species were toxic capable of producing paralytic Shell fish poisoning if they bloom.**
- **A total of 78 species of seaweeds and 2 species of sea grasses were observed.**
- **Intertidal rocks along the Islands registered fairly good flora of brown seaweeds dominated by *Sargassum ilicifolium,* having economic importance for extracting algin.**

No. of phytoplankton species from different grids along Karnataka

Grid no & location		Inter-tidal	Sea	Island
G1 Mangalore	14	10	27	
G2 Mulki	35	11	29	
G3 Malpe	28	13	35	14
G4 Kundapura	17	16	8	
G5 Byndoor	14	12	11	
G6 Murdeshwar	-	11	8	16
G7 Kumta	22	11	10	
G8 Ankola	20	12	10	14
G9 Karwar	26	14	11	16

Number of seaweed species from each sampling grid along Karnataka coast.

Grid no & location	Estuary	Inter-tidal	Sea	Island
G1 Mangalore	14	10	27	
G2 Mulki	35	11	29	
G3 Malpe	28	13	35	14
G4 Kundapura	17	16	8	
G5 Byndoor	14	12	11	
G6 Murdeshwar	-	11	8	16
G7 Kumta	22	11	10	
G8 Ankola	20	12	10	14
G9 Karwar	26	14	11	16

Zooplankton

- Total of 115 zooplankton species belonging to 56 families were recorded from the Karnataka coast.
- Generally, maximum zooplankton biodiversity was observed in the marine environment compared to the estuaries.

- **Six species of Demospongia sponges coming under 6 families were collected from the Karnataka coast.**
- **Twenty-five species of sea anemones were collected and identified from the intertidal, sea and island ecosystems along Karnataka coast.**
- **Three species of bryozoans under the order cheilostomata were collected and identified from the Karnataka coast.**

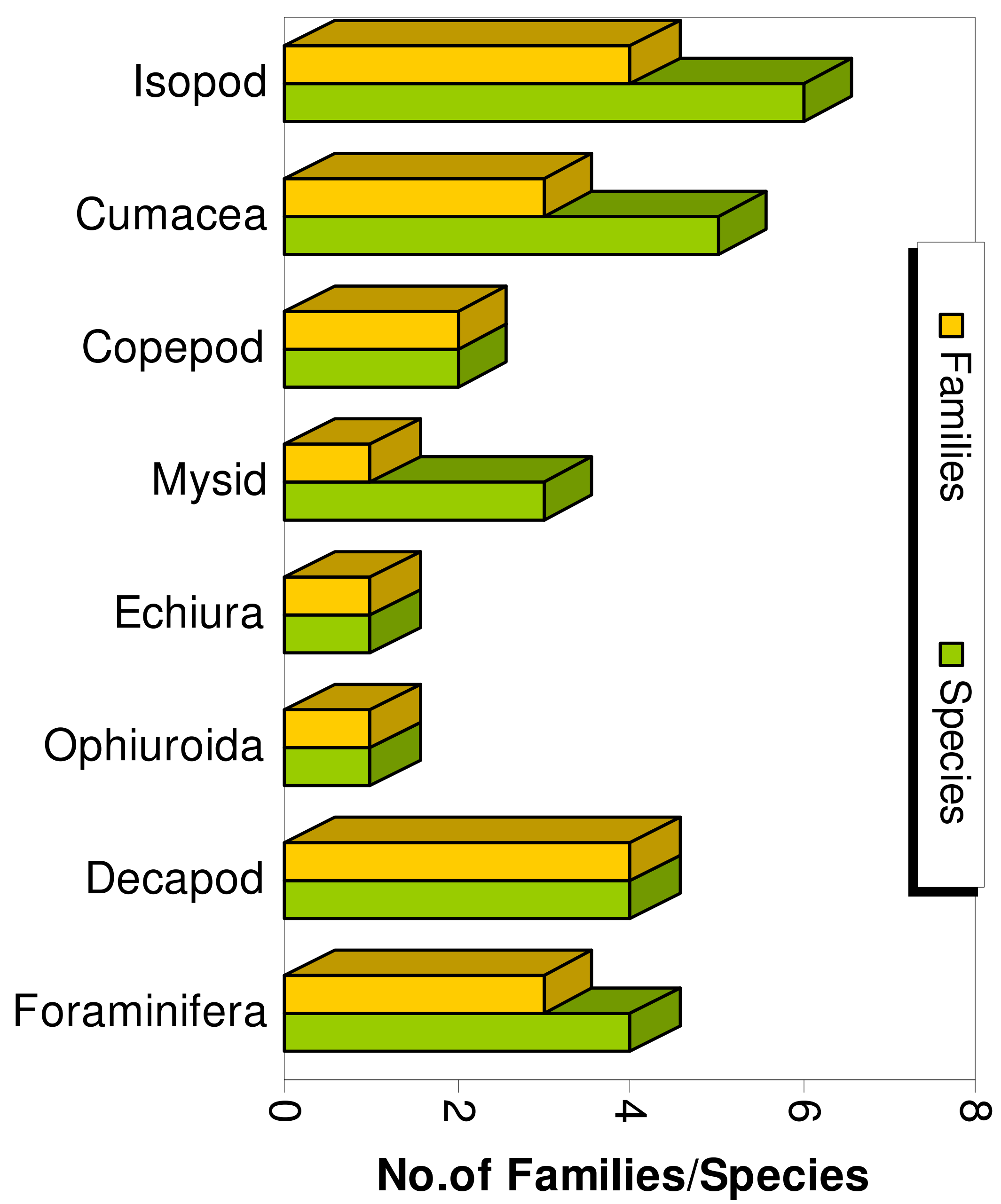
Sponges collected from Karnataka

	Scientific name	Class	Order	Family	IT	Sea	IS
1	*Axinysria flabelliformes*	Demospongiae	Epipolasidae	Sollasellidae			√
2	*Halisarca* sp	Demospongiae	Halisarcida	Halisarcidae	√	√	√
3	*Acanthella elongata*	Demospongiae	Poecilosclerida	Hymeniacidonidae			√
4	*Echinodictylum longistylum*	Demospongiae	Poecilosclerida	Phorbaridae			√
5	*Raspailia hornelli*	Demospongiae	Poecilosclerida	Raspailiidae			√
6	*Adocia* sp	Demospongiae	Poecilosclerida	Adociidae	√	√	√

Benthic organisms

- Polychaetes were the most dominant of the benthic faunal groups recorded along the Karnataka coast. Nearly 143 species of polychaetes belonging to 34 different families were recorded in the present study.

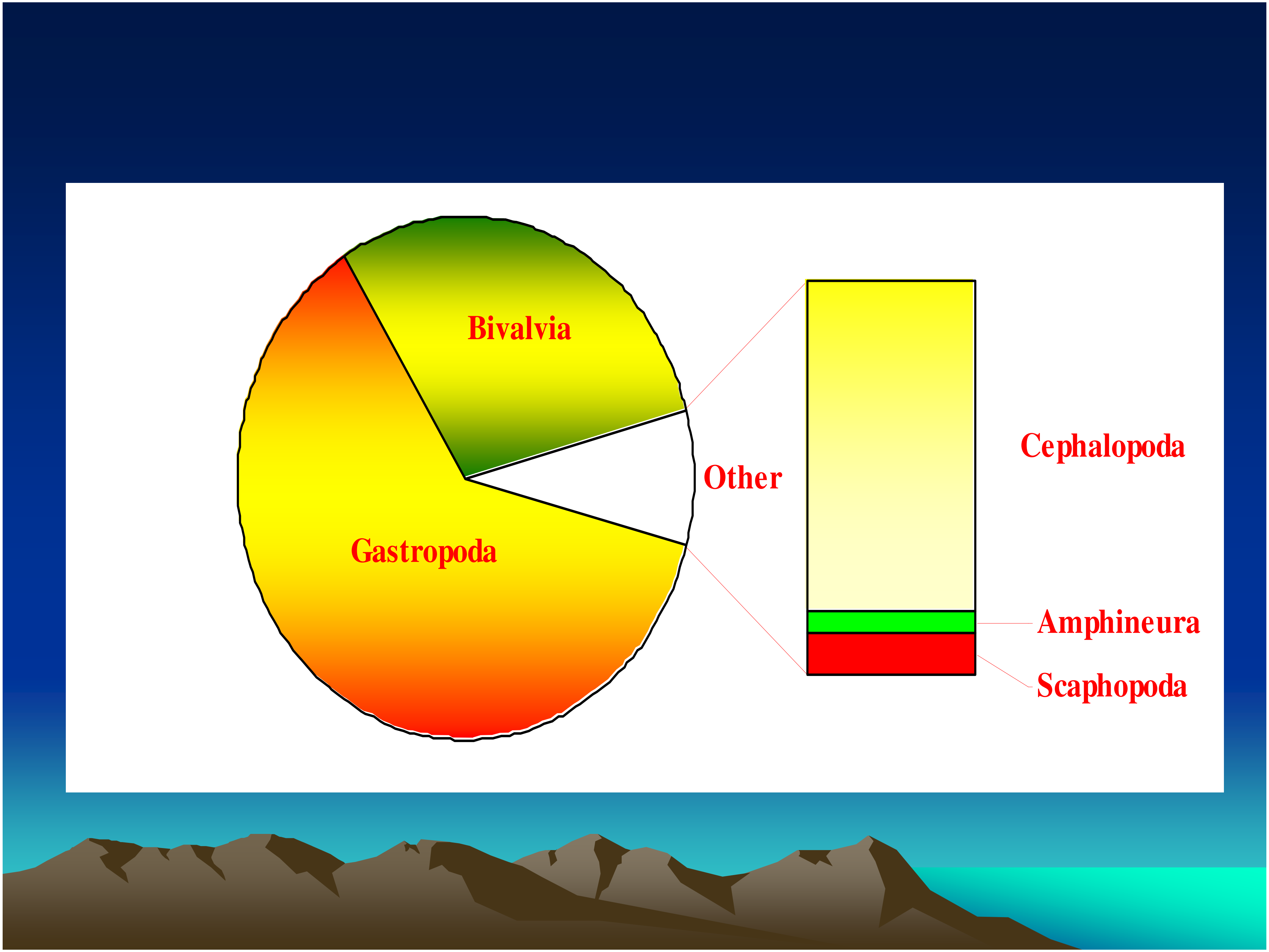
- Four species of nematodes and 1 species nemertians were recorded.

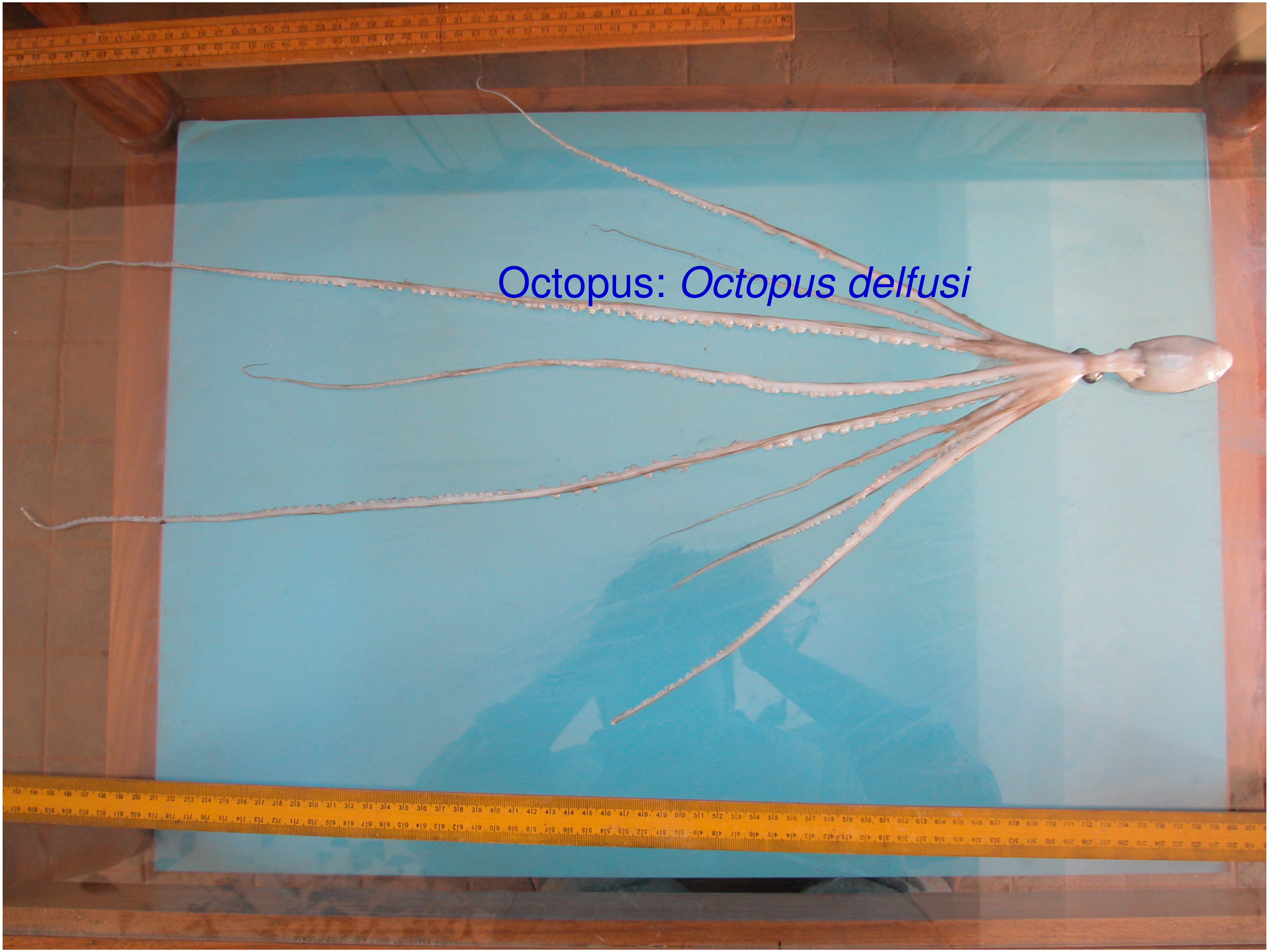


Isopod
Cumacea
Copepod
Mysid
Echiura
Ophiuroida
Decapod
Foraminifera
0
2
4
6
8
No.of Families/Species
Families
Species

Molluscs

- Total of 234 molluscan species were recorded belonging to 65 families and 132 genera, of which 145 are gastropods, 70 are bivalves, 16 are cephalopods, a single species of polyplacophores and two species of scaphopods.
- The Class Gastropoda accounted for 62% of the molluscan diversity followed by Bivalvia (30%); Cephalopoda (7%) and Amphineura & Scaphopoda (1%).

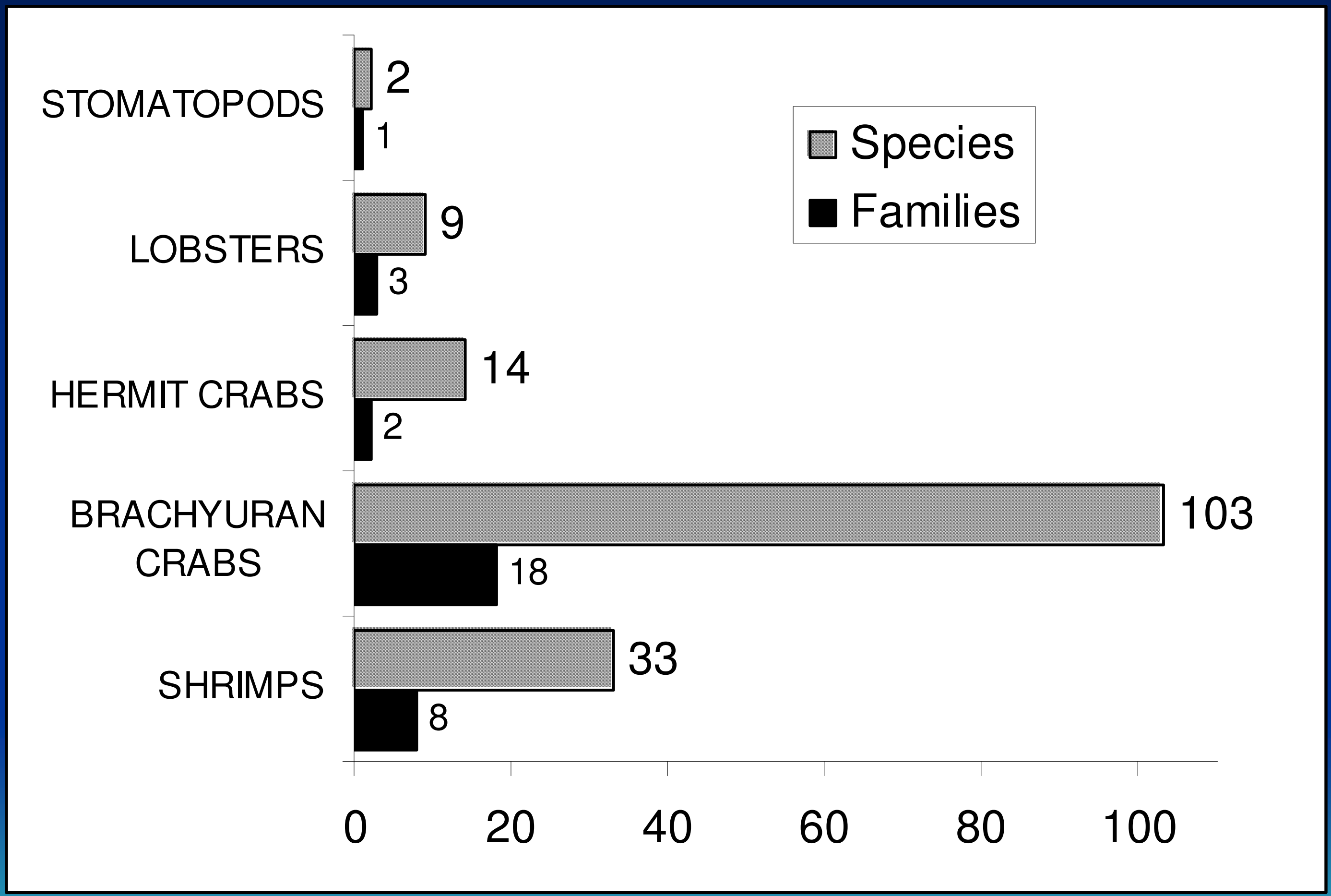

Bivalvia
Other
Gastropoda
Cephalopoda
Amphineura
Scaphopoda


Octopus: *Octopus delfusi*

Crustaceans

- **Along Karnataka coast, 19 species of shrimps belonging to 4 families; 13 species of brachyuran crabs belonging to 9 families and one hermit crab species belonging to Diogenidae family were collected from estuaries.**
- **A total of 29 species of shrimps, belonging 6 families were collected from coastal and marine zones of Karnataka. Penaeidae was the largest family with 16 species.**

Distribution of larger crustaceans in the sub-tidal area along the Karnataka coast



List of larger crustacean species recorded for the first time from Karnataka coast

Sl. no.	Group	Family	Species
1	Shrimps	Penaeidae	*Parapenaeus fiissuroides indicus*
2	Shrimps	*Rhynchocinetidae*	*Rhynchocinetes durbanensis*
3	Shrimps	*Pandalidae*	*Heterocarpoides levimana*
4	Crabs	*Portunidae*	*Portunus monomia gracillimanus*
5	Crabs	*Carpiliidae*	*Carpilius convexus*
6	Crabs	*Carpiliidae*	*Carpilius maculates*

- Five species of starfishes were identified from intertidal, island and sea collections.
- Two species of Sea urchins coming under two families were collected and identified. .
- Only one species of sea cucumber, *Holothuria leucospilota* was recorded from the coast.

List of Chaetognaths identified from Karnataka coast

Sl.no	Scientific name	Class	Order	Family	Sea	Is	Es
1	*Krohnitta subtilis* (Grassi)	Sagittoidea	Aphragmophora	Krohnittidae	√	√	√
2	*Sagitta bedoti Berneck*	Sagittoidea	Aphragmophora	Sagittidae	√	√	√
4	*Sagitta elegans Verrill*	Sagittoidea	Aphragmophora	Sagittidae	√	√	√
5	*Sagitta enflata Grassi*	Sagittoidea	Aphragmophora	Sagittidae	√	√	√
6	*Sagitta maxima*	Sagittoidea	Aphragmophora	Sagittidae	√	√	√

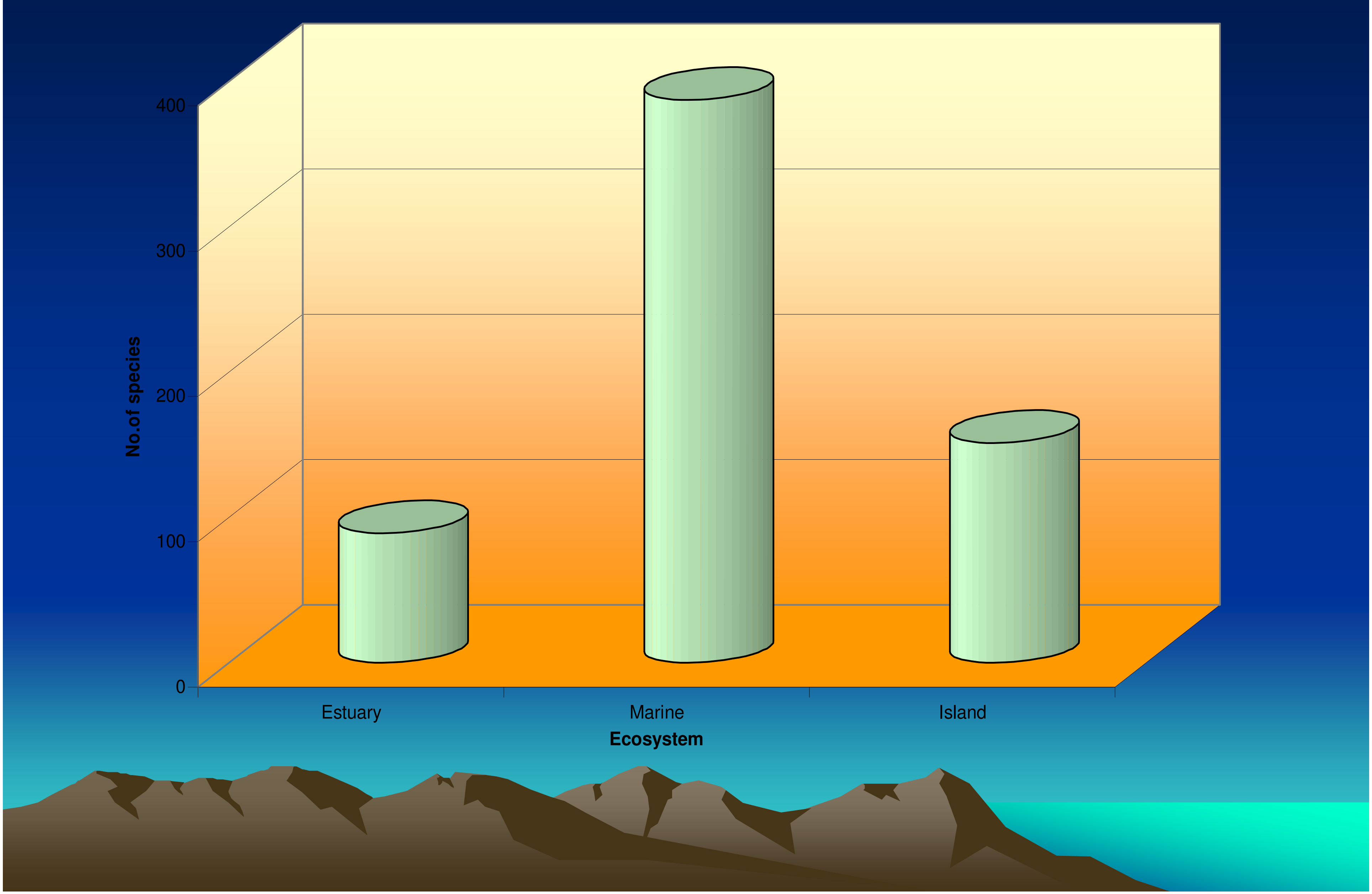
List of ascidians identified from Karnataka coast

Sl.no	Species	Class	Order	Family	Es	Sea	IT	IS
1	*Diplosoma listeranium*	Ascidiacea	Aplousobranchia	Didemnidae		√		
2	*Polyclinum indicum*	Ascidiacea	Aplousobranchia	Polyclinidae		√		
3	*Diplosoma macdonaldi*	Ascidiacea	Aplousobranchiata	Didemnidae		√		
4	*Symplegma viride*	Ascidiacea	Pleurogona	Styelidae		√		
5	*Botryllus schlosseri*	Ascidiacea	Pleurogona	Styelidae		√		
6	*Styela bicolor*	Ascidiacea	Pleurogona	Styelidae		√		

Fishes

- Three hundred and ninety (390) fish species belonging to 24 orders and 118 families were collected and identified from the coast, which forms 15.3% of the coastal fishes reported from Indian coast.
- Consisted of 40 elasmobranch species (sharks, rays and skates) and 350 bony fishes.

Fig.1.Fish species number in different ecosystem



List of threatened/vulnerable fishes

No	Species	Status
1	*Carcharhinus hemiodon*	Critically endangered (IUCN)
2	*Alopias vulpinus*	Data Deficient (IUCN)
3	*Carcharhinus amboinensis*	Data Deficient (IUCN)
4	*Carcharhinus limbatus*	Lower Risk/Near threatened(IUCN)
5	*Carcharhinus melanopterus*	Lower Risk/Near threatened(IUCN)
6	*Galeocerdo cuvieri*	Lower Risk/Near threatened(IUCN)
7	*Carcharhinus dussumieri*	Near Threatened (IUCN)
8	*Carcharhinus macloti*	Near Threatened (IUCN)
9	*Carcharhinus sealei*	Near Threatened (IUCN)
10	*Carcharhinus longimanus*	Vulnerable (IUCN)
11	*Chiloscyllium griseum*	Near Threatened (IUCN)
12	*Chiloscyllium indicum*	Near Threatened (IUCN)
13	*Dasyatis zugei*	Near Threatened (IUCN)
14	*Hippocampus kuda*	Vulnerable (IUCN)
15	*Hippocampus histrix*	Data Deficient (IUCN)
16	*Sphyrna lewini*	Lower Risk/Near threatened(IUCN)
17	*Sphyrna mokarran*	Data Deficient (IUCN)
18	*Mobula mobular*	Vulnerable (IUCN)
19	*Rhina ancyclostoma*	Vulnerable (IUCN)
20	*Rhincodon typus*	Vulnerable (IUCN)
21	*Rhinobatos typus*	Vulnerable (IUCN)
22	*Rhynchobatus djiddensis*	Vulnerable (IUCN)
23	*Stegostoma fasciatum*	Vulnerable (IUCN)
24	*Galeocerdo cuvier*	Lower Risk/Near threatened(IUCN)
25	*Scoliodon laticaudus*	Lower Risk/Near threatened(IUCN)
26	*Aetobatus narinari*	Data Deficient (IUCN)
27	*Manta birostris*	Data Deficient (IUCN)

Marine reptiles

- Three species of sea turtles belonging to a single family (Chelonidae) have been recorded (endangered).
- Three species of sea snakes belonging to a single family (Hydrophiidae) was recorded.

Species of marine reptiles recorded along the Karnataka coast

Sl. No.	Species	Family	Common name
Sea turtles			
1	Chelonia mydas	Cheloniidae	Green turtle
2	Lepidochelys olivacea	Cheloniidae	Olive ridley turtle
3	Eretmochelys imbricata	Cheloniidae	Hawksbill turtle
Sea snakes			
5	Hydrophis spiralis	Hydrophiidae	Yellow sea snake
6	Hydrophis cyanocinctus	Hydrophiidae	Annulated sea snake
7	Hydrophis schistosa	Hydrophiidae	Net-biter sea snake

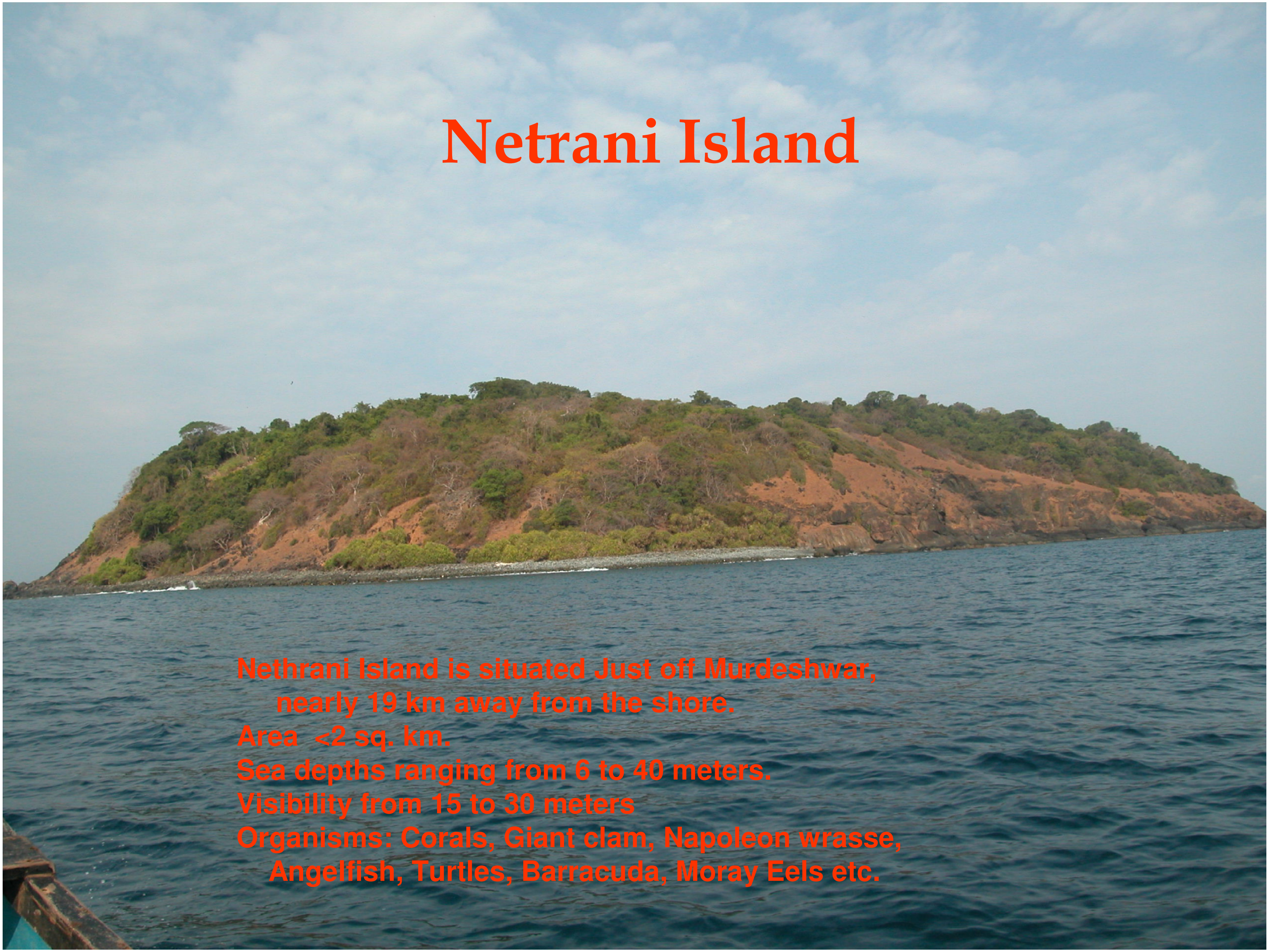
Mammals

Dolphin	Common name	IUCN Red list status
Sousa chinensis	Indopacific Humpback	DD-Data Deficient
Stenella longirostris	Spinner dolphin	LR/cd-Lower Risk (conservation dependent)
Tursiops truncatus	Bottlenose	DD-Data Deficient
Porpoise		
Neophocaena phocaenoides	Finless porpoise	DD-Data Deficient
Whales		
Balaenoptera edeni	Byrde whale	**Not in Red list**
Balaenoptera acutorostrata	Minke whale	LR/nt- Lower Risk (near threatened)
Balaenoptera musculus	Blue whale	EN- Endagered
Physeter macrocephalus	Sperm whale	**Not in Red list**

Netrani Island

Studied using professional divers
Baracuda Diving India, Goa


Murdeshwar
Mavalli
19 km away from the shore
N 14º 00″ 56; E 74º 19″ 47
Image © 2006 DigitalGlobe
© 2006 Europa Technologies
Google
Pointer 14°05'22.93" N 74°29'04.04" E elev 15 ft
Streaming 100%
Eye alt 11252 ft


Netrani Island
Nethrani Island is situated Just off Murdeshwar, nearly 19 km away from the shore.
Area <2 sq. km.
Sea depths ranging from 6 to 40 meters.
Visibility from 15 to 30 meters
Organisms: Corals, Giant clam, Napoleon wrasse, Angelfish, Turtles, Barracuda, Moray Eels etc.

Coral Distribution
west coast

- Ratnagiri
- Malvan
- Redi

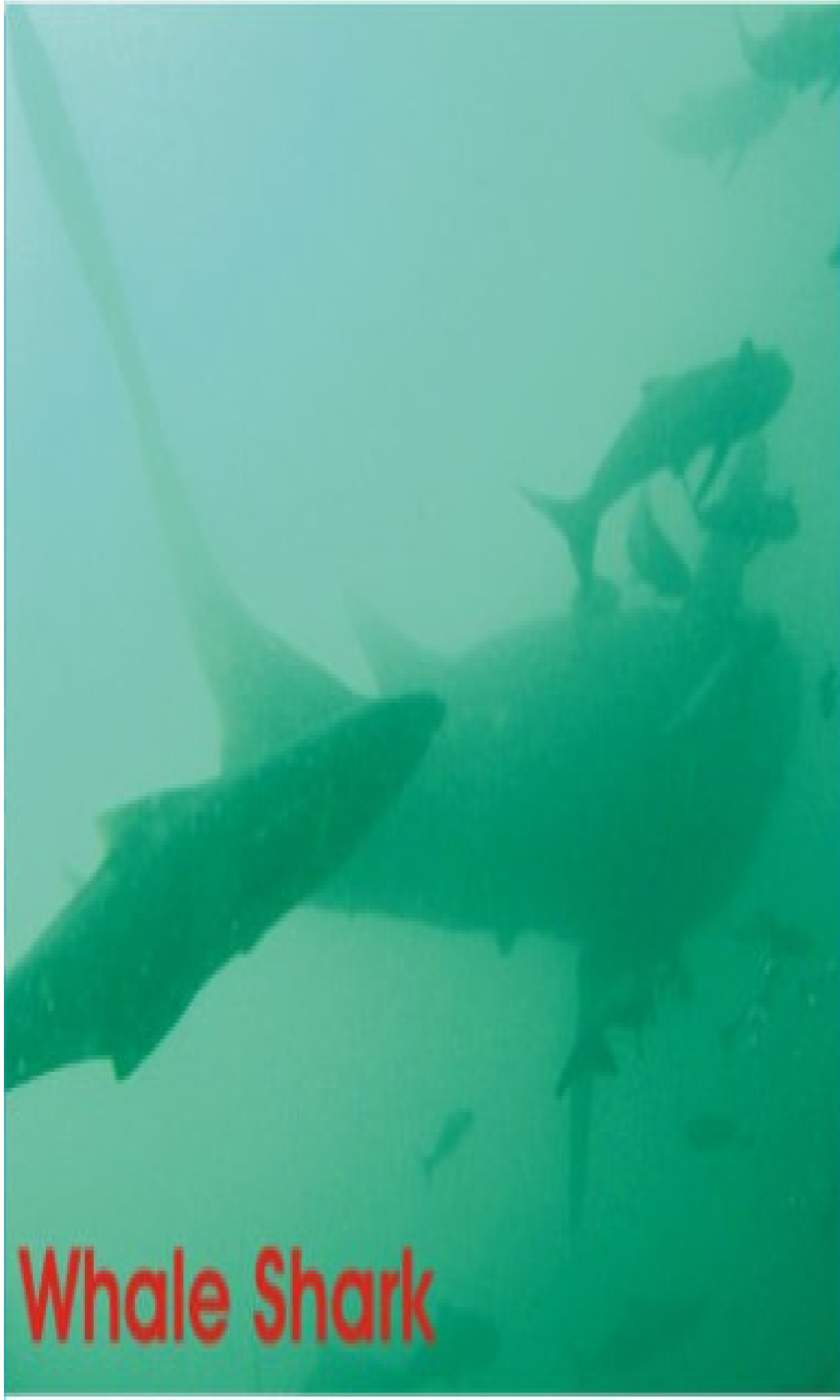
- Netrani Island (off Muredeshwar)
- Gaveshani Bank (off Malpe)

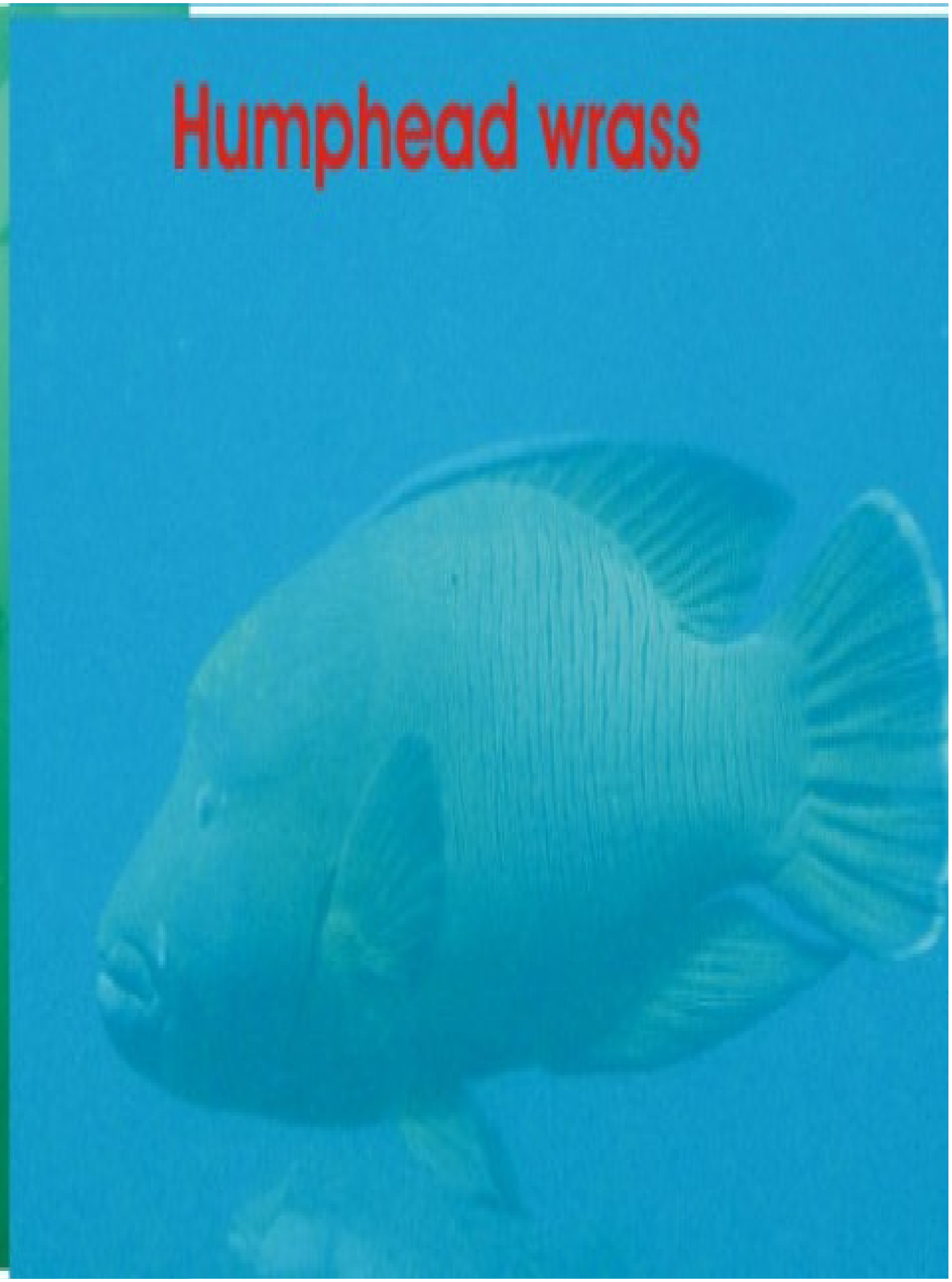
Diversity of coral reef- India

Locations	Total Genus
Palk Bay	21
Gulf of Mannar	26
L.D. Island	28
Andaman Is	25
Nicobar Is	42
Gulf of Kutch	20
Ctrl. West Coast	8
Gaveshani Bank	5
Netrani Is	12

Coral fishes

- Total of 89 coral associated fishes were recorded from the area in which 27 species were new record from the Indian coast.
- Four fish Genus were reported for the first time from Indian coast.
- Out of the nine grouper fish species identified from this island, two species such as *Cheilinus undulates* (endangered) and *Rhincodon typus* (vulnerable) are included in the IUCN red list.


Whale Shark


Humphead wrass

Coral species

- **Total of 14 coral species and 4 sponge species collected & identified.**
- **Total of 15 bivalve species, 48 gastropod species and 8 nudibrach species collected & identified.**
- **Several small giant clams (*Tridacna maxima*) which are protected under the Indian Wildlife (Protection) Act and included in the IUCN Invertebrate Red Data Book as 'Lower Risk: Conservation Dependent' species was observed from this area.**

No. of species recorded from Netrani Island

Sl.no	**Group**	No. of species
1	**Phytoplankton**	16
2	**Seaweed**	7
3	**Porifera-** Sponges	6
4	**Scyphozoa-** Jelly fish	12
5	**Ctenophora**	2
6	**Anthozoa**- sea anemones	2
7	**Cnidaria**	**7**
8	**Holothuria**	1
9	**Zooplankton**	2
10	**Nudibranch Molluscs**	8
11	**Bivalve Molluscs**	15
12	**Gastropod Molluscs**	48
13	**Cephalopod Molluscs**	3
14	**Shrimp**	12
15	**Crabs**	17
16	**Lobster**	4
17	**Sea snake**	3
18	**Finfish**	92


Destruction of the Island

No	Taxa	Karnataka	India	%
1	Cholorophyta	25	216	12
2	Rhodophyta	30	434	7
3	Cyanaophyta	2		
4	Phaeophyta	21	191	11
5	Crysophyta	57		
6	Tracheophyta	2		
7	Dinoflagellata	6	90	7
8	Porifera	6	486	1
9	Cnidaria	73	842	9
10	Ctenophora	2	12	17
11	Rhizopoda	11		
12	Nemertea	1		
13	Ciliophora	3		
14	Nematoda	4		

No	Taxa	Karnataka	India	%
15	Brachiopoda	1		
16	Annelida	143	378	38
17	Echiura	2	33	6
18	Chaetognatha	5	30	17
19	Mollusca	259	3370	8
20	Bryozoa	3	200	2
21	Echinodermata	11	765	1
22	Arthopoda	310	3448	9
23	Protochordata	6	119	5
24	Pisces	389	2546	15
25	Reptilia	6	15	40
26	Mammalia	8	25	32
	Total	1,386	16,173	9

No. of marine species in Karnataka included in the IUCN Red list of threatened species as per SSC (species survival commission) and protected under Indian Wildlife (Protection) Act, 1972

(EN=Endangered; VU=Vulnerable; LR=Lower Risk; DD=Data deficient; CD=Conservation dependant; nt=near threatened; lc=least concern)

Group	IUCN Red list Categories						Indian Wild life Act (1972) Schedules		
	EN	VU	LR/nt	LR/CD	DD	lc	I	III	IV
Mammals	5	1		1	1		8		
Turtles	1								
Sea snakes									3
Elasmobranchs		8	11		3	2	2		
Fin fishes	1	1					2		
Molluscs							1		2
Sea cucumber							1		
Corals							14		
Sponges								4	

Conclusion & recommendation

- This was a first large scale scientific study conducted on the marine biodiversity along the Karnataka coast.

- The giant clam *Tridacna maxima* was reported for the first time from the coast.

- The candy shrimps, *Rhynchocinetes durbanensis*, collected from Nethrani island was the first record from the coast. This is a commercially important ornamental species, which is having heavy demand all over the world.

- False rose shrimp', *Parapenaeus fiissuroides indicus,* ' 'Doredotes shrimp' *Heterocarpoides levimana,* 'Hairy crab' *Portunus monomia gracillimanus* and coral crabs, *Carpilius convexus* and *Carpilius maculates* were recorded for the first time from the coast.

- Underwater surveys carried out at Netrani Island revealed the presence very rich and diverse coral ecosystem. For the entire west coast it is a very unique biodiversity rich area showing some of the very rare species.
- The Netrani Island ecosystem is under threat due to Indian Navy's shelling/shooting practice exercise. This should be stopped immediately for saving this unique ecosystem.
- Netrani Island has to be protected as a marine reserve with regulated ecotourism. A detailed investigation is again required to completely document the marine biodiversity of the area covering all seasons.

- Sea birds which are abundant in the coastal areas and play a vital role on the ecological interaction of the coastal areas could not be covered in the present study.

- The turtles come to shore for laying the eggs during their breeding season. There are several sandy beaches ideal for nesting of turtles. Human activities in those beaches should be restricted.

- Rapid shore based advancement like large scale reclamation, construction of seawater barriers pollution of various origin is changing the nature of estuarine ecosystem, which in may reduces number of survival of the estuarine dependant marine crustaceans.

- The accidental introduction of exotic plankton species through ballast water carried by foreign ships arriving in New Mangalore and Karwar port pose bio-invasion threat along Karnataka coast.
- Sea-level rise due to climate change may increase the salinity profile of the estuaries. Twenty eight zooplankton species are having limited distribution in estuaries.
- Targeted fishery for marine dolphins exist in some areas. This should be stopped.
- **Groups like bryozoans, echinoderms, barnacles, hermit crabs are least studied from Karnataka waters. Due to limitations of the present study, several species might have been missed in our sampling. Therefore while taking up further studies, these groups should be given priority.**


Thank You

Biotechnology And Biodiversity: Challenges and Opportunities

DR. K.K. VIJAYAN,

Head, Marine Biotechnology Division

Central marine Fisheries Research Institute, Kochi-18.

- **India harbours >10% of global fish biodiversity**
- **ranks 3rd in the world fish production (6.4 million t in 2002, 0.60 million t in 1950)**
- **The fisheries sector contributes > 1% of the total national GDP and 5.3% of agricultural (GDP)**
- **The sector is growing at a rate of over 10% (2% in agriculture and animal husbandry)**
- **Major contributors to foreign exchange, +…Rs. 6000 crores**
- **Valuable protein, livelihood and employment to millions of people**

Man and Fish

- *World human population projected to double between the years 1980 and 2025 to total of 8 billion*
- *The production of aquatic foods will have to increase from the 100 million metric tonnes to 165 million metric tonnes in the year 2025, to keep the present per capita availability*
- *The exploitation from natural waters (sea and other water bodies) has already been stagnating*
- *Only alternative, for meeting the global fish demand is THROUGH AQUACULTURE and Aquaculture Biotechnologies*

- Application of modern biology
- Marine Biotechnology
- Marine Biodiversity

- Biotechnology is the KEY, for the intervention, in Fisheries and Aquaculture

- Understanding and preserving biodiversity was one of the most important global challenges for the past 20 years and will continue to be an important scientific issue into the new millennium.

- The global environment is experiencing rapid and accelerating changes, largely originating from human activity,
- they come from local requirements or from the more dispersed effects of global climate change.
- Widespread realization that biodiversity is strongly modified by these changes has generated plans to conserve and protect biodiversity in many parts of the world.

Our understanding of marine biodiversity is weak.

we do not have enough scientific information to design programmes for conservation and the sustainable use of coastal resources. Some of the unique features of marine systems are:

The physical environment in the oceans is three dimensional, land is only two-dimensional.

The main marine primary producers are very small and usually mobile, whereas on land primary producers are large and stationary.

Higher level carnivores often play key roles in structuring marine biodiversity and overexploitation and overfishing results in severe cascading effects on biodiversity and on ecosystem functions.

Marine systems are more open and dispersal of species occurs over much larger geographical ranges.

Life in the sea is much older, the diversity at higher taxonomic levels is much higher in the sea (we have14 totally marine animal phyla, whereas only one phylum is unique to land)

The sum total of genetic resources in the sea is much more diverse and on average, genetic diversity within a species (i.e. below the species level) is higher in marine than in terrestrial species.

Exploitation of marine biodiversity is less regulated, still in the hunting-gathering mode but advanced harvesting technology is threatening many marine species with extinction

- **Marine organisms are the major, sustaining components of ecosystem processes and are responsible for biogeochemical reactions that drive our climate changes.**

- **Many marine organisms are poorly described and little is known of broad spatial and temporal scale trends in their abundance and distribution.**

- **With new molecular and analytical techniques we can advance our knowledge of marine biodiversity at the species level to understand how marine biodiversity supports ecosystem structure, dynamics and resilience.**

- **We can then interpret environmental, ecological and evolutionary processes controlling and structuring marine ecosystem biodiversity.**

- **With better analytical methods available, we can augment our understanding of biodiversity and ecosystem dynamics.**

- **Using novel molecular tools, researchers in marine ecosystems were able to provide better, faster and more accurate estimates of marine biodiversity in the community.**

Attention to genetic diversity and biodiversity in aquaculture development and aquatic resource management are therefore, crucial elements for sustainable environments.

Introduction of new species/strains can affect biodiversity via impacts on the native gene pool.

New species/strains can hybridize with native stocks, and hence alter the natural genetic architecture.

This may be expressed as a loss of valuable genetic material such as locally adapted genes or gene complexes or homogenization of previously structured populations via flooding with exogenous genes.

One example of such impacts is the outcome of hybridisation between the Thai walking catfish, Clarias macrocephalus and the African catfish *C. gariepinus*

- Application of Molecular Taxonomy:

- Resolving taxonomic uncertainties, and phylogenetic relationships, especially for those species or populations that are endangered and/or commercially important

- Documenting patterns of natural genetic diversity and identifying management units

- Assessing genetic impacts of cultured stocks on indigenous stocks

- populations may diverge genetically without any changes appearing in their external morphology.

Molecular Taxonomy: Molecular markers

Used in stock assessment, aqua farming & conservation of Biodiversity"

Isozymes, the molecular genetic markers used in early studies, evolve so slowly that closely related populations appear identical.

This fact has undoubtedly propagated the early ideas of the absence of genetic diversity in marine biota.

The use of high resolution DNA fingerprinting techniques *sensu lato* circumvents these problems and has thus opened areas previously considered intractable.

- **Morphologic identification of fish eggs and larvae from field collections are cumbersome and imperfect**
- **Molecular taxonomy for larval identification, a promising tool**
- **Molecular marker-based prediction system of bivalve spatfall and larval abundance**

- Molecular tools in general offer the possibility to estimate biodiversity at all levels, e.g., kingdom/class/family/species level, in a comparatively small environmental sample. In some cases even a few milliliters of seawater may be enough.

- Moreover, some of the techniques are very sensitive, e.g., offer the possibility to detect single cells in a sample. One may wish to detect as many species as possible in a given sample.

- The establishment of an rRNA clone library with subsequent sequencing of as many clones as possible can uncover the biodiversity in the sample in great detail.

- General assessment of comparative biodiversity in a larger number of samples can be achieved with fingerprinting methods based on restriction fragment length polymorphisms (RFLPs), RAPDs, Microsatellites

- Presence or absence of a known species can be monitored with species-specific probes using chemiluminescent detection with dot blot techniques or, more sophisticated, with fluorescent *in-situ* hybridization (FISH) .

- Distinction of individuals at the family or even species level can be obtained using highly variable molecular markers such as ITS sequences (inter-transcribed spacer) or microsatellites.

Advantages of Molecular techniques over traditional methods:

1. Only very small samples (in the range of milliliters up to a liter) are required for most analyses.
2. Sensitivity of many methods is very high, e.g., enabling the researcher to detect even single specific cells among thousands of others.
3. Dead or non-culturable cells can be analysed.
4. Species-specific data (such as sequences) can be obtained without the need to culture or even isolate a species.

- Before development of molecular technologies, studies of external morphological phenotypes was in vogue.
- **RFLPs were the first DNA markers to be used by population biologists (Parker et al. 1998).**
- **The technique involves cutting a DNA strand at specific nucleotide sequences using a restriction endonuclease and thereby producing a pool of different sized DNA fragments.**
- **RFLP variation can be visualized directly by staining with ethidium bromide following electrophoresis of the DNA in an agarose gel.**
- **This can be done for small molecules, such as the entire mitochondrial DNA, which produce a manageable number of fragments with many restriction enzymes**

- RAPD markers are produced by PCR using short oligonucleotide primers of random sequences.
- Different RAPD patterns arise when genomic regions vary according to the presence/absence of complementary primer annealing sites.
- The primers are typically 10 bp long (Williams et al. 1990) and no specific knowledge of a particular DNA sequence is required.
- Primers suggests that the technique will be useful for a variety of questions, including individual identification, pedigree analysis, strain identification, and phylogenetic analysis.

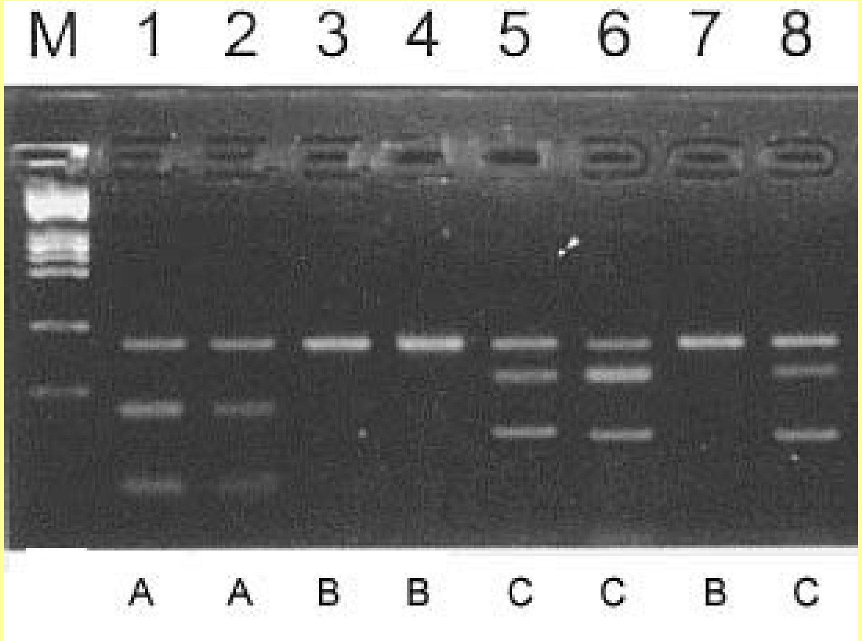
- The AFLP protocol involves the following steps:

1. DNA digestion with two different restriction enzymes (typically EcoR I and Mse I),
2. Ligation of double-stranded adapters to the ends of the restriction fragments,
3. Optional DNA pre-amplification of ligated product directed by primers complementary to adapter and restriction site sequences,
4. DNA amplification of subsets of restriction fragments using selective AFLP primers and labeling of amplified products,
5. Separation of fragments via electrophoresis

- Microsatellite loci can be identified by screening genomic libraries with probes made up of tandemly repeated oligonucleotides and then sequenced to identify conserved flanking regions for primer design.

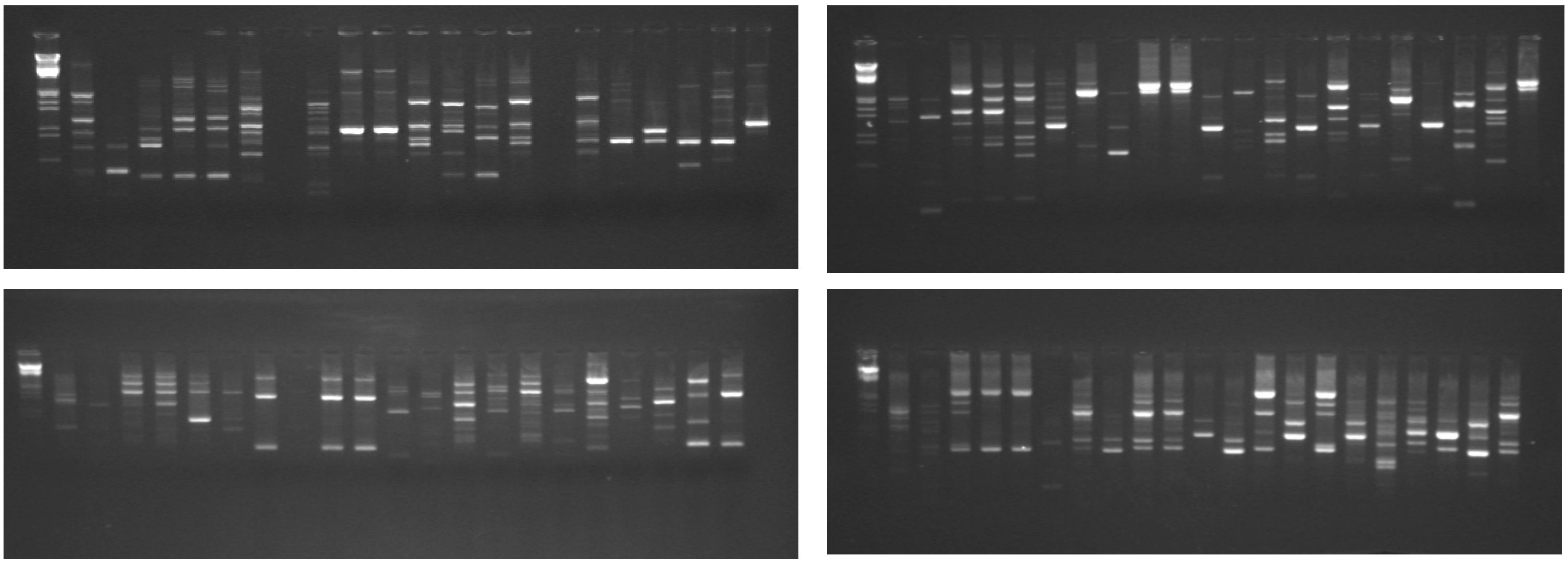
- Loci identified in this way are analysed by amplifying the target region using PCR, followed by electrophoresis

An Example of RFLP



DNA(RAPD) fingerprinting-Molecular systematics is not an alternative for classical Taxonomy, but a novel complimenting tool.

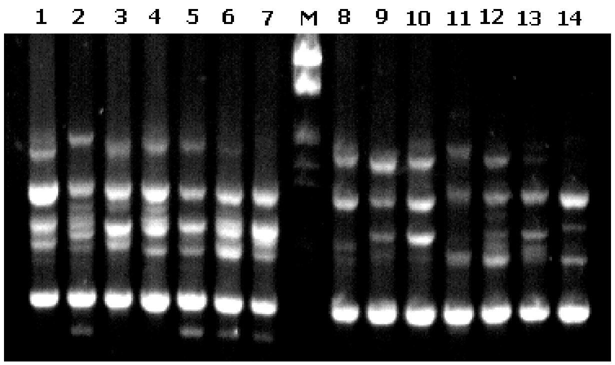
<u>Finfishes</u>

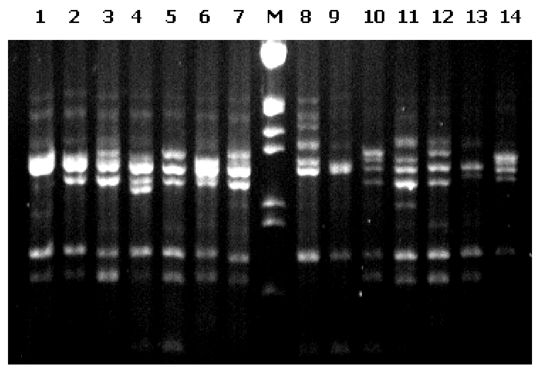


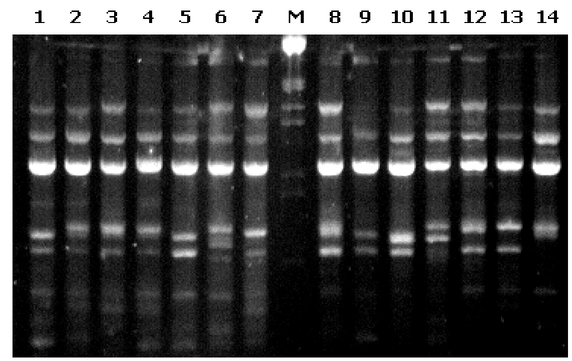
OPD 5, 11, 16, 20

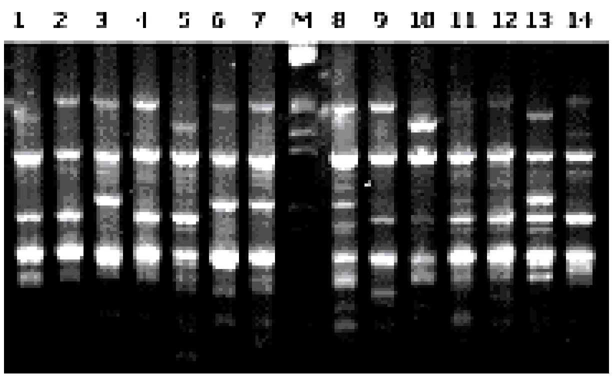
Bivalves : Genetic analysis (RAPD)

Primers: OPA-07, OPAA-12, OPAC-14 & OPB-08









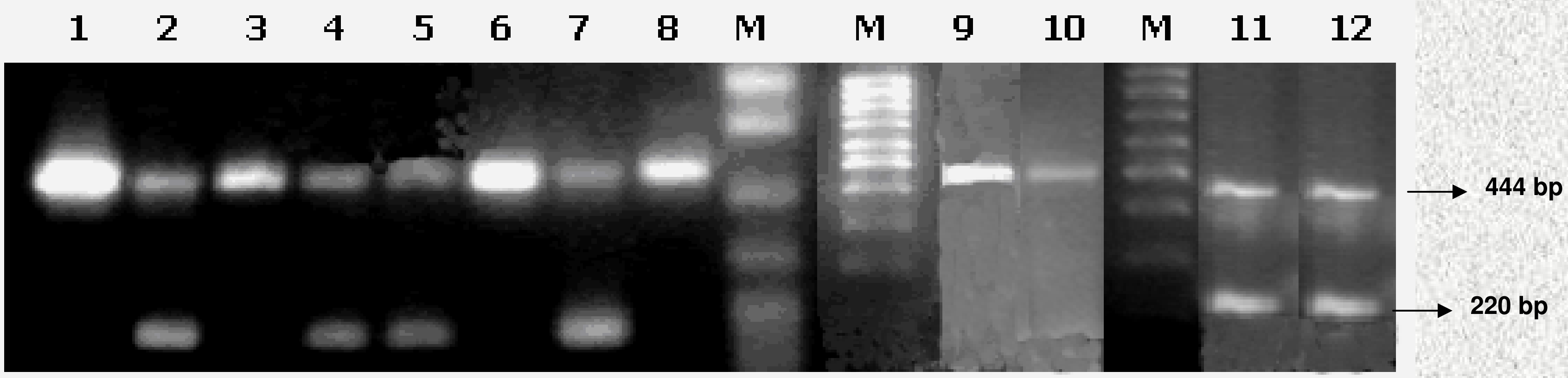
- **Further studies with mtDNA and microsatellites envisaged**

***For* Conservation…**

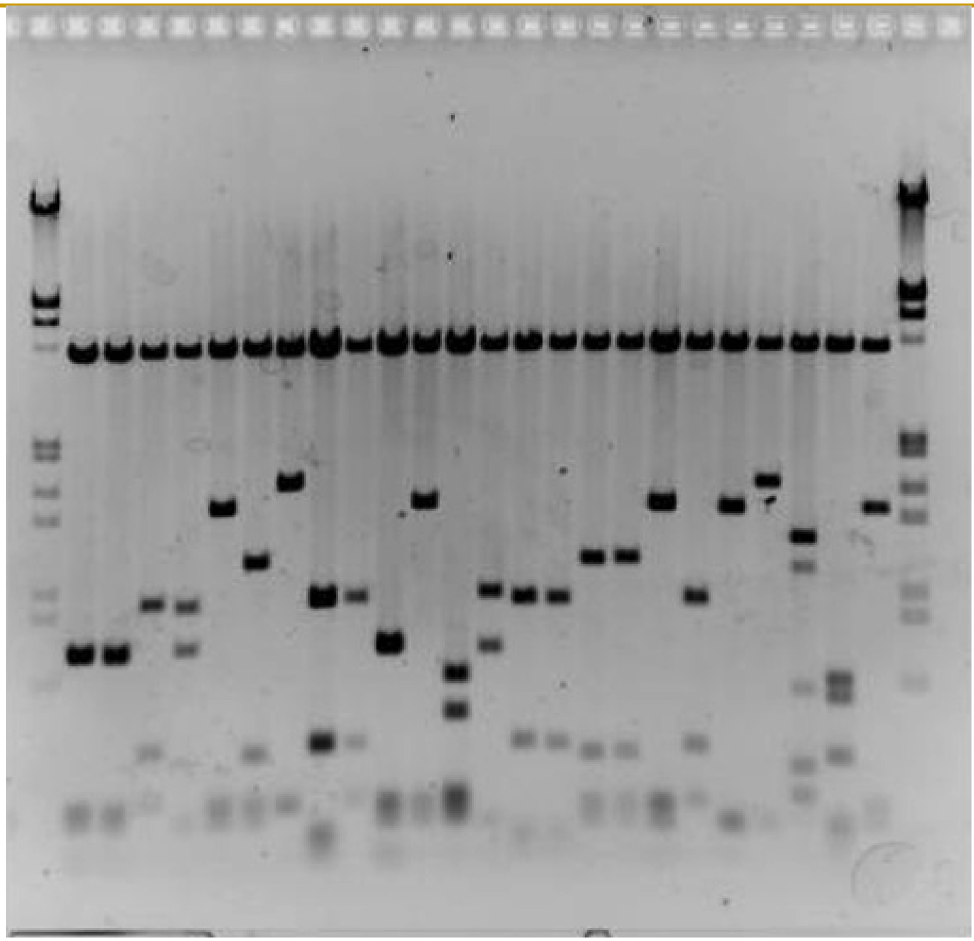
Sex-specific molecular markers

- Unambiguous identification of female and male brood fishes for captive breeding programmes
- Estimation of sex ratio of fish at early stages of maturity
- The markers could serve as the starting points for the identification of genes involved with the regulation of sex determination as well as early gonad differentiation
- Molecular identification of sex could be useful for rapid testing of possible environmental and chemical effects on the reproduction of cultured species

DNA (PCR) based gender identification in marine mammals (8 species)



1, Finless porpoise Female; 2, Finless porpoise Male; 3, Spinner dolphin Male; 4, Spinner dolphin Female; 5, Bottlenose dolphin Male; 6, Bottlenose dolphin Female; 7, Indopacific humpbacked dolphin Male; 8, Indopacific humpbacked dolphin Female; 9, Risso's dolphin Female; 10, Dugong Female; 11, Blue whale Male; 12, Bryde's whale Male; M, DNA size markers



Biodiversity of marine Picoplankton. DNA was isolated from an environmental sample, i.e., 3 µm filtered sea water. A clone library of PCR-amplified SSU rRNA was established and plasmids were analysed by restriction enzyme digestion. The figure shows the typical variability of such clone libraries.

(Lanes 1 & 26 = size markers, lanes 2-25 = 24 individual clones digested with restriction enzymes.)

Molecular Methods-certain biases:

- The harvesting of cells through filtration or centrifugation may be harmful for fragile organisms, which thus may escape the analysis.
- For many techniques the lysis of organisms with subsequent isolation of DNA is a prerequisite. Both steps may not be equally effective in all organisms.
- In PCR-based approaches biases are evident concerning the choice of (universal) primers, PCR conditions (e.g., the amount of DNA or primers used, the annealing temp., cycle number etc.), machines or enzymes used etc.
- The copy number of genes of interest (mostly ribosomal RNA genes) differ greatly among various organisms.
- If cloning steps are involved, then the choice of vectors, enzymes or bacterial strains may be relevant.
- Hybridization experiments are susceptible to hybridization conditions (temperature, salt concentration, time) or base composition and subsequent detection of fluorescence may be hampered by auto-fluorescence.
- All these are important when absolute quantification of results is desired.
- In general, the same caution need to be taken when interpreting the results of molecular methods, as for all other methods. Results are not more reliable because they come from a “molecular” approach rather than a “classical” one.

Indian Aquaculture-Mariculture

STRENGTH

- Coastline- 8118 km, EEZ- 2.02 million sq.km
- Water bodies suitable for aquaculture
  - Reservoirs- 3 million ha
  - Swamps, Ponds, lakes n paddy fields-2.5 million ha
  - Brackishwater-1.9 million ha
  - Coastal seas for cage culture, seaweed culture.
- Tropical Climate, Species diversity and Cheap labour

WEAKNESS

- Unregulated development
- DISEASE PROBLEMS
- Lack of scientific approaches

Diseases in Ocean Ecosystems and their Dynamics in relation to Climate Change.

Emerging diseases

- Fifty years ago, many experts believed that the war against infectious diseases had largely been won

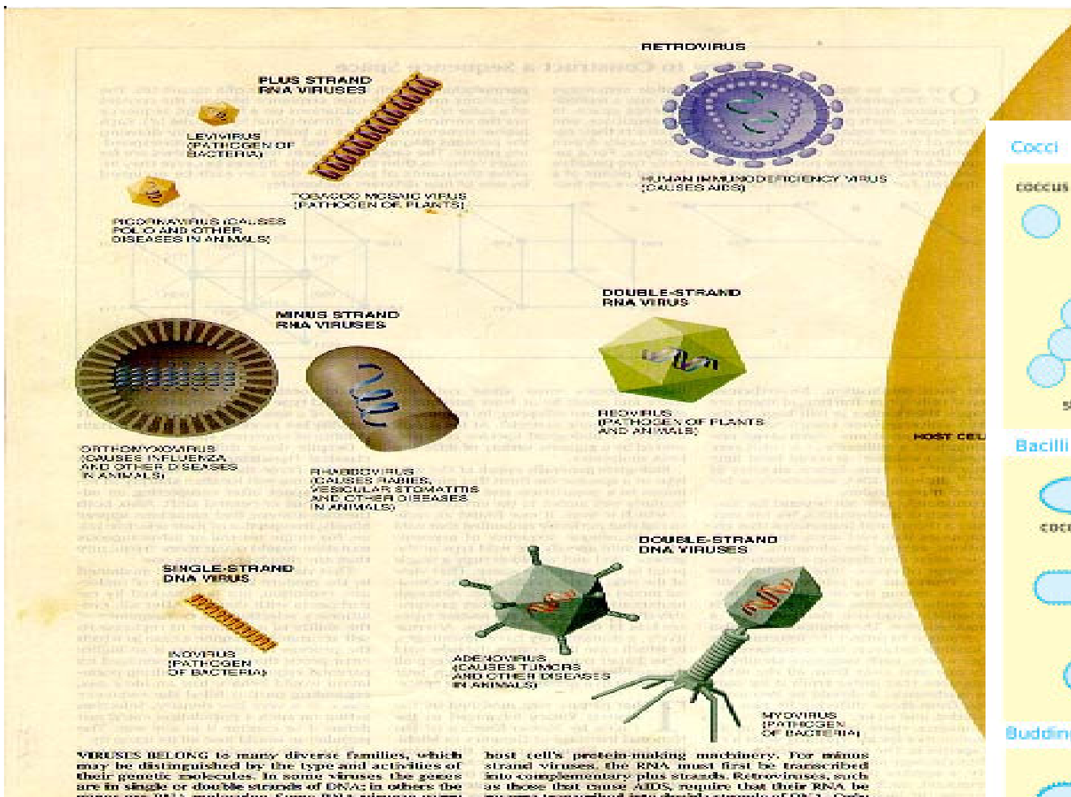
- But during the last 30 years, when humans altered and polluted the ecosystem, numerous viruses (for example, HIV, Ebola, avian respiratory viruses-bird flu) have jumped from their long-term animal hosts to people, probably with a less immune status

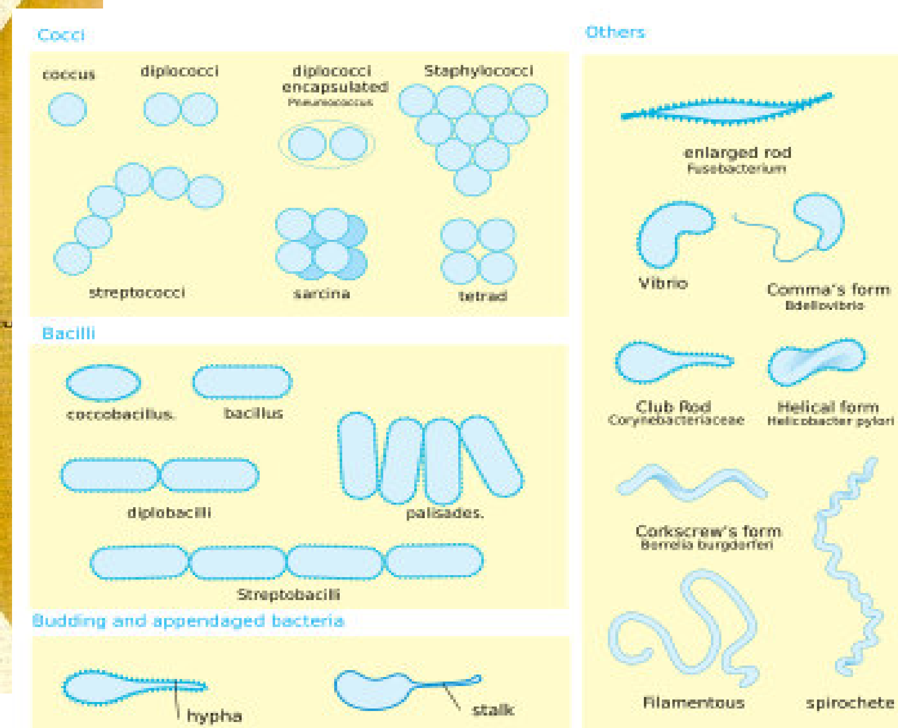
- Often succumb to virulent ‘emerging diseases’

- Also, old enemies such as dengue has re-emerged to cause human epidemics

Although the importance of diseases and disease causing pathogens in terrestrial ecosystems has long been recognized, their role in most marine communities is comparatively unknown

This paucity of information is surprising, given that the sea is a ‘microbial soup’ supporting an immeasurable abundance and diversity of potential parasites-pathogens





Disease causing organisms can have significant impacts on marine species and communities, as demonstrated by series of disease outbreaks that have even caused mass mortalities over a wide range of marine taxa

For some important marine taxa, diseases and their impacts appear to have increased over the past 30 years. These include turtles, corals, molluscs, urchins and marine mammals.

Molecular Diagnostics

- Short life span hence rapid accurate diagnostics
- Viral pathogens of shrimp and prawns
- PCR based diagnostics
- CIBA has developed Molecular diagnostic kits for white spot and white muscle viral disease which are commercialized

WSSV: change in viral virulence or viral accommodation in the host shrimp?

•WSSV the most lethal animal virus

•Affects all stages of farmed and wild penaeids

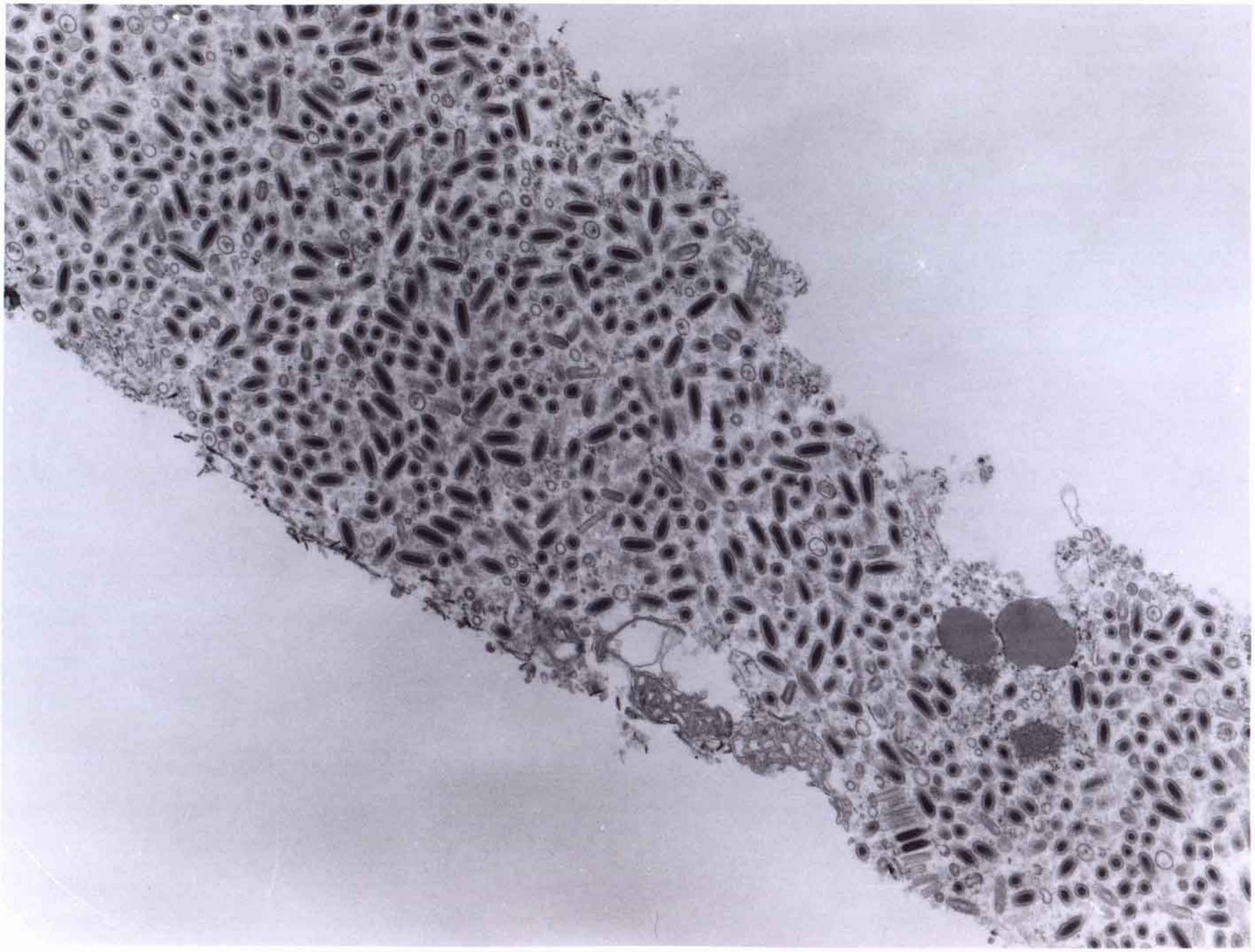
100% mortality within 2-10 days of post infection

Collapse of the shrimp farming industry across the world

•Annual loss of ~Rs 300 crores (@80 Million US $) in India,

•Accumulated Loss during the last one decade is about 1 Billion US $)

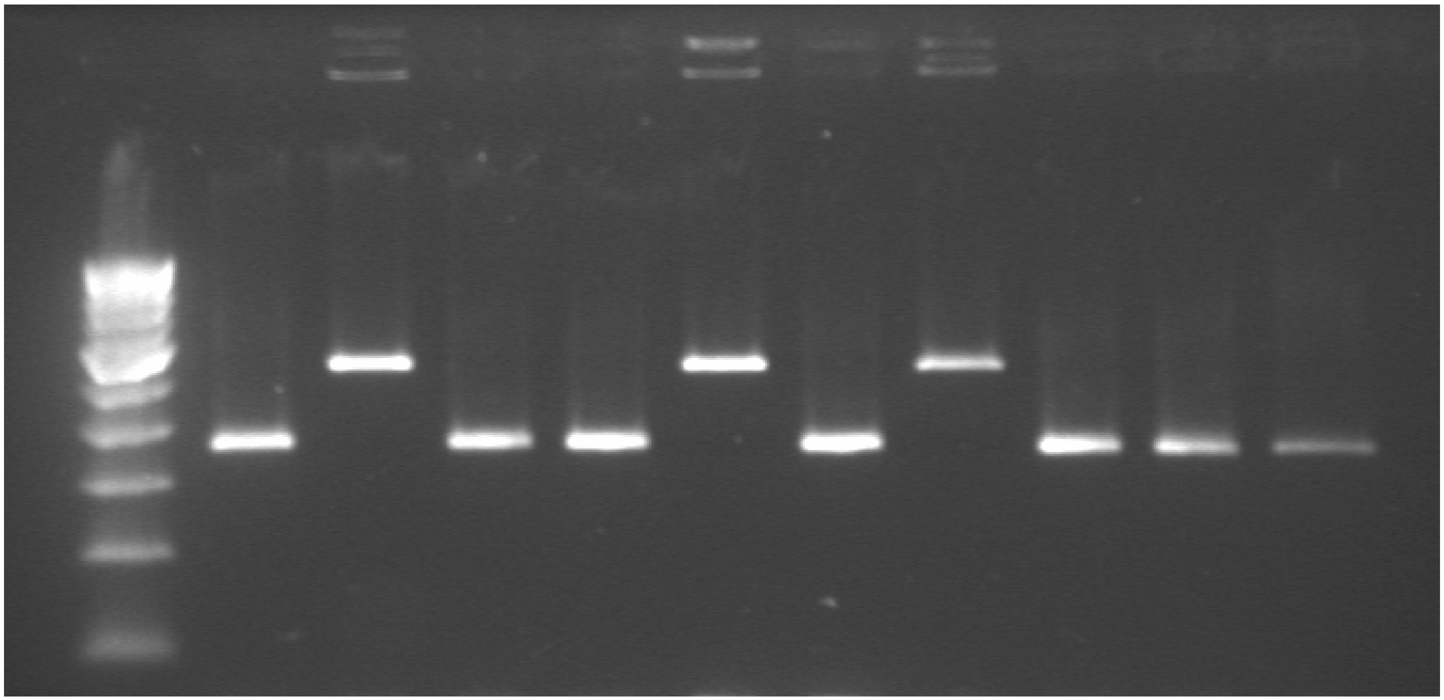
Electron micrograph of White Spot Syndrome Virus in infected nuclei in epidermal tissue



WSSV Sequence

TTGCAAGCTATATTTAACTTACGCAACAAGGTAGAAGTATCTACCAAAAATTG
CGCCTCGTCTATGAGATTGCCATCTATATTTCCTACTGTAGGTACTAGTGATG
GAGGTGATAATTACGTTGGGTCGGCTAGCGATTCTAGAGTATTGTCCAAGACT
CTTAGTACGCGACTTTTAAACTTTTATGTTCATGCTGATCATGCCGCCTATCA
CTTTAATCAGTTTATAAAAACGGGTGATGCGGGCTATGATCATGAAGATATAA
GGACTAGAAAGATGCCGTTGAAACCAAGAGAGGTTAAATACTGTCACGATCTA
ATCTCTTCTATACCCAATAAACACTTGACTGACTATTTAAAGTCCCATGATGT
ACTTAGGATTGAAGACGTTGCAGTTTCAAACAGTCATTGTTCTAA TTTGGAA
GTATATTTACTCATAATTCCGATTCAAGTGATAACGAATGAATATTATAAAGT
AGTATAGATGAAACAGTATTTTTAGTTATTACCATTGTAATAATGGGAGGGCA
TTCAGATTATTGGAAGTCTATGGGATTCACTTCCCTTCAGACTATACATTCAA
AATGTGAAAAGAAGGAGAGTTTAACAGTGGAAGATATAATTGAGGATATATAT
TTTACCAACAAGTCGTTTTTTGCTAATACCAATTTAGTAAAATTACCAATCGT
CTCTATTGATGGTACCTGTTGTACTGGCAAGACTACAAT

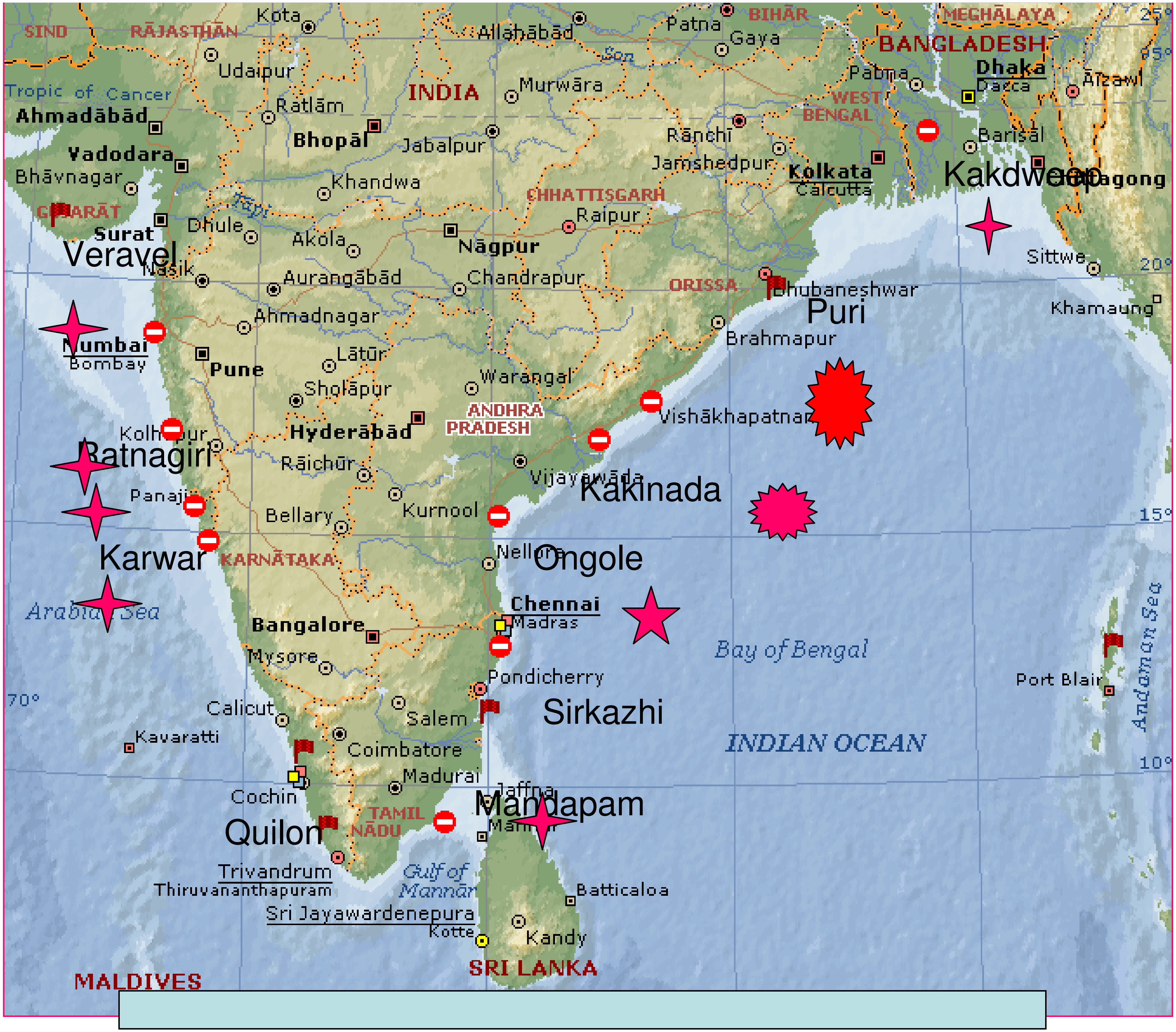
WSSV-*nested* PCR



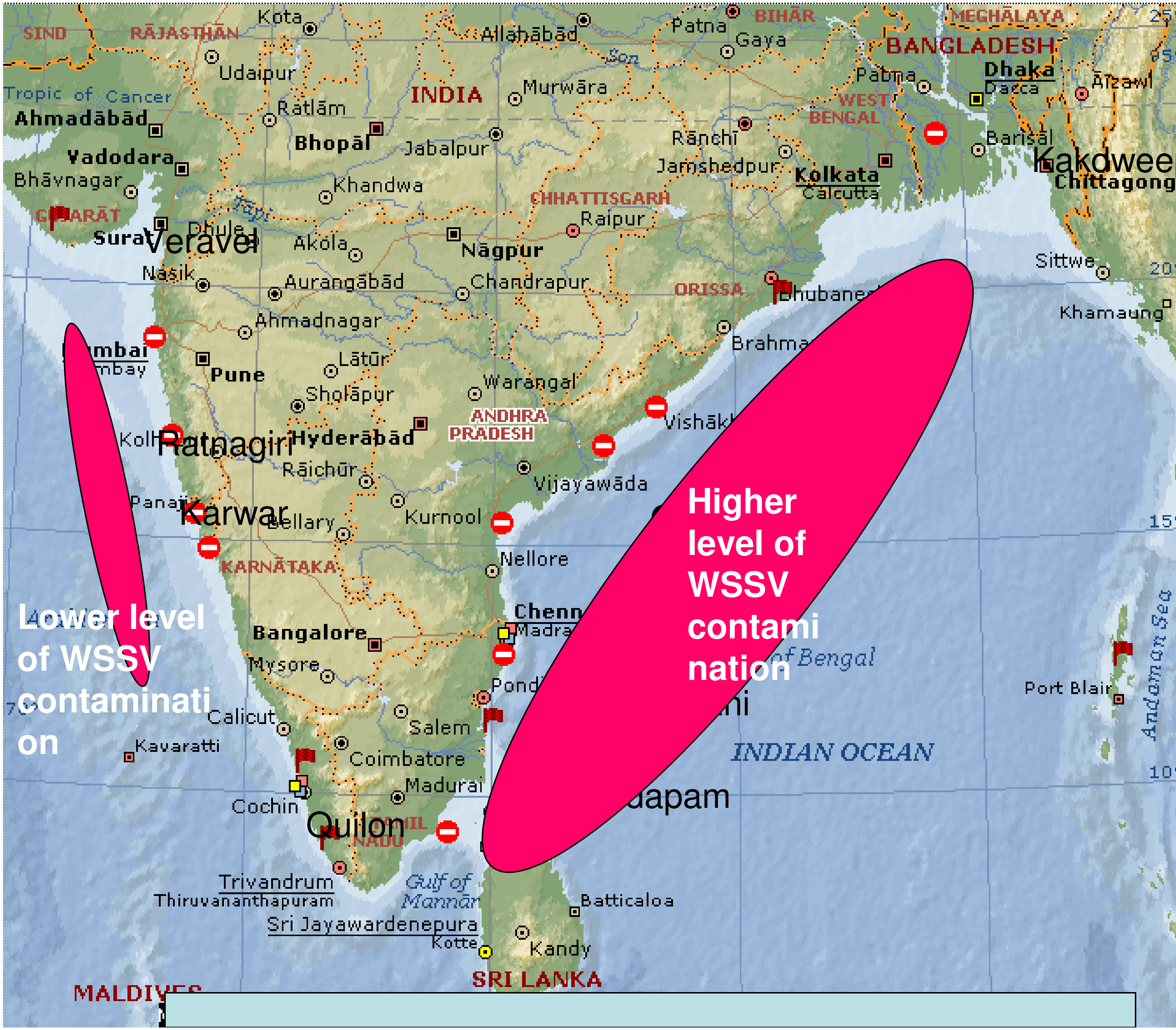
600 kb

300 kb

CIBA-ICAR *nested PCR* KIT for WSSV
(Commercialized with Genei Bangalore)



Kakdweep
Veravel
Puri
Mumbai
Ratnagiri
Kakinada
Karwar
Ongole
Sirkazhi
Mandapam
Quilon
INDIA
BANGLADESH
Bay of Bengal
INDIAN OCEAN
Arabian Sea
Andaman Sea
SRI LANKA
MALDIVES
Tropic of Cancer
Ahmadābād
Vadodara
Bhāvnagar
Surat
Nasik
Pune
Kolhāpur
Panaji
Bangalore
Mysore
Calicut
Kavaratti
Cochin
Trivandrum
Thiruvananthapuram
Madurai
Coimbatore
Salem
Pondicherry
Chennai
Madras
Nellore
Kurnool
Vijayawāda
Vishākhapatnam
Hyderābād
Bhubaneshwar
Brahmapur
Kolkata
Calcutta
Dhaka
Dacca
Port Blair
Jaffna
Batticaloa
Kandy
Sri Jayawardenepura
Kotte
Gulf of Mannār



Veravel
Ratnagiri
Karwar
Quilon
Kakdweep
Higher level of WSSV contami nation
Lower level of WSSV contaminati on
INDIA
BANGLADESH
SRI LANKA
INDIAN OCEAN
Mumbai
Pune
Hyderābād
Bangalore
Chennai
Kolkata
Calcutta
Dhaka
Chittagong
Cochin
Trivandrum
Thiruvananthapuram
Madurai
Coimbatore
Salem
Nellore
Vijayawāda
Kurnool
Port Blair
Kavaratti
MALDIVES

Mariculture

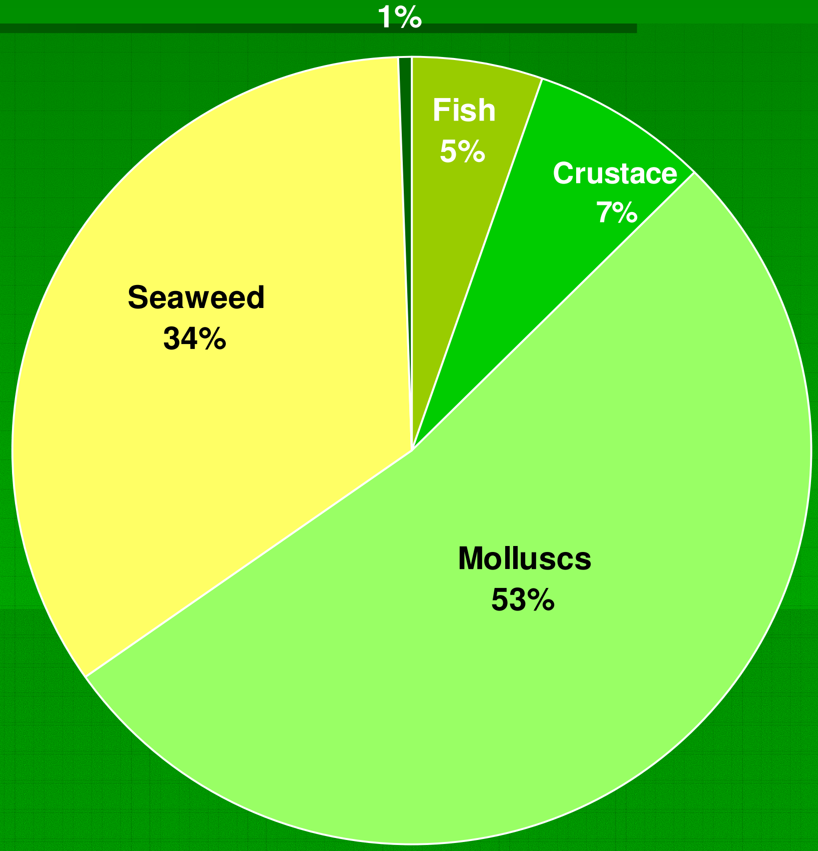
Global mariculture production in 2002
26.08 million tonnes valued at US$ 25 billon

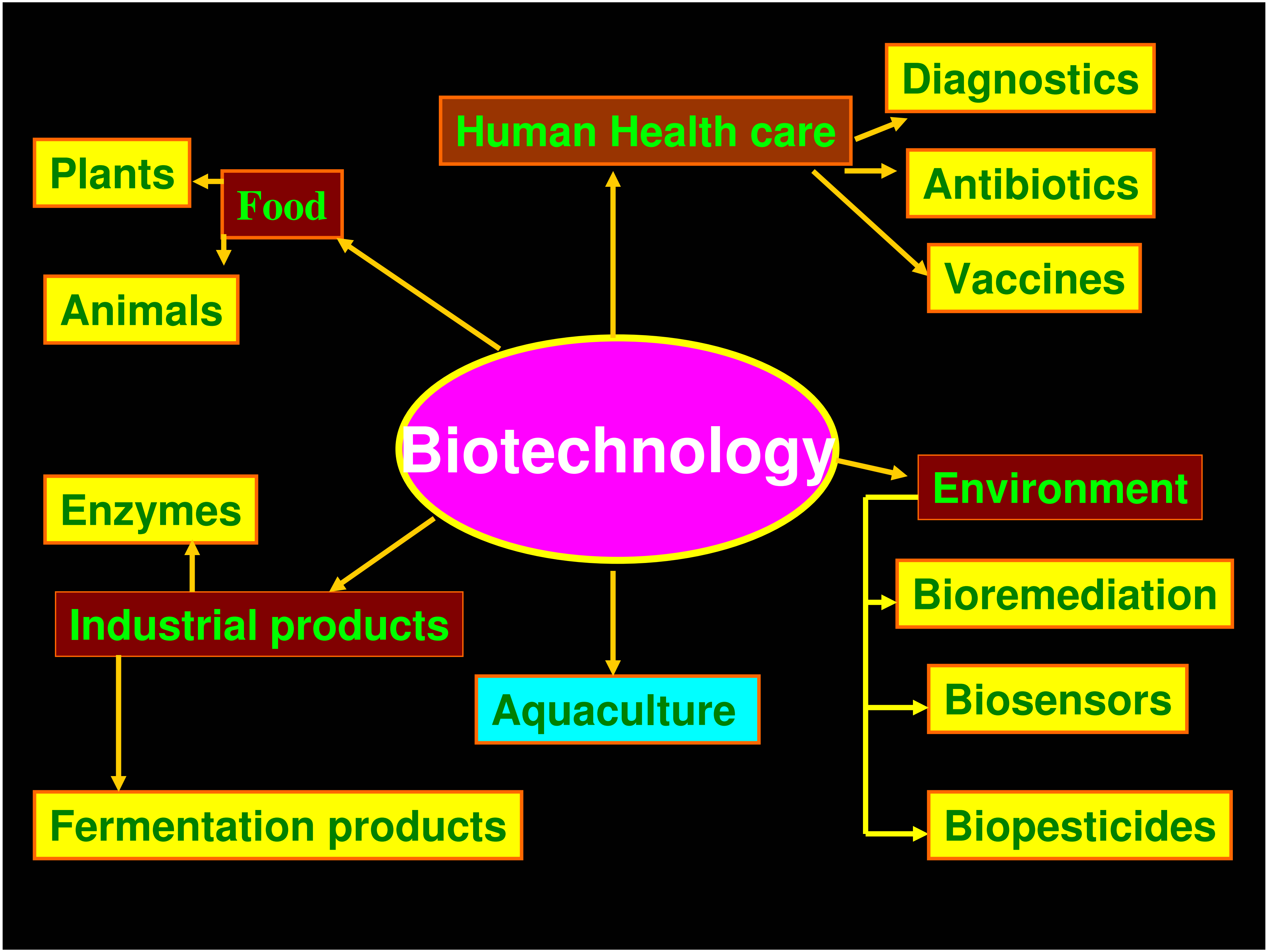
Most popular farming resources are oysters, clams, scallops and mussels

Seaweed farming popular in Asia

Finfish farming is capital intensive, feed requirement high; 5 kg of wild fish is required to produce 1 kg of farmed carnivorous fish.

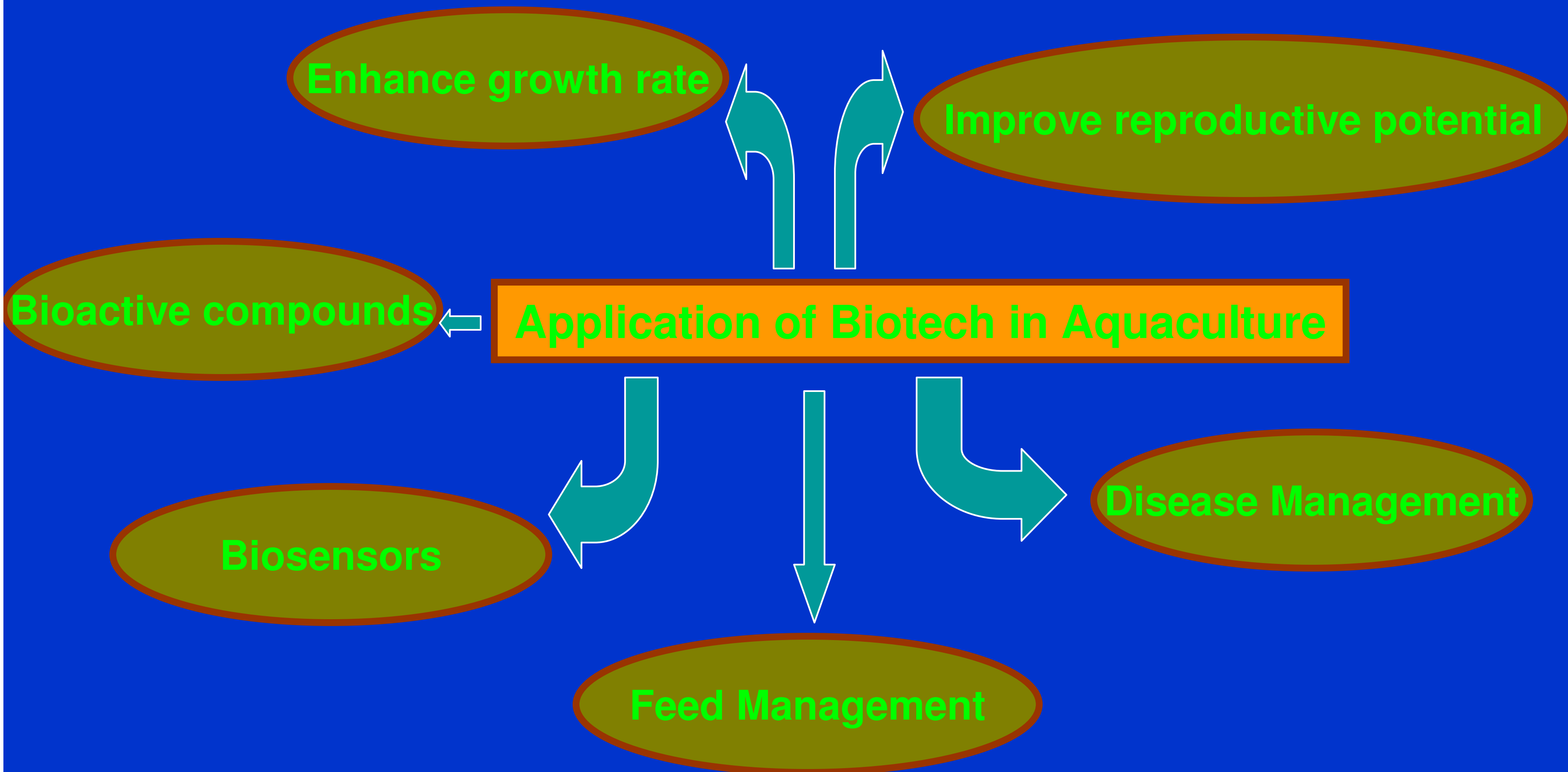
Emergence of sea cucumber farming, abalone farming and other minor invertebrates like corals





Biotechnology
Human Health care
Diagnostics
Antibiotics
Vaccines
Food
Plants
Animals
Environment
Bioremediation
Biosensors
Biopesticides
Industrial products
Enzymes
Fermentation products
Aquaculture

Biotechnology in Aquaculture/ Mariculture



Marine biotechnology

- Marine biotechnology is in its infancy
- Biotechnology is a cocktail of biology and engineering principles
- It is a modern science of our time
- It has evolved into a powerful tool
- It is influenced by modern developments

Prospects of marine biotechnology

- It deals with freshwater, brackish water & marine ecosystems
- Aquatic biotechnology is the apt terminology
- Throws new insight into aquatic biology
- Aims at providing food security, nutritional security & novel business opportunities
- Employment, and gender equity too

Aquaculture/Mariculture Biotechnology

Opportunities and Challenges

- Reproduction
- Genetics
- Nutrition
- Health Management – Disease Problems
- Bioprospecting

Fish Breeding

- Hormonal manipulations
- Cryopreservation

Aqua-- biotechnology

- Aquaculture for food: shellfish and finfish culture
- Single cell proteins (*Spirulina)*
- Drugs and chemicals - vitamin A (*Dunaliella)*
- *Artemia* culture -larval feed
- Ornaments- pearl culture
- Ornamental fishes- with colour genes
- **Green fluorescent protein from Jelly fish**

-Genomics

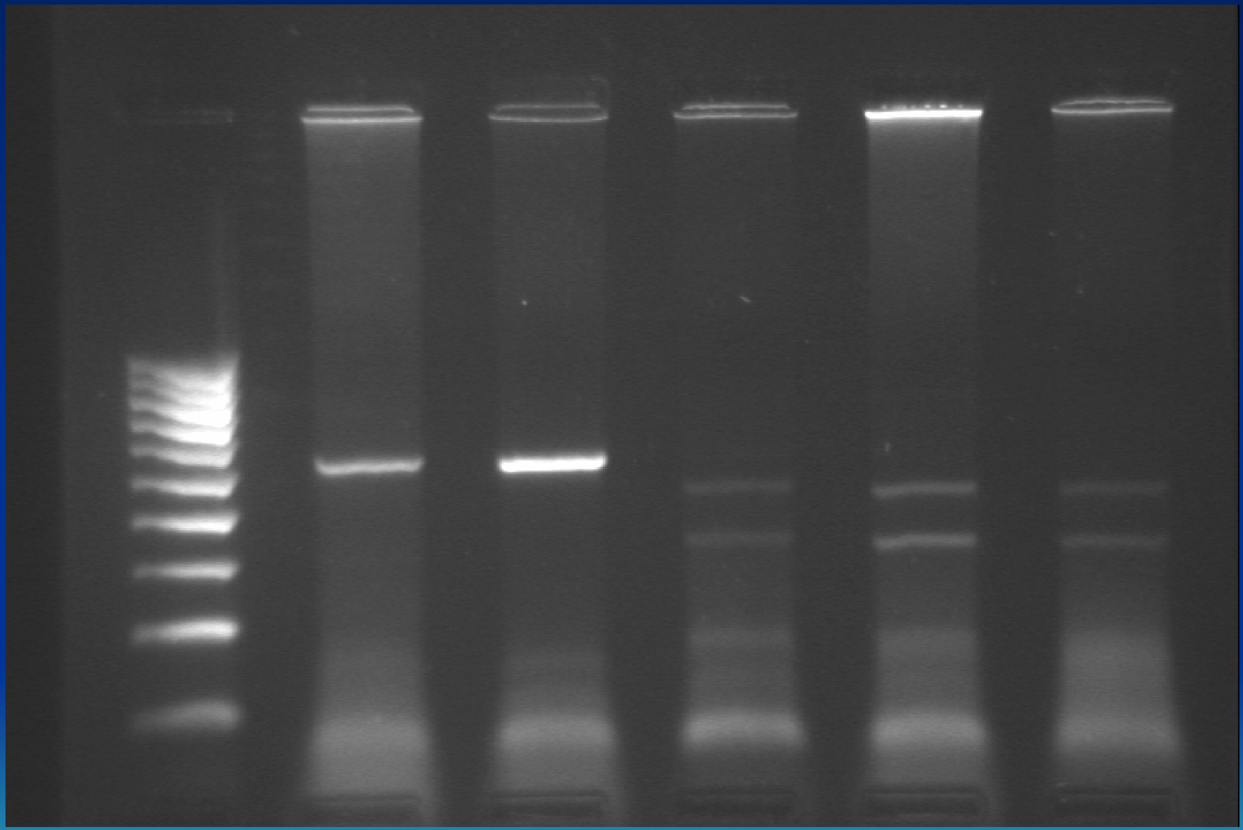
-Human Genome Project

- **Genomic mapping and sequencing, has steadily extended its dominion in all areas of applied biology**
- **While understanding biological systems with 100s, 1000s to 100,000s of genes, require organizing the parts by their properties.**

Gene mining

- Aquatic animals harbour novel genes of economic importance
- Antifreeze genes, GFP genes
- Antiviral genes, penaedins, salt tolerant genes bioluminescent genes
- They are used for health management and in molecular biology

Antiviral genes in *Penaeus monodon* *and* *Machrobrachium rosenbergii*



Lanes 2 & 3 *p. monodon*, lanes 4,5 &6 *M.rosenbergii*

Safeguarding against bio-piracy

- ‘Diversity’ thy name is India
- Microbial diversity
- *V. harveyi*, *Pseudomonas,* Mangroves, corals etc.
- Requires molecular cataloguing
- DNA finger prints, RAPD, RFLP, AFLP etc.
- Helps in safeguarding from bio-piracy

Fish Transgenesis

- Integration into a living organism of a foreign gene that confers upon the organism a new property that it will transmit to its descendents
- Transgenic fish have been produced that exhibit accelerated growth rates, increased disease resistance, altered body shape and composition, altered coloration, expression of anti-freeze proteins and potential sterility
- GENE MINING

Transgenics

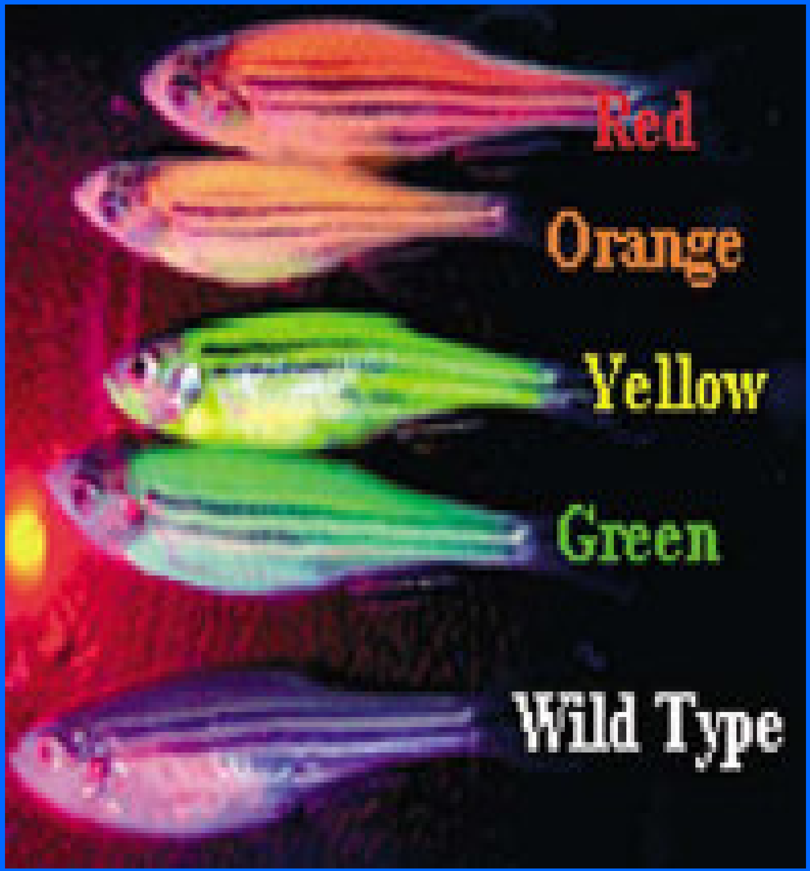
- Introduction of novel genes into an organism
- It is successful in plants and in animals
- Fish has certain advantages
- No ethical considerations
- Large number of eggs, external fertilizations
- Easy screening, short life span, genetic plasticity
- Flavour, palatability and as bioreactor

Example of transgenic species

- rainbow trout (*Salmo gairdneri*)
- goldfish (*Carassius auratus*)
- northern pike (*Esox lucius*)
- walleye (*Stizostedium vitreum vitreum*)
- transgenic loach,
- Carp
- northern pike
- Zebra fish (Glofish)
- Medaka
- Tilapia
- Brine shrimp, Sea urchin, Abalone, sea weed……

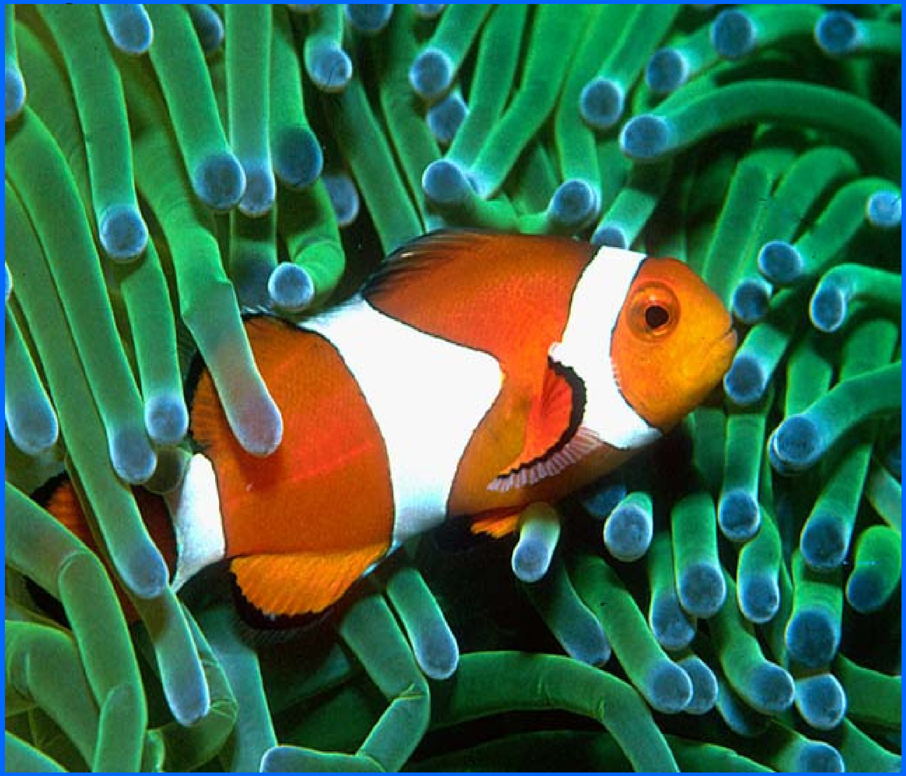
Atlantic salmon expressing GH transgene

GloFish



Potential candidates for transgenesis

•



Bioremediation

- Soil and water pollution
- Pollution accumulators
- Probiotics , immunostimulants
- DNA vaccines
- Therapeutic RNAi

Microbes from aquatic ecosystem

- Good guys and bad guys
- Industrially useful microbes:
  - *Saccharomyces, Streptomycetes*
- Bioactive: agarase, antimicrobials
- Mol biol tools: Restriction Enzymes
- Source of drugs and antiviral compounds
- It is a source of great wealth
- Duty to safeguard and pass it on to the generations to come

It is recorded that only 7% of the oceans and 1% of the oceans' floor has been sampled till date and over 93% of the ocean still remain unexplored and thus, the current state of knowledge regarding its biodiversity and distribution is extremely poor.

Among the 1.7 million species catalogued today, about 2,50,000 are from the marine environment. So far only about 1,80,000 species of marine algae, animals, bacteria, fungi and viruses have been identified and characterized and more are yet to be discovered.

Estimates of the number of described species and possible un-described species of microorganisms

Group	Described Species	Estimated species	%known
Bacteria	4000	3,000,000	0.1
Fungi	70,000	1,50,000	5.0
Viruses, Plasmids, Phages	5000	500,000	1.0

~only 3% of the worlds microorganisms have been described !!!!

Marine Bioprospecting

'*Bioprospecting is the systematic search for and development of new sources of chemical compounds, genes, micro- and macro organisms, and other valuable products from the nature'*

Why Marine Bioprospecting?

- Oceans harbour about 300,000 described plants & animals to date and already yielded about 12,000 novel chemicals from only a small portion of that diversity
- **Applications of marine biomolecules/metabolites: pharmaceuticals, enzymes, cryoprotectants, cosmaceuticals, agrichemicals, bioremediators, nutraceuticals etc.**
- **Wide range of useful organisms: Microbes, tunicates, sponges, soft corals, sea hares, nudibranchs, bryozoans, sea slugs and seaweeds/seagrass**

'Estimates put worldwide sales of marine biotechnology-related products at over US$100 billion'

Bio-business from sea

Sales of products developed through biotechnology were up 17% in 1998 to $13 billion a figure with the potential to reach $34 billion in 2008.

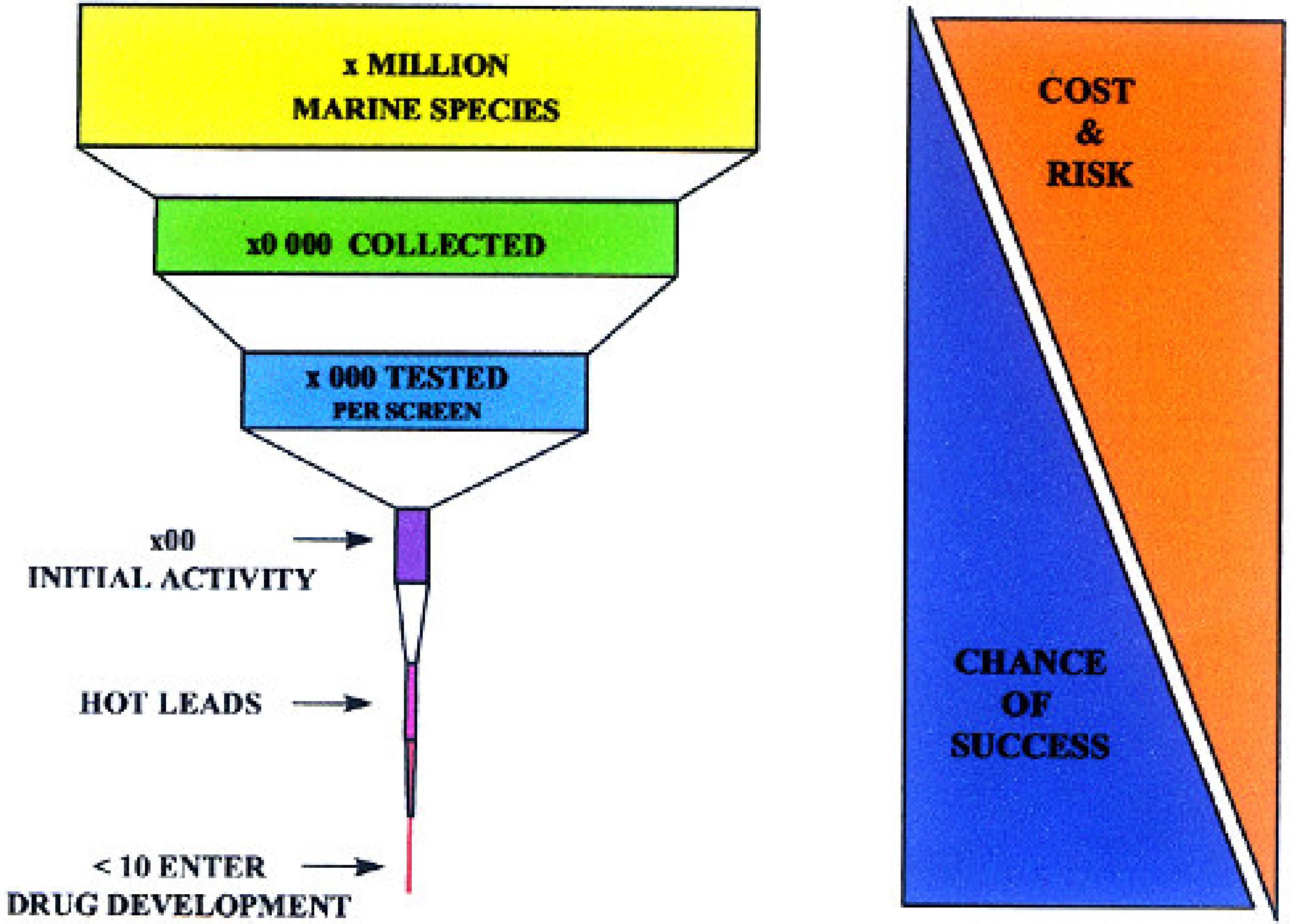
These developments have been largely based upon the molecular genetic characteristics of terrestrial organisms, even though more than 80 percent of all the Earth's phyla are found only in the sea.

In 1992, the U.S. invested $40 million in marine biotechnology research leading to at least 190 U.S. patents and at least 30 preclinical trials targeting cancer, inflammation and AIDS. The market value of just five of these has been estimated to be $2 billion.

Glimpse of Global Research Outputs

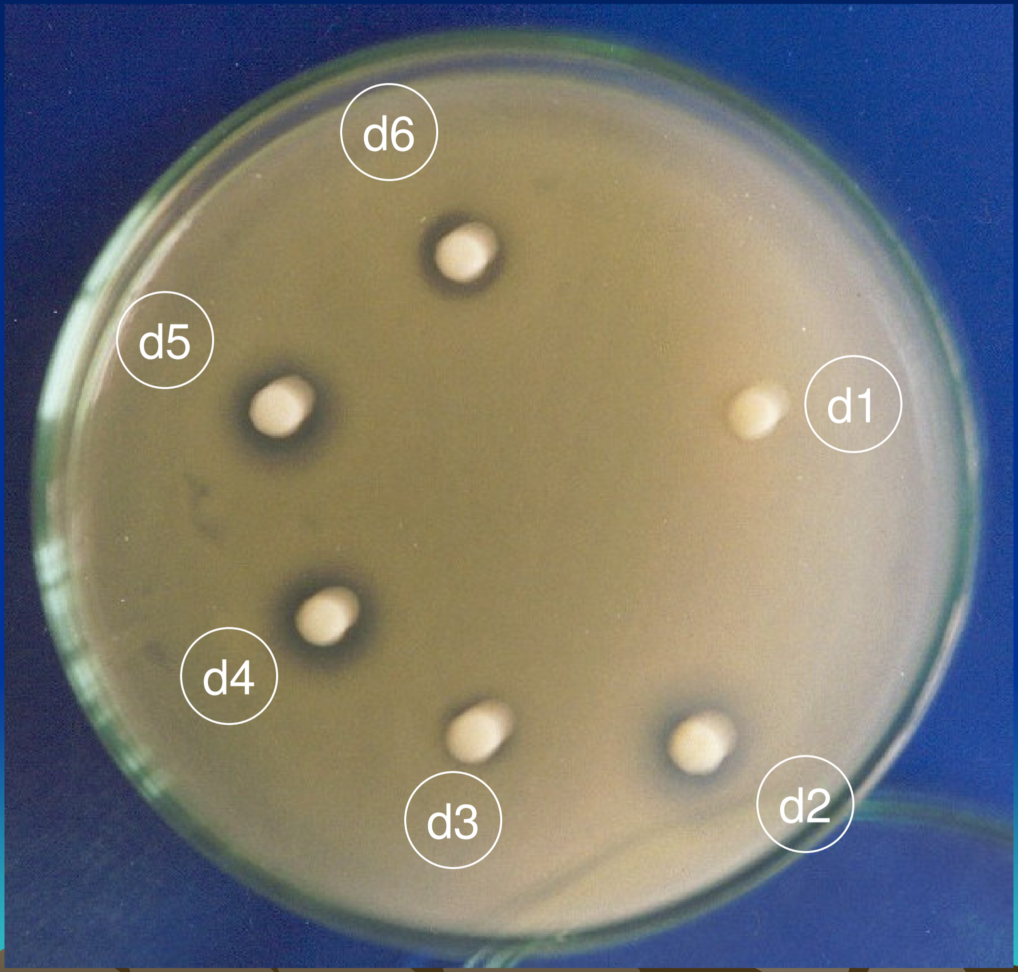
Marine organism	Metabolite/Biomolecule activity & Novel genes	Reference
Microorganisms - cyanobacteria	Anti-tumour, antibiotic & anti HIV agents, carotenoids and phycobiliproteins	Carte 1996, Cardillina *et al.* 2004, Greer & Harvey 2004
Seaweeds	Anti-tumour, anti-inflammatory & anti bacterial agents	Donia and Hamann 2003, Haefner 2003 & Faulkner 2002
Sponges & Ascidians	Anti-tumour, anti-inflammatory & Anti asthma agents	Burres and Clement 1989, Petitt et al. 1993 & Fenical et al 2002
Cnidarians	Prostaglandins & Palytoxins	Carte 1996
Molluscs	Neurotoxins, cytotoxins & anitfungal agents	Pickrell 2003 and Rorsener & Scheuer 1986
Fishes & sea snakes	Antidotes, hormones, Fugu poison & Ciguatoxin	Oliviera *et al*. 2003
Atlantic salmon & Abalones	Growth hormone gene & antifreeze gene	Hew & Fletcher 2001
Sea grass & Mangroves	Genes encoding anti porter, proton pump & osmolytes	Fukuhara *et al.*1996, Parani and Parida 1999 & Benito *et al*. 2002

Expensive and effort-intensive



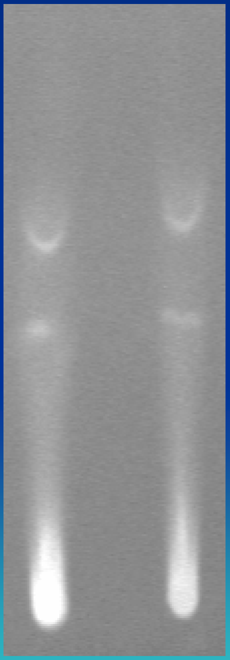
Orders of Magnitude in Drug Discovery

Preliminary characterization of the antibacterial compound from 99 H isolate:



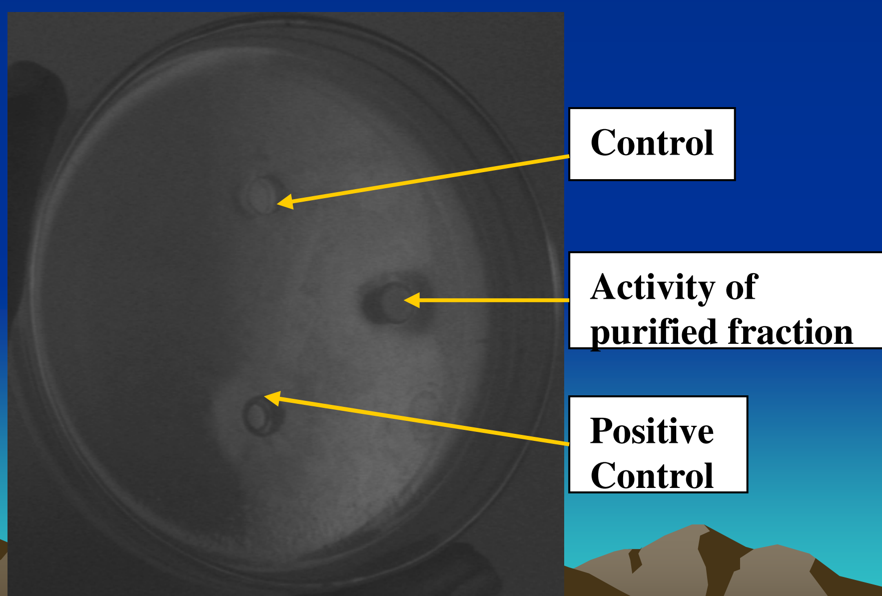
- Culture sup extracted with acetone
- Concentrated the extract by freeze drying
- 25 µl spotted on TLC plate
- Mobile phase: Chloroform: methanol: water (1.2:0.6:0.08)

RF values:
Spot 1: 0.625
Spot 2: 0.55



Agarolytic bacteria

- Isolated from marine environment
- Shows high agarolytic activity
- Potential source for molecular grade agarase enzyme.



- Biotechnology has the potential to replace *information technology* as the engine of economic development for India n Asia
- New jobs, Business opportunities
- Green revolution helped India to meet the challenges in food sector at that point of time..
- Now A GENE REVOLUTION IS IN WAITING…..

Potential stakeholders

Scientific and technological Personnel from Universities Research Institutions and Centres Pursuing R&D in

- **Human Health**
- **Agriculture**
- **Veterinary**
- **Fisheries and Aquaculture**

Biotechnology industry

- **Biopolymers**
- **Enzymes**
- **Pharmaceuticals**
- **Starter cultures**

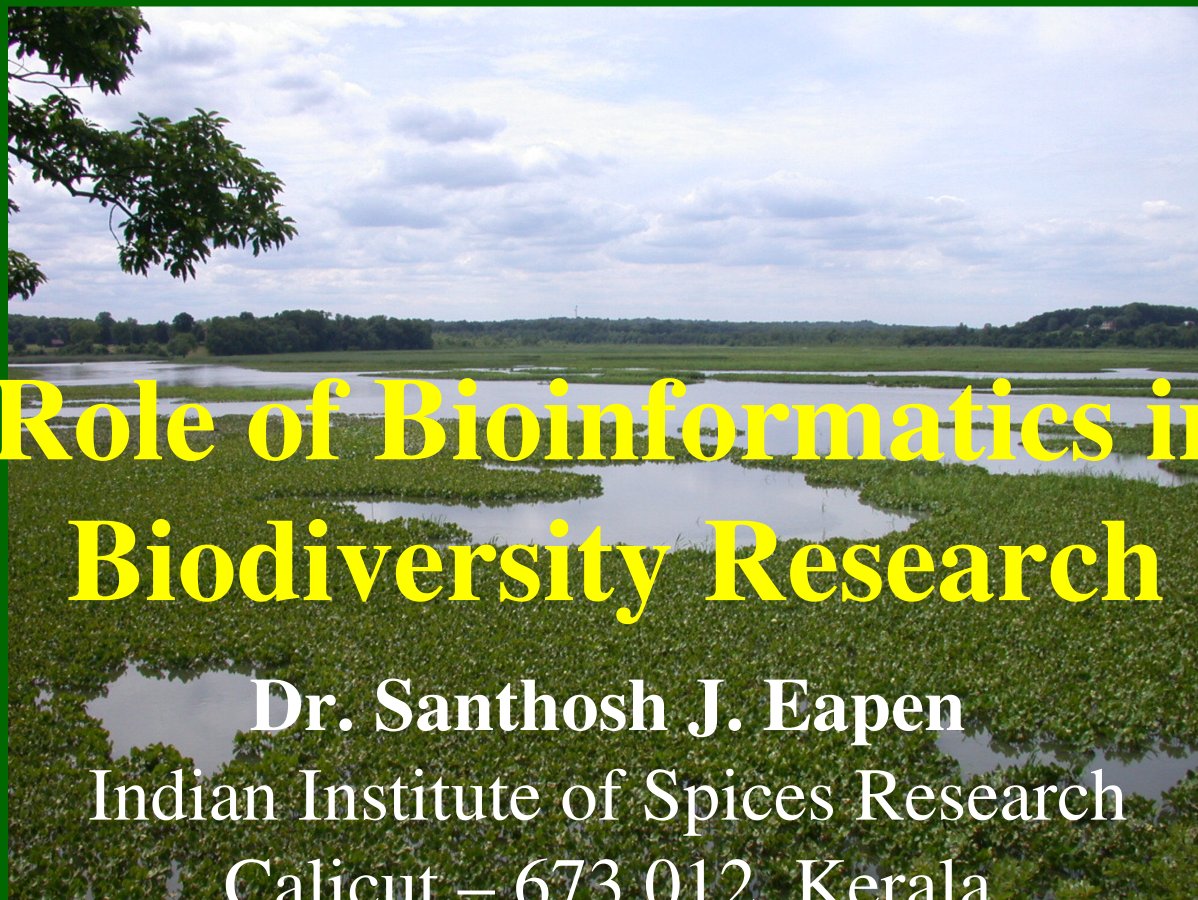
Manufacturing industries

- **Fermentation**
- **Food and beverages**

This and the coming decades is all set to see a *(AQUA)*<u>*BIOTECHNOLOGY BOOM …*</u>

- And our time will belong to those who have the power, energy and vision to convert their dreams into realities..

- Thank you all



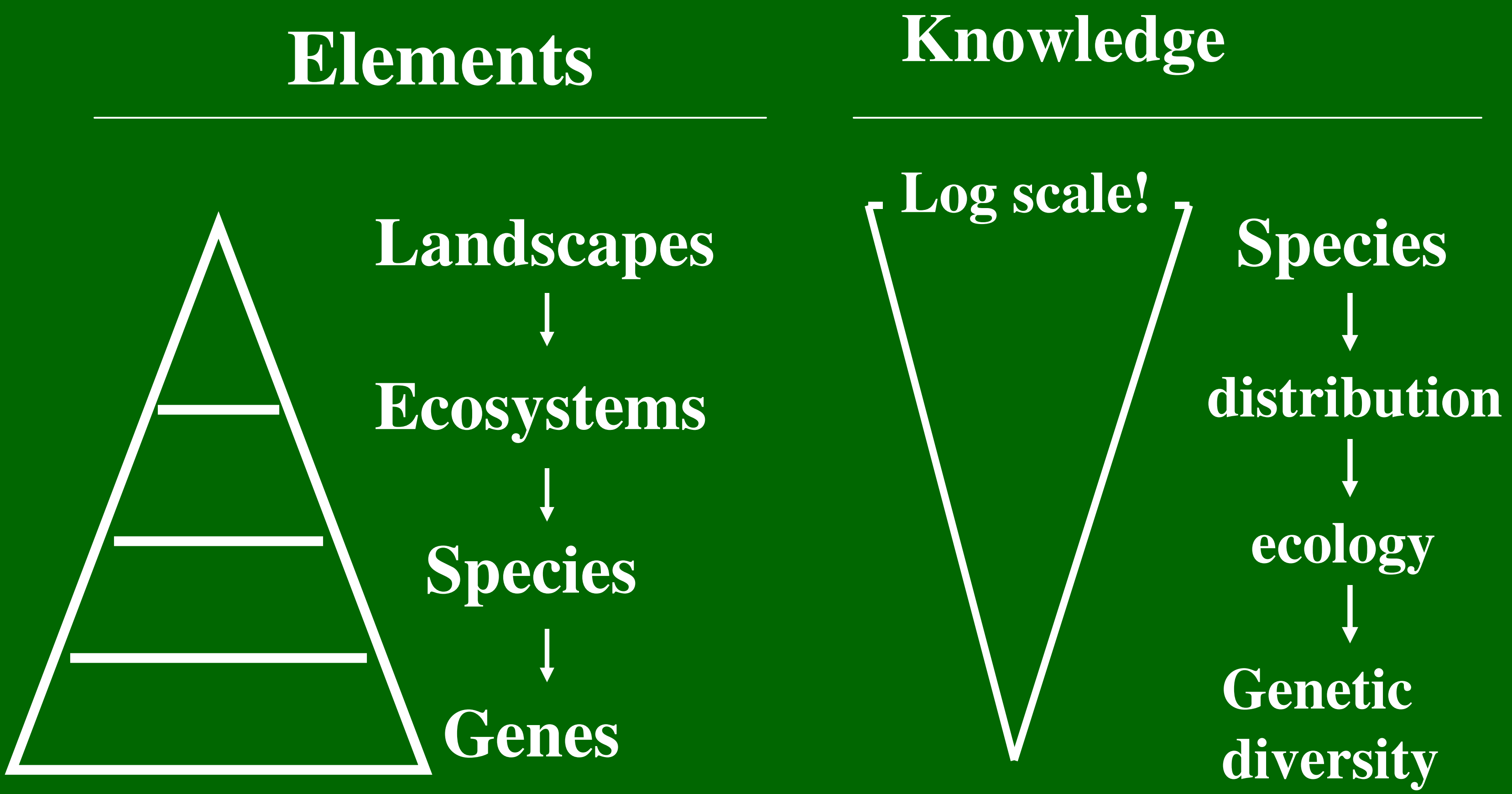
Role of Bioinformatics in Biodiversity Research

Dr. Santhosh J. Eapen
Indian Institute of Spices Research
Calicut – 673 012, Kerala
sjeapen@spices.res.in

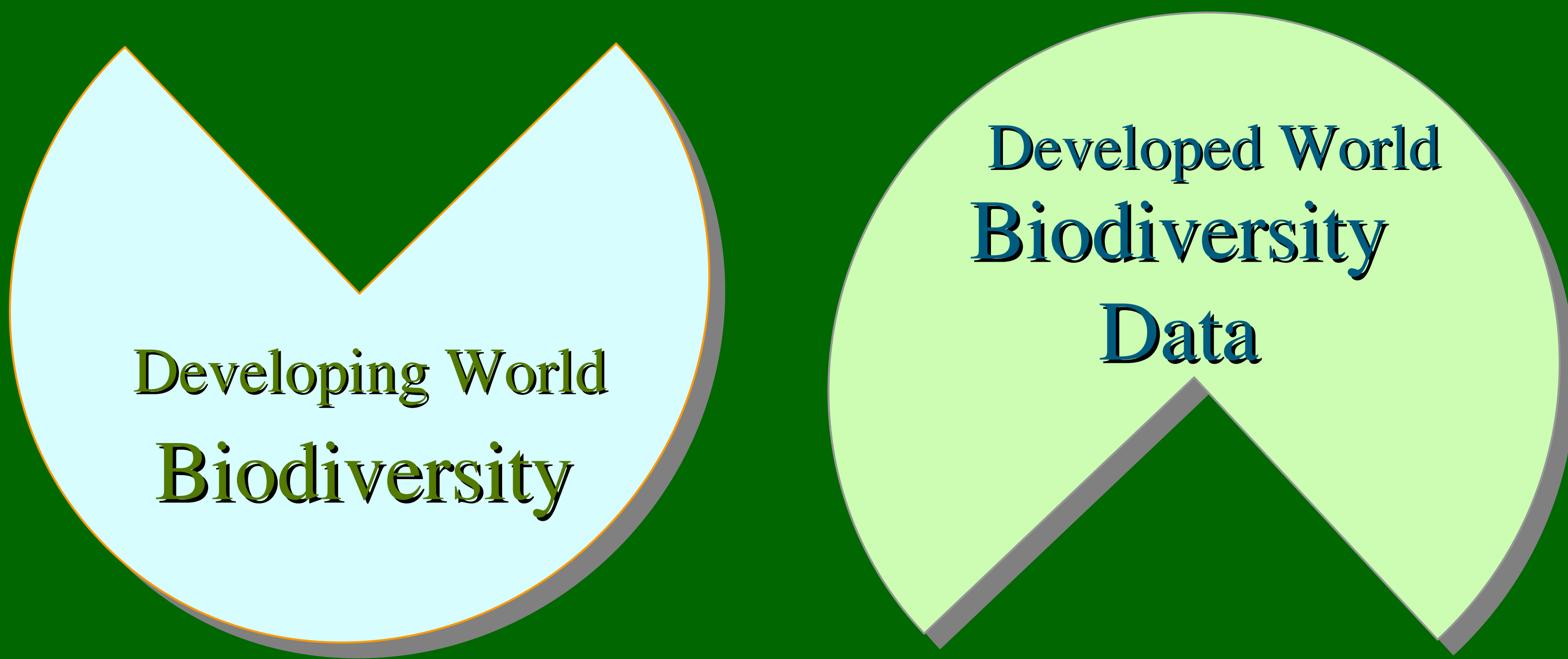
Biodiversity is the extraordinary variety of all life on Earth - from genes to species to entire ecosystems.

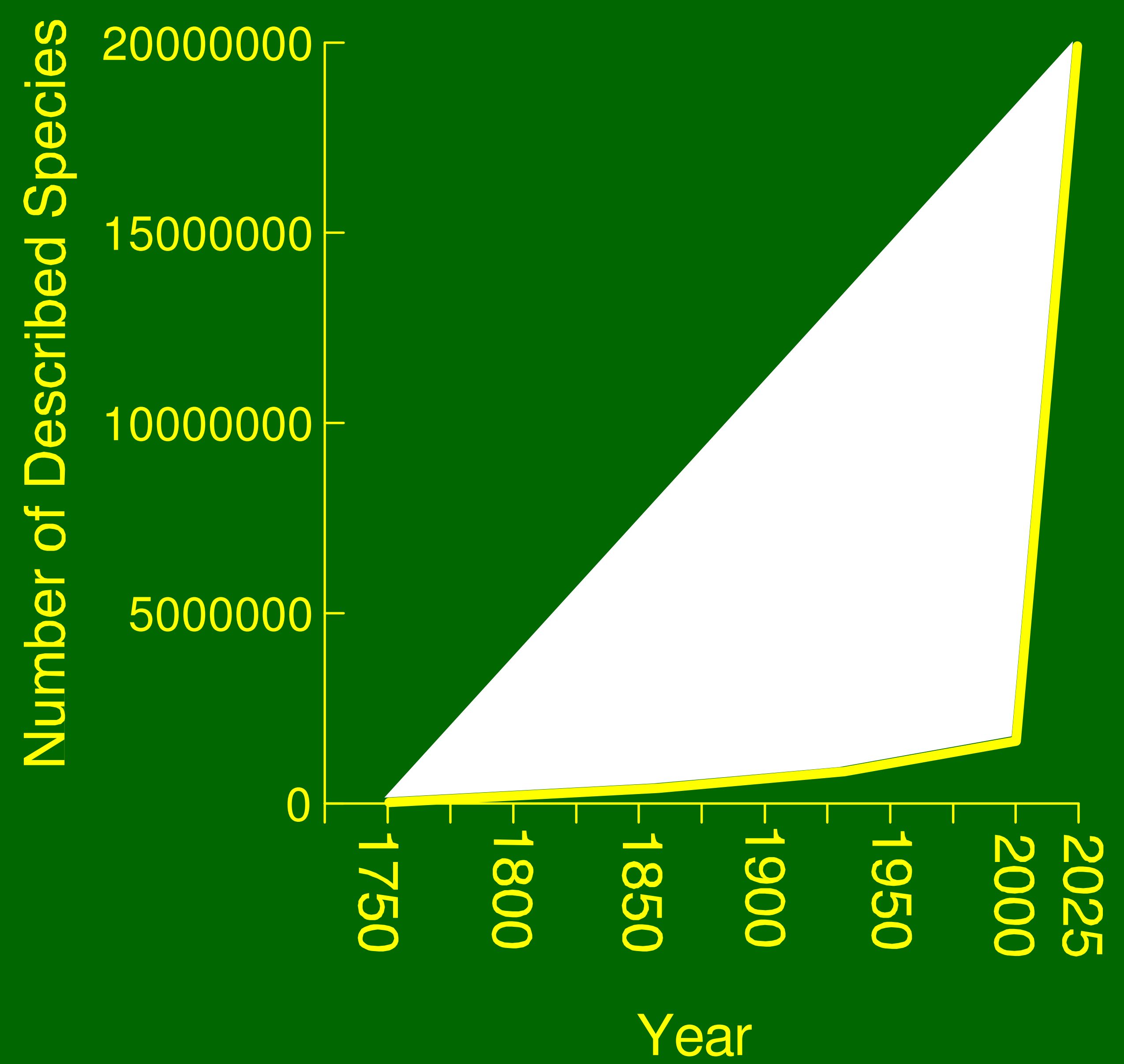
Edward O. Wilson coined the term ‘biodiversity’, to encompass the taxonomic and functional diversity of living organisms.

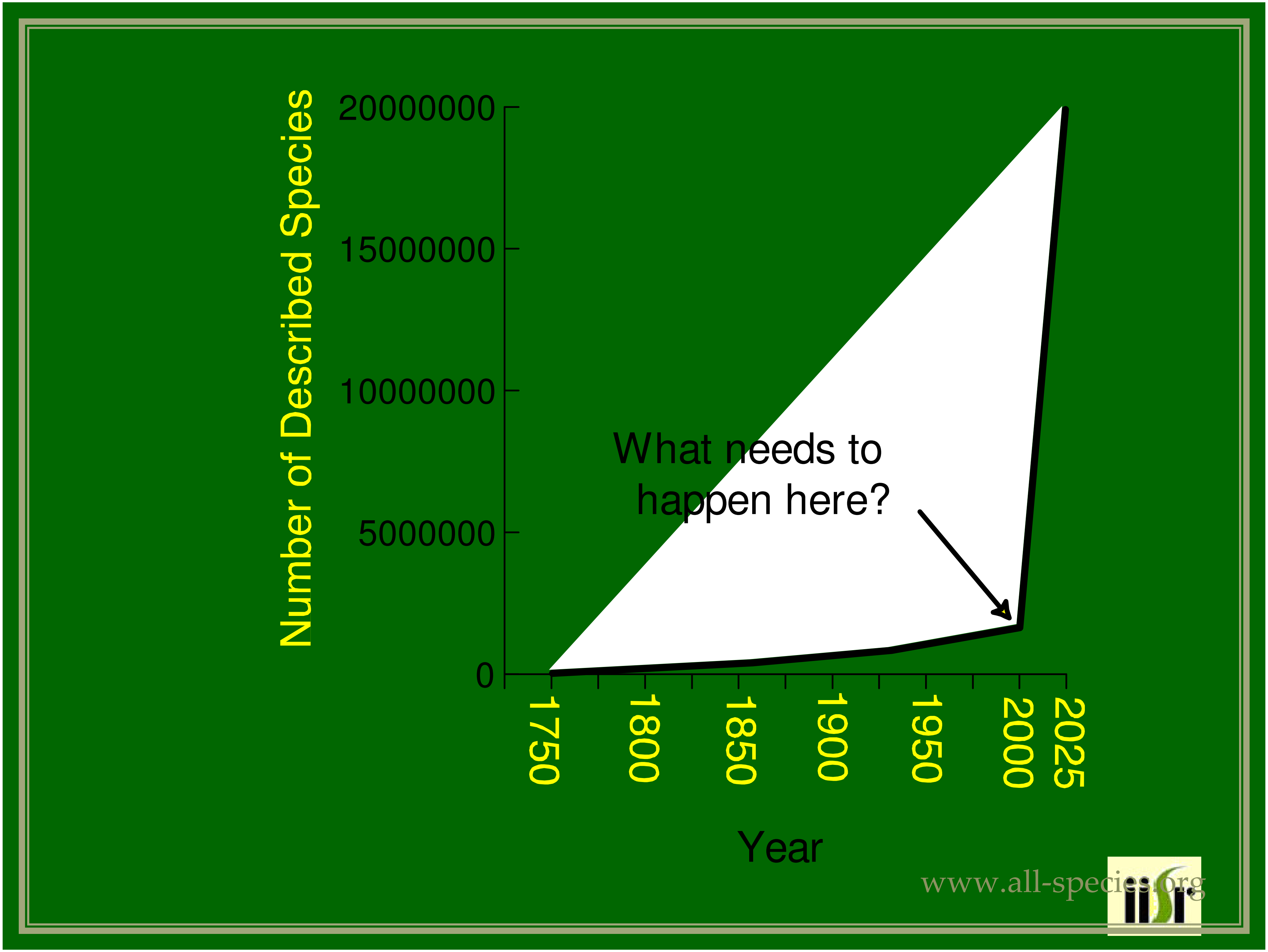
Hierarchies of biological diversity & ignorance



- Both biodiversity and biodiversity data are unevenly distributed around the world:



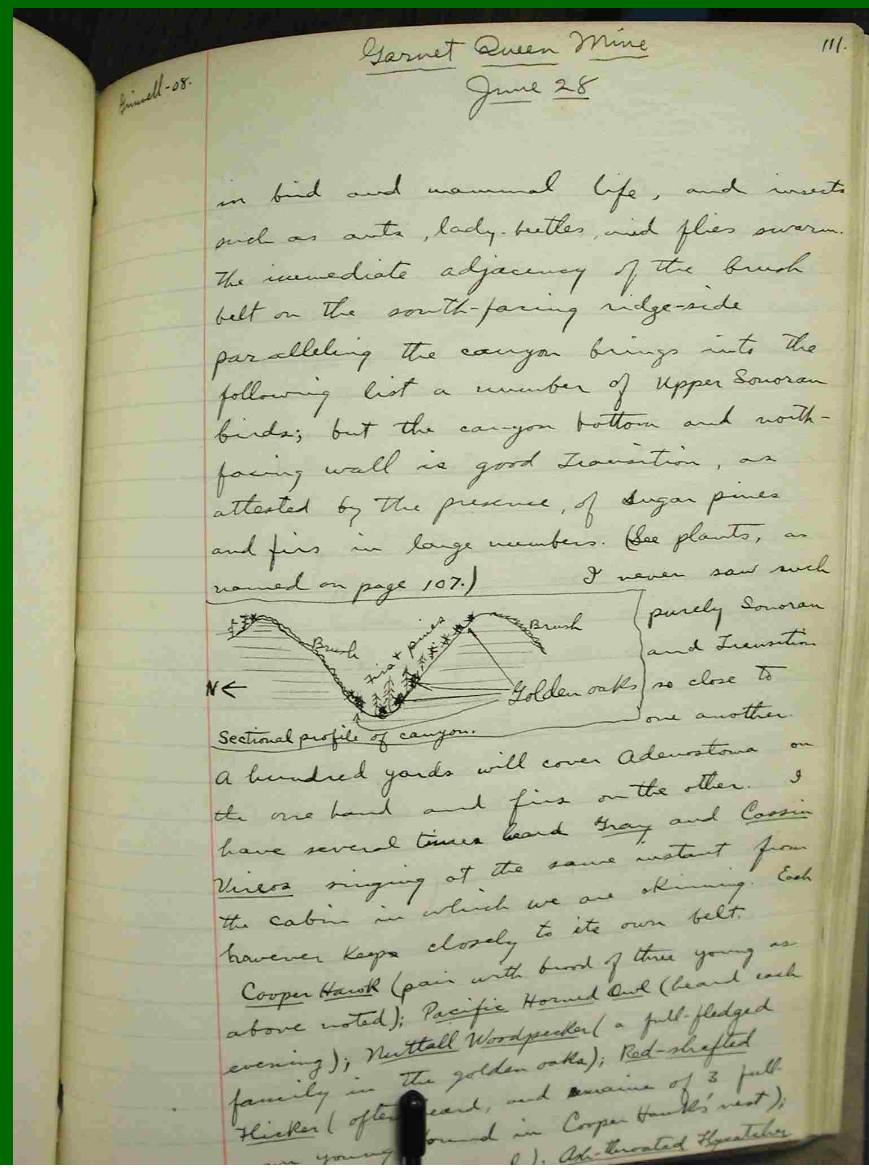

Number of Described Species
20000000
15000000
10000000
5000000
0
1750
1800
1850
1900
1950
2000
2025
Year
www.all-species.org



Number of Described Species
20000000
15000000
10000000
5000000
0
1750
1800
1850
1900
1950
2000
2025
Year
What needs to happen here?
www.all-species.org

Beyond the specimen:

genetic samples, field notes, images, recordings….



Grinnell-08.

Garnet Queen Mine
June 28

111.

in bird and mammal life, and insects
such as ants, lady-beetles, and flies swarm.
The immediate adjacency of the brush
belt on the south-facing ridge-side
paralleling the canyon brings into the
following list a number of Upper Sonoran
birds; but the canyon bottom and north-
facing wall is good Transition, as
attested by the presence of sugar pines
and firs in large numbers. (See plants, as
named on page 107.) I never saw such
purely Sonoran
and Transition
so close to
one another.

A hundred yards will cover Adenostoma on
the one hand and firs on the other. I
have several times heard Gray and Cassin
Vireos singing at the same instant from
the cabin in which we are skinning. Each
however keeps closely to its own belt.
Cooper Hawk (pair with brood of three young as
above noted); Pacific Horned Owl (heard each
evening); Nuttall Woodpecker (a full-fledged
family in the golden oaks); Red-shafted
Flicker (often heard, and remains of 3 full-
young found in Cooper Hawk's nest);
Ash-throated Flycatcher

Biodiversity Information

- Scattered
- Non digitized
- Not easily accessible BUT
- Unprecedented data are generated
  - Biochemical
  - Molecular

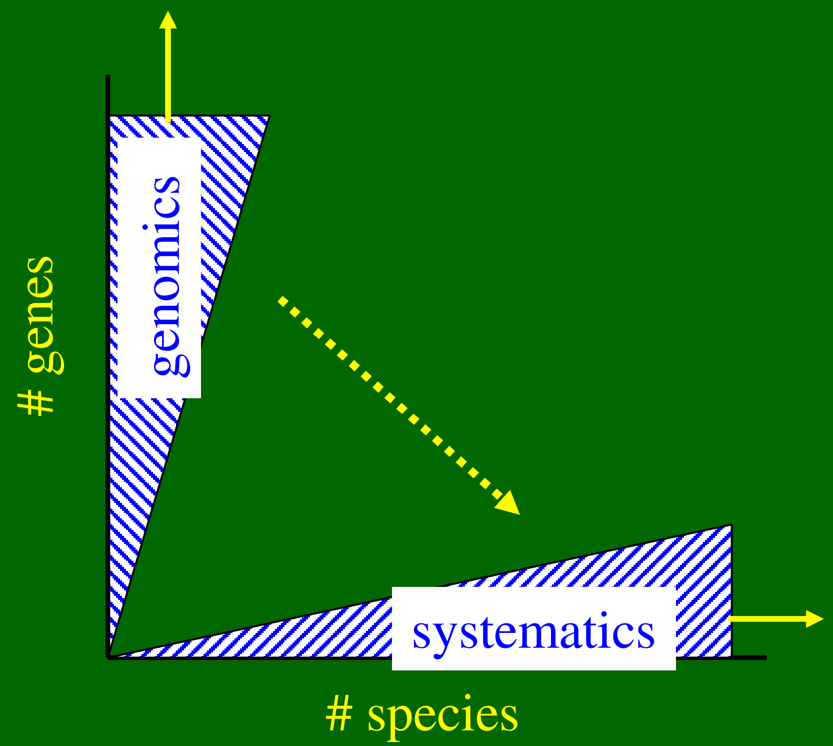
Biological Data Domain

Subdomain	Digital Status	Data Status	Greatest Informatics Problems
Molecular Sequence & Gene/Genome Data	95% digital	Persistent *digital, universally accessible* data stores	Data migration, cleansing, vouchering, taxonomy (gene & species)
Species- & Specimen Data	<5% digital	Persistent *physical* data stores, accessible with difficulty	Digitisation, migration of legacy data, indexing
Ecological & Ecosystem Data	80% ? digital	Persistent ? digital and physical data stores, moderately accessible	Migration of legacy data, metadata generation, taxonomy (species)

Subdomains could contribute to each other…

	Gene	Species	Ecosystem
Gene		Taxonomy, Registry, Context	Context, analytical tools
Species	Model accessibility mechanism, 'member' information		Context, 'member' interaction, link to abiotic data & GIS
Ecosystem	Model accessibility mechanism, analytical tools	Taxonomy, Registry, 'member' information	

The current gap between genomics and biodiversity analysis



Different strategies for sampling of species/genes

Inadequate molecular assays of diversity

Targeting of genes important to survival and reproduction

Immune systems, Stress resistance etc.

BIOINFORMATICS

- Interface between biological and computational sciences
- Computational management of all kinds of biological information

Why Bioinformatics?

- To manage unprecedented, massive data
- To make information globally available and readily accessible to anybody - decision makers (Who uses the information….)
- To convert paper-based data to computer based (How information is used….)

Biodiversity Informatics

- "the application of information technologies to the management, algorithmic exploration, analysis and interpretation of primary data regarding life, particularly at the species level of organization"

-Soberón & Peterson 2004

Biodiversity Informatics

- Facilitate research and management by developing ways to
- access biodiversity data
- integrate
  - databases of biodiversity information
  - computational services such as predictive models, analytical, and planning tools
- Helps to document primarily the occurrence of organisms in space and time.

How it helps…….

Integration of systematics, biogeography, spatial modelling and genomics will:

- Improve understanding of evolutionary processes underlying current diversity
- Improve use of biodiversity information in conservation BUT
- Depends crucially on connectivity of information

iisr

Bioinformatics: Implications

- Analyzing data structures
- Designing the schema to store the data precisely and effectively (data repository)
- Developing systems to input and output the information (web interface)

Bioinformatics Tools

- Linux based platform
  - Free OS
- Database Management Systems
  - Relational/Object Oriented Databases (SQL/Oracle)
  - Meta database technology
- Image Analysis
  - Estimation of spectral distribution from multi-band image
- Statistical Analysis & Modelling
- Handling narrative and descriptive text
  - Keywording, indexing, hypertext linking etc.
- Spatial Referencing - GIS
- Networking - online
  - Use of XML (Extensible Markup Language)

Data capture & storage

- **Specimen-Occurrence Data**
  - **XMl schemas**
- **Georeferencing**
  - BioGeoMancer (http://www.biogeomancer.org/)
  - GEOLocate (http://www.museum.tulane.edu/geolocate/)
- **Authority Files**
  - ITIS (http://www.itis.gov/),
  - Species2000 (http://www.sp2000.org/),
  - uBIO (http://www.ubio.org/),
  - ECAT (http://www.gbif.org/prog/ecat)
- **Databases**
  - Specimen-level databases and taxon -level databases

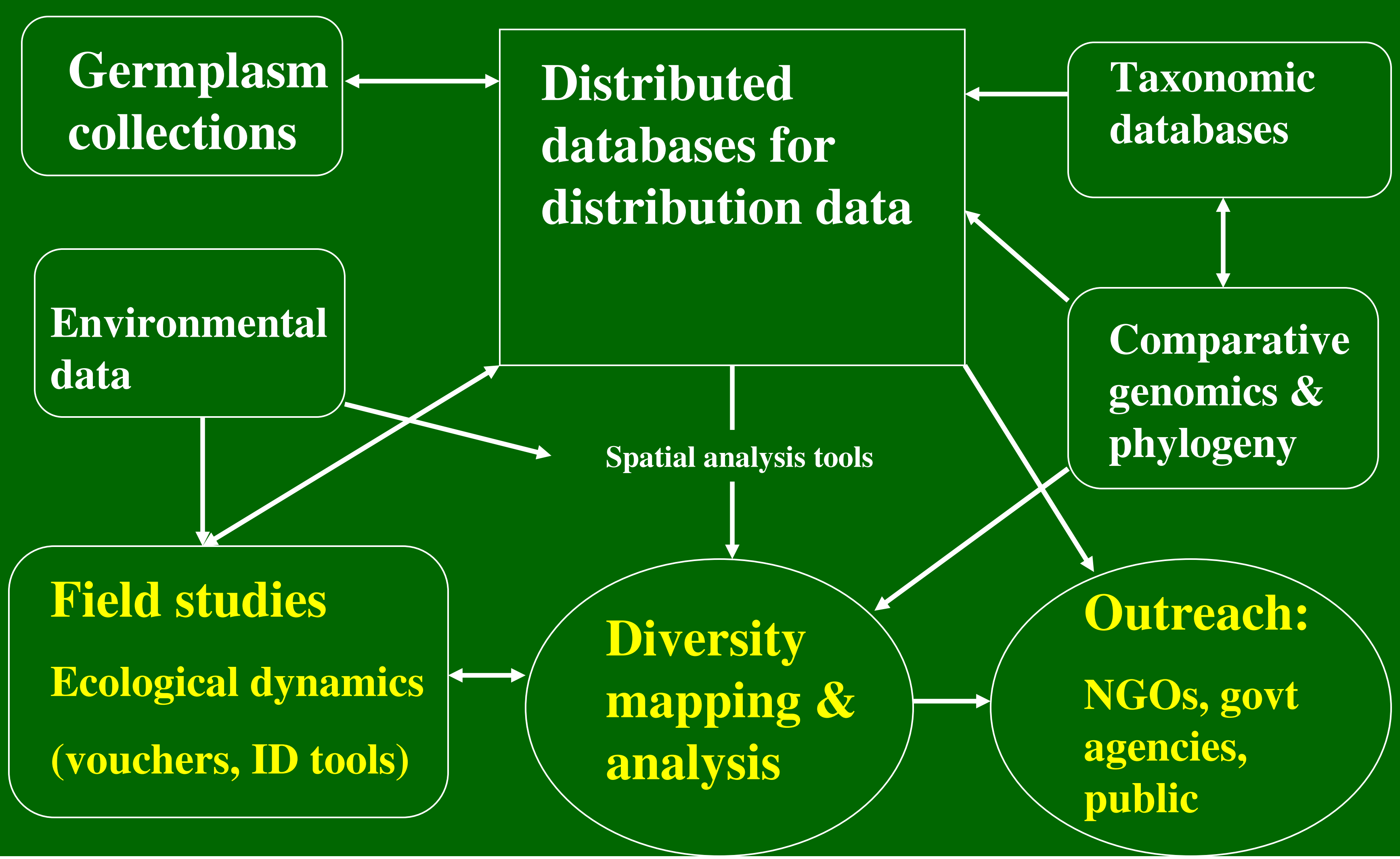
Data Sharing & Integration

- Standards development - the Taxonomic Database Working Group (TDWG) in conjunction with the GBIF (http://www.gbif.org/)
  - Darwin Core
  - Access to Biological Collections Data (ABCD)
  - Taxonomic Concept Transfer Schema (TCS)
  - SDD (structure of descriptive data)

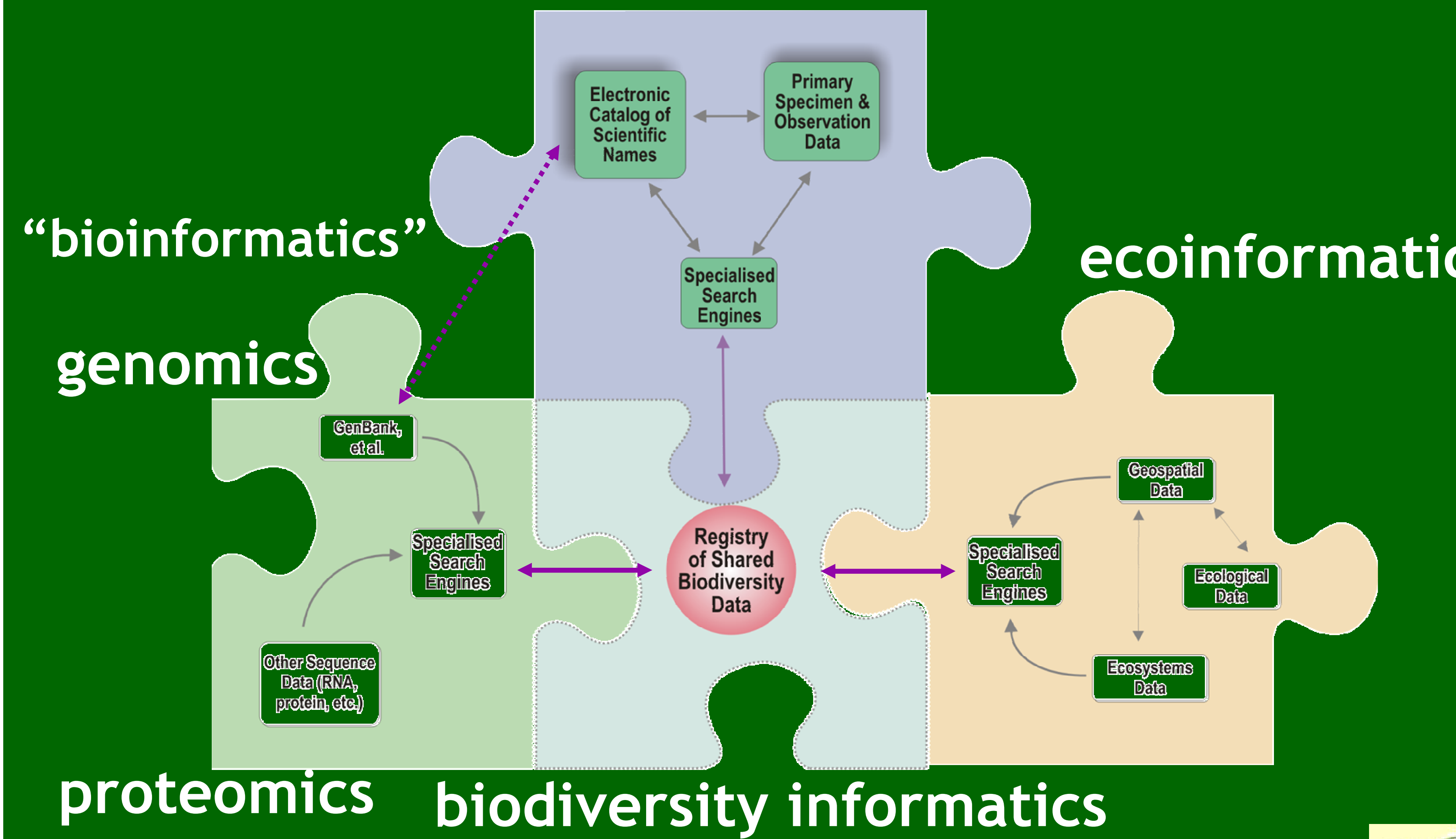
Data Analysis

- **Species Richness**
  - the number of species occurring in an area
- **Geographic Distributions**
  - **f**or making land-use decisions,
  - for predicting the probability of success for biological control introductions,
  - for predicting the potential negative impact of invasive species ,
  - biodiversity hotspots
    - BIOCLIM, Genetic Algorithm for Ruleset Production (GARP)
- **Online identification**
  - **i**mages and dichotomous keys,
  - Interactive, or multiple-entry, keys
    - Intkey, Lucid, Electronic Field Guide, MorphBank (for images) (http://morphobank.geongrid.org/)

Connectable information for biodiversity analysis

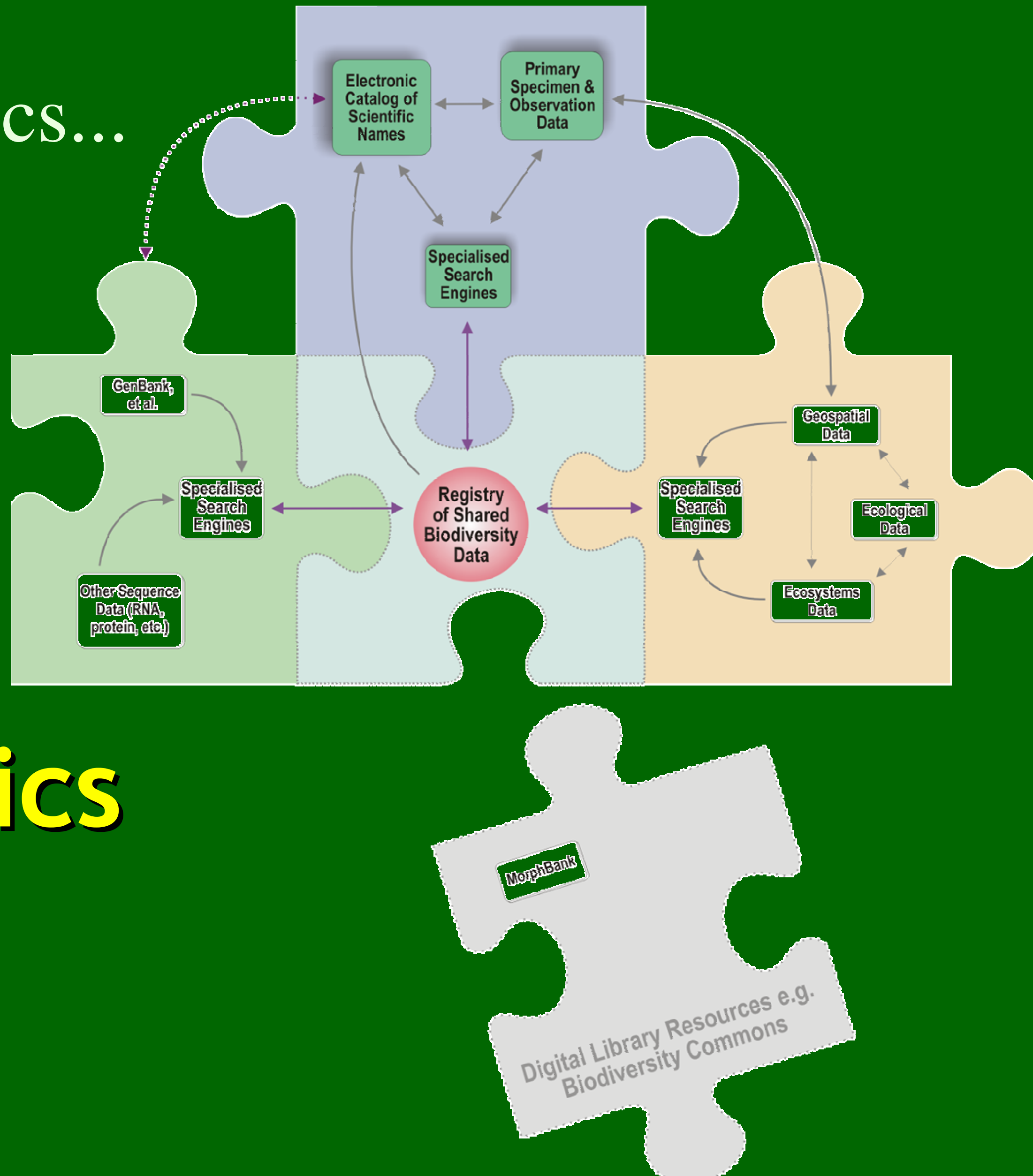


True bioinformatics …



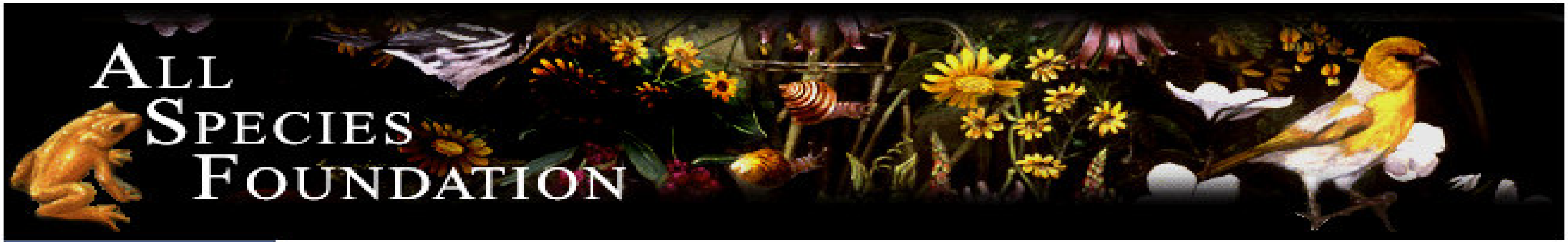
True bioinformatics...

Real bioinformatics



Global Organization

- Several parallel and complementary initiatives:
  - Global Biodiversity Information Facility (GBIF) - http://www.gbif.org/
  - Taxonomic Databases Working Group (TDWG) - http://www.tdwg.org/
  - Global Taxonomic Initiative (GTI) - http://www.cbd.int/gti/
  - International Organization for Plant Information (IOPI) - http://plantnet.rbgsyd.nsw.gov.au/iopi/iopihome.htm
  - Species 2000 - http://www.sp2000.org/
  - All Species Foundation (ALL) - http://www.all-species.org/



The ALL Species Foundation is a non-profit organization dedicated to the complete inventory of all species of life on Earth within the next 25 years - a human generation.

To describe and classify all of the surviving species of the world deserves to be one of the great scientific goals of the new century.

In applied science, this completion of the Linnaean enterprise is needed for effective conservation practices, and for impact studies of environmental change.

In basic science, it is a key element in the maturing of ecology, including the grasp of ecosystem functioning and of evolutionary biology. It also offers an unsurpassable adventure: the exploration of a little-known planet.

ALL IN 2004

With continued support from our 2003 sponsors, ALL Species will remain located at the California Academy of Sciences in San Francisco with one full time staff person. In addition, a new partnership agreement with Conservation International will fund one half time ALL Species representative at their Washington DC office.

PLANETARY BIODIVERSITY INVENTORIES

Integral to ALL's primary mission is encouraging new funding opportunities for inventory, and we are proud to report that our partnership with the National Science Foundation helped to establish a $14M fund for Planetary Biodiversity Inventories. We are pleased to announce the first four awardees of this significant new program:

- Dr. Lynn Bohs-University of Utah, Solanum: a Worldwide Treatment
- Dr. Larry Page- Florida Museum of Natural History, All Catfish Species
- Dr. Randall Schuh-American Museum of Natural History, Phytophagous Insects (plant bugs)

Species 2000

SPECIES 2000

- **Home**
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CATALOGUE OF LIFE

- About the CoL
- Using
- Contributing

Home

News

The **2008 Catalogue of Life Annual Checklist** is now online following its launch at the Institute of Zoology at the Chinese Academy of Sciences, Beijing, China.

Welcome to the Species 2000 website
and the Species 2000 and ITIS 'Catalogue of Life'

Please use the menu on the left to browse for more information about the Species 2000 project or use the links below to search the **Species 2000** and **ITIS "Catalogue of Life** ".

- **Annual Checklist 2008** *New!*
  - Species 2000 & ITIS assembly of 52 taxonomic databases as a fixed annual edition
  - 1,105,589 species
  - Also available on a free CD-ROM. **Order your personal copy** or download an **ISO image**

  - **Archive versions** of 2000-2008 Annual Checklists are available

- **Dynamic Checklist**
  - real time access to the Species 2000 array of 26 online taxonomic databases
  - 450,000 species

Please note that database coverage differs between the **Dynamic** and the **Annual** Checklists.

International Organization for Plant Information

Commission of the International Union of Biological Sciences (IUBS) and a member of Species 2000

Home

Projects
- Global Plant Checklist
- Species Plantarum Project

About IOPI
- IOPI general information
- IOPI Constitution
- IOPI Annual Meeting
- IOPI membership
- IOPI Council
- Checklist Committee
- Species Plantarum Steering Committee
- Information Systems Committee

Contact us

The International Organization for Plant Information (IOPI) manages a series of cooperative international projects that aim to create and link databases of plant taxonomic information.

IOPI is a Commission of the International Union of Biological Sciences (IUBS) and a member of Species 2000

IOPI Projects

- **Global Plant Checklist** - Check to see what other datasets have been added since your last visit
- **Species Plantarum Programme** - Find out what parts of the **'Flora of the World'** have been published
- **Species 2000 and ITIS Catalogue of Life** - Global Species Datasets (GSDs) in the IOPI GPC are available here, too

General Botanical Information

- The Internet Directory for Botany
- WWW Virtual Library: Botany - Plant Biology
- W3MOST - global mosses checklist
- Algaebase - global algal checklist

About IOPI

- IOPI general information
- IOPI General Meetings
- IOPI membership, constitution and committees

Data standards and scientific access to data

- Proposed regulation of access to databases - Intellectual Property issues
- The Taxonomic Databases Working Group (TDWG)

Biodiversity sites

- The Global Taxonomy Initiative
- The Global Biodiversity Information Facility
- The Convention on Biological Diversity
- BioNET-INTERNATIONAL

Home > Programmes & Issues > Global Taxonomy Initiative

Global Taxonomy Initiative

Confronting the taxonomic impediment to biodiversity conservation

Effective conservation and management of biodiversity depends in large part on our understanding of taxonomy. Unfortunately, inadequate taxonomic information and infrastructure, coupled with declining taxonomic expertise, hinders our ability to make informed decisions about conservation, sustainable use and sharing of the benefits derived from genetic resources. Governments, through the Convention on Biological Diversity, have acknowledged the existence of a "taxonomic impediment" to the sound management of biodiversity, and have developed the Global Taxonomic Initiative to remove or reduce the impediment. More »

What's New

1 May 2008
'Taxonomic Training and Access to Collections in Belgium' Call for Proposals. More »
More news »

Notifications

17 April 2008 (2008-050)
Eighth meeting of the Coordination Mechanism for the Global Taxonomy Initiative, 31 May 2008, Bonn, Germany. More »
More Notifications »

GBIF

... free and open access to biodiversity data

GLOBAL BIODIVERSITY INFORMATION FACILITY

SITE SEARCH:

GBIF DATA
- Browse
- Search
- How to search
- Providers
- Data policy

ABOUT GBIF
- Press
- What is GBIF?
- Demonstration Projects
- GBIF's Current Members
- How to Join GBIF
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- Documents & History
- Ebbe Nielsen Prize
- Symposia & Workshops
- Work Programme

TOOLS AND SERVICES
- Newsletters
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- Standards
- Links
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- Calls for tender and jobs
- GBIF tools download

SUPPORT
- Become a data provider
- GB documents [login]
- GB14
- Helpdesk

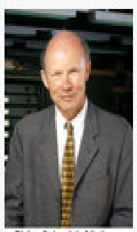
HOME

Latest news [More...]

- GBIF surveying Observational datasets in biodiversity - GBIF's Observational Data Task Group is ... - posted on 2008-05-13
- EDIT Summer School 2008 - Call for the EDIT Summer School 2008: Modern ... - posted on 2008-05-08
- Luxembourg has joined the GBIF family of participating countries - GBIF welcomes Luxembourg as its newest Associate ... - posted on 2008-05-08
- GBIF is surveying biodiversity multimedia resources - GBIF's Multimedia Resources Task Group is ... - posted on 2008-05-05
- Bibliographies of GBIF citations accessible at EditGrid.com - Articles from both professional publications and ... - posted on 2007-12-10

Latest articles [More...]

- GBIF Science Committee Seeks Nominations for 2008 Ebbe Nielsen Prize



Ebbe Schmidt Nielsen
1950 - 2001

The Ebbe Nielsen Prize will be awarded for the seventh time in 2008 to a person or small team that is demonstrating excellence in combining biodiversity informatics and biosystematic research. The Science Committee of the GBIF Governing Board seeks nominations for the Prize, which are due by 1 July 2008.
Posted on 2008-05-05

- New Head of Informatics Begins at the GBIF Secretariat

Samy Gaiji has joined the GBIF Secretariat in the role of Head of Informatics.
Posted on 2008-04-24

Upcoming events [More...]

Calendar of events

May
2008

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

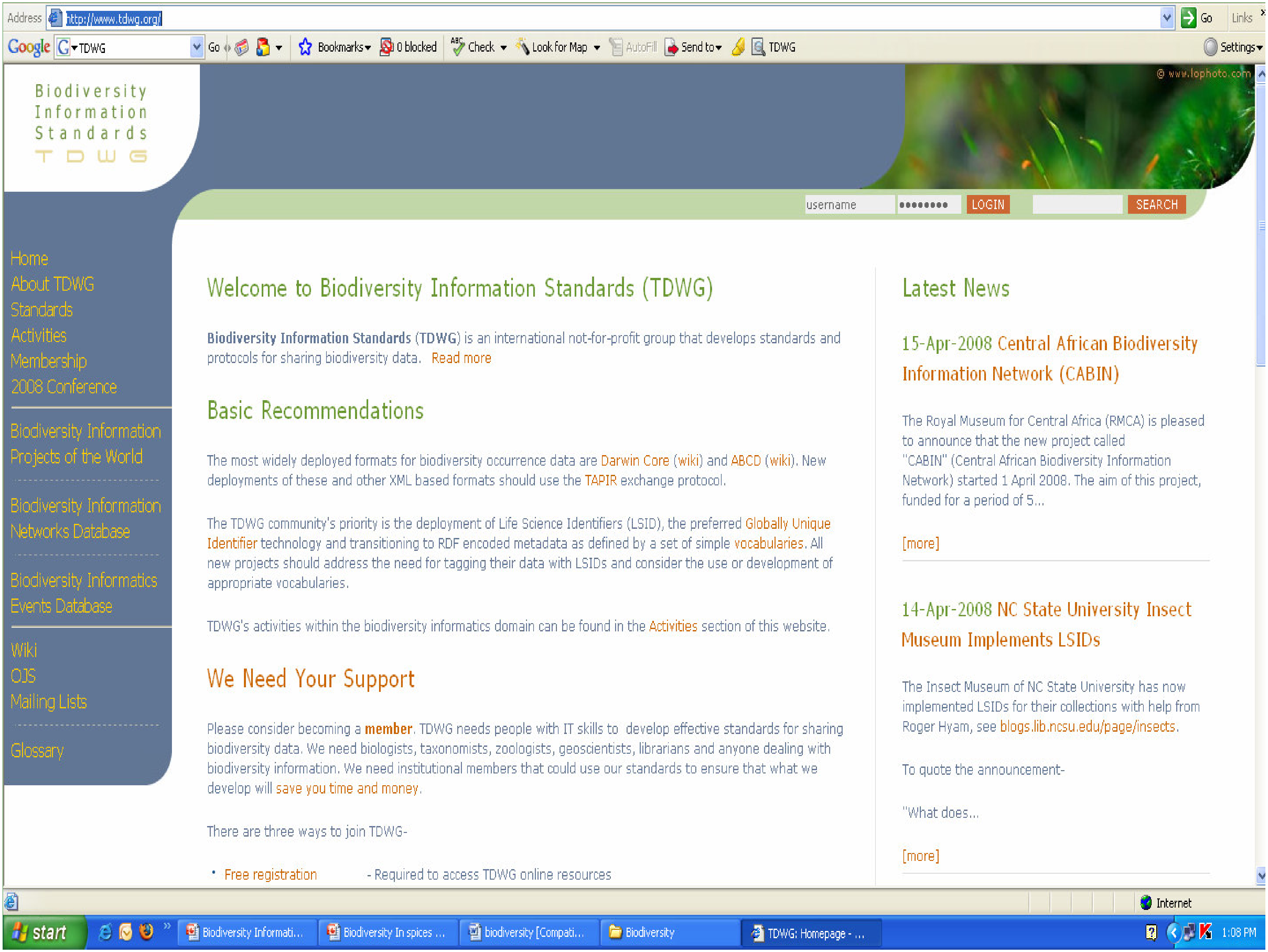
GBIF UDDI Registry
* registration
* update information

Data Providers	221
Collections	1679
Records	157222043

Personalised news channels

GBIF CIRCA - MOST POPULAR ITEMS

- Drawing Maps for the GBIF Data Portal
- DiGIR Provider Package for Windows - Users' Guide
- GBIF standard email lists
- Guide to Best Practices for Georeferencing
- Helpdesk procedures



Address http://www.tdwg.org/ Go Links

Google TDWG Go Bookmarks 0 blocked Check Look for Map AutoFill Send to TDWG Settings

Biodiversity
Information
Standards
TDWG

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2008 Conference

Biodiversity Information Projects of the World

Biodiversity Information Networks Database

Biodiversity Informatics Events Database

Wiki
OJS
Mailing Lists

Glossary

Welcome to Biodiversity Information Standards (TDWG)

Biodiversity Information Standards (**TDWG**) is an international not-for-profit group that develops standards and protocols for sharing biodiversity data. Read more

Basic Recommendations

The most widely deployed formats for biodiversity occurrence data are Darwin Core (wiki) and ABCD (wiki). New deployments of these and other XML based formats should use the TAPIR exchange protocol.

The TDWG community's priority is the deployment of Life Science Identifiers (LSID), the preferred Globally Unique Identifier technology and transitioning to RDF encoded metadata as defined by a set of simple vocabularies. All new projects should address the need for tagging their data with LSIDs and consider the use or development of appropriate vocabularies.

TDWG's activities within the biodiversity informatics domain can be found in the Activities section of this website.

We Need Your Support

Please consider becoming a **member**. TDWG needs people with IT skills to develop effective standards for sharing biodiversity data. We need biologists, taxonomists, zoologists, geoscientists, librarians and anyone dealing with biodiversity information. We need institutional members that could use our standards to ensure that what we develop will save you time and money.

There are three ways to join TDWG-

- Free registration - Required to access TDWG online resources

Latest News

15-Apr-2008 Central African Biodiversity Information Network (CABIN)

The Royal Museum for Central Africa (RMCA) is pleased to announce that the new project called "CABIN" (Central African Biodiversity Information Network) started 1 April 2008. The aim of this project, funded for a period of 5...

[more]

14-Apr-2008 NC State University Insect Museum Implements LSIDs

The Insect Museum of NC State University has now implemented LSIDs for their collections with help from Roger Hyam, see blogs.lib.ncsu.edu/page/insects.

To quote the announcement-

"What does...

[more]

Internet

start Biodiversity Informati... Biodiversity In spices ... biodiversity [Compati... Biodiversity TDWG: Homepage - ... 1:08 PM

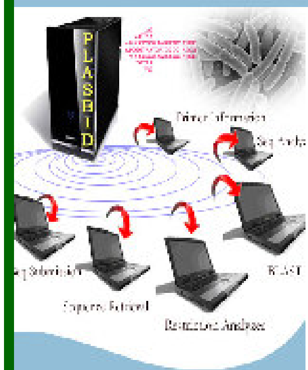
IISR Initiatives……

Biodiversity Database / Tools Name	**Crop / Organisam**	**Availability**
Spice Genes I	Black pepper	Online and CD-ROM
Spice Genes II	Curcuma Species	CD-ROM
Spice Genes III	Nutmeg	CD-ROM
Piper base	*Piper* species	CD-ROM
PhyDish	*Phytophthora* spp.	Online
PIR	*Phytophthora* spp.	Online
PLASBID	Plant associated bacteria	Online

PLASBID

Home | About | Contact | IISR | Admin | Feedback

Welcome to PLASBID



- Sequence Information
- Bacterial Identification
- Primer Information
- Restriction Analyzer
- Sequence Analyzer
- Sequence Submission

PLant ASsociated Bacterial Identification Database

Bacteria associated with plants are diverse in their ability to affect plant health, their genotypic and phenotypic characteristics and their phylogeny. These bacteria are typically members of complex microbial communities, with only a few establishing pure clonal populations within a plant. Majority of research on plant associated bacteria has focused on phytopathogens and diazotrophic photosymbions. Increased interest in the diversity of organisms associated with plant has induced developement of several tools to assess their diversity. It is clear that many plant associated microbes, even those that comprise only a small proportion of a community, can have functions that are of agricultural or environmental importance. Technical advances in microbial ecology and genomics have been paralleled by advances in our understanding of the structure and dynamics of these microbial communities and in the molecular basis of plant microbe and microbe- microbe interactions.

What is PLASBID?

PLASBID is an attempt to consolidate information available on bacteria reported to be associated with plants. It contains nucleotide sequences belonging to 16S rRNA. The sequence information, G + C content of each sequence are given, and also a link to NCBI database for additional information. You can also see the bacterial taxonomy and their salient features in brief.

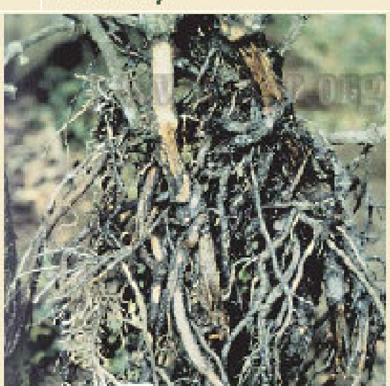
The sequence level identification of the bacterial species can be done with the Bacterial Identification Tool. It does a sequence similarity search using BLAST and outputs the results based on the percentage of similarity. The sequence provided by the user is searched against PLASBID 16S rRNA nucleotide database and identifies

Thanks For Your Visit

000873

phytophthora

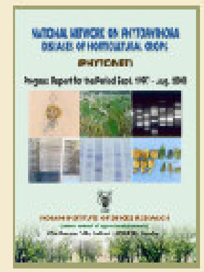
Phytophthora....Diseases.... in.....Horticultural....Crops

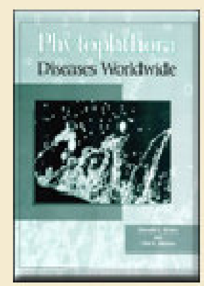


Phytophthora

Phytophthora is not a true fungus, although it shares many features with the fungi. There are many species, and the differentiation between individual Phytophthora species can be extremely difficult. Although identification requires a high degree of expertise and training, it is important as species can vary significantly in their aggressiveness as pathogens. There is much debate and confusion in the characters used to define species, but general features such as colony morphology, and the production of structures such as sporangia and oospores are the basis of the taxonomy. It is likely that molecular techniques will become the best method for identification in the future.

Courtesy





iisr

PHYTOPHTHORA INFORMATION RESOURCE

Search Nucleotide for Submit

Phytfinder
Species
Literature
Nucleotide
Protein
Genome
Structure
Links
Submit

Phytophthora is one of the most destructive plant pathogenic oomycete. This fungus devastates crops such as alfalfa, cucurbits, peppers, strawberry,tobacco, potato, black pepper and a variety of tree crops including almonds, apples, avocado, citrus, cocoa and walnuts.

Within the genus *Phytophthora* there are about sixty four species. The *Phytophthora* Information Resource is an initiative to understand and control this pathogen by integrating data from morphology to genomics. The system provides an expert system to identify the fungus up to species level using the morphological data .

The summary of sequencing results also provided. Besides information on latest developments from research front, the recent literature on *Phytophthora* and links to other web resources on *Phytophthora* are also included.We intended to develop as a comprehensive portal on *Phytophthora* research. We seek your feedback and inputs for the success of this venture.

News

Access the Phytophthora Database
(Mar, 2005)

Pepper Trees, Graceful and Tough By Ron Sullivan
(Mar, 2005)

2005 Wildflower Forecast
(Feb, 2005)

World Phytophthora Collection
(Jan, 2005)

Biosystematics

South Indian Species

Other Species

Biochemistry

Publications

Patents

About Us

Exit

- OTHER DATABASES
- PIR
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- Chitinase
- PAL
- Cardcc & Mphase
- Spice Bibliography

Piper Germplasm

(A database on the rich germplasm resources of various spice crops conserved at IISR)

Surf to

- Cultivar Collection
- Cultivar Database
- Wild Collection
- Wild Database

List of Collectors: please select Go

and some of the other South Indian species co-exist in many localities in the Western Ghats. The cultivars, except the improved varities, are evolved directly from the wild P. nigrum. Natural selection and conscious selection by humans for various traits have created diversity in cultivated. Most of the cultivates are in their respective area of cultivation.

Besides P. nigrum, which is used as spice the other economically important Indian Species are P. longum, P. chaba, P. hapnium and P. betle. The first three are used as long pepper and P. betle is used for masticatory use.

iisr

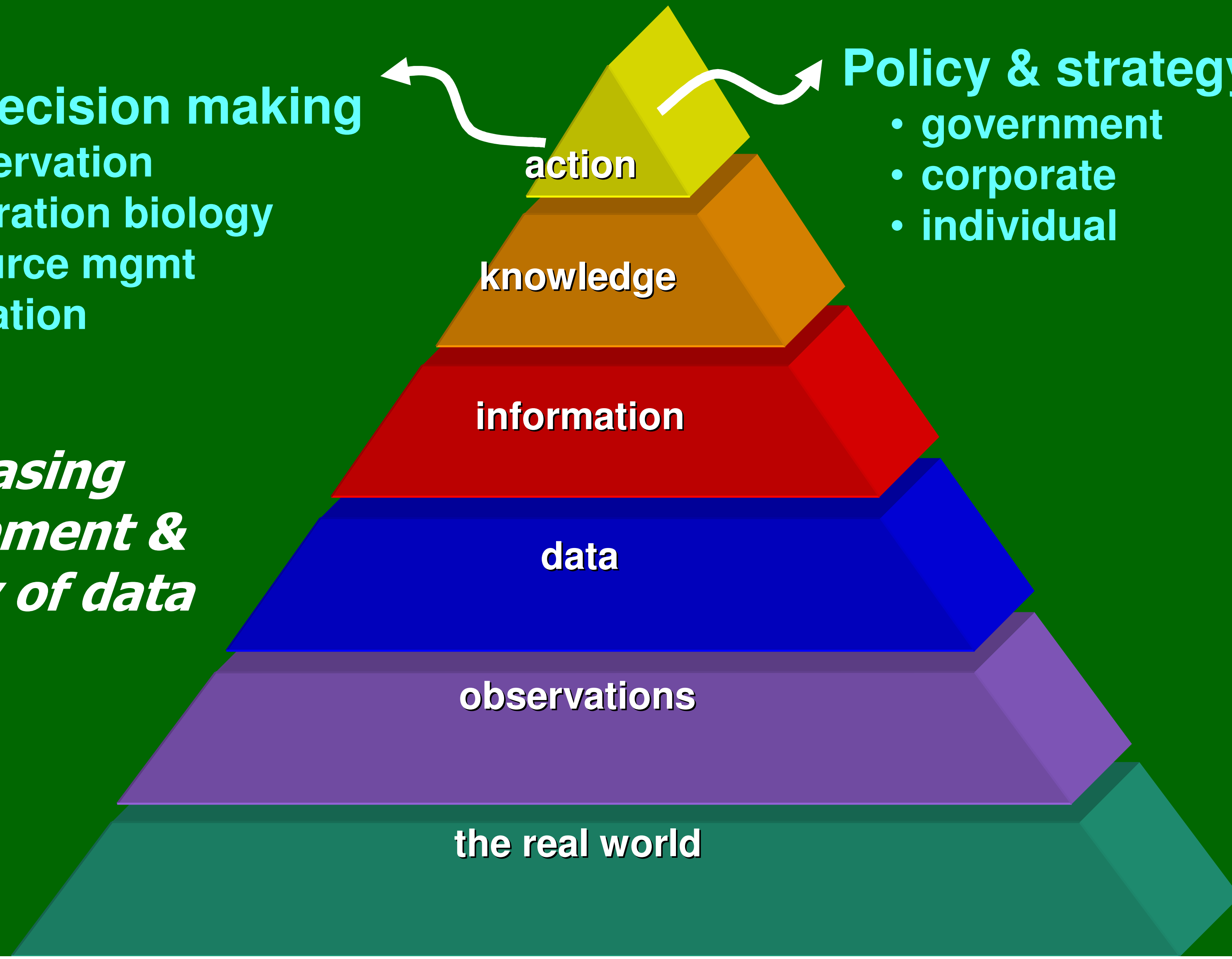
Trends in Biodiversity Information Management

Nomenclatural	→	Taxonomic
Regional	→	Global
Text-based	→	Image-based
Taxon-based	→	Spatially-based
Individual effort	→	Partnerships
Single user	→	Multi-user
Standalone	→	Networked
Centralized	→	Distributed
Proprietary system	→	Open system
Idiosyncratic design	→	Standard architecture
Nonstandard data content	→	Standard data content
Conventional	→	Innovative
Developmental	→	Stable
Access charges	→	Freely available

Data refinement

Envir. decision making
- conservation
- restoration biology
- resource mgmt
- utilization

Policy & strategy
- government
- corporate
- individual



Increasing refinement & utility of data

THANK YOU

Trade Related Issues in Biodiversity

Dr. K. Sunil Mohamed
CMFRI, Kochi

Definitions

Trade

Exchange of goods for money or other goods; business carried out as means of livelihood or profit; buy and sell

Trade in fish is common to all societies and has taken place from time immemorial

A fisher returning with more fish than is needed to meet personal needs will tend to exchange surplus fish for other goods or services

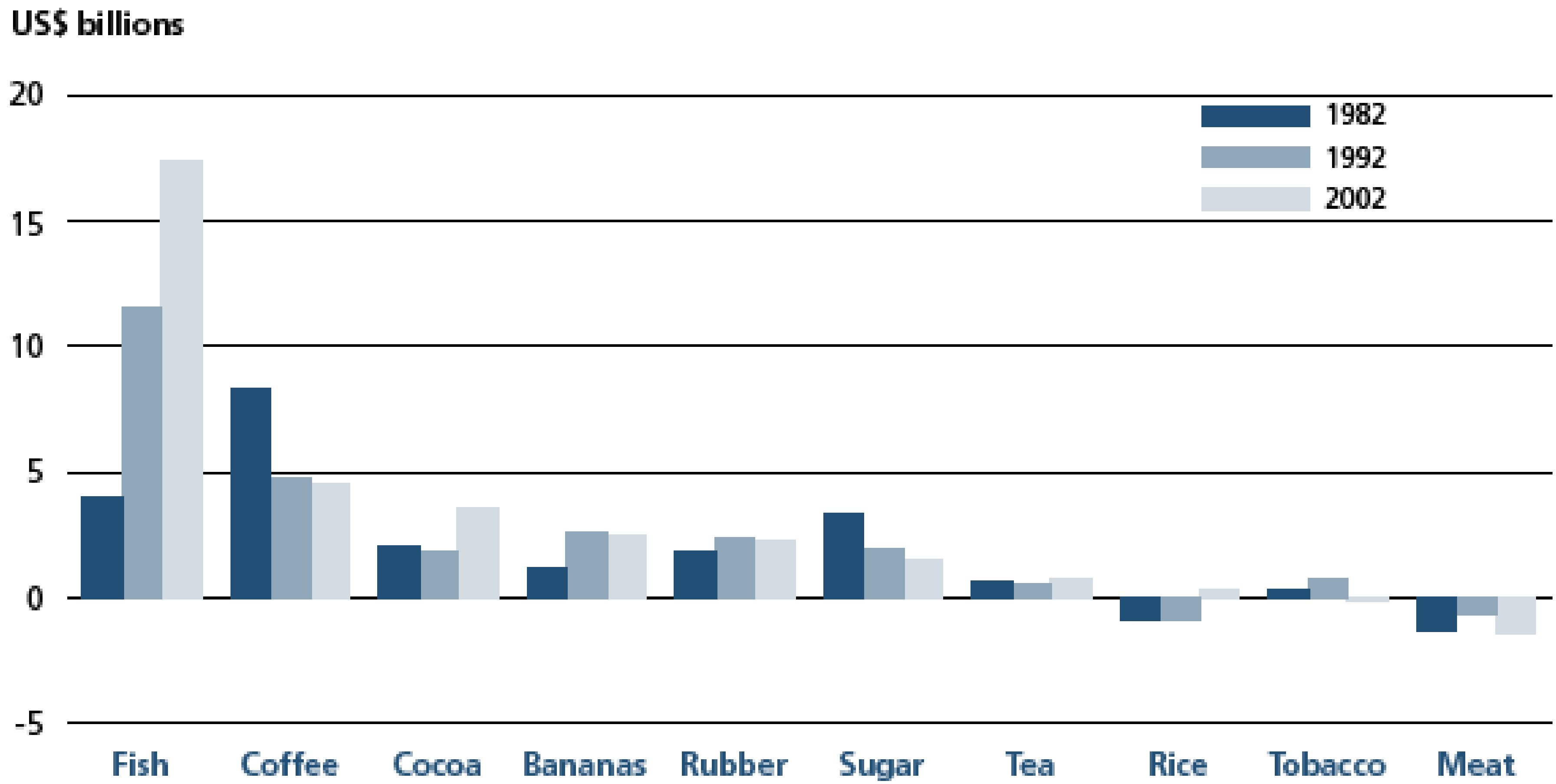
The distribution of fish globally is very uneven. Some places enjoy abundance far beyond the needs of the local population, while others may have no direct access to fisheries resources

This means that trade has a role to play in order to achieve a more even distribution of fish around the globe

An estimated 45% of the world catch is now traded internationally

Fish is the most traded of agricultural commodities

Net exports of selected agricultural commodities in developing countries



Definitions

Biodiversity

The most straightforward definition is "variation of life at all levels of biological organization"

A second definition holds that biodiversity is a measure of the relative diversity among organisms present in different ecosystems. "Diversity" in this definition includes diversity within a species and among species, and comparative diversity among ecosystems

A third definition that is often used by ecologists is the "totality of genes, species, and ecosystems of a region"

Genetic diversity - diversity of genes within a species

Species diversity – diversity among species in an ecosystem

Ecosystem diversity – diversity of habitats in a given area

Governance of Trade

- Important frameworks relative to trade in fisheries have been established
- International trade rules have developed through several rounds of trade negotiations under General Agreement on Tariffs and Trade (GATT)
- The last of these, the 1994 Uruguay Round, agreed to establish the World Trade Organization (WTO) and a number of important agreements with relevance to fisheries were concluded
- The FAOs Committee on Fisheries has a Sub-Committee on Fish Trade, which provides an intergovernmental forum for consultations on technical and economic aspects of trade in fish and fish products

Governance of Trade

- The idea of free trade in the fisheries, however, is often vehemently contested because there are often tariff and non-tariff barriers to trade and other distorting factors, such as subsidies, present in trading relationships

- Exchange of and access to information is vital to successful trade practices

Exploitation of Marine Biodiversity

- Carried out from time immemorial
  - Coastal and deep-sea Fisheries
  - Aquaculture
  - Pharmaceutical industry (newly emerging)

An Idea about Marine Biodiversity

- **Oceans cover 71 per cent of the earth's surface and account for 90 per cent of the biosphere**
- **In 1998, 'only' 200,000 marine animal species, about 20,000 algae and fewer microorganisms had been described;**
- **Not very impressive figures, compared with over 2 million animal species and 40,000 plants with flowers inhabiting the continents.**
- **Only five out of the 33 existing animal phylum are not represented in the marine environment, while 13 of them are exclusively marine.**
- **As a result, genetic, biochemical and physiological animal diversity is much larger in the oceans than on land**

Number of marine chemical structures discovered or refined from marine organisms

Group of organisms	Chemical structures
Marine Microorganisms	140
Green Algae	8
Brown Algae	10
Red Algae	39
Sponges	316
Coelenterates	193
Bryozoans	7
Molluscs	45
Tunicates (ascidians)	74
Echinoderms	24
Miscellaneous (crustaceans and others)	13

Source: Extracted from Faulkner, J. Marine natural products, *Nat. Prod. Rep.*, 2002, 19: 1–48

Marine Bioprospectors at work

- Research is in progress on antibacterial, anticoagulant, antifungal, anti-inflammatory, anti-helminthic, anti-platelet, antiprotozoal and antiviral substances with actions on the cardiovascular, endocrine, immune and nervous systems

- Between 1969 and 2005, 63 marine substances were patented as anti-tumor agents, accounting for half the marine molecules patented for pharmaceutical purposes

Control and Regulations over Marine Biodiversity

- Convention on Biological Diversity (CBD)
  - the sovereign rights of States over biodiversity;
  - the rights of the holders of industrial technology, who enjoy IPRs and may keep their information confidential; and
  - the rights of the holders of TEKS (traditional ecological knowledge systems), which are subject to national legislation, and whose knowledge must be made publicly available

- Trade-related Aspects of Intellectual Property Rights (TRIPS) Agreement of the World Trade Organization (WTO).
  - all WTO members to establish IPR systems covering all technologies and products, including, to an unprecedented extend, life forms and their parts.

- The United Nations Convention on the Law of the Sea (UNCLOS)

United Nations Convention on the Law of the Sea

UNCLOS

- Negotiated between 1973 and 1982 and entered into force in November 1994, UNCLOS is the international convention governing the world's oceans.
- UNCLOS is relevant to control over biodiversity in three ways:
  - it establishes the rights and obligations of coastal States on the marine areas surrounding them, and the rights and obligations of other States on those waters;
  - it sets the conditions to conduct marine research; and
  - it forces countries to give access to "surpluses"

Convention on Biological Diversity

CBD

- The Convention on Biological Diversity (CBD or the Convention) was born out of a bundle of common concerns and conflicting interests, including:
  - the growing recognition that biological diversity is a global asset of tremendous value to present and future generations;
  - the unprecedented threats to species and ecosystems;
  - the rise of biotechnology, genetic engineering in particular;
  - the spectacular increase of IPR claims on developed countries' "inventions" building on genetic resources and associated knowledge from developing countries

Objectives of the CBD

- The conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding

- Recognizes the following:
  - **the sovereign rights of States over biodiversity;**
  - **the rights of the holders of industrial technology, who enjoy IPRs and may keep their information confidential; and**
  - **the rights of the holders of TEKS (traditional ecological knowledge systems), which are subject to national legislation, and whose knowledge must be made publicly available**

Trade-Related Aspects of Intellectual Property Rights

TRIPS

The Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement of the World Trade Organization (WTO) came into force on 1 January 1995, as an outcome of the negotiations of the Uruguay Round of the General Agreement of Trade and Tariffs (GATT)

Some of the main features of TRIPS

- Setting minimum standards
  - TRIPS forces countries that are members of the WTO to fulfil minimum standards for protection in the areas of copyright, trademarks, geographical indications, industrial designs, patents, layout designs of integrated circuits and undisclosed information.
- Equal treatment for all inventors and all exporters
  - The National Treatment clause requires WTO members to treat the nationals of all other member countries exactly the way that they treat their own nationals
- Developed countries were to implement TRIPS within one year after the Agreement was adopted; developing countries until 1 January 2005

Some of the main features of TRIPS

- Countries failing to fulfil TRIPS requirements may be challenged before a WTO dispute settlement mechanism and eventually be subject to retaliatory measures in any segment of their trade

- Under TRIPS Article 27 countries are obliged to grant patents for any product or technology, in all fields of technologies.
- The only exceptions are:
  - inventions whose utilization is against *ordre public* and morality.
  - diagnostic, therapeutic and surgical methods.
  - plants and animals other than micro organisms, although States must grant protection over plant varieties through an effective *sui generis* system

Resolution of Conflicts – The Swordfish Case

- For the past decade, the EU and Chile have been engaged in a controversy over swordfish fisheries in the South Pacific, resorting to different international law regimes to support their positions.
- Chile claims that the EU fails to cooperate with the coastal state to ensure the conservation of the highly migratory species, in violation of the United Nations Convention on the Law of the Sea (UNCLOS).
- The EU claims that Chilean denial of port access violates substantive provisions of the General Agreement on Tariffs and Trade (GATT 1994).

Resolution of Conflicts – The Swordfish Case

- During the last week of January 2006, the EU and Chile finally reached an agreement that effectively suspends proceedings at the WTO and at the ITLOS
- Port access for fish caught under a new scientific fisheries program, and the creation of a multilateral conservation forum for the Southeast Pacific
- The scientific fisheries program will allow each Party to unload in the Chilean ports of Arica, Iquique, and Punta Arenas up to a thousand tons of swordfish each year
- Long liners and fishing gear used in scientific fisheries will be subject to a satellite vessel monitoring system (VMS) and the fishing vessels will carry scientific observers on board
- The provisional agreement reached by the Parties is a first step in setting up the legal framework necessary to ensure the conservation of marine biodiversity in the South Pacific

Access & Benefit Sharing (ABS)

- Since the CBD entered into force, many countries and international organizations have established several measures to ensure their participation in the benefits arising from the exploitation of their genetic resources.

- Countries are not obliged to provide access to their genetic resources.

- Australia, for example, has closed its hugely wealthy waters to foreign researchers

- Therefore, companies interested in accessing and developing active agents from the organisms of Australia’s Great Reef Barrier (and from the rest of the countries’ coral reef systems) need to do so through contract with national institutions like the Australian Institute of Marine Sciences (AIMS).

New & Future Pressures

- In 2002, one of the major fish distributors in the world UNILEVER, partnered a conservation NGO, the WWF, in creating the Marine Stewardship Council (MSC)
- MSC is designed to bring market pressure to bear on what is perceived as underperforming management regimes
- The MSC also recognizes the need to observe and respect the long term interests of people dependent on fishing for food and livelihood

- Other NGOs (for example Greenpeace) are pressurizing governments to ensure sustainable management of fish stocks –

- to make sure that the product that reaches the market is eco-labeled

- The example of Indian squid fisheries

Eco-label:
A non-tariff trade barrier?

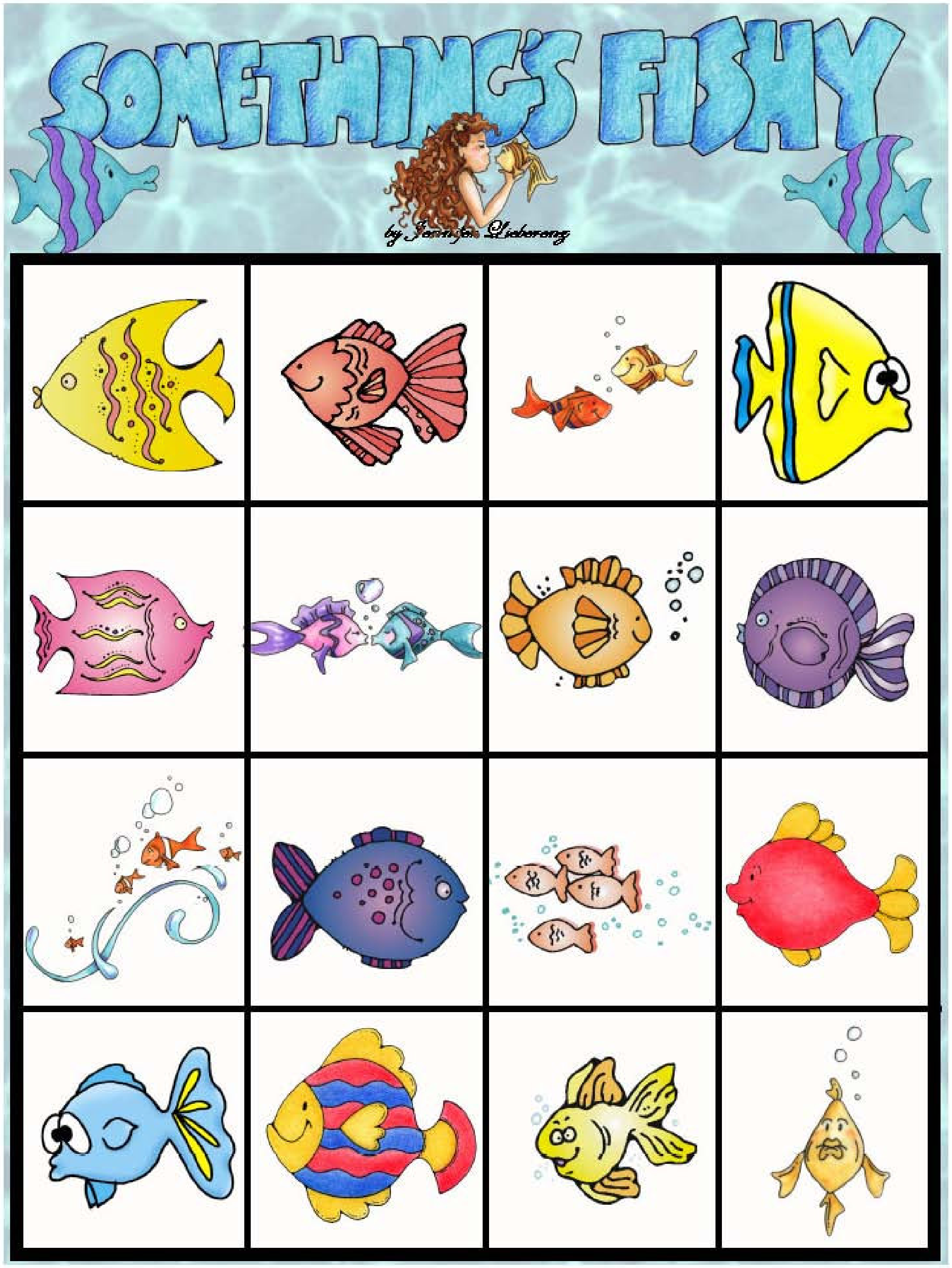
- In the general sense, an eco-labeled product is entitled to bear a logo that comes with a claim that the product has been produced in accordance with certain environmental standards.
- An eco-label for fisheries products is expected to pursue two objectives:
- sustainable resources and
- a sustainable ecosystem

Conclusions

Developing Countries need to Overcome Fear by….

- The pressures for developing and least developed countries to allow the patenting of genetic resources and living beings are so strong, both under TRIPS and under TRIPS-plus agreements, that countries could find, in the mid-term, that the sovereignty of their biodiversity has been appropriated through IPRs
- Establishing rights regimes ensuring the inalienability of indigenous peoples' and local communities' rights to access, conserve and sustainable use of biodiversity
- The CBD offers a space for countries to provide such rights— provided that they are established independently from the frame of IPRs, as is now happening.

Thank You



Biodiversity Regime Challenges and Opportunities

K. Vijayakumaran
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Mangalore Research Centre

vijayettan@yahoo.com

Is our perception right?

Every inconvenience is an adventure wrongly perceived. And every adventure is an inconvenience rightly perceived

-G.K. Chesterton

Is Biodiversity Regime another inconvenient truth ?

Where we are ?

- International Obligations
- Legal instruments
- Institutional mechanism
- Local Initiatives
- Research and Advocacy
- HRD

Challenges at Community level

- **Education and empowerment**
- **Organizing and Training**
- **Civil society partnership**
- **Documenting traditional knowledge**

Challenges for CSOs

- Design programmes to educate people on Biodiversity Regime
- Network with National and International agencies
- Build up capacity to meet the challenges in sharing of benefits
- Engage in conservation and documentation at community level

What are we doing in HRD ?

- Initiatives -few
- Levels-Higher
- Focus- Biology and Ecology
- Objective- Conservation
- Awareness and reach-Insufficient
- Geographical spread - Limited

Options for HRD

- Strengthening traditional disciplines
- Integrating new topics to suit to Biodiversity Regime
- Introducing New Course
- Introduce extra curricular activities in line of NSS

Challenges for Academics

- Design courses to cater to the needs of Biodiversity Regime at under-graduate and PG level
- Conceive and introduce Certificate and diploma level programme for common people in regional languages
- Promote dialogue, interaction and partnerships with CSOs

Challenges for Researchers

- Open up and come out of the shell
- Be active participants in raising public concerns
- Organize, create platforms for exchange of ideas
- Perform the social responsibility
- Instill the youngsters with the skill and courage

Challenges for Students

- Develop a passion for learning and a concern for environment
- Think laterally and break traditions
- Seek knowledge and Share your knowledge
- Discuss and debate issues boldly and openly
- Explore the areas where you can help your community
- Believe that every one of you have mission

Thank You !

There are only two lasting bequests we can give our children... one is roots, the other wings.

–Stephen Covey

Report of the National Seminar on

Biodiversity Regime: Emerging Challenges and Opportunities

May 22 2008, Mangalore

Background

Conservation of diversity of flora and fauna of the Earth had been in the agenda of environmentally conscious individuals and organizations for several decades. Since the Convention on Biological Diversity (CBD) in 1992 at the Earth Summit in Rio de Janeiro, 'Biological Diversity' has become a catchword.

As per the obligations as a party to the Convention, India has introduced her domestic legal regime by enacting the Biological Diversity Act in 2002. The provisions of this Act, CBD and the rules of Trade Related Intellectual Property Rights (TRIPS) has rendered the issues pertaining to biological diversity a serious subject of study and debate.

Biological diversity is no more a topic of biology alone as it has acquired various dimensions. There are a multitude of challenges to be tackled regarding Biodiversity resources. At the same time, several opportunities are also emerging in the field of studies, research, advocacy, trade, IPR etc. In order to fully exploit the emerging opportunities, we need to sensitize, create awareness and educate the people, especially the young generation, about the various issues. This Seminar was conceived with that objective. It could not have been appropriate on any other day than the 22nd May 2008 when the International Biodiversity Day is observed all over the world.

Respecting the importance of the subject, Central Marine Fisheries Research Institute (CMFRI) had established a dedicated division for Marine Biodiversity. Mangalore Research Centre of CMFRI had done commendable work in the assessment of Marine Biodiversity of Karnataka. It is rightly felt to convene a seminar on such an important topic at Mangalore, especially for the benefit of the people of Karnataka.

Inauguration

The inaugural function started at 0950 hours with an opening remark by the Convener Dr. K. Vijayakumaran. He mentioned that biodiversity has emerged as an interdisciplinary area and is no more a subject of biology alone. He pointed to the urgent need for sensitizing the stakeholders, academics and students on different facets and dimensions of biodiversity regime.

Following a silent prayer, Dr. A. P. Dineshbabu, Scientist-in-Charge and Chairman of the Seminar welcomed the gathering. Dr. N.G.K. Pillai, Director of Central Marine Fisheries Research Institute, Kochi inaugurated the seminar by lighting the traditional lamp. He also released a CD containing resources for the benefit of stakeholders and students.

In his inaugural address Dr. Pillai touched upon the important issues of biodiversity and the highlighted the relevance of sensitizing the people about conservation and management. He mentioned that destructive fishing practices and over exploitation had led to the depletion of catfish resources in coastal waters. Without prejudice to the development imperatives, he also mentioned that projects like *Sethusamudram* will have impact on the biodiversity of Gulf of Mannar and Palk Bay. Development activities like Sethusamudram Project are very important. The need of the hour is to tune our development activities to minimize the impact on biodiversity and environment, he said. Measures should be taken to safeguard the biodiversity of the area where such development activities are undertaken.

Dr. H. Sivananda Murthy, Director of Extension, Karnataka Veterinary, Animal Sciences and Fisheries University and Dr. B.R. Venkatesh, Director Geological Survey of India spoke on the occasion highlighting the need for biodiversity conservation. Dr. P.S. Swathilekshmi proposed a vote of thanks and the session closed with the National Anthem at 1055 hrs.

Presentations

The technical session began with the presentation on the *Legal Regime of Biodiversity* by Dr. B.K. Ravindra, Principal, S D M Law College, Mangalore. He elaborated on the provisions of the Convention on Biological Diversity (CBD) and on the domestic law - the Biological Diversity Act (2002). He mentioned that these laws, the relevant rules and the institutions established for implementing them are very comprehensive to achieve the objectives of conservation and equitable benefit sharing of biodiversity. He pointed to the need for educating people and stakeholders on the legal aspects of Biodiversity Conservation.

The second presentation was on the *Plant and Animal Biodiversity in Ayurveda* by Dr. T. Sridhara Bairy, Head of the Department of Dravya Guna, S D M College of Ayurveda, Udupi. He took the audiences to a treasure trove of the use of diverse flora and fauna in ayurveda highlighting the rich heritage of traditional medicine, he stressed the need for conserving biodiversity, popularizing the traditional knowledge and protecting the same from exploitation by others.

Dr. Ramachandra Bhatta, Professor and Head of the Department of Fisheries Economics spoke on the issues of *Valuation of Marine Biodiversity in India*. He highlighted the difficulty of economic valuation of non-market commodities, especially related to ecosystem services as well as our cultural and traditional value systems. The need for promoting research in the field was underlined.

The fourth presentation was on *Climate Change and Biodiversity* by Dr. E. Vivekanandan, Principal Scientist and Head, Demersal Fisheries Division, CMFRI, Kochi. He presented an outline of the emerging issues related to global climate change and focused on the impact of climate change on marine biodiversity. Apart from species loss, the shifting of fish population distribution, coral bleaching, impact on turtles etc. were touched upon by the speaker. This presentation attracted a lot of questions and discussion. Concluding the presentation, Dr. Vivekanandan stressed the need for changing our lifestyle to mitigate the impact of climate change.

The presentation on *Marine Biodiversity of Karnataka* unraveled a wonderful world of marine life along the coastal Karnataka. This presentation by Dr. P.U. Zacharia Senior Scientist of Tuticorin RC of CMFRI and Principal Investigator of *Karnataka Marine Biodiversity* Project was sprinkled with a generous supply of colorful photographs of flora and fauna. The speaker revealed that this study for the first time reported the unique, rich and diverse reef ecosystem around *Netrani Island* and stressed the need for protecting the same as a biodiversity heritage site. He also mentioned the need for taking up further studies especially on little known areas such as *ecology of marine birds*.

The sixth presentation was by Dr. K.K. Vijayan, Head, Division of Marine Biotechnology, CMFRI on *Biotechnology and Biodiversity – Challenges and Opportunities*. The speaker gave an overview of the latest developments in biotechnology and molecular genetics and explained the possibilities of its application in conservation of biodiversity. He clearly explained the use of DNA fingerprinting in identifying the species even from small bit of body part of the animal or plant. He expressed confidence that biotechnology will revolutionize human life in the coming years, provided we take adequate measures to promote HRD and research in the field of biotechnology.

The seventh presentation was on *Role of Bioinformatics in Biodiversity Research* by Dr. Santhosh J. Eapen, Senior Scientist and Coordinator of Bioinformatics Division of Indian Institute of Spices Research, Calicut. He beautifully presented the emerging world of bioinformatics and the tremendous scope for bioinformatics in biodiversity regime. The need for developing database on various aspects of our rich and diverse biological resource is a daunting task and there is tremendous scope for research and development in that area, he said.

The eighth presentation on *Trade Related Issues in Biodiversity* by Dr. K.S. Mohamed, Principal Scientist and Head, Molluscan Fisheries division, CMFRI, Kochi was one of the key presentations pertinent to the Biodiversity Regime. The speaker explained the intricacies of the trade barriers and provisions under the Trade Related Intellection Property Rights (TRIPS). Touching on the provisions of UNCLOS, the role of WTO and the dispute settlement mechanisms, he gave the example of how disputes on trans-boundary resources like swordfish are settled. Stressing the need for understanding the rules of the trade to take advantage of the global trade opportunities properly, he suggested that we need to embark on capacity building on this aspect.

The last presentation was on *Biodiversity Regime: Challenges and Opportunities* of by Dr. K. Vijayakumaran, Senior Scientist, Mangalore RC of CMFRI. He expressed the emerging Biodiversity Regime as another inconvenient truth and urged all members of the society to play a key role in turning the game to a winning situation. The need for training and capacity building, restructuring and expanding the HRD scenario and promoting partnership among government, research organizations, civil society organizations and other stakeholders were identified as urgent needs of the time.

Conclusion

The seminar came to a close with a brief summing up by Dr. S.M. Siva Prakash, College of Fisheries, Mangalore and a concluding remark by Dr. N.G.K. Pillai, Director, CMFRI. Based on the subjects presented at the Seminar and the deliberations that followed, the following recommendations were made which was read out by Dr. K. Vijayakumaran, the Convener of the Seminar.

Recommendations

- Initiate programmes to educate public on the Biodiversity Act, CBD, and the provisions under the law to safeguard the interests of the community.

- Sensitize the stakeholders about our rich traditional knowledge in flora and fauna, especially in traditional medicine, promote their documentation and equip the communities with knowledge and capacity to safeguard their knowledge from exploitation by outside agencies.

- Initiate research for validation of the concepts of our traditional system of medicines in the context of modern scientific methods of clinical testing and protocols.

- Promote research on valuation of biodiversity and ecosystem service to develop standard methods to suit the Indian value system.

- Sensitize the people on climate change and its impacts with outreach programmes for making them adapt to the situation. Embark on education programmes to change the lifestyle of people to mitigate the climate change scenarios.

- Promote conservation unique marine biodiversity hot spots such as Netrani Island by declaring them as biodiversity heritage site and take up studies on marine birds on which there is very little information.

- Evolve exclusive criteria for listing of marine organisms in Red List.

- Promote research in bioactive compounds, bioinformatics and database creation for facilitating the country to exploit the resources in a judicious way.

- Promote research in molecular genetics, to take advantage in the field of disease diagnosis, gene transfer technology etc. and strengthen the country's stake in biotechnology globally.

- Initiate programme to revise and restructure the school and college curriculum and introduce new courses to sensitize the importance of biodiversity among young generation and cater to the needs of biodiversity regime.

- Promote partnership between different organizations for sharing resources and working together for meeting the challenges of biodiversity regime.

The Seminar was attended by students and faculty from College of Fisheries, Mangalore University, St. Aloysius College, S D M Law College, S D M College of Ayurveda and several other institutions in the city. Members of civil society organizations from various parts of Karnataka, fishermen associations, government departments and a large number of media person also participated in the Seminar. The seminar was organized by the funding from the institute. School Book Company, Mangalore partially sponsored the Seminar kit. The Seminar attracted a lot of media attention and was appreciated as an excellent event in terms of content as well as the style of conduct.

Dr. K. Vijayakumaran

Senior Scientist & Convener

National Seminar on Biodiversity Regime

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