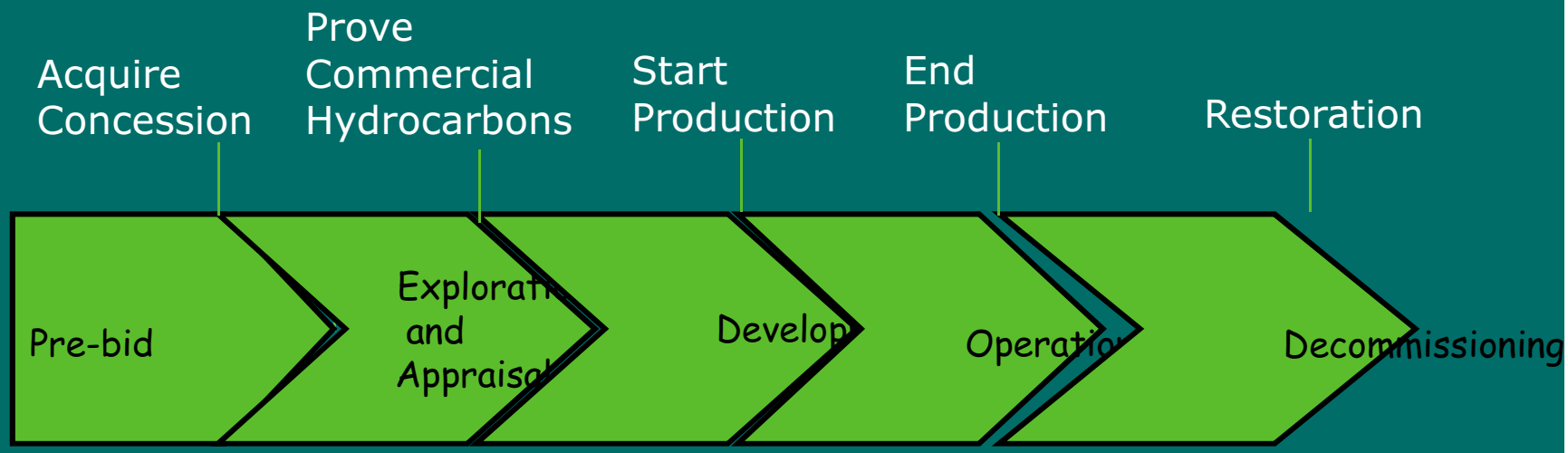
OVERVIEW OF THREATS TO BIODIVERSITY FROM DEVELOPMENTS IN OIL AND GAS SECTOR

Prof. B.C.CHOUDHURY

Oil and Gas

The Oil and Gas Project Lifecycle



Risk Assessment studies

Seismic and drilling

Drilling and construction

Production, maintenance and transportation

Oil and Gas

Meeting global energy demand

- World energy demand is expected to grow by 66% by 2020, with demand for natural gas doubling in that time frame (*IEA World Energy Outlook, 2002*)
- In the short and medium term, much of that demand will be met by oil and gas
- Natural gas will be an important bridging fuel to a renewable energy mix mix
- *Challenge to society:* Ensure continued global development while managing oil and gas activities to minimize long-term disturbance to valuable ecosystems

Energy and Biodiversity

- Growing tension between energy needs and biodiversity values
- Many areas that are potentially valuable for oil and gas are also recognized for biodiversity values
- Oil and gas development can have a wide range of impacts on biodiversity

Energy and Biodiversity

- *Challenge to energy companies*: Find a way to meet public demand for abundant, low-cost oil and gas products and, at the same time, meet society's expectations for corporate social and environmental responsibility, including biodiversity protection
- *Challenge to conservation organizations*: Because there is a balance to be struck between economic development and the conservation of biodiversity, be a strong voice for biodiversity protection while seizing appropriate opportunities to partner with industry

The Role of National Governments

- Energy companies and conservation organizations cannot solve biodiversity problems on their own
- Government officials shape and implement conservation strategies and set priorities
- In some cases national oil companies control most of the production in a country
- Governments face the challenge of balancing economic growth and development with biodiversity conservation
- Companies and NGOs should work closely with government officials to encourage them to play a leading role in conservation

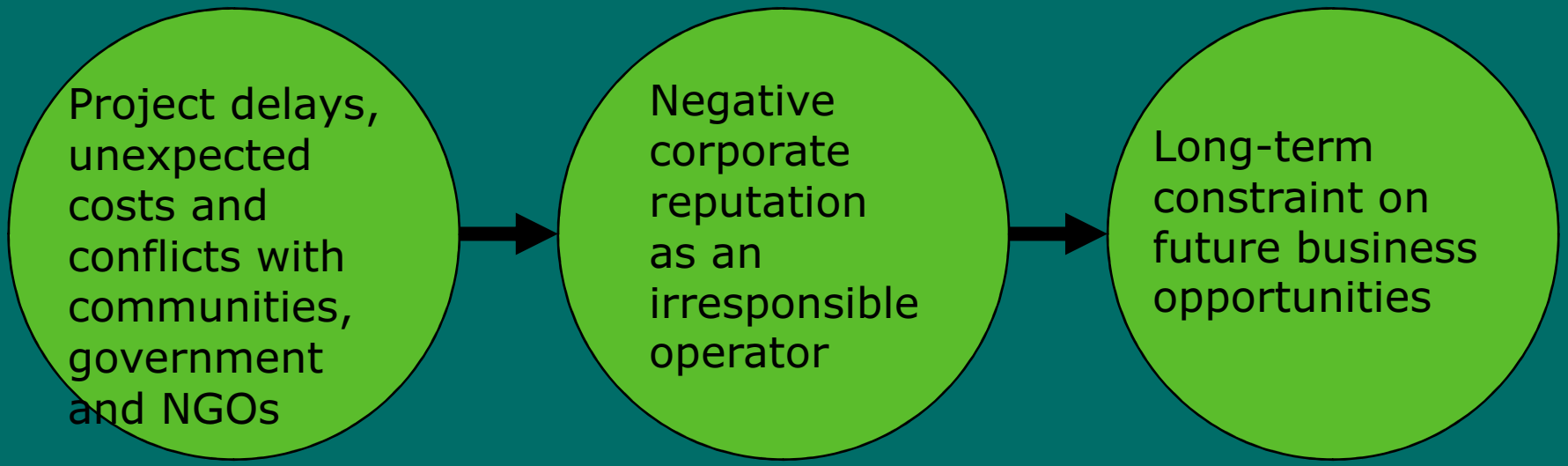
Building the Business Case

- Biodiversity issues ARE identified and addressed at the project level:

Continued access to key business resources

Building the Business Case

- Biodiversity issues ARE NOT identified and addressed at the project level:



Diminished access to key business resources

Integrating Biodiversity into Management Systems

How can companies integrate biodiversity considerations into their systems and operations?

- By integrating biodiversity considerations into both project- and corporate-level environmental management systems (EMS) and the environmental and social impact assessment (ESIA) process
- By having a valid and transparent risk assessment process to manage and conserve biodiversity

Integrating Biodiversity into Management Systems

Environmental and Social Impact Assessment

- In some countries, impact assessment is managed by governments, in others, companies are responsible
- The CBD recommends evaluating impacts at all levels, encompassing the appropriate temporal and spatial scales of impacts, values for affected people, mitigation requirements and the need for stakeholder participation
- ESIA processes should address relevant government standards, requirements, enforcement and ESIA processes
- The ESIA process should begin as early as possible in the project lifecycle
- Stakeholder engagement is key to ensuring that the ESIA process is fair and credible

Integrating Biodiversity into Management Systems

Environmental and Social Impact Assessment

Stages of an ESIA relevant to biodiversity

- Identification of alternatives
- Screening
- Scoping
- Baseline establishment
- Evaluation (impact analysis)
- Development of mitigation options and implementation
- Monitoring and adaptation

Stakeholder engagement on biodiversity issues and estimation of secondary and cumulative impacts should occur throughout all stages

Mitigating Impacts

What are the potential negative impacts on biodiversity from oil and gas development, and what practices can companies adopt at their operational sites that will mitigate these impacts?

- Primary vs. Secondary Impacts
  - Similar in ultimate effect on biodiversity
  - Different in cause, scope, scale, intensity and boundaries of responsibilities

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Mitigating Impacts

Primary impacts

- Changes to biodiversity from project activities
- Geographic area relatively near to the project
- Become apparent within the lifetime of the project
- Often immediate effects
- Relatively easily predicted through ESIA
- Can usually be minimized or avoided through technological solutions
- e.g. land take, habitat loss and soil erosion

Primary impacts generally result from operational decisions and the activities of project personnel

Mitigating Impacts

Secondary impacts

- Tend to result from government decisions and the actions and practices of nearby communities or immigrants, in response to the presence of the project
- Are the most controversial and difficult to manage, because of shared spheres of responsibility
- May cause the most problems for the project and company
- Are most difficult to predict and control
- Nevertheless, a company may be responsible

Mitigating Impacts

Factors that may lead to secondary impacts

- Immigration and new settlements
- Increased access to undeveloped areas
- Introduction of non-native species

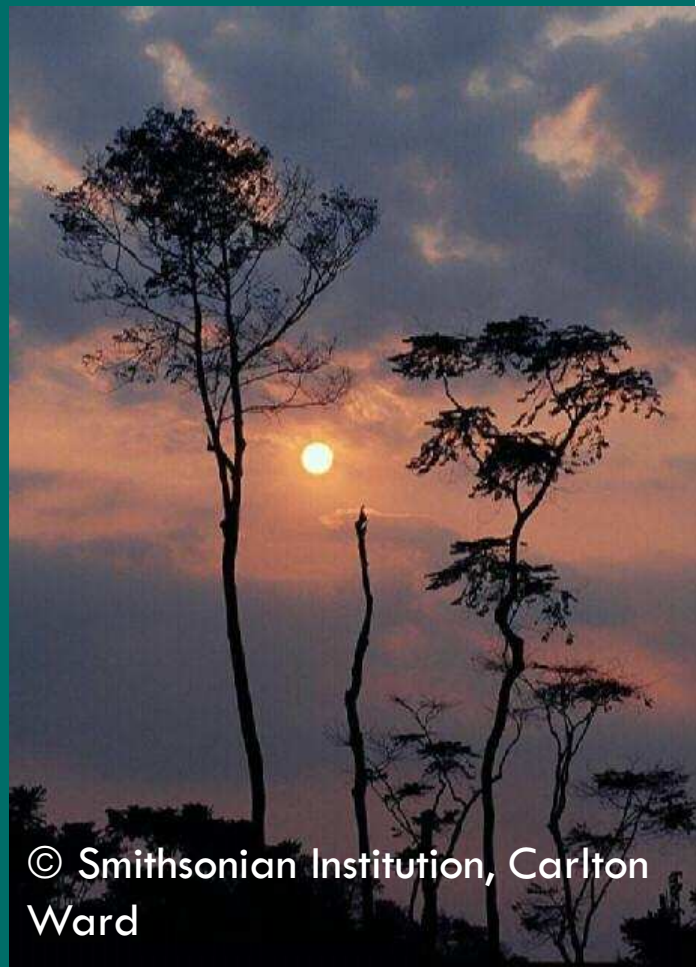
Source:Sader,S.A .,et al.Time-series tropical forest change detection for The Maya Biosphere Reserve: Updated Estimates for 1995 to 1997. Maine Image Analysis Laboratory,University of

Maine Department of Forest Management

Mitigating Impacts

Approaches for managing secondary impacts

- Cooperation among many partners
- Early and continuous involvement with all relevant stakeholders
- Government involvement and responsibility
- Transparency and responsiveness to concerns
- Promotion of and participation in government-led land-use planning processes at an appropriate geographic scale



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Deciding Where to Work

Protected areas and conservation priority areas

- High biodiversity values exist both in and outside of protected areas
- While some governments may permit oil and gas development in certain protected areas, this can present significant risks to biodiversity
- Companies should seek to avoid protected areas by considering alternate locations, routes and technologies

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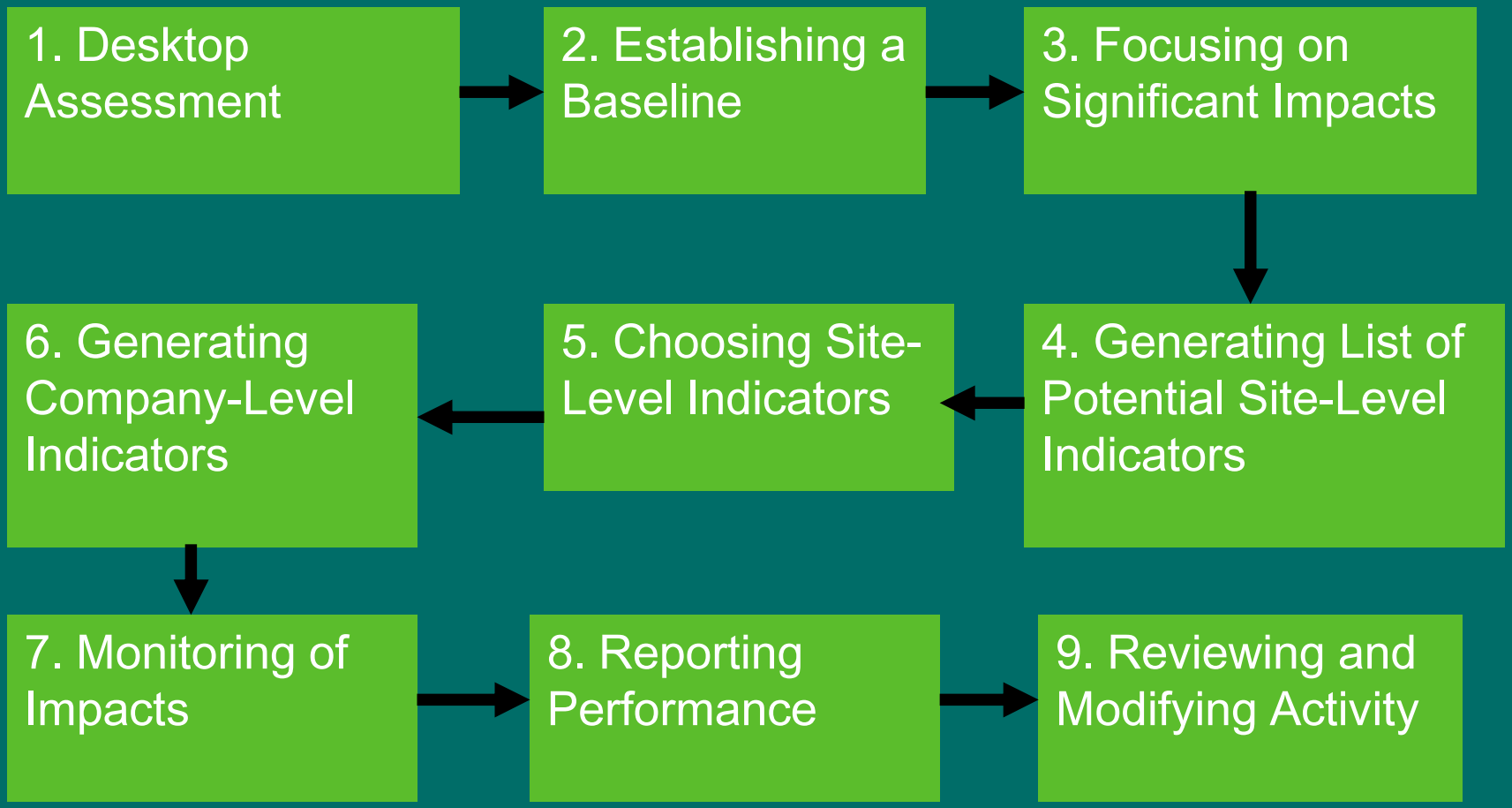
Measuring Impacts and Actions on Biodiversity

Developing biodiversity indicators



Measuring Impacts and Actions on Biodiversity

Examples of biodiversity indicators

- **Species:** Globally threatened and data deficient species in area; restricted-range species; invasive non-native species that are threatening to ecosystems, habitats or species; species used by local populations
- **Habitat:** Operational site overlap with conservation priority areas containing globally threatened or restricted-range species; amount of land within the operational site that has a management plan with a biodiversity conservation focus; contribution to habitat conservation
- **Corporate management:** Biodiversity elements included in management system; corporate/business unit budget allocation for biodiversity; sites with biodiversity action plans; ongoing biodiversity conservation projects, at site or collaborations at company level

Mitigating Impacts

Secondary impacts

- Usually triggered by the operations
- May reach outside project or even concession boundaries
- May endure or begin after a project's life cycle
- May or may not be predicted by ESIA
- May not be identified or realized until much later in the project cycle, or after decommissioning

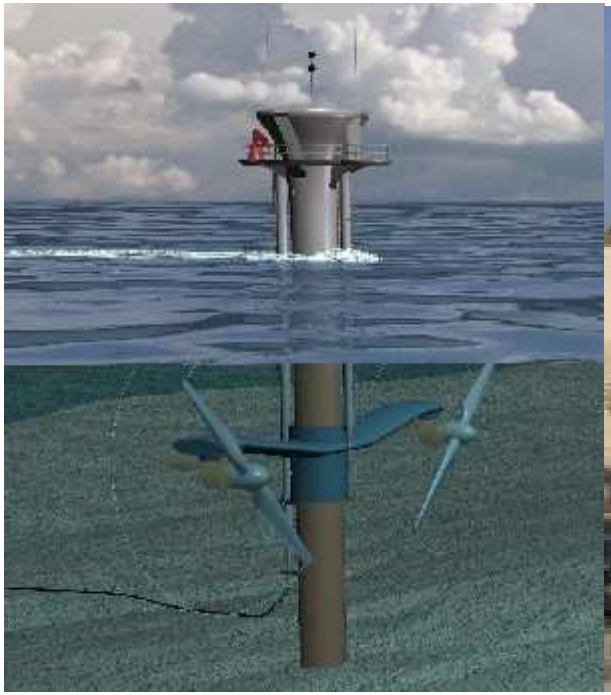
Benefiting Biodiversity

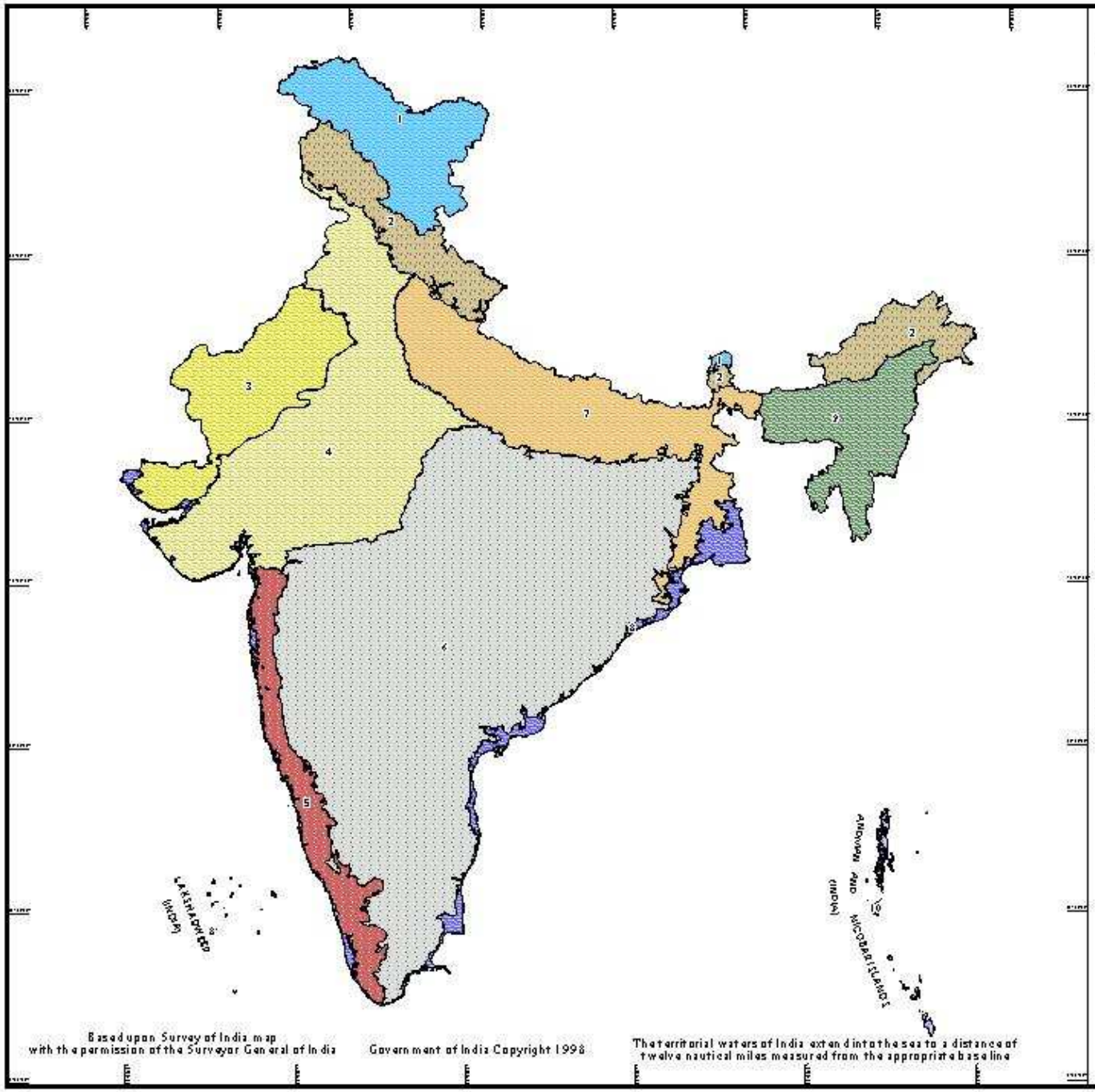
Most outstanding biodiversity needs/challenges	Possible opportunities for benefiting biodiversity conservation
1. Lack of resources or structure to manage protected areas	> Trust fund, financial contribution to protected areas management > Support for a new protected area
2. Important, threatened and unprotected ecosystems or species	> Manage concession as protected area > Campaign to protect ecosystem by using charismatic, endangered flagship species > Support conservation easements

Benefiting Biodiversity

Most outstanding biodiversity needs/challenges	Possible opportunities for benefiting biodiversity conservation
3. Lack of government or scientific capacity to study and manage biodiversity	> Support for scientific research, analysis > Support for technical capacity-building and training > Support for managerial capacity-building in government agencies
4. Lack of public awareness of or involvement in conservation	> Support for environmental education and awareness building > Support for integrated conservation and development

Impacts and Hazards of Oil Exploration Activities on Marine Biodiversity





Biogeographic Classification of India : Zones

	% *
1: Trans-Himalaya	5.6
2: Himalaya	6.4
3: Desert	6.6
4: Semi-Arid	16.6
5: Western Ghats	4.0
6: Deccan Peninsula	42.0
7: Gangetic Plain	10.8
8: Coasts	2.5
9: North-East	5.2
10: Islands	0.3

* Represents percentage of the total geographical area of India : 3287263 sq.km

The Biogeographic Classification of India recognizes 10 Biogeographic Zones ranging from the Trans-Himalaya to the Islands. These zones indicate a unique set of geo-physical and hydro-climatic conditions as well as distinct geological origins. They also have unique floral and faunal elements. The Himalaya and Gangetic Plain are examples of two adjacent but extremely different zones.

The Biogeographic Classification is sufficiently detailed with a distinctive hierarchy of units, to facilitate conservation planning at national and intra-state levels. The scheme is comparable with other international classifications and is also compatible with other landuse planning classifications in India.

0 100 200 300 400 500 600 700 800 900 1000

Kilometers

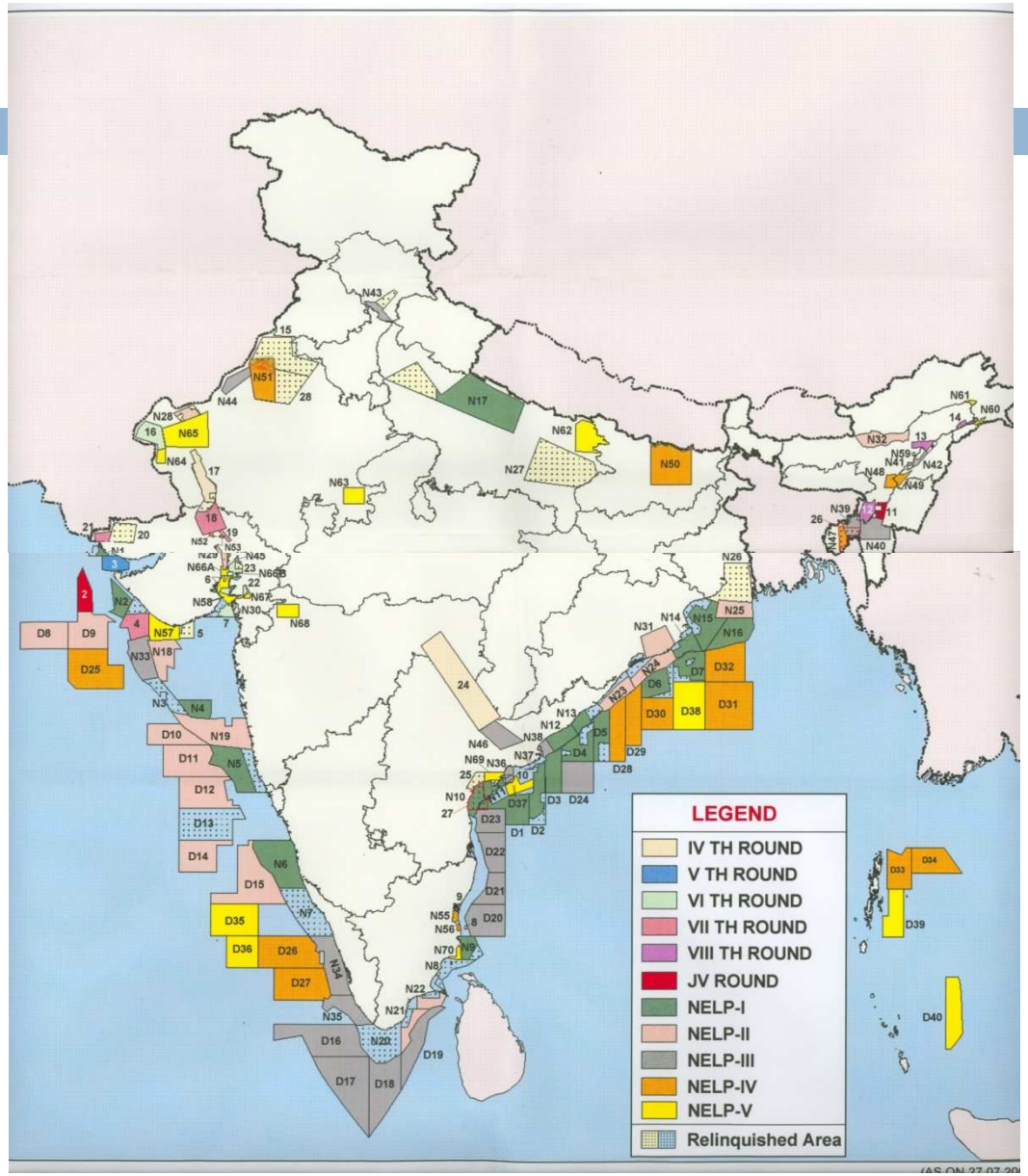
Based upon Survey of India map with the permission of the Surveyor General of India

The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate baseline

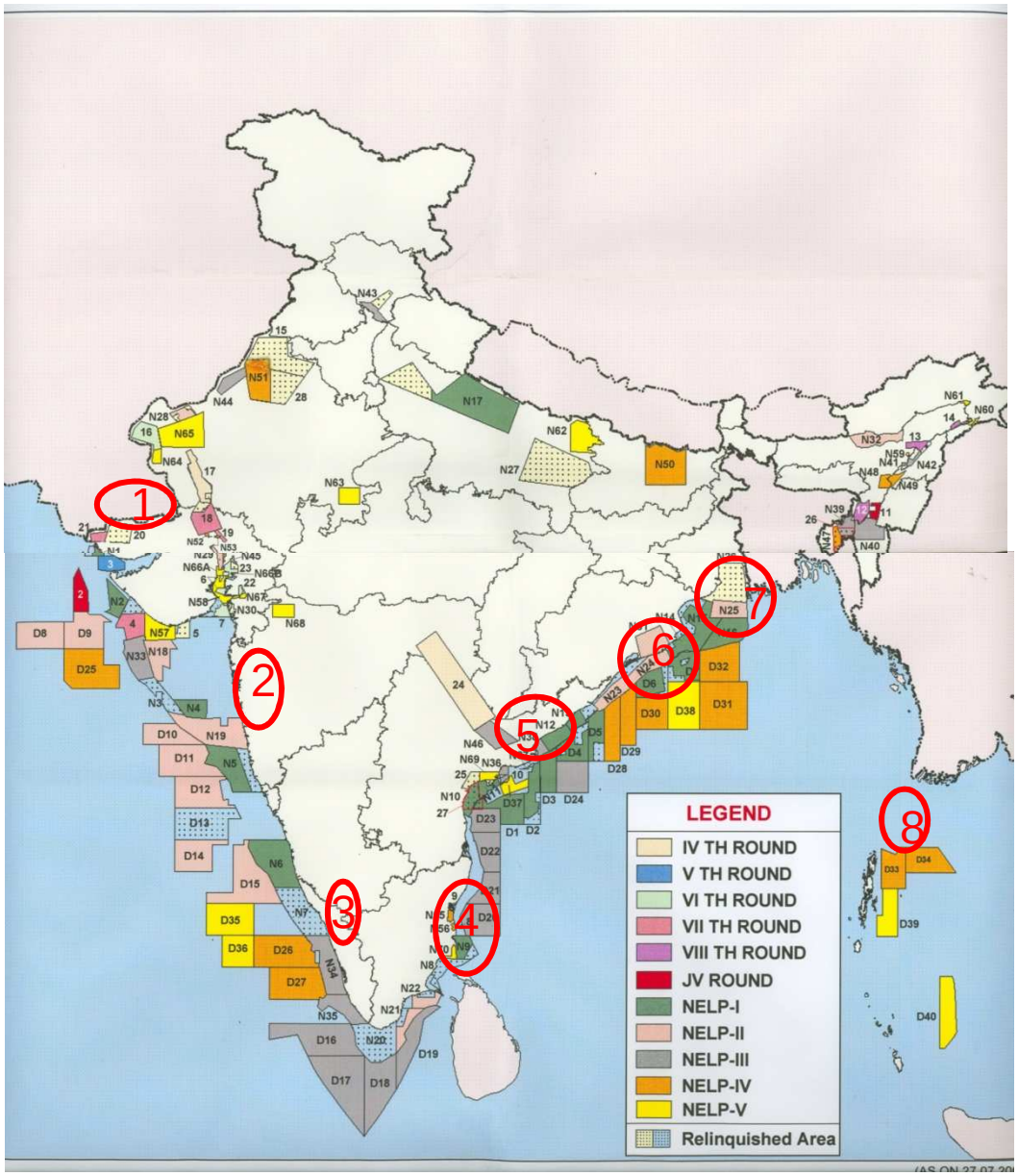
भारतीय वन्यजीव संस्थान
Wildlife Institute of India
GIS Cell, March 2000

Source : Rodgers, Panwar & Mathur (2000)

Ongoing & proposed oil exploration blocks, India-2005



Ongoing & proposed oil exploration blocks w.r.to ecologically Sensitive coastal and marine biodiversity areas



Important coastal & marine biodiversity areas w.r.to
oil exploration blocks

Sl. No.	Place	Type	Block
1	Gulf of Kutch & Rann of Kutch	Marine NP & Biospher Reserve	N1, N3, N21
2.	Malvan	Marine Turtle Nesting beach	N19
3.	Calicut coast	Marine Turtle Nesting Beach	N34
4.	Gulf of Mannar & Point Calimier	Biosphere Reserve & Marine Turtle Nesting beach	N22, N70, N8, N9
5.	Godavari coast & estuaries	Coastal PA, estuary & marine turtle nesting beach	N37, N38, N12
6.	Southern Orissa & Northern AP coast	Marine turtle arribada and congregation site	N23, N24, D6
7.	Devi & Gahirmatha region, Orissa	Marine Sanctuary, marine turtle arribada site & congregation area	N14, N15, N25, N31
8.	North Andaman	National Park	D33, D34

Onshore oil refinery

Impact to marine environment (Onshore)

- Onshore (Loss of Critical Habitat)

Removal of natural coastal vegetation for infrastructures

Flattening of coastal sanddunes and intertidal mudflat reclamation

Solid waste, garbage and other chemical pollutants from infrastructure and refineries etc.

Ground water removal, changes and alteration of traditional livelihood

Beach alteration

Coastal Sand Mining and flattening of sanddunes

Impact on coral reefs and corals

- Spill impacts vary in severity with the specific conditions at a given spill, including oil type and quantity, species composition, and the nature of oil exposure.

- Oil can kill corals, depending on species and exposure.

- Longer exposure to lower levels of oil may kill corals as well as shorter exposure to higher concentrations.

Impact on coral reefs and corals (continue..)

Chronic oil toxicity impedes coral reproduction, growth, behavior, and development.

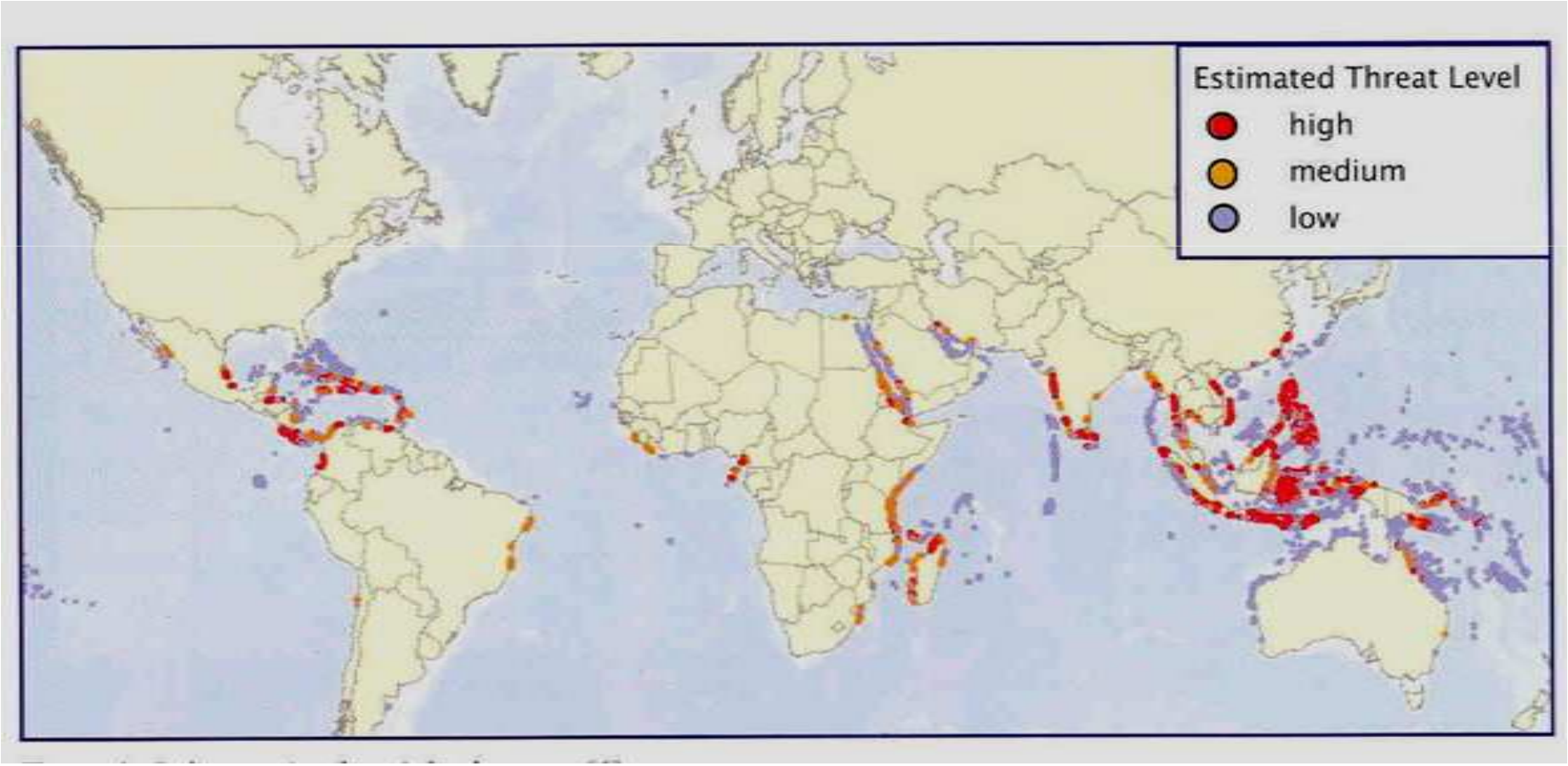
The time of year when a spill happens is critical, since coral reproduction and early life stages are particularly sensitive to oil.

Branching corals are more sensitive to oil impacts than are massive or plate-like corals.

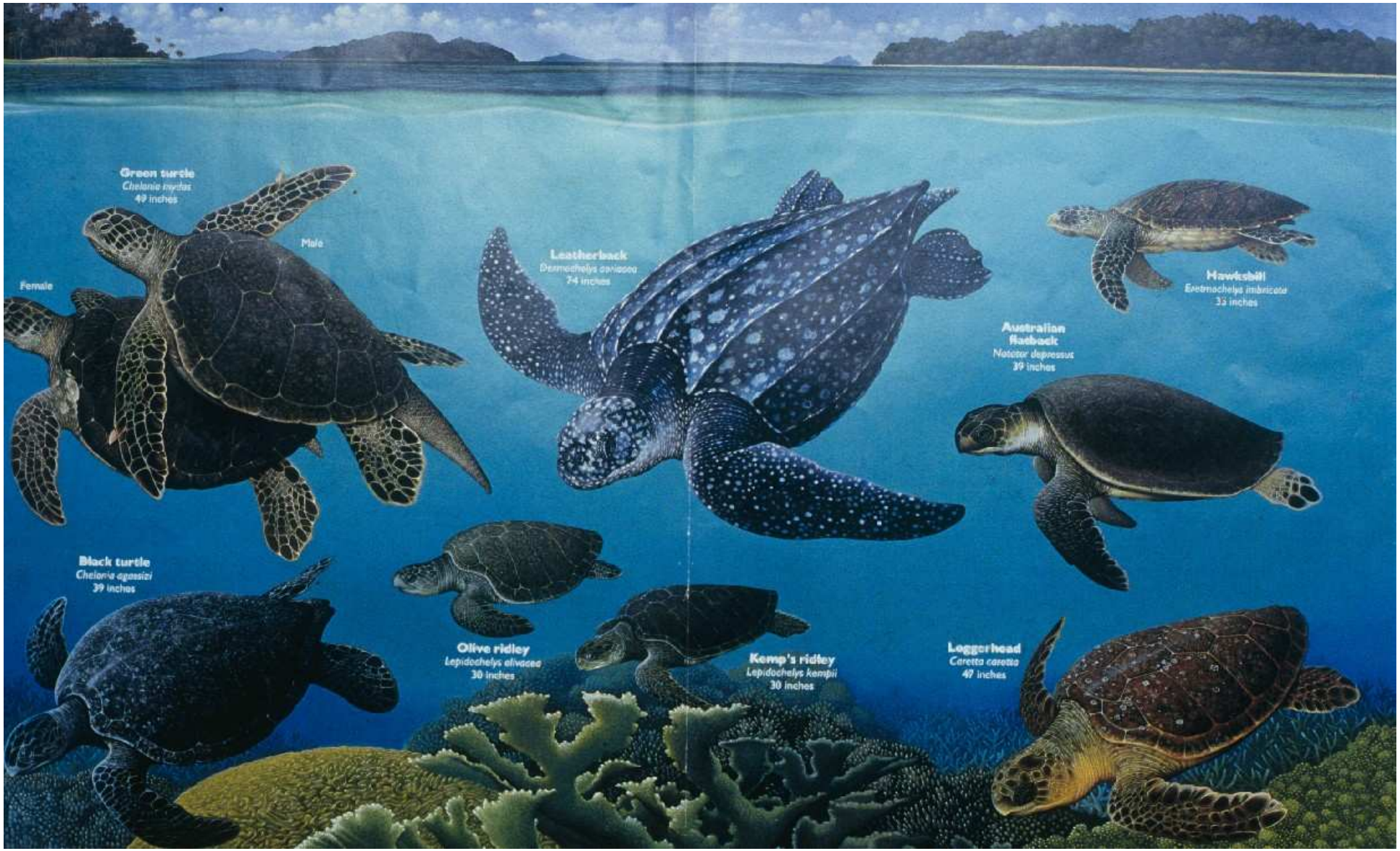
Seagrass beds and associated fauna

Sheltered bays and lagoons

Runoff and land based pollution related to coastal development including hydrocarbon exploration area



Impact on sea turtles

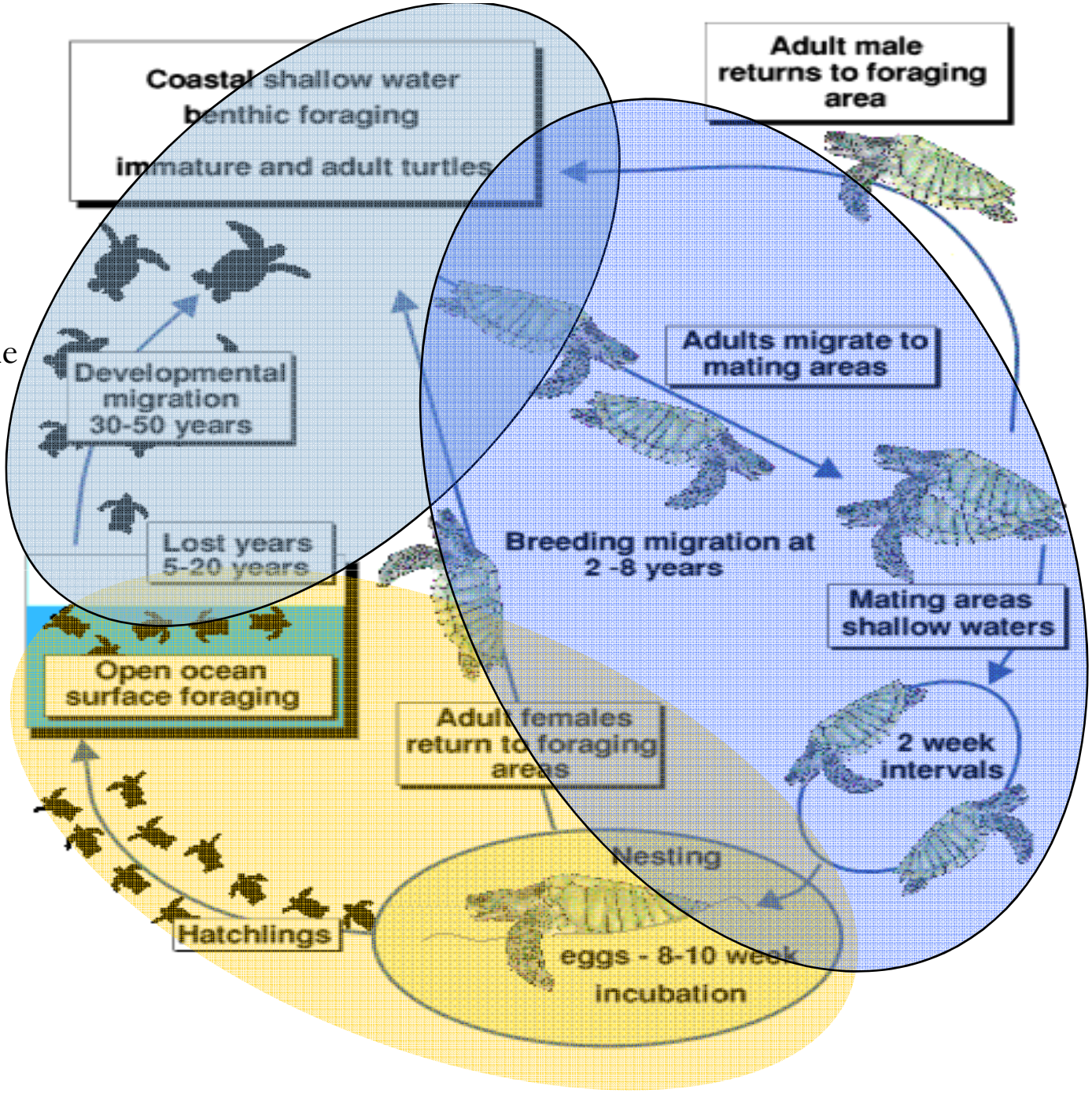


Olive Ridley is the smallest compared to other species of marine turtles, less endangered and only species of marine turtle that resorts to mass nesting behaviour. Currently such mass nesting sites for this species exists only in Orissa in India, Costa Rica and Mexico

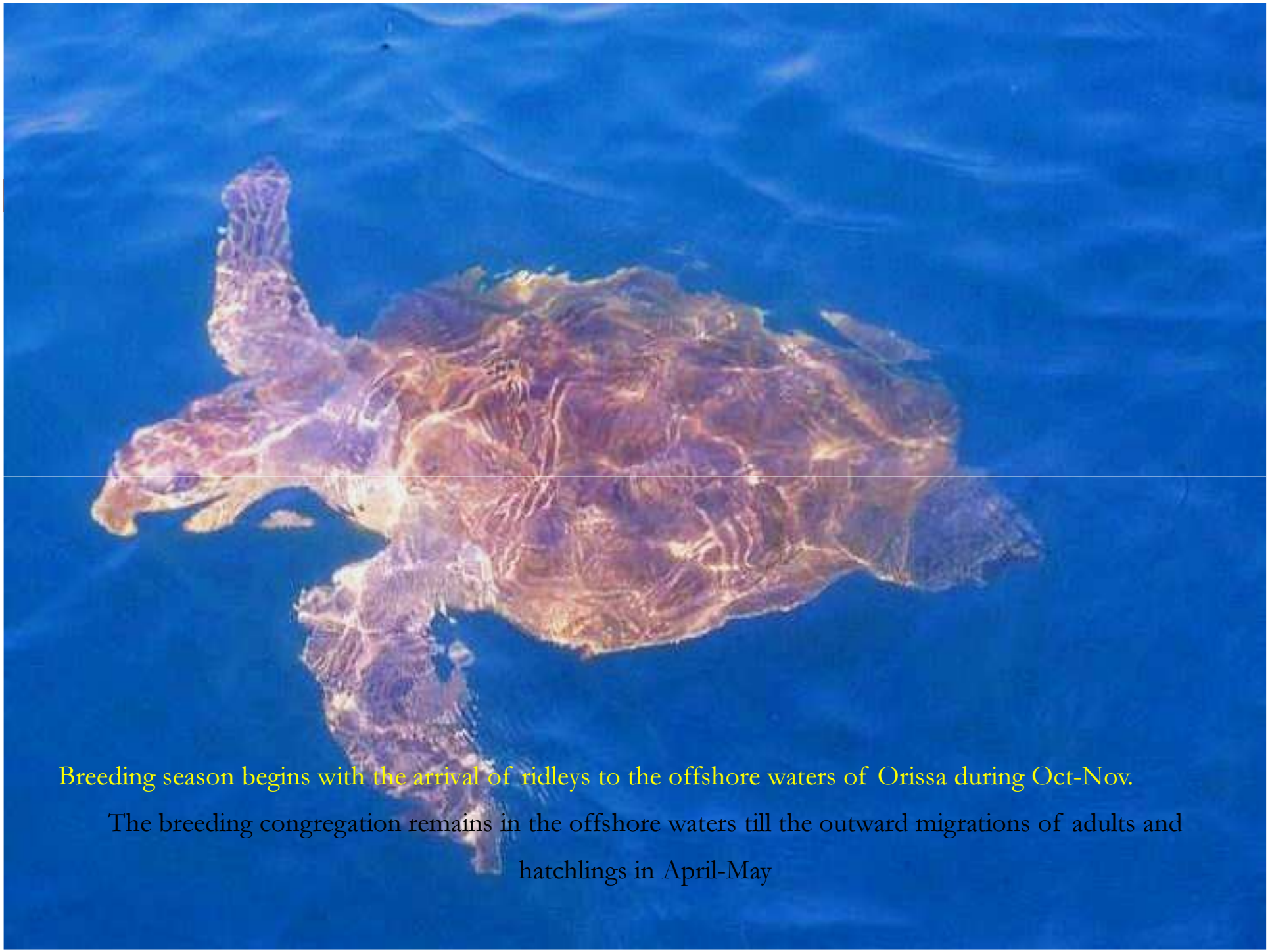
Critical Habitats for
Marine Turtles

Beyond the beach (Marine Environment)

On the beach
(Coastal Environment)



Generalised life cycle of sea turtles



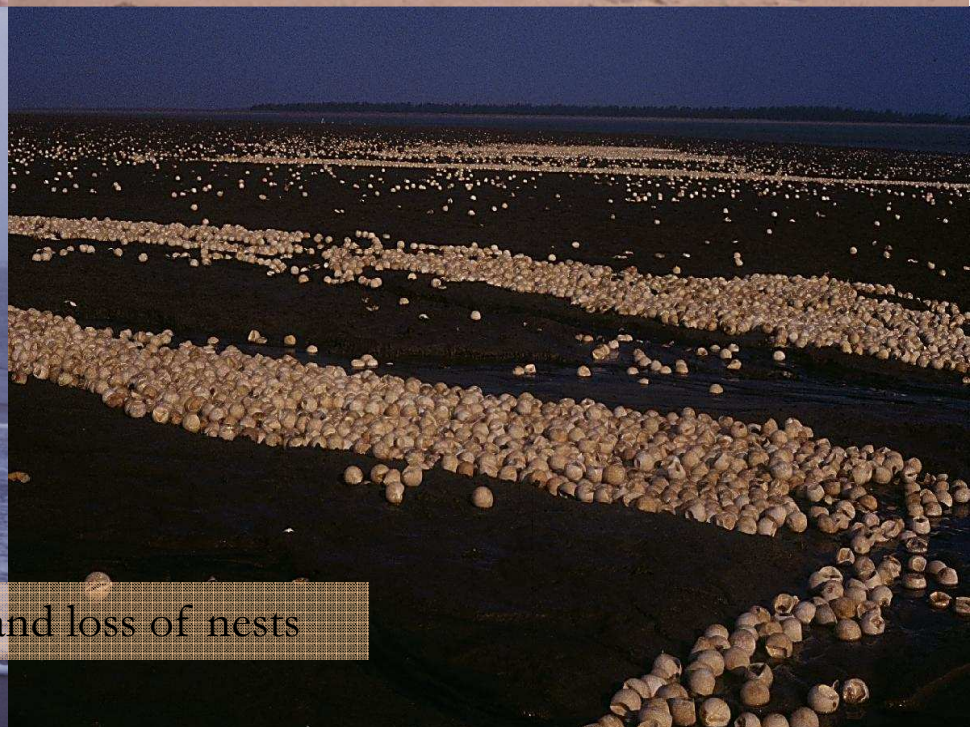
Breeding season begins with the arrival of ridleys to the offshore waters of Orissa during Oct-Nov.

The breeding congregation remains in the offshore waters till the outward migrations of adults and hatchlings in April-May

The World's highest density arribada (Mass Nesting) of olive ridleys at Gahirmatha, Orissa

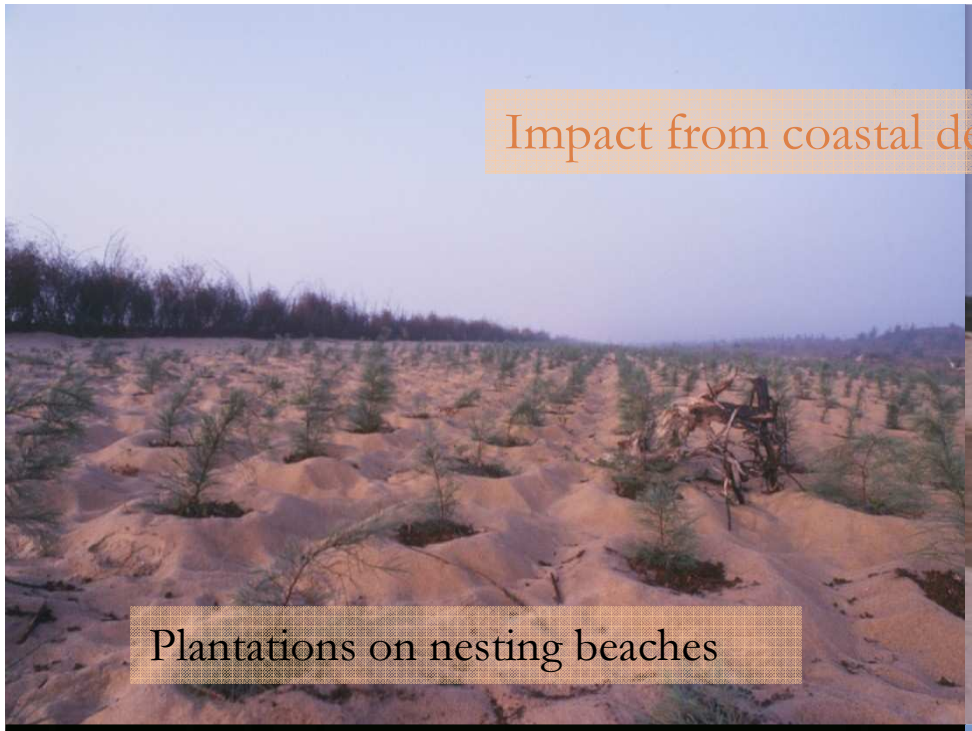
Sporadic nesting all along the Orissa coast on suitable beaches begins in December and mass nesting in arribada sites between Jan-March

Predation



Seashore erosion and loss of nests

Impact from coastal developmental projects



Plantations on nesting beaches

Beach sand mining

Illumination from industries/resorts/coastal highways

Beach armouring and loss of nesting beach

Anticipated Risks of hydrocarbon development in sea turtle habitats

- Abandonment of traditional breeding site fidelity, migration routes by marine turtles
- Change in quality/quantity of associated pelagic and benthic organisms
- Change in water quality due to pollution and other spillages
- Complete abandonment of congregating sites and
- Abandonment of arribada sites

(Risks are highest during the breeding season i.e.Oct. to May) in congregations in offshore waters and nesting beaches due to infrastructures on nesting grounds

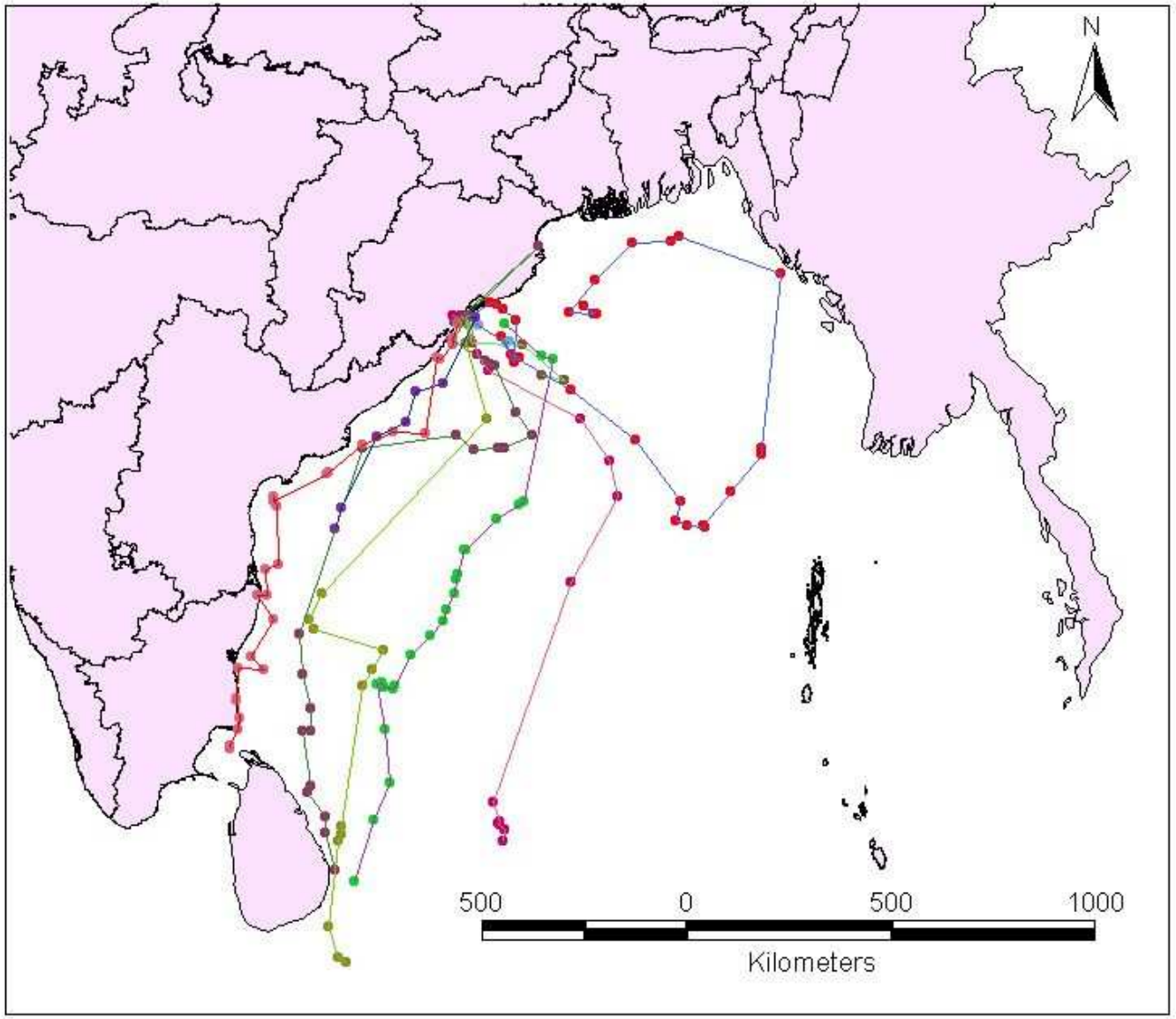
SATELLITE TRACKING AND OTHER STUDIES FOR DETERMINING OLIVE RIDLEY SEA TURTLE MIGRATION ROUTE, FORAGING HABITATS AND OFFSHORE CONGREGATION PATTERNS IN THE BAY OF BENGAL AND DEVELOPMENT IMPACTS ASSOCIATED WITH HYDROCARBON EXPLORATION

Use of Satellite Transmitters for migration/breeding congregation study

Data from ARGOS Satellite Tracking System

ID No.	Prg No.	Latitude	Longitude	Loc. quality	Loc. date	Frequency	SENSOR #01	SENSOR #02	SENSOR #03
33338	3449	16° 32' 40"N	82° 54' 47"E	0	7/8/2007 1:26	401646406	0	0	0
33338	3449	16° 32' 40"N	82° 54' 47"E	0	7/8/2007 1:26	401646406	77	2583	59
33338	3449	16° 32' 40"N	82° 54' 47"E	0	7/8/2007 1:26	401646406	0	0	0
33338	3449	16° 32' 40"N	82° 54' 47"E	0	7/8/2007 1:26	401646406	78	2583	59
33338	3449	16° 20' 30"N	82° 51' 15"E	0	7/9/2007 17:30	401646482	0	0	0
33338	3449	16° 20' 30"N	82° 51' 15"E	0	7/9/2007 17:30	401646482	0	0	0
33338	3449	16° 20' 30"N	82° 51' 15"E	0	7/9/2007 17:30	401646482	0	0	0
33338	3449	16° 20' 30"N	82° 51' 15"E	0	7/9/2007 17:30	401646482	80	2826	58
33338	3449					401650000	78	2826	58
33338	3449	16° 00' 25"N	82° 07' 08"E	0	7/11/2007 8:50	401646518	74	1940	58
33338	3449	16° 00' 25"N	82° 07' 08"E	0	7/11/2007 8:50	401646518	74	1940	59
33338	3449	16° 00' 25"N	82° 07' 08"E	0	7/11/2007 8:50	401646518	74	1940	58
33338	3449	16° 00' 25"N	82° 07' 08"E	0	7/11/2007 8:50	401646518	74	1940	59

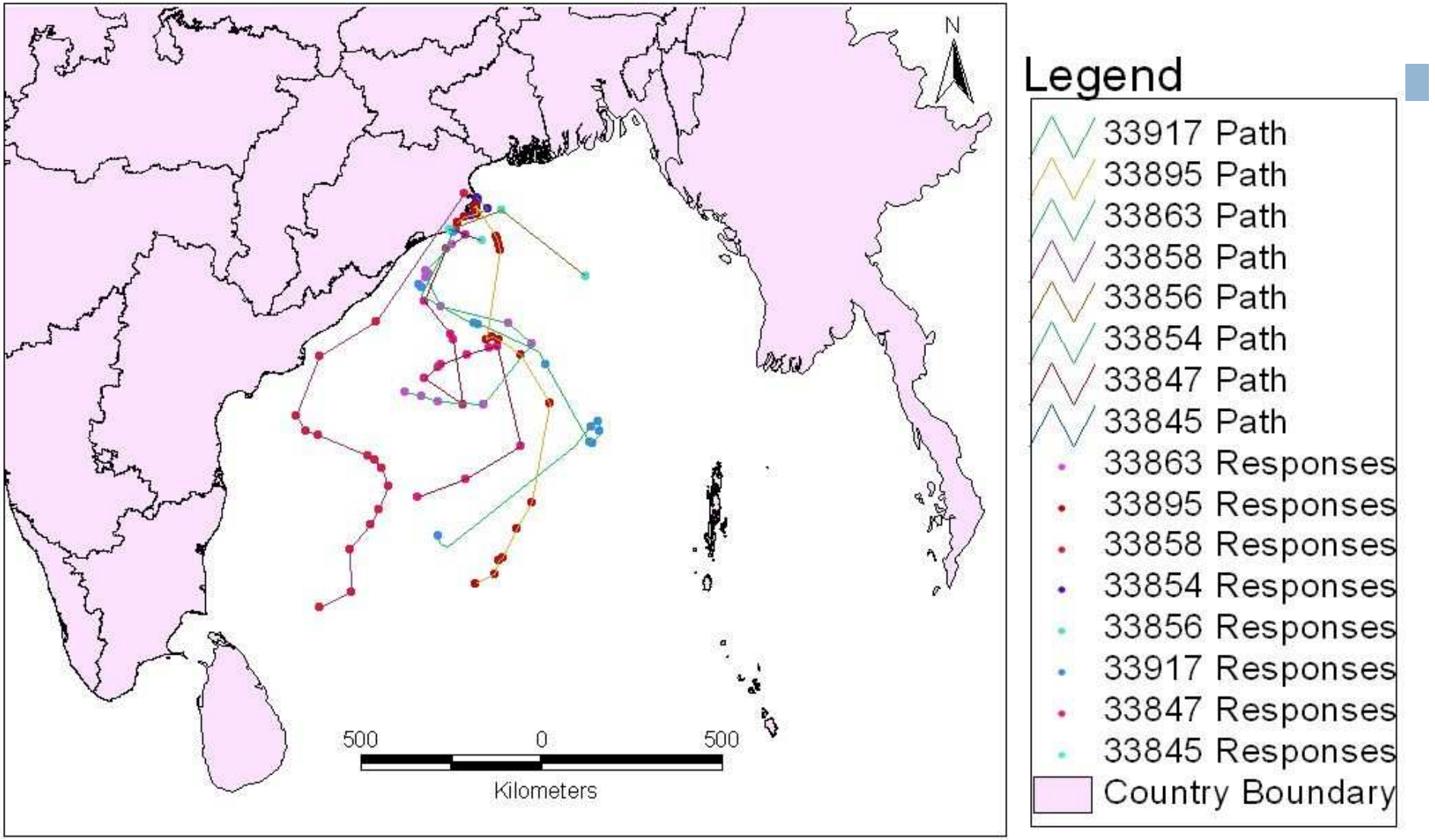
Rishikulya Turtle Movement



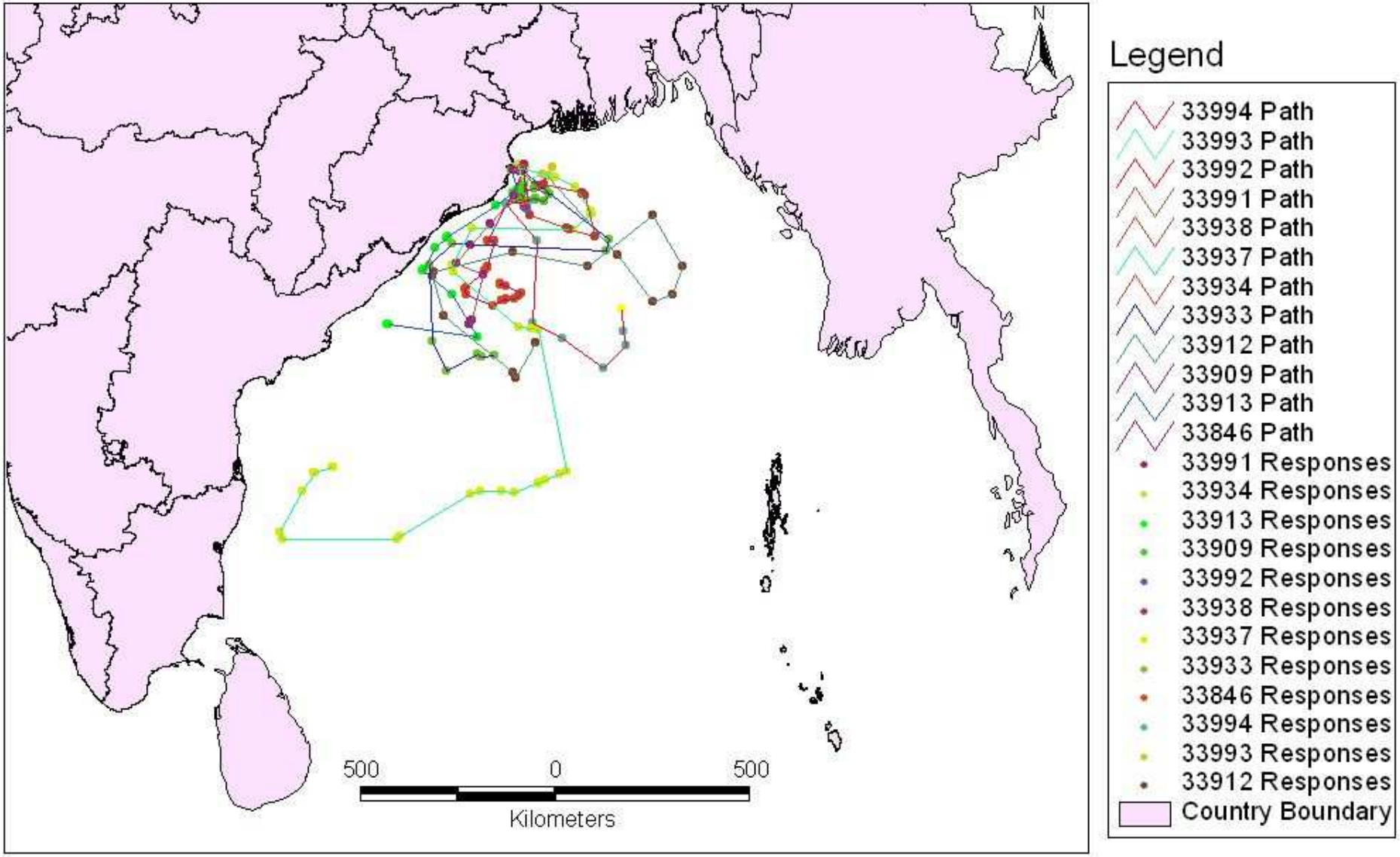
Legend

- 33875 Path
- 33908 Path
- 33898 Path
- 33866 Path
- 33841 Path
- 33352 Path
- 33345 Path
- 33338 Path
- 33343 Path
- 33339 Path
- 33339 Responses
- 33908 Responses
- 33898 Responses
- 33345 Responses
- 33352 Responses
- 33841 Responses
- 33875 Responses
- 33866 Responses
- 33343 Responses
- 33338 Responses
- Country Boundary

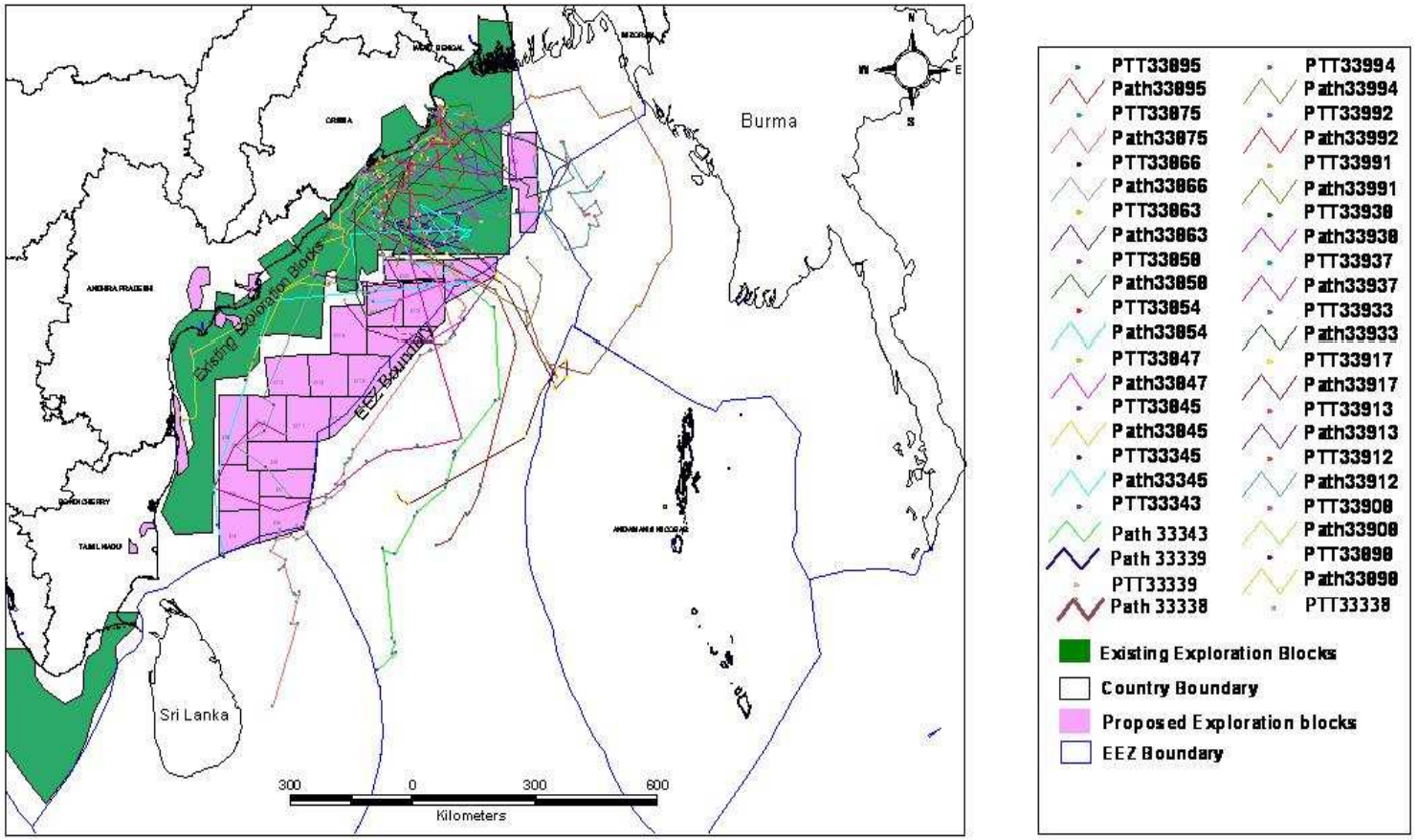
Devi River Turtle Movement



Gahirmatha Turtle Movement

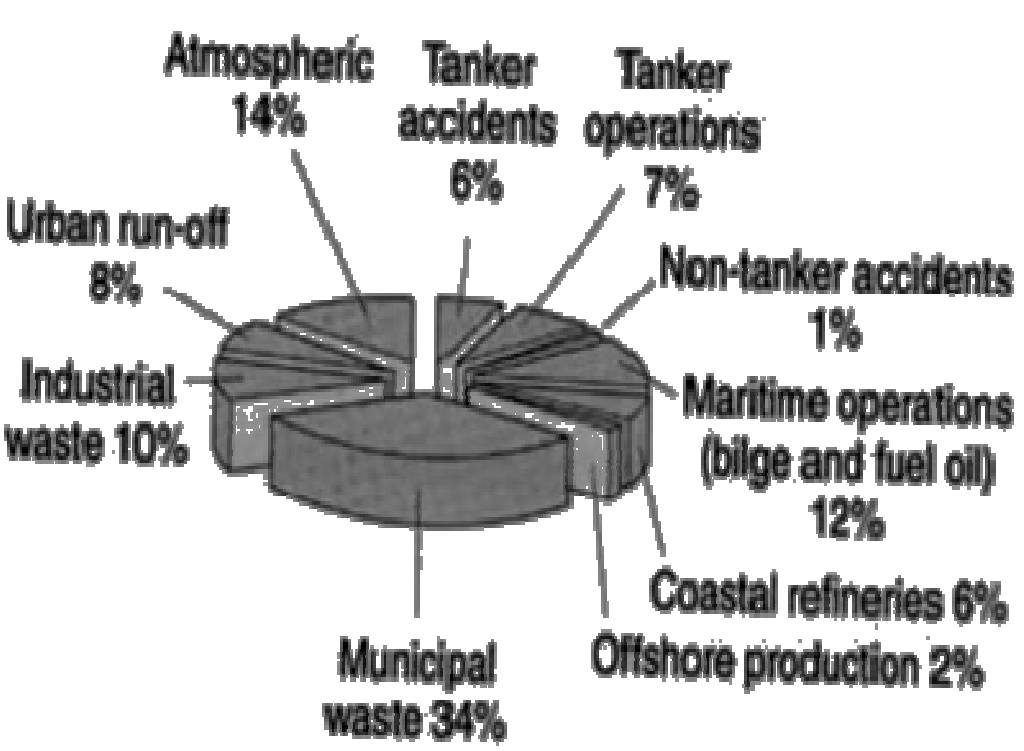


Movement patterns of PTT tagged Olive Ridleys in Bay of Bengal with respect to the proposed and operational Oil Exploration

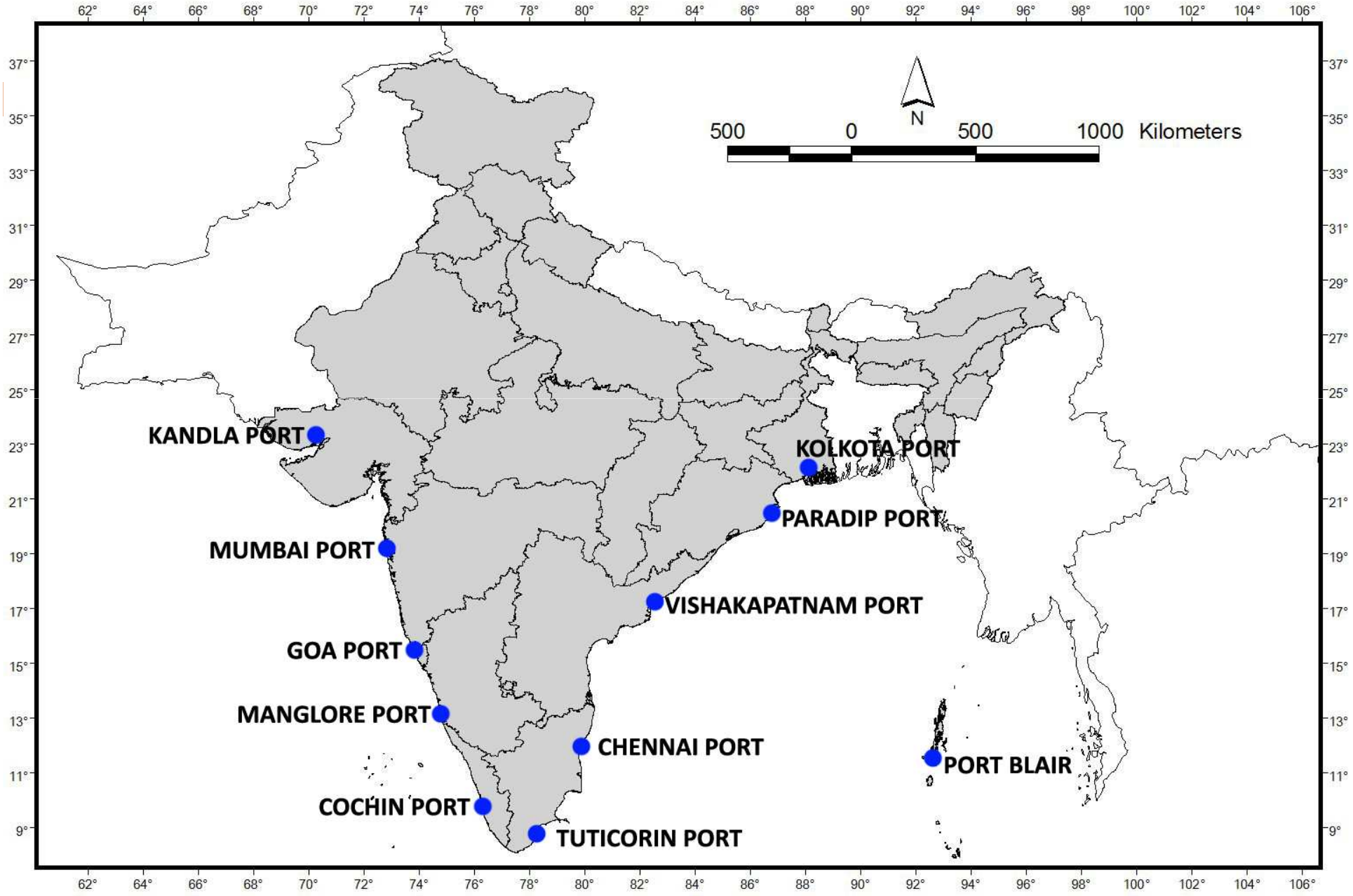


Major sources of oil pollution

- Oil exploration
- Oil refineries
- Off shore oil rigs
- Sea ports
- Major and minor ship accidents
- Oil pipe lines



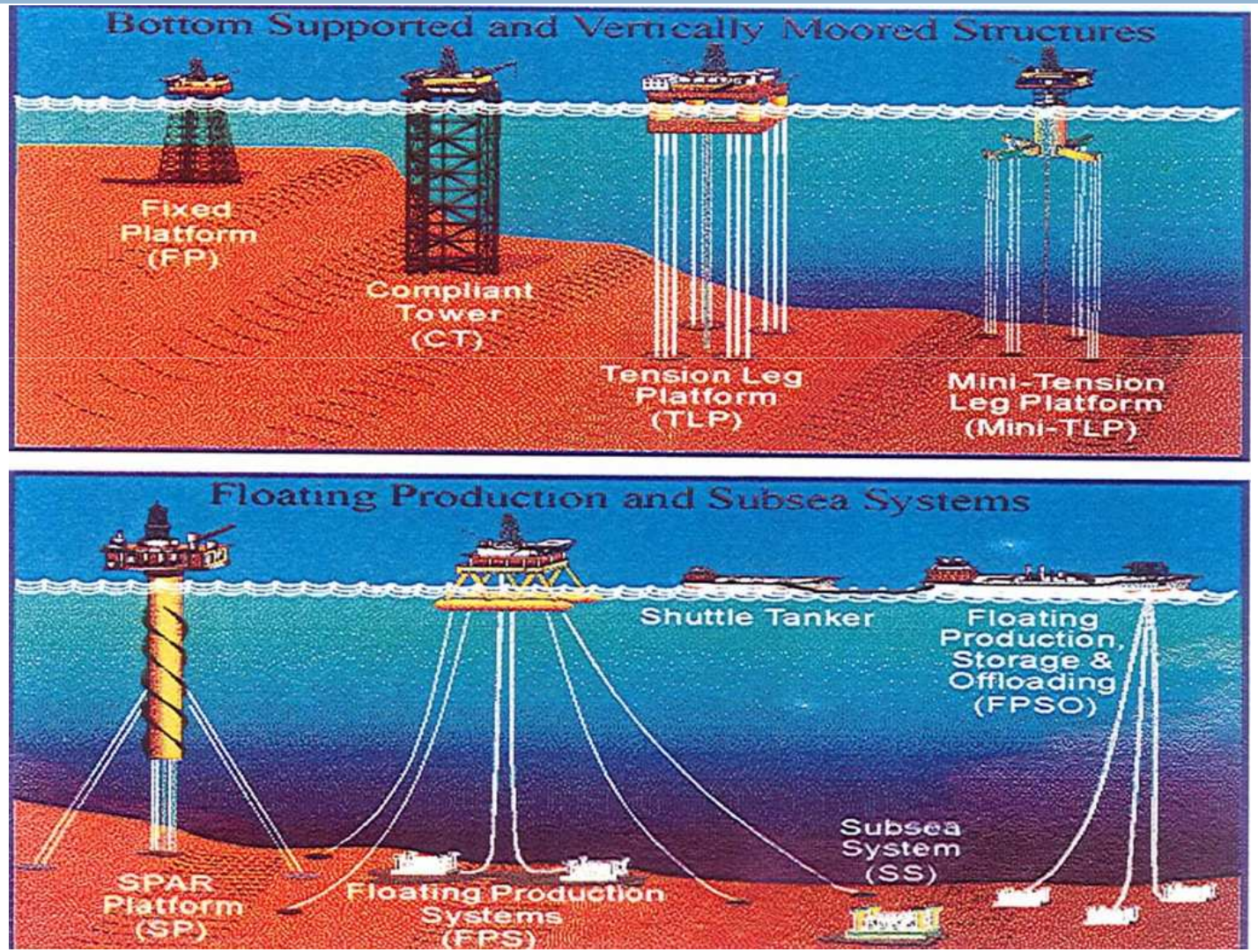
Major sea ports of India



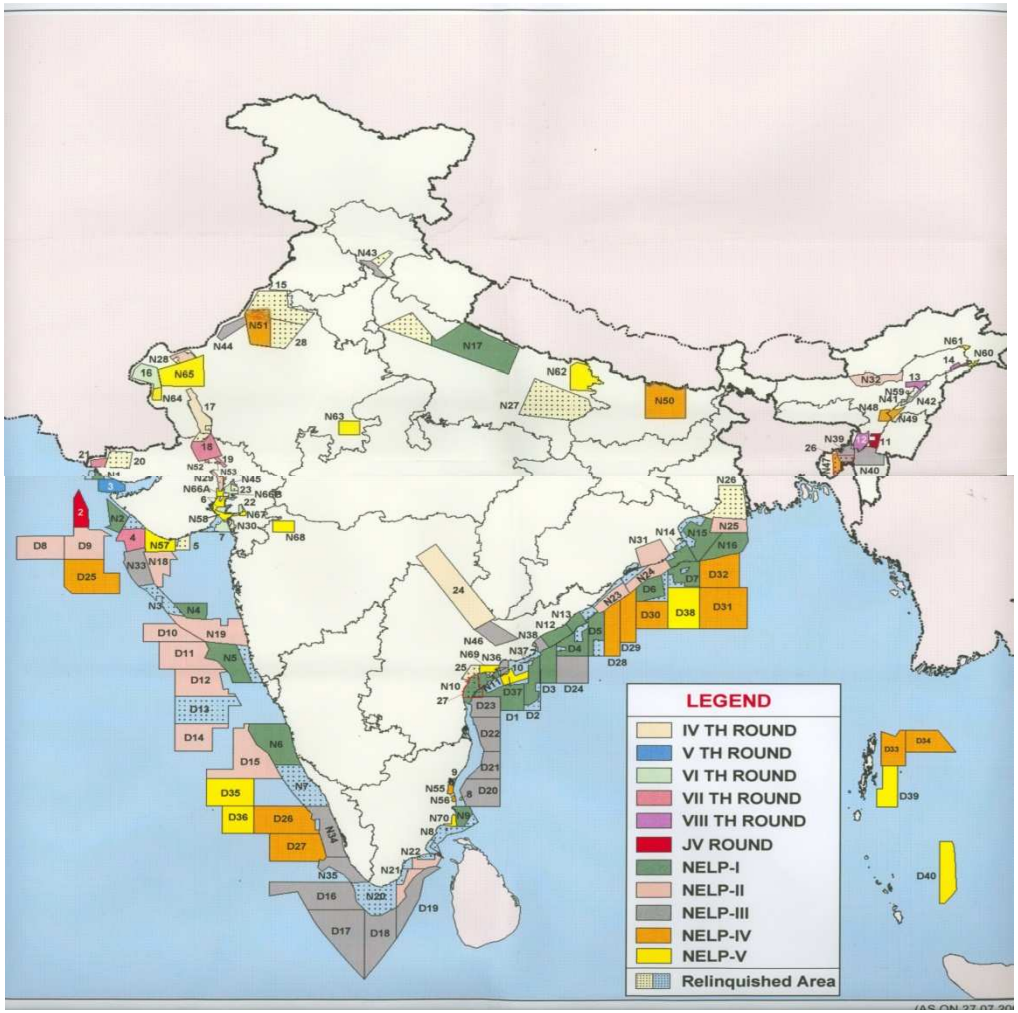
List of minor ports in India

States/Union Territories	No. of Minor Ports
Gujarat	40
Maharashtra	53
Goa	5
Karnataka	10
Kerala	13
Diu & Daman	2
Lakshadweep Islands	10
Pondicherry	1
Tamil Nadu	15
Andhra Pradesh	12
Orissa	2
West Bengal	1
Andaman & Nicobar Islands	23
Total	187

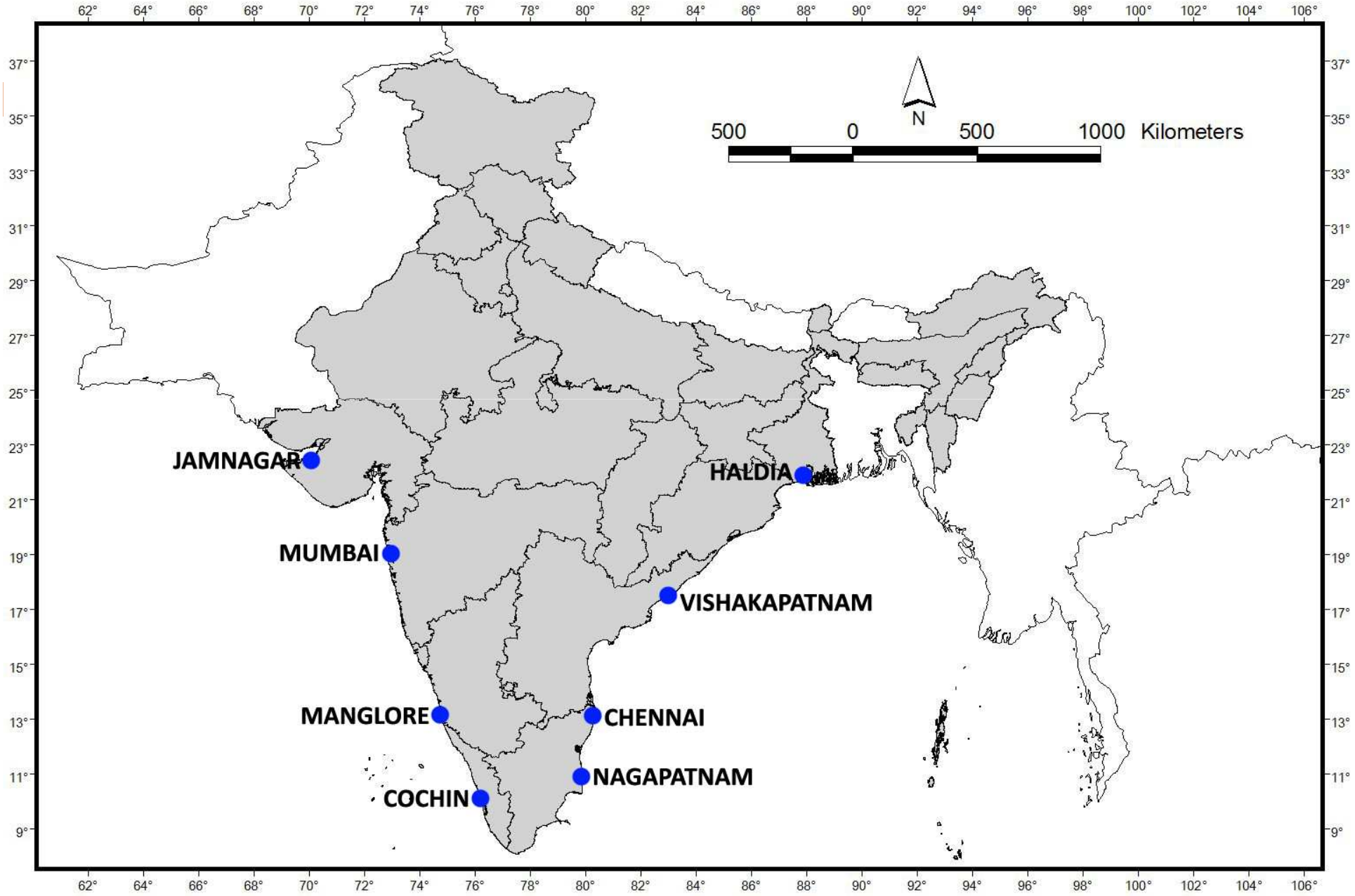
Offshore oil exploration systems and structures



Ongoing & proposed oil exploration blocks, India-2005



Major coastal oil refineries of India



What is oil spill ?

- An oil spill is accidental (acute or chronic) release of liquid petroleum hydrocarbon products (crude or refined) into the environment due to various factors (Natural or anthropogenic).
- Oil spills include releases of crude oil from tankers, offshore platforms, drilling rigs, Refineries and wells, as well as spills of refined petroleum products (such as gasoline, diesel) and their by-products, and heavier fuels used by large ships such as bunker fuel, or the spill of any oily white substance refuse or waste oil.

What all will be affected by the oil spill ?

Oil Spill is one of the most dangerous disaster which leave its stains on the environment for a very long time.

- It affects on ecosystem, flora and fauna, such as:
- Coral reefs
- Mangroves
- Sea weed and sea grass
- Benthos
- Fishes
- Aquatic birds and
- Aquatic mammals
- Coasts and beaches

What are the impacts of oil spills ?

- Because oil floats on top of water, less sunlight penetrates into the water, limiting the photosynthesis of marine plants and phytoplankton. This, as well as decreasing the fauna populations, affects the food chain in the ecosystem.
- Hypothermia and drowning of birds as the oil breaks down the insulating capabilities of feathers, makes them heavier and compromises flying ability
- If oil is ingested, it can either poison the animal outright, make them extremely sick or create a level of toxins in their system that then causes poisoning further up the food chain.

Impacts contd…

- Damage to animal immune systems.
- Damage to sea grass beds and other shelter/feeding areas
- Tainting of algae, which perform a vital role in waterway ecosystems
- Interruption of breeding and fouling of breeding grounds
- Thinner bird and turtle egg shells and also damage to fish larvae, causing deformities
- Even once the oil appears to have dissipated, it can still lurk beneath the surface of beaches and the sea bed, severely affecting marine benthic organisms for decades.

Impact on mangroves

- Mangroves are highly susceptible to oil exposure; oiling may kill them within a few weeks to several months.
- Lighter oils are more acutely toxic to mangroves than are heavier oils. Increased weathering generally lowers oil toxicity.
- Oil-impacted mangroves may suffer yellowed leaves, defoliation, and tree death.
- More subtle responses include branching of pneumatophores, germination failure, decreased canopy cover, increased rate of mutation, and increased sensitivity toother stresses.

Impact on coral reefs and corals

- Oil can kill corals, depending on species and exposure.
- Longer exposure to lower levels of oil may kill corals as well as shorter exposure to higher concentrations.
- Chronic oil toxicity impedes coral reproduction, growth, behavior, and development.
- The time of year when a spill happens is critical, since coral reproduction and early life stages are particularly sensitive to oil.
- Branching corals are more sensitive to oil impacts than are massive or plate-like corals.

Impact on the shores

- Onshore (Loss of Critical Habitat)
- Removal of natural coastal vegetation for infrastructures
- Flattening of coastal sanddunes and intertidal mudflat reclamation
- Solid waste, garbage and other chemical pollutants from infrastructure and refineries etc.
- Ground water removal, changes and alteration of traditional livelihood

Mitigation measures for mangroves

- Mangroves are highly sensitive to oil and often are priority areas for protection.
- Winds and tides carry spilled oil into mangrove forests, where oil coats the soil surface, aerial roots, and propagules.
- Dispersing or burning oil offshore can prevent or lessen impacts to mangroves.
- Spill containment and cleanup techniques should minimize any additional impacts to mangroves and other natural resources at risk.

Mitigation measures for coral reefs

- Remote locations, lack of response equipment, and waste disposal issues limit options for spill response in some coral regions.
- Mechanical cleanup and salvage efforts should avoid additional impacts to coral by using floating lines and minimizing coral damage from boats and anchors.
- In-situ burning can remove large amounts of oil rapidly, containing up to 90% or more of the oil.
- Smoke plumes from burning oil present a health hazard from fine particulates; monitoring protocols (SMART) can aid in setting safe boundaries around smoke plumes.
- Natural containment areas or special fire-resistant boom can collect oil for burning.
- In-situ burning needs fewer personnel and less equipment than mechanical cleanup methods and creates little waste material.

Mitigation measures…(continue)

- Heat from in-situ burning penetrates only a few cm below the water surface.
- Dispersants are chemicals that break up oil slicks, allowing oil particles to disperse into the water column.
- Chemically dispersed oil biodegrades at a faster rate than non-dispersed oil.
- Dispersing oil at sea can help reduce shoreline impacts and mortality of birds and other wildlife.
- Dispersants are most effective on light to medium oils, and are less effective on more viscous oils.
- The window of opportunity for effective use of dispersants is short.

Recent Oil spills

STATE	DATE	MODE OF ACCIDENT	TONNAGE
Maharashtra (Mumbai-Uran)	21-January-2011	Oil pipe leakage	55
Maharashtra-off Mumbai coast	07-August-2010	MV Chithra oil spill	400
Orissa- off Gopalpur	12-April-2010	MV Malavika Oil spill	6
Orissa- off Paradip	12-Sept-2009	MV Black Rose accident	No data

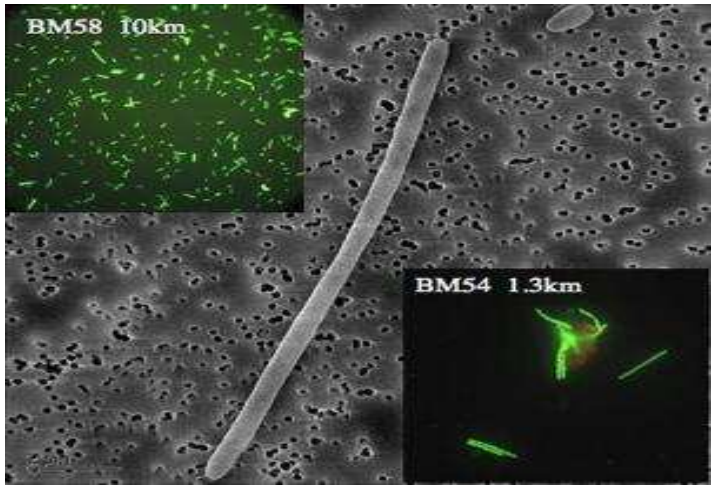
How the oil on the water or the beaches can be cleaned up after a spill?

There are many ways to stop the spread of oil in the ocean.

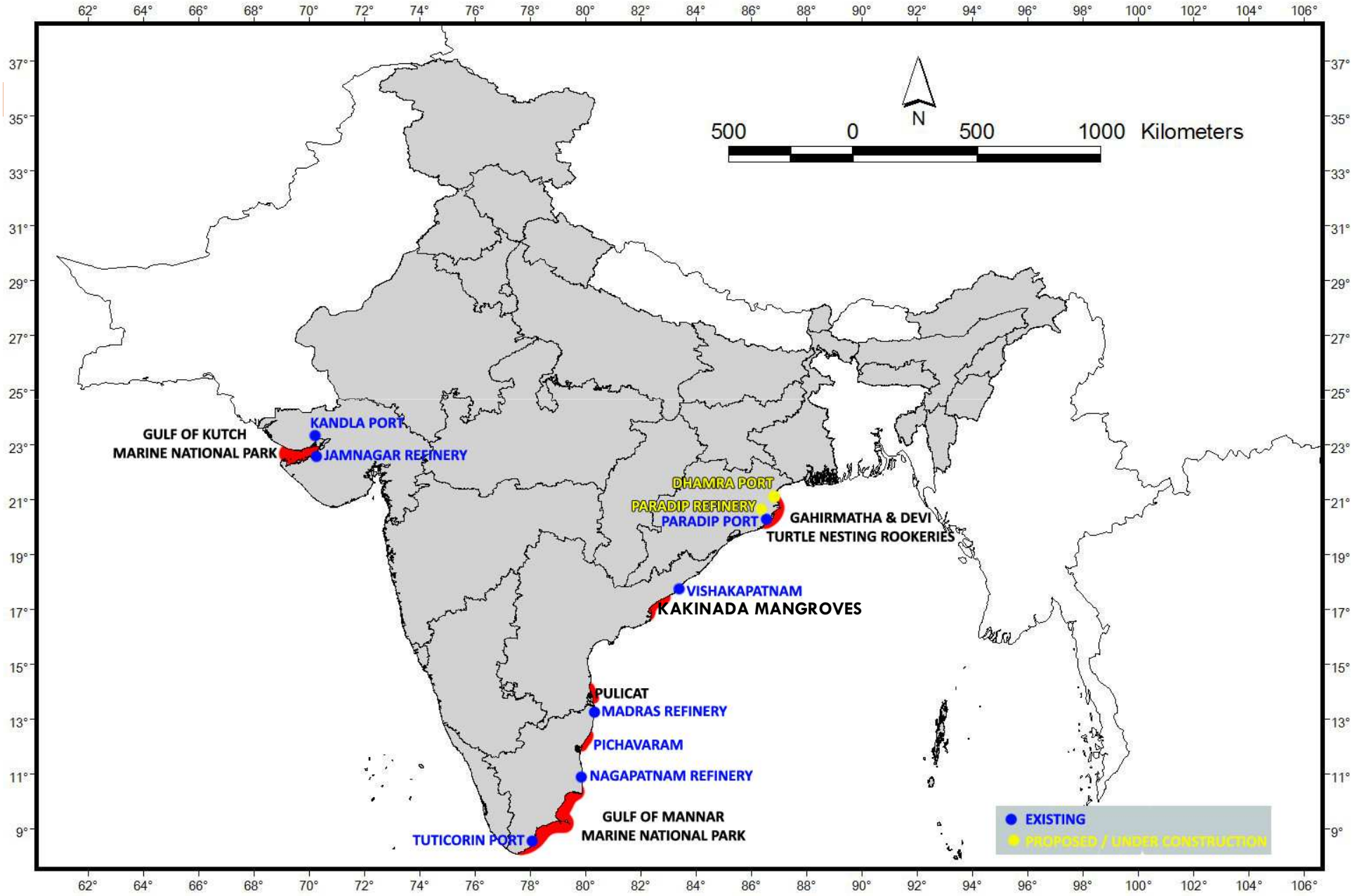
- **Booms** collect the oil off the water. A boom may be placed somewhere before oil spill. They can be placed around an entrance to the ocean, like a stream. They also can be placed around a habitat with many animals living there. These booms will absorb any oil that flows around it.
- **Skimmers** are boats that can remove the oil off the water, having sorbents and sponges that can collect the oil.

How the oil can be cleaned up……

- **Dispersants** are chemical agents that include surface active agents which are partly oil and water soluble. Dispersants change the fate of oil at sea by facilitating the breakdown of an oil slick into tiny droplets, which are suspended and disseminated in water mass, thus enhancing the penetration of oil into the water column.
- **Bioremediation.** Treatment of the spilled oil with oil degrading microbes. Bioremediation can eliminate only a portion of the compounds present in oil, and the process can take years.



Eco-sensitive zones under great threat from oil spills



What measures should be taken

- All the coastal National Parks, Sanctuaries and Biosphere reserves should have,
- **Disaster Management Plan**
- **Oil spill contingency protocol**
- **Rescue and rehabilitation protocol**
- **Beach restoration protocols**
- **Short and long term monitoring protocol**

Disaster Management Plan

- Disaster management plans deals with both natural and anthropogenic caused acute and chronic disasters
- Often a roll over plan since disasters are not regular events
- Plan encompasses the following contents

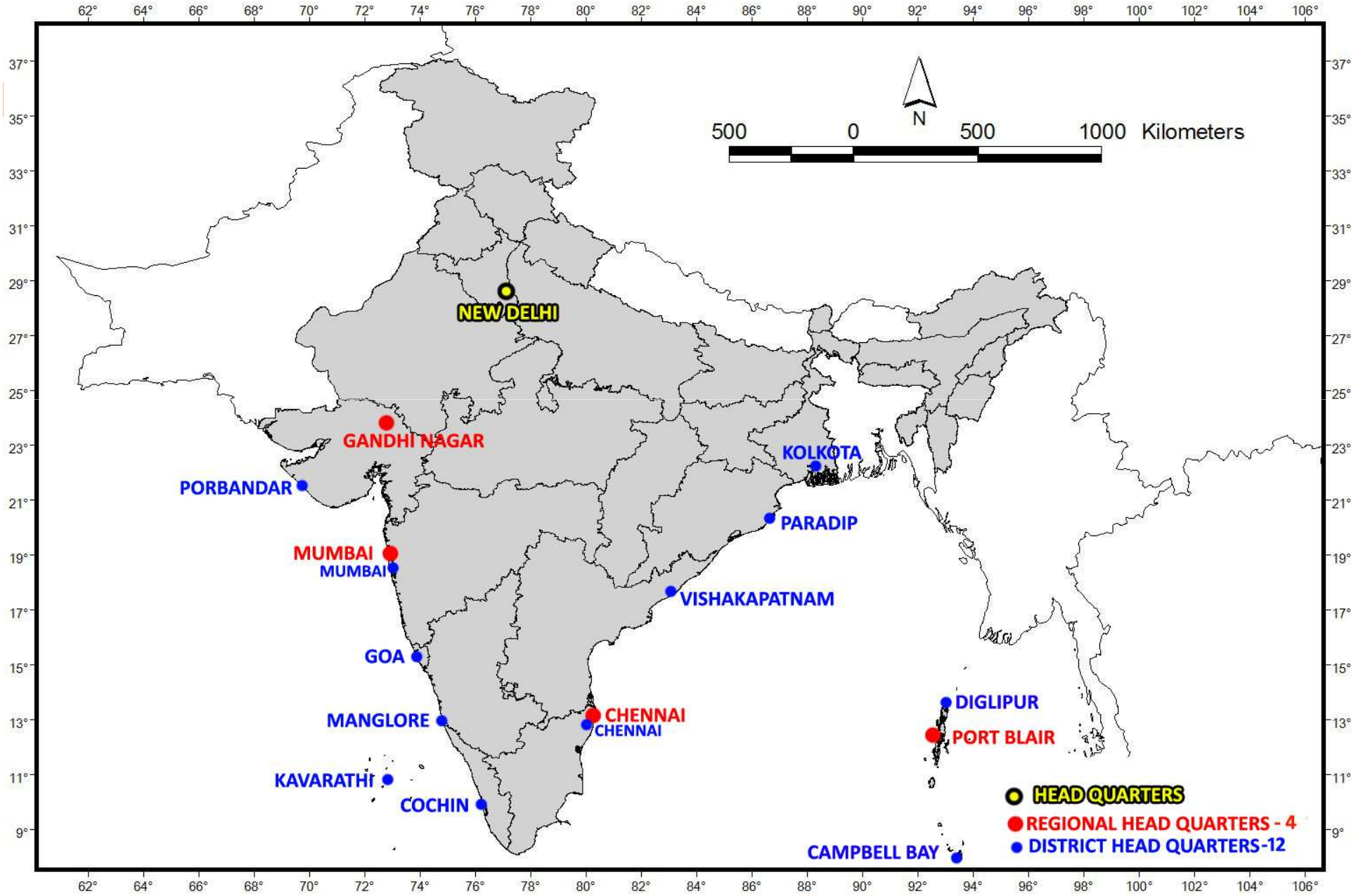
1. Possible disaster sources
2. Possible impact inventory
3. A disaster preparedness protocol
4. A rescue and rehabilitation protocol
5. Permanent or emergency support infrastructure plan
6. A monitoring protocol
7. Budgetary requirements

Oil spill contingency protocol

In case of an oil spill what all should do and whom should contact

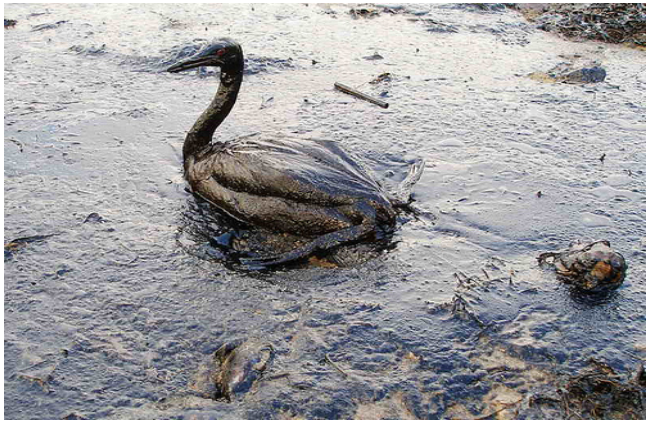
- **Coast Guard** is the responsible authority and they should be informed (in addition to the CG headquarters the nearest CG district commandant to be informed)
- All the regional Joint directors and regional CCF's of MoEF should be informed
- Seek the expert opinion of Central and state pollution control board.
- Other professional organizations dealing with oil spill disasters such as oil companies, Indian Institute of petroleum, National institute of Oceanography (NIO) etc

Coast guard head quarters of the country



Rescue and rehabilitation protocol

- All the animals affected by the oil spill should be rescued and given proper shelter and treatment for the removal of oil coating and de-hydration and re-hydration protocol
- Rehabilitation of the injured or permanently handicapped animals and birds



Shore restoration protocols

- Shore (sandy, rocky or muddy) is a habitat for millions of micro, meio and macro organisms.
- Oil will peculate through the interstitial space and clog the gas exchange
- Proper cleaning and removal of the washed ashore oil debris is a must
- Thus collected materials should be properly disposed as mentioned by Hazardous Substance Disposal Management (HSDM).

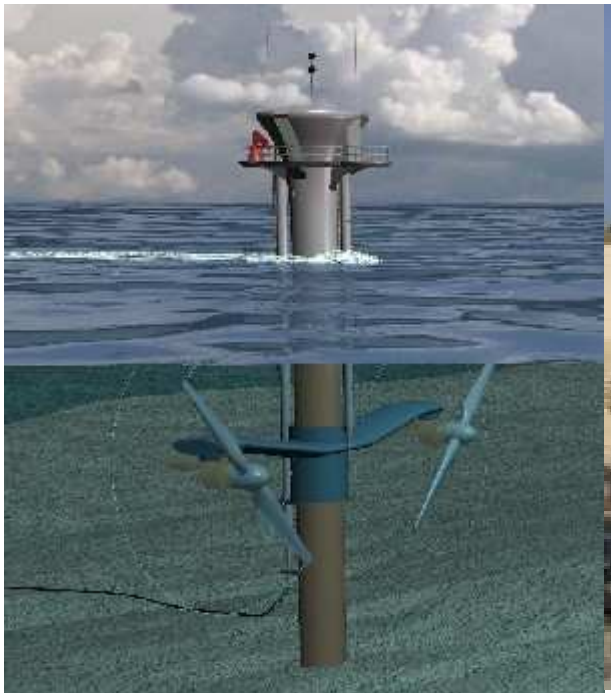
Short and long term monitoring protocol

- Monitoring is imperative to understand the impact of the oil spill on the habitat.
- Samples (water, sediment and planktons) should be collected periodically, and analyzed.
- Seek the help of National laboratories

Recommendations of MEG, MoEF on Safeguards for Hydrocarbon Exploration in Coastal & Marine Environment

- MEG suggested to adopt the precautionary principle approach due to the sensitive nature of the coastal and marine environment
- To adopt preventive measures rather than curative measures in hydrocarbon exploration in environmentally sensitive areas
- To consult professional and expert organizations before any phases of exploration activities to understand critical habitats of endangered species in time and space for open windows of exploration time
- Wherever necessary, to support and conduct detailed studies by professional organizations to built in preventive, mitigatory and restoration measures w.r.t. biodiversity hotspot and rare, threatened and endangered flora and fauna in eco-sensitive oil exploration and development blocks
- Consider the above mentioned eco-compatible activities as corporate social responsibility and built in such cause in the detailed project report
- Include professional ecologists and biologists for development and implementation of evironment management plan for each hydrocarbon exploration blocks

Possible Impacts of Hydrocarbon Exploration and Related Activities on Gangetic River Dolphin and Brahmaputra Riverine Habitat in Assam



Hazards and impacts on riverine biodiversity from hydrocarbon exploration and other related development may arise from:

- Exploratory Seismic Survey – Noise Pollution
- Exploratory Drilling – Noise, Photo & Chemical Pollution
- Support - Infrastructures & Transport and Photo-pollution Impact
- Production – Flare, Pollutants & Oil Spill
- Transport – Pipelines
- Refineries – Crude, Effluent & Photo-pollution

Impact on Gangetic Dolphins

- Seismic survey air gun pulse energy levels in excess of 1000hz ranges travel 100 km^2 in aquatic environment and impacts the auditory capacity or echo-location ability of cetaceans

- Intense sound sources and resultant shock waves cause tissue damage in aquatic mammal because of imbalance between gas in their swim bladders, body tissue and surround waters

- Noise also makes these mammals abandon their preferred habitat as well as social groups including infants

Contd…..

Impact on Gangetic Dolphins (Contd..)

- Chronic exposure to low noise expected from continued seismic survey could affect the accessibility of Gangetic River Dolphins to their prey species because of the impact on their eco-location based communication processes.
- Significant alarm/avoidance behaviour by Gangetic Dolphin is also expected because of disturbances by Seismic Survey. This may be severe in seasonally non migrating Gangetic River Dolphin particularly during carving and feeding. Continued displacement from such areas could have much more preformed effect on the population.
- There may be further threats from support vessels and operational noise including chemical pollution that normally follows drilling etc. after seismic survey and search for oil.
- Unlike marine cetaceans the Gangetic Dolphin in a linear riverine habitat do not have the opportunity of dispersing from the source of seismic noise and therefore, the impact may be high.

Anticipated Risks of hydrocarbon development in Gangetic River Dolphin Habitats

- Abandonment of traditional breeding site fidelity, migration routes by gangetic dolphins
- Change in quality/quantity of associated prey base
- Change in river water quality due to pollution and other spillages
- Complete abandonment of preferred seasonal habitat locations of social groups

(Risks are highest during the breeding season in deep water pools i.e. October to February with the breeding groups in the riverine habitat)

Impact on residential and migratory water birds

Floating viscose oil, chemical and other pollutants contaminate their food sources as well as their feathers, particularly vulnerable are chicks

Cumulative Impact of Other Allied Activities Post Seismic Survey and Follow-up Hydrocarbon Exploration

- Vessel and infrastructure related disturbances to a highly sensitive and elusive critically endangered species.
- Possible problems associated with hydrocarbon related pollution.
- Changes in the riverine bathymetry and geomorphology related to drilling and other infrastructure.

The Need for Risk Assessment and Environmental Safeguards

- A multi disciplinary expert group's opinion and initiation of study.
- Anticipated risk assessment.
- Prospect of use of precautionary principle and avoidance and/or mitigatory measures including Best Practice Guidelines.
- Development of an environmental management plan by the multi disciplinary group to be implemented by the Exploration Agency.

THANK YOU