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Guidelines for Developing a Coastal Zone Management Plan for Belize

The GIS Database



A Marine Conservation and Development Report

Guidelines for Developing a Coastal Zone Management Plan for Belize

The GIS Database

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Guidelines for Developing a Coastal Zone Management Plan for Belize

The GIS Database

Compiled by J.P. Gibson, A.R.G Price and E. Young

in collaboration with the

World Conservation Monitoring Centre

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in collaboration with WCMC



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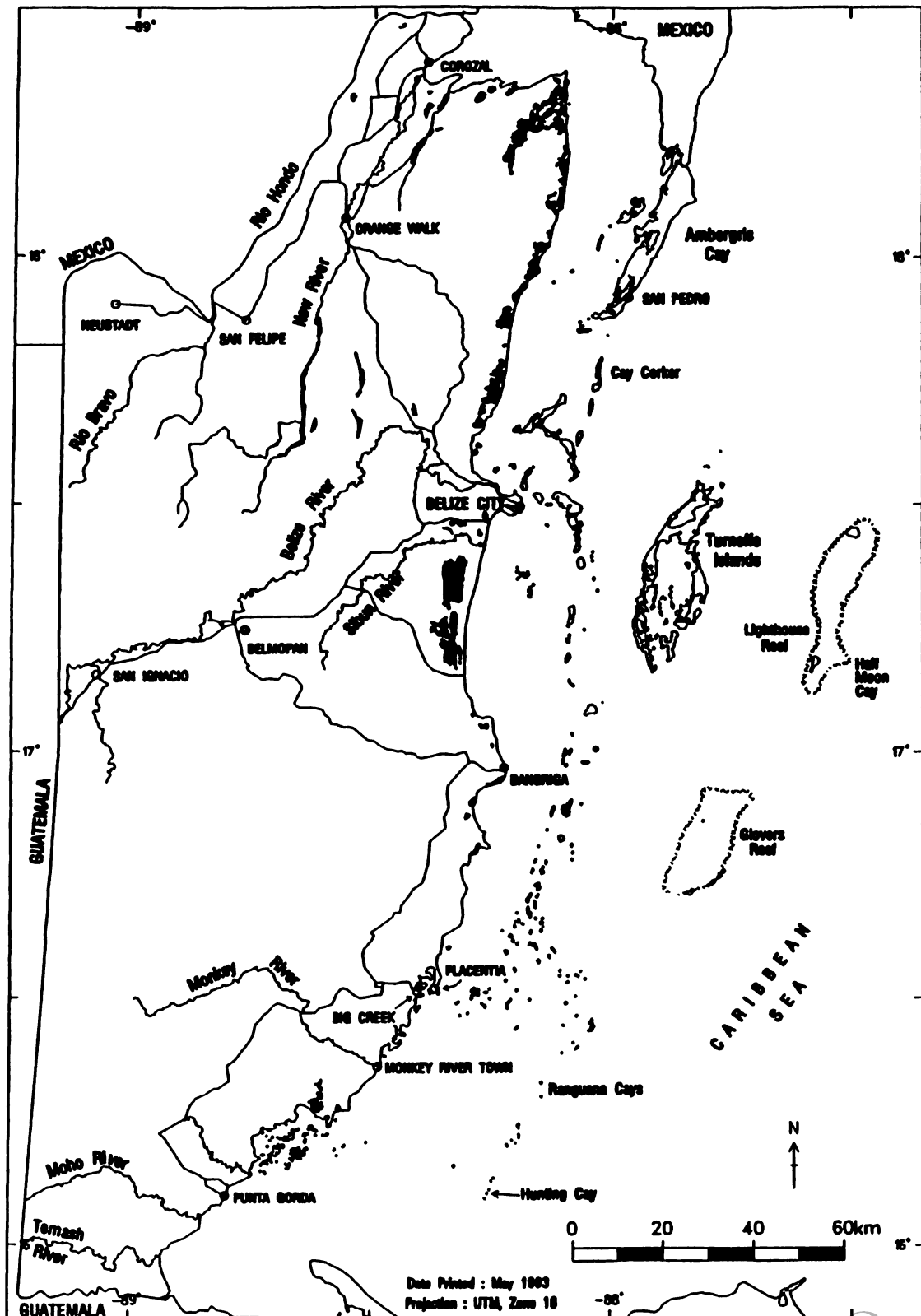
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The coastal zone of Belize



Introduction

Provisional guidelines and an analytical framework to help reconcile the needs of coastal development and conservation in Belize were set out in *Guidelines for Developing a Coastal Zone Management Plan for Belize* (Price *et al.*, 1992). This document highlighted the benefits of adopting an integrated approach to coastal zone management (CZM). The planning process is usually made up of several interlinked, coordinated phases, and data collection / compilation and analysis are particularly important in development phases. Such an approach was applied in several earlier coastal zone management plans (e.g. IUCN, 1987; Salm *et al.*, 1988) and provided a basic framework for the CZM guidelines for Belize.

The value of mapping resource, resource use and conservation data is becoming increasingly recognised in coastal and environmental management. Such data can be conveniently compiled, retrieved and analysed using a geographic information system (GIS). This system enables periodic updating and reanalysis of information which may result in the need to modify existing CZM plans. In addition to GIS, a wide range of other analytical tools (e.g. non-linear dynamical models) are now becoming available to assist with problem solving in the coastal zone.

The detailed resource, use and conservation maps presented in this supplementary volume formed the basis of the summary maps in the CZM guidelines for Belize. These summary maps graphically portrayed the major resource areas and the overall status of the marine environment. Maps including areas of fishery resources, key coastal species, key coastal ecosystems, reserves, archaeological sites and wrecks, collectively represent ecological and cultural cornerstones of Belize's marine national heritage. The summary maps also illustrate the approach to conflict avoidance and resolution during coastal planning and management through overlay analysis. For example, the maps of concentrated coastal resource areas and major coastal uses and environmental pressures were combined to produce a map showing the main coastal resource-use conflicts.

The maps in this supplementary volume were compiled at the World Conservation Monitoring Centre (WCMC) Cambridge using a GIS ('ArcInfo'). These larger scale maps are a useful tool for detailed coastal planning, while the previously published summary maps were used mainly to provide an overall picture and illustrate some of the principles of coastal zone planning and management. However, even the detailed maps in this volume are not complete and accurate in every respect, particularly since not all areas of Belize have been surveyed or assessed to the same extent. As more extensive and precise information becomes available it will be necessary to periodically update and reanalyse the data and produce modified maps as an input to evolving CZM plans.

This report could not have been completed without the many collaborators living and working in Belize. Particular thanks are due to those individuals who provided invaluable information based on their experience of specific areas, features and resources of the coastal zone - their names are listed under the information sources for each map. Their further collaboration in the development of coastal zone management plans to ensure a future for this exceptional environment is anticipated.

Throughout the text, formal publications are indicated in bold text, while personal communications are in normal text.

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- Salm, R.V., Dobbin, J.A. & Papastravou, V.A. 1988. *Oman Coastal Zone Management Plan. Quriyat to Ras al Hadd.* IUCN, Gland, Switzerland**

Map 1: Fishery Resources

This map indicates the location of coastal and marine areas of Belize containing important fishery resources. Principal fishery resources include crustaceans (shrimp, lobster and stonecrab), molluscs (conch) and fish (deep-water fish, reef fish, grouper and mutton snapper). The fishery resources are found primarily in inshore waters, but are also associated with the shallower waters of the barrier reef lagoon and the lagoons of various atolls including the Turneffe Islands and Glovers Reef.

Fisheries represent the most important coastal resource of Belize in terms of economic and social values. In 1989, the total export earnings of Belize fishery amounted to US\$8.8 million, of which over half came from lobster. Fishery production may be adversely affected by non-sustainable practices including overfishing, use of damaging gears, and degradation of the marine ecosystems upon which fishery species directly or indirectly depend.

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Carter, J. 1990. *Biology and Management of Nassau Grouper* *Epinephelus striatus* *in Belize, Central America.* Proceedings of Coastal Resources Management Workshop.

Gibbin Report.

Gillett, V. Fisheries Administrator, Fisheries Department, Belize.

Hartshorn et al. 1984. *Belize Country Environmental Profile: A field study.* USAID, R. Nicolait and Associates, Belize City, Belize.

Map 2: Critical Habitats for Species

This map illustrates the distribution of critical habitats or nesting sites for key species or species groups. Among the birds shown are Pelicaniformes (frigate, anhinga, booby spp. and cormorants), Ciconiiformes (spoonbill, woodland stork, white ibis, reddish egret, snowy egret, great egret, cattle egret, tri-coloured heron), Laridae (roseate tern, royal tern, least tern, sooty tern, brown noddy) and ospreys. Other important fauna include reptiles (American crocodile, Morelets crocodile, green turtle, loggerhead turtle, hawksbill turtle and hicatee) and mammals (manatee).

All of the above are species of known conservational or local importance. Protection of this fauna and conservation of biodiversity in general should be considered a high priority in coastal management. Of particular significance are those species considered to be threatened. Green and hawksbill turtles are listed on the IUCN Red List of Threatened Animals as endangered and the loggerhead turtle and manatee are listed as vulnerable.

Information sources

Belize Audobon Society Office, Belize City.

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Smith, G. 1989. *Partial Survey for Sea Turtle Nesting Sites in Belize.*

Smith, G. 1990. *Ground Survey for Sea Turtle Nesting Sites in Belize.*

Map 3: Key Coastal Ecosystems

This map illustrates the distribution of the key coastal ecosystems of surveyed areas of Belize, namely mangroves, seagrasses, and coral reefs. Information for some areas is partly schematic.

The three mapped ecosystems are particularly important for their exceptionally high biological productivity and their provision of feeding and habitat areas for most of the region's marine species at some stage in their life cycles. These ecosystems also have many other human and economic values. Like Australia's Great Barrier Reef, the reef complex of Belize represents one of the greatest manifestations of life on earth, dwarfing even the most ambitious structures of modern man, and providing valuable coastal protection by functioning as 'self-repairing breakwaters'. The reefs of Belize harbour important fishery resources and are a major repository of biodiversity. Mangroves also provide coastal protection and are important to several species at some phase of their life cycle. Seagrasses provide important pasture and sanctuary for species such as the green turtle and manatee, and an indirect form of food via detrital food chains, to many other organisms. These three ecosystems are interdependent in terms of cycling of nutrients and sediments.

Particularly useful to coastal zone planners and managers is an overall picture of the location of *concentrated key resource areas*. These can be identified and mapped by combining the maps of fisheries, important species or species groups and key habitats/ecosystems. A summary map of concentrated key resources is illustrated in figure 5 of the CZM guidelines (Price *et al.*, 1992).

It is evident that one or more of the key coastal ecosystem types are found along most of the coastline and over extensive tracts of the subtidal area. Less information is available for other ecosystems, such as sand and rock beaches, which are regarded as less critical. However, such ecosystems are undoubtedly important to the overall integrity of Belize's coastal zone and should not be disregarded in the development of a CZM plan.

Information sources

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Map 4: Marine and Coastal Protected Areas

This map shows the locations of existing and proposed marine and coastal protected areas in Belize. Of particular significance is the highly successful Hol Chan Marine Reserve, established in 1987 on the south of Ambergris Cay. Also shown are areas of National Land, No Hunting Land, and Forest Reserves. These are principally terrestrial reserves but some extend to the sea and have a coastal component.

Protected areas are usually designed to protect important natural resources. At the same time they provide a focus for management efforts to avoid, minimise and reconcile the often conflicting needs of conservation and development. Interventative management techniques in protected areas may include habitat restoration and bioremediation. Marine protected area management is often most successful when such targetted management is augmented by broadscale measures, such as coastwide resource and resource-use policies within an integrated coastal management plan.

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Map 5: Major Coastal Uses 1

This is the first of two maps illustrating the different uses to which the coastal zone and its resources are put. Illustrated on this first map are areas of sportfishing (billfish, bonefish, snook, tarpon, kingfish), as well as the coastal infrastructure of ports, fishing settlements and cooperatives which supports general fishing activities.

Sportfishing is practised along much of the coastal zone as well as on the barrier reef and atolls, and sportfishing areas can be seen to correspond closely with the location of major fishery resources illustrated on Map 1. The distinction between coastal uses and human impacts leading to evident environmental stress, shown on Map 7, is often not clear-cut since all human activities inevitably place some pressure on the environment. Certain activities such as sportfishing, while not intrinsically damaging to marine ecosystems, require careful regulation to ensure that they are not carried out to excess.

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Woods, R.L. *et al.* 1988. *The Field Guide to Ambergris Cay, Belize, C.A.*

Map 6: Major Coastal Uses 2

This second map of major uses of the coastal zone represents a rather heterogeneous group of activities from tourism and water extraction to research, farming, and defence.

Tourism is an increasing source of income in many coastal areas of Belize, and one of the principal attractions for those tourists who venture beyond the beach is the reef with its extraordinarily diverse fauna. Dive sites are centred on reef areas, and are associated with shipwrecks and archaeological sites as well as with sportsfishing. Its potential direct and indirect impacts mean tourism is a use which needs to be carefully controlled if it is not to exceed the carrying capacity of the environment on which it depends.

Another important source of income is aquaculture, and aquaculture products such as penaeid shrimp (*Penaeus vanami*) and aquarium fish are important overseas currency earners. Aquaculture areas are situated principally behind the coastal mangrove belt.

Information Sources

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Institute of Archaeology, UCLA.
Zabaneh. Hotelier, Blue Marlin's Lodge, Southwater Cay, Belize.

Map 7: Human Impacts

This map illustrates the principal human activities which are causing impacts on the natural environment including hunting and poaching (crocodiles, turtles and turtle eggs, birds and manatees), sand mining, dredging and landfilling, oilspills, land development, and development concessions (agriculture, industrial, tourism, and aquaculture). Such activities are often of an opportunistic or accidental nature, and will tend to shift in focus over time, particularly as non-renewable resources become exhausted. The data on this map should thus be regarded as demonstrative, providing an illustration of the nature and diversity of human threats rather than of the precise locations where they are taking place.

An overall picture the location of coastal uses and human impacts is of particular value to coastal zone planners and managers. These can be rapidly identified and mapped by combining the data on coastal uses and human impacts/environmental pressures. Figure 6 of the CZM guidelines showing *major coastal uses and environmental pressures* (Price *et al.*, 1992) represents a summary of the data presented on maps 5-7. By comparing this map with areas of *concentrated key coastal resources* (Price *et al.*, 1992: figure 5) it is also possible to identify the main areas of *resource use conflict*. The shaded areas on figure 8 are areas of overlap between the maps and denote actual or potential *resource use conflicts areas*, and hence areas that might be in most need of management. This analysis is also means of determining suitable candidate sites for protected areas. Unshaded areas represent areas where there is presently no conflict and where there is potential for development of certain coastal zone uses.

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Smith, G. 1990. *Ground Survey for Sea Turtle Nesting Sites in Belize.*

Map 8: Transport and Concession Blocks

This map illustrates the principal transportation routes within the Belize coastal zone and the division of the coastal zone into concession blocks. Concession blocks are leased both for oil exploration and for the salvage of wrecks. Only three oil blocks have active leases in the coastal and marine area.

In addition to merchant and passenger ships, two oil tankers, which between them carry almost two million gallons of oil, visit Belize City each month. A major oil spill would present a serious hazard to coastal ecosystems and species and the development of an oil spill contingency plan based on a detailed analysis of ecosystem vulnerability should be regarded as a major national priority. Fortunately there has been little spill related damage to date despite the sinking in 1988 of an oil barge carrying Bunker C fuel to Belize from Honduras and other minor incidents.

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Map 9: Physical Features

This map shows the physical features and maritime boundaries of the coastal zone of Belize. Bathymetry and salinity data are mapped only for the areas surveyed, which extended little beyond the demarcated international border at three nautical miles from the shoreline. The limit of territorial waters has now been extended to 12 nautical miles to the region north of Ranguana Cays; south of this point the three mile limit remains. A 200 mile Exclusive Economic Zone (EEZ) has also been declared opening future options to exercise certain prescribed rights under the UN Convention on the Law of the Sea (UNCLOS III). This convention has yet to be ratified by sufficient member states for it to be legally binding but, nevertheless, is already working as a broad umbrella agreement to help minimise coastal resource use conflicts and alter the notion of the seas as common property resource.

Information Sources

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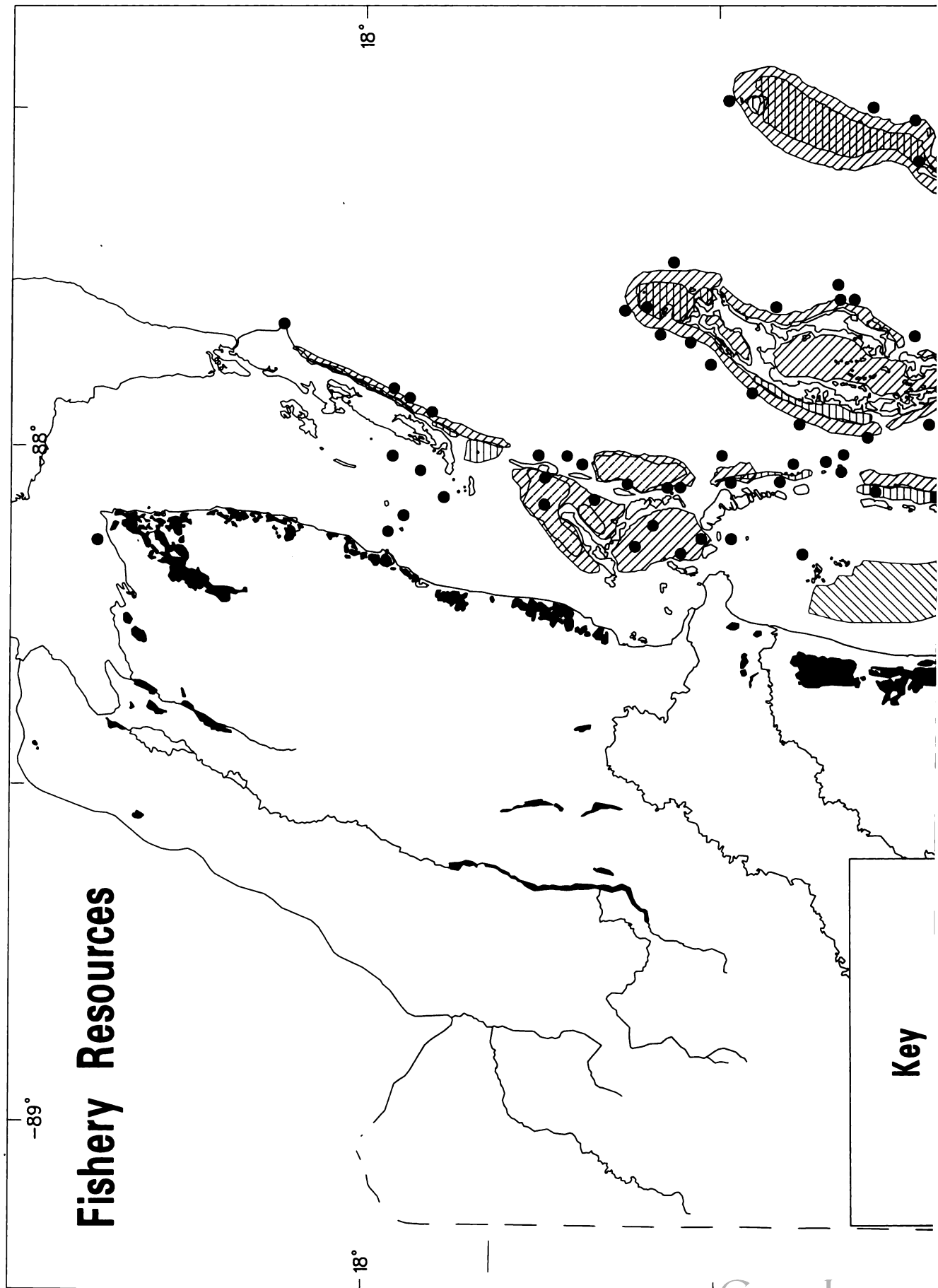
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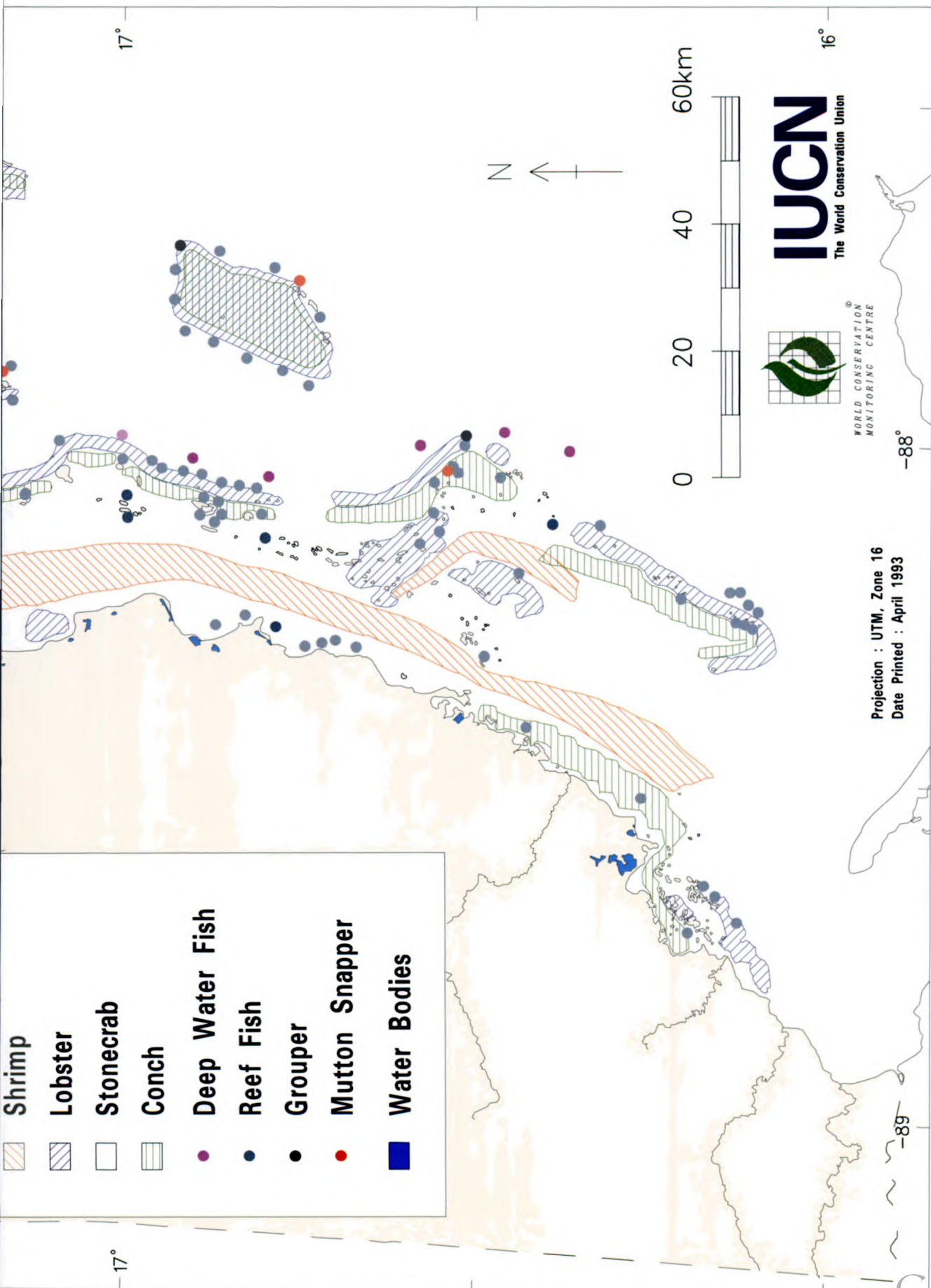
The following titles are now available in IUCN's Marine Conservation and Development Series:

1. Kelleher, G. & Kenchington, R. 1992. *Guidelines for Establishing Marine Protected Areas*. vii + 79 pp.
2. Price, A.R.G.; Jeudy de Grissac, A. & Ormond, R. 1992. *Coastal Assessment of the Parc National du Banc d'Arguin, Mauritania: Understanding Resources, Exploitation Patterns and Management Needs*. x + 44 pp.
3. Sherman, K. & Laughlin, T. (Eds). 1992. *The Large Marine Ecosystem (LME) Concepts and its Application to Regional Marine Resource Management*. vi + 62pp.
4. Price, A.R.G.; Heinanen, A.P.; Gibson, J.P. & Young, E.R. 1992. *Guidelines for Developing a Coastal Zone Management Plan for Belize*. ix + 37 pp.
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7. Price, A.R.G. & Humphrey, S.L. (Eds). 1993. *Application of the Biosphere Reserve Concept to Coastal Marine Areas. Papers presented at the UNESCO/IUCN San Francisco Workshop of 14-20 August 1989*. viii + 114pp
8. Pernetta, J.C. (Ed.). 1993. *Marine Protected Areas Needs in the South Asian Seas Region*.
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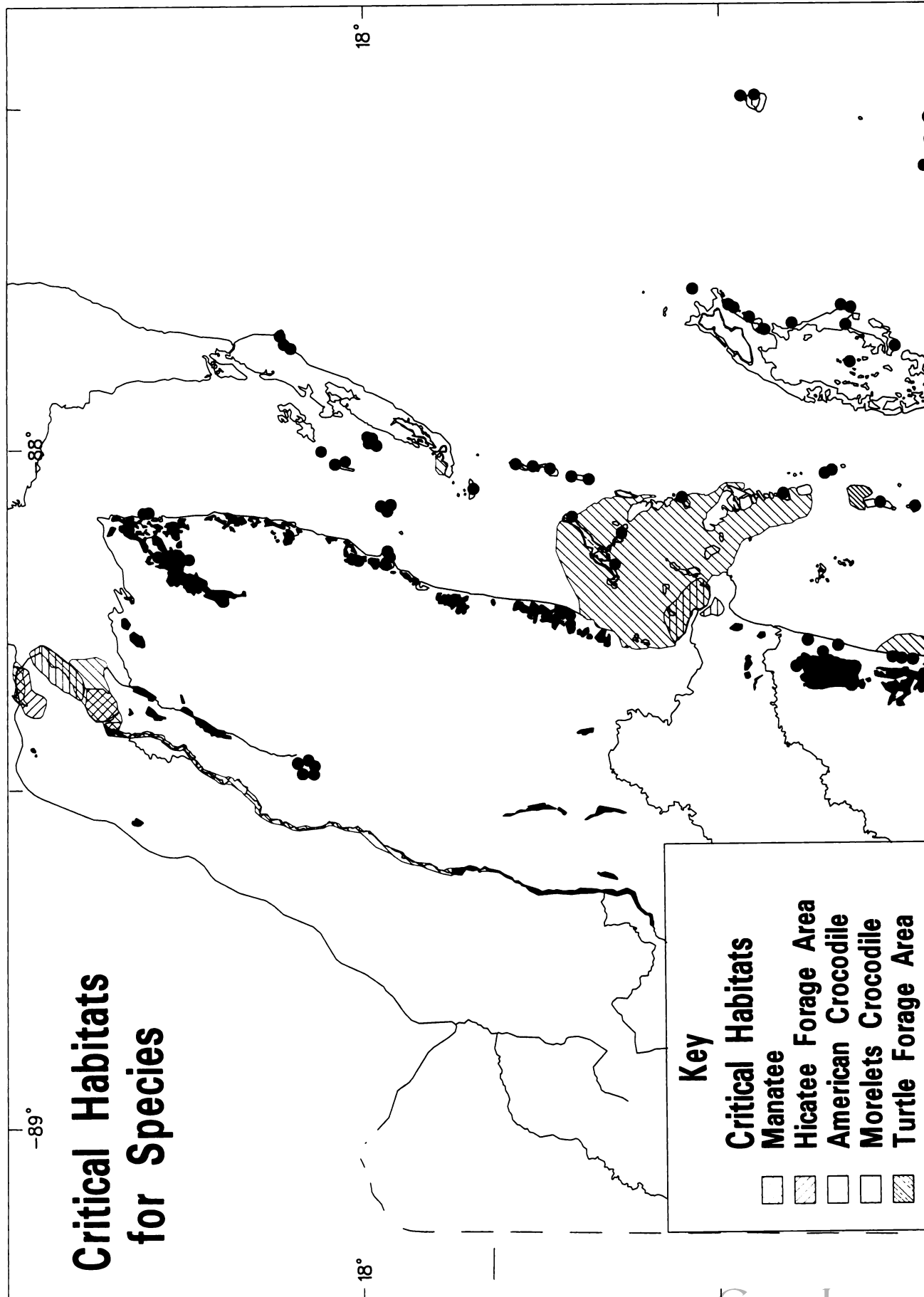
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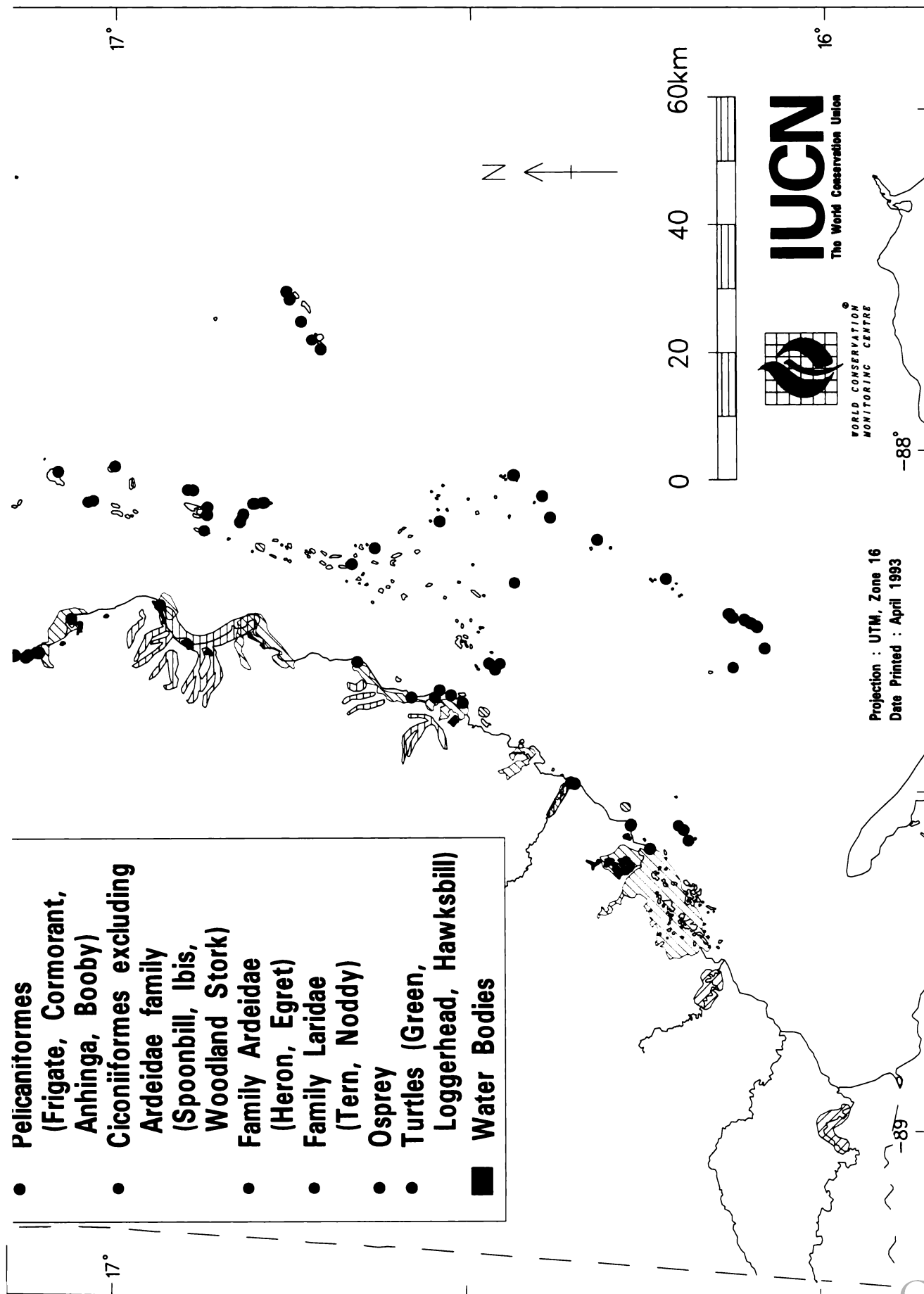
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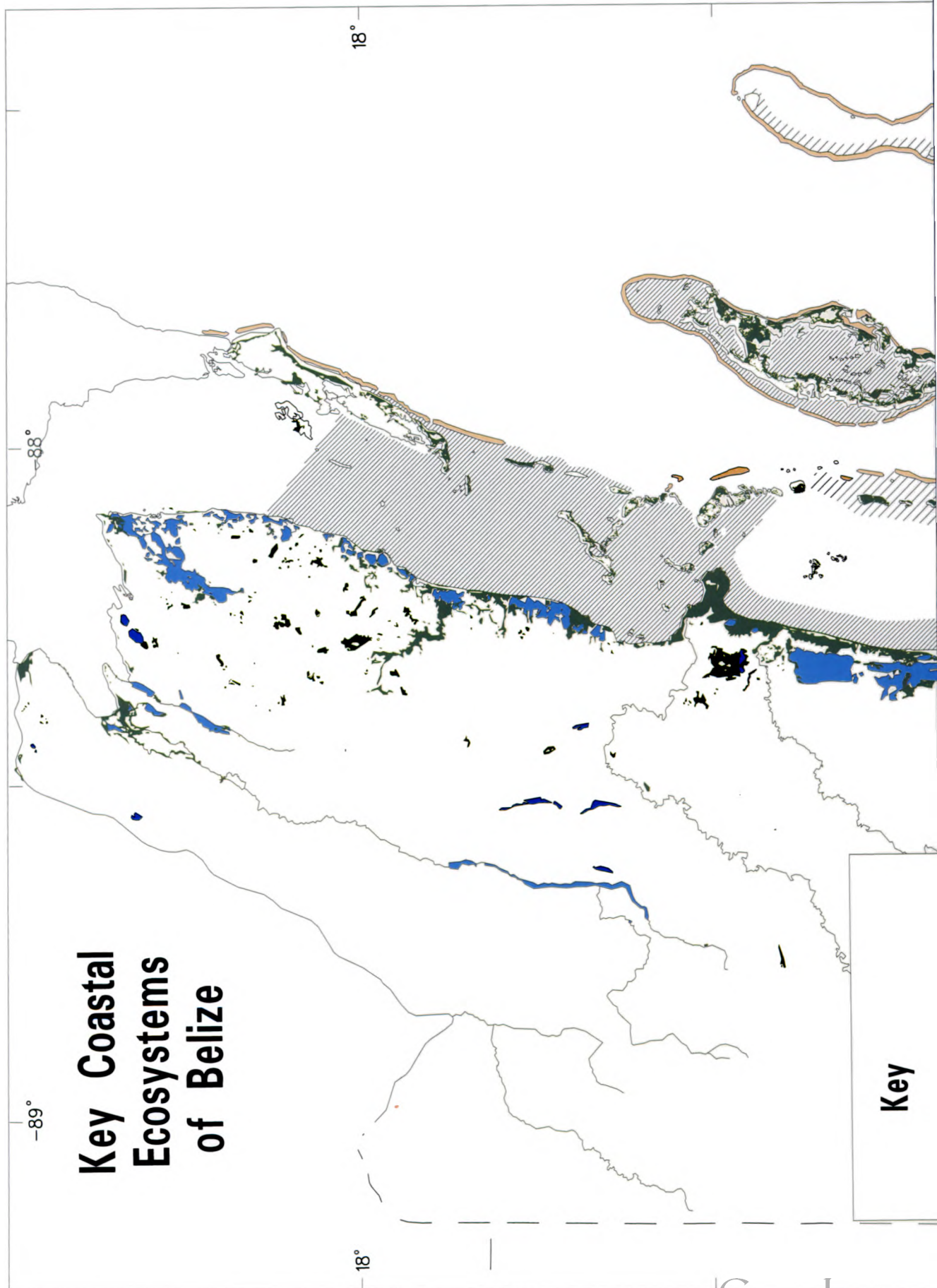
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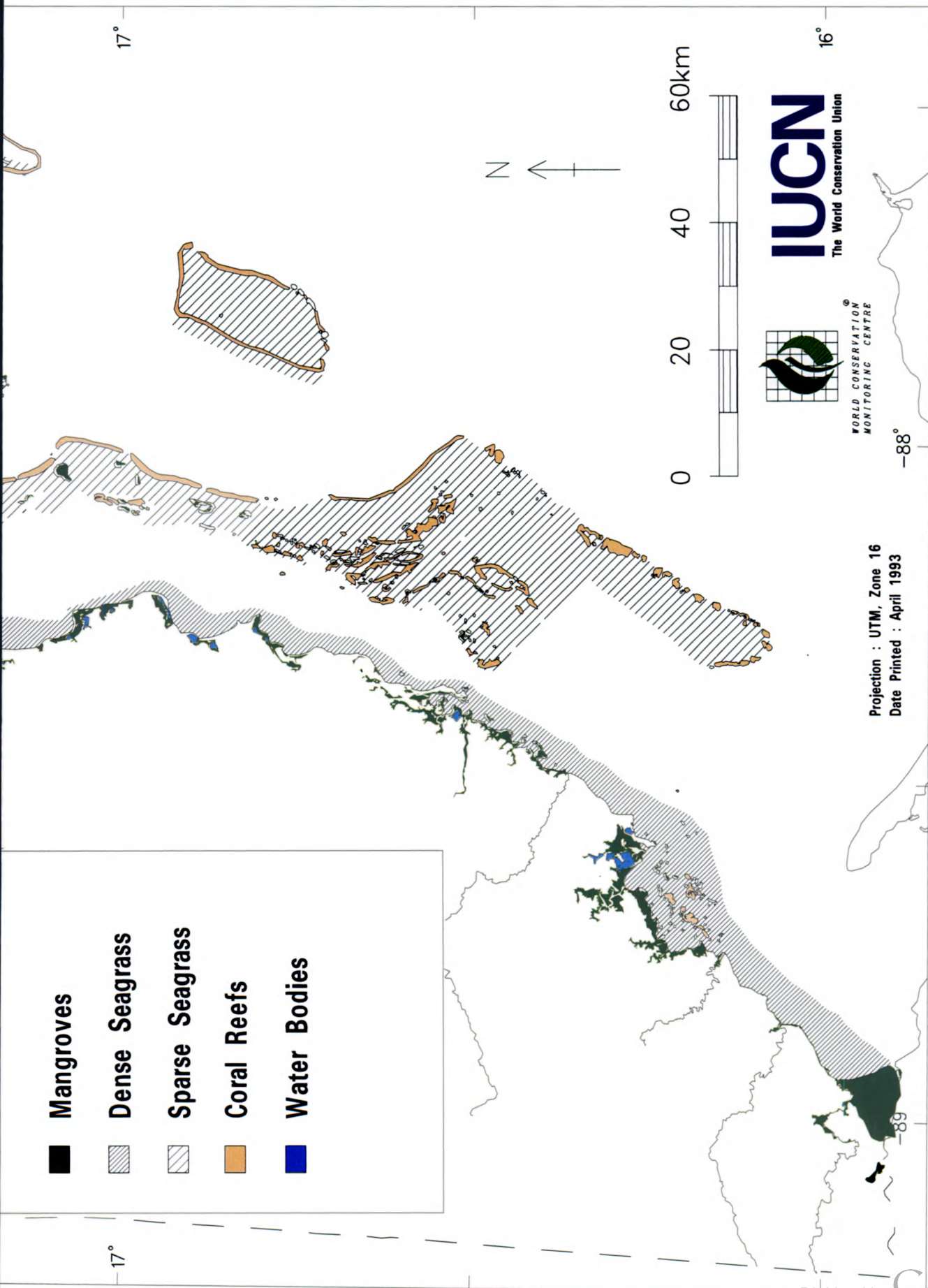




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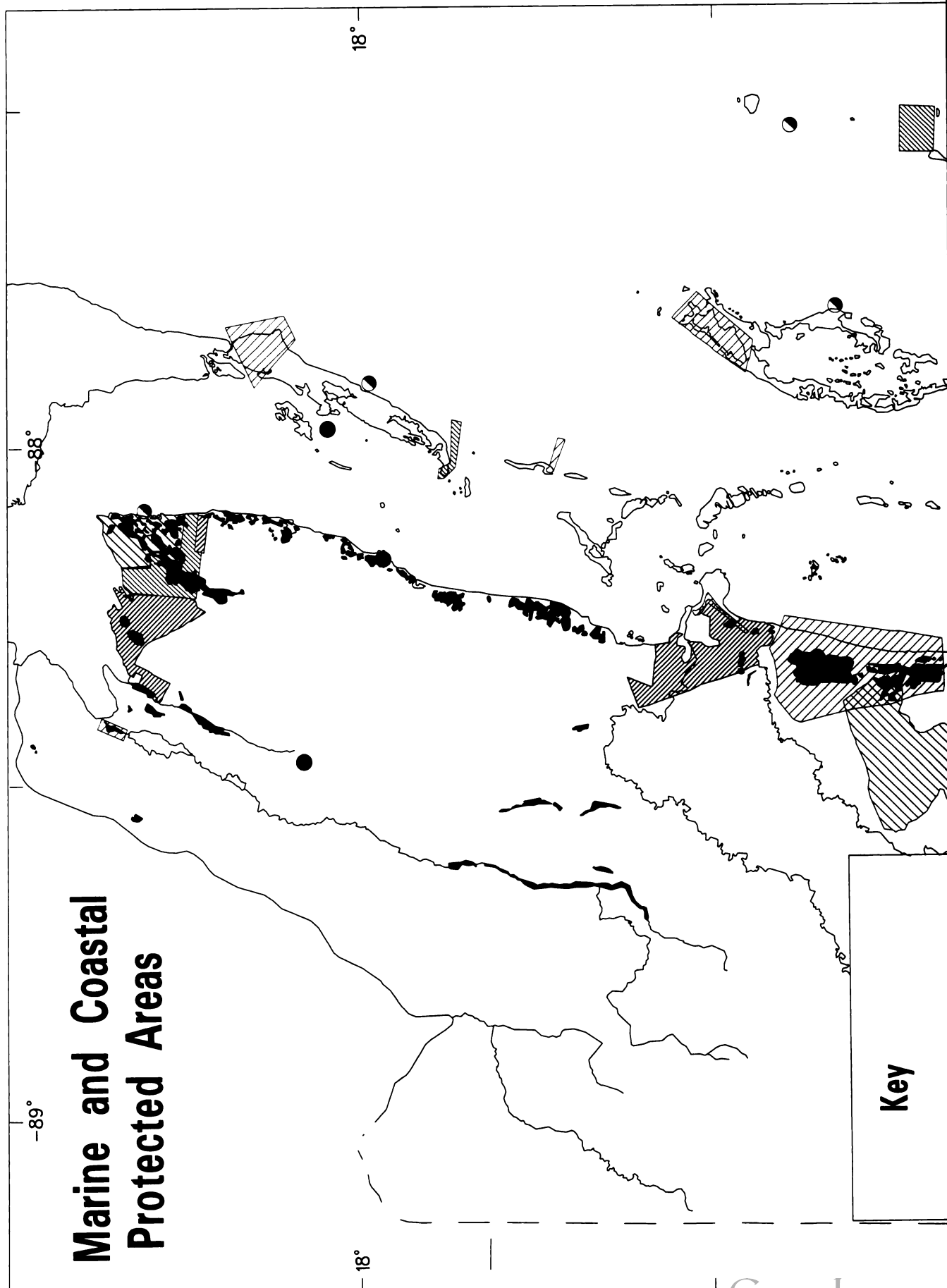
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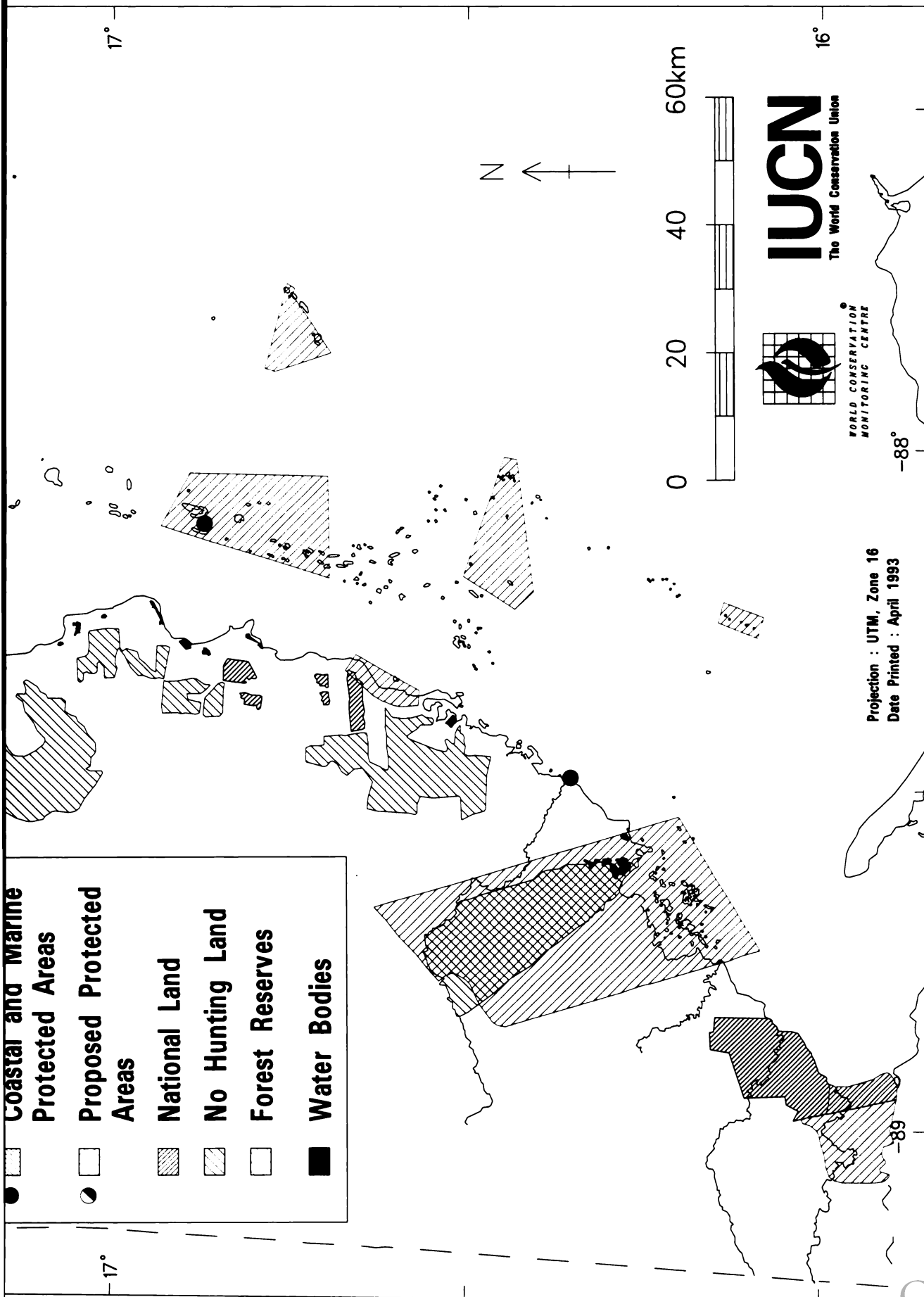




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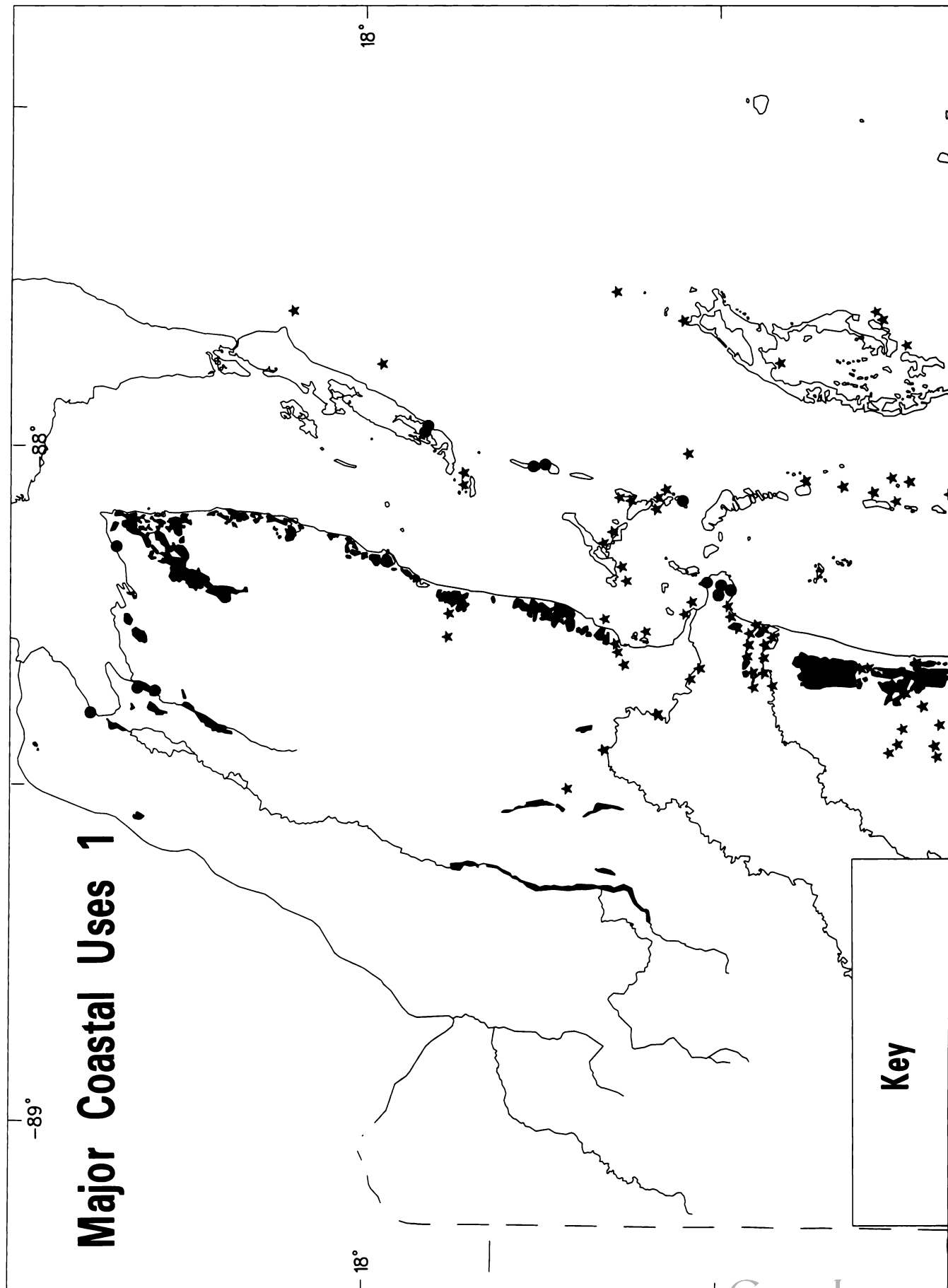
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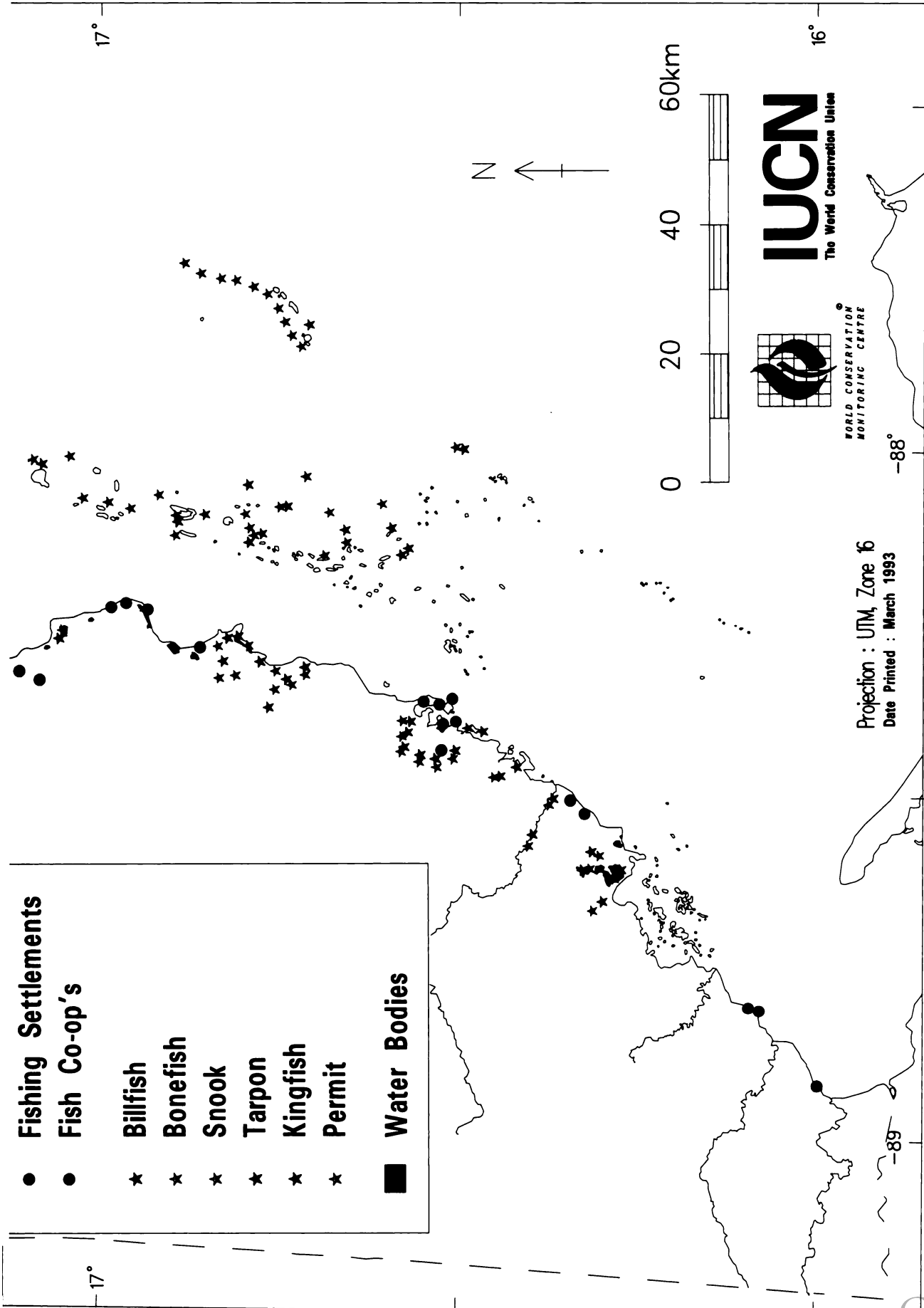




Map 4

Map 5

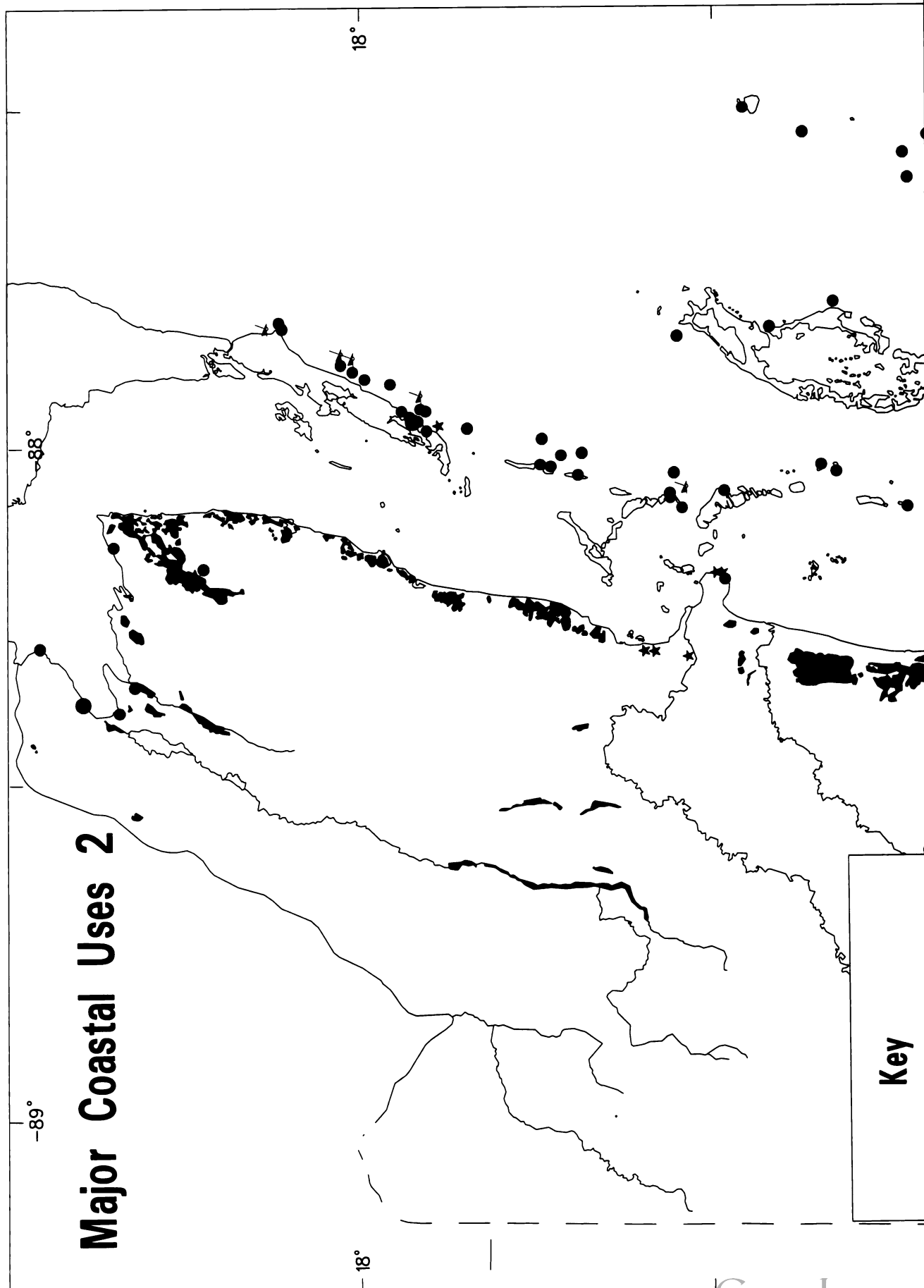


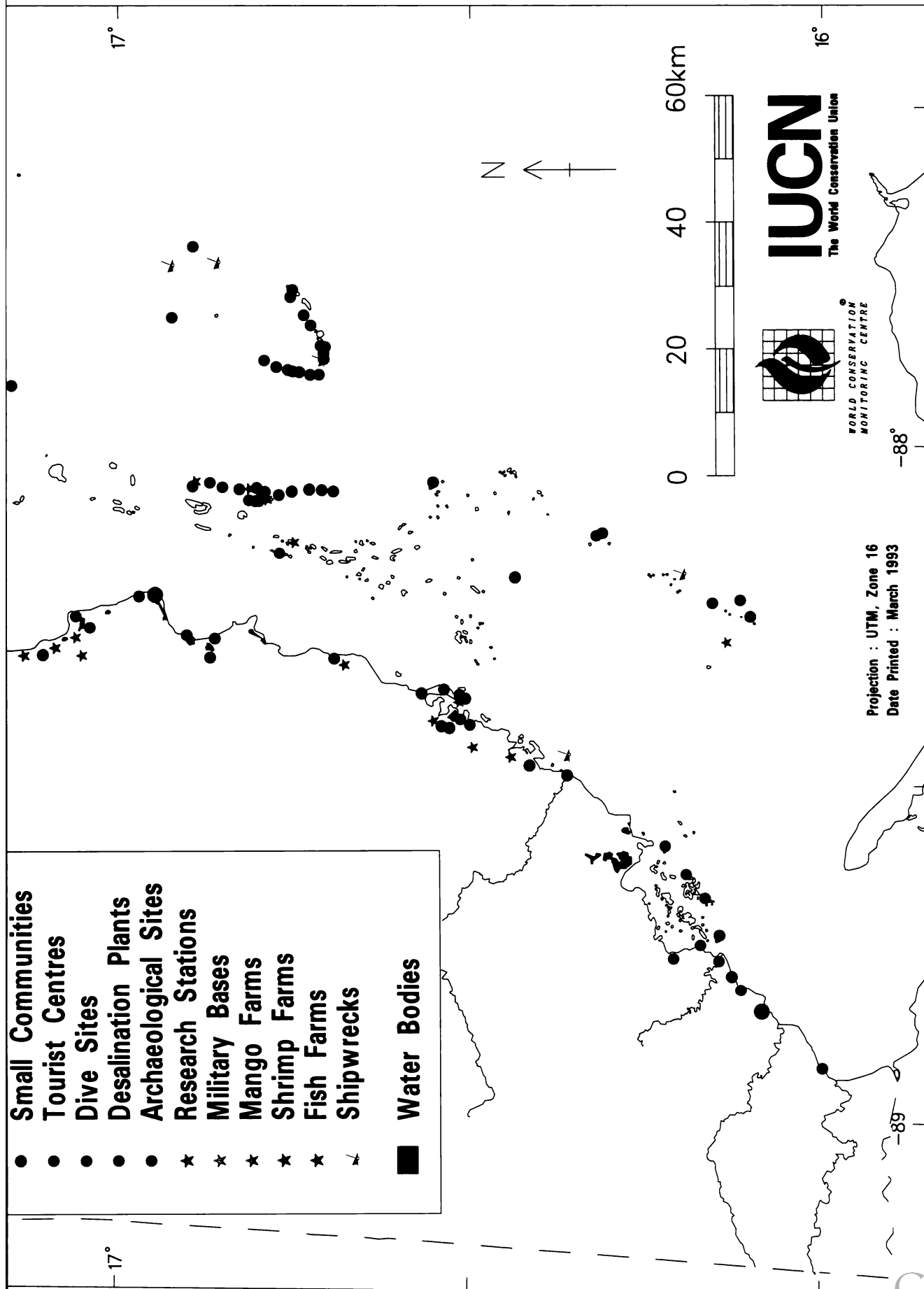


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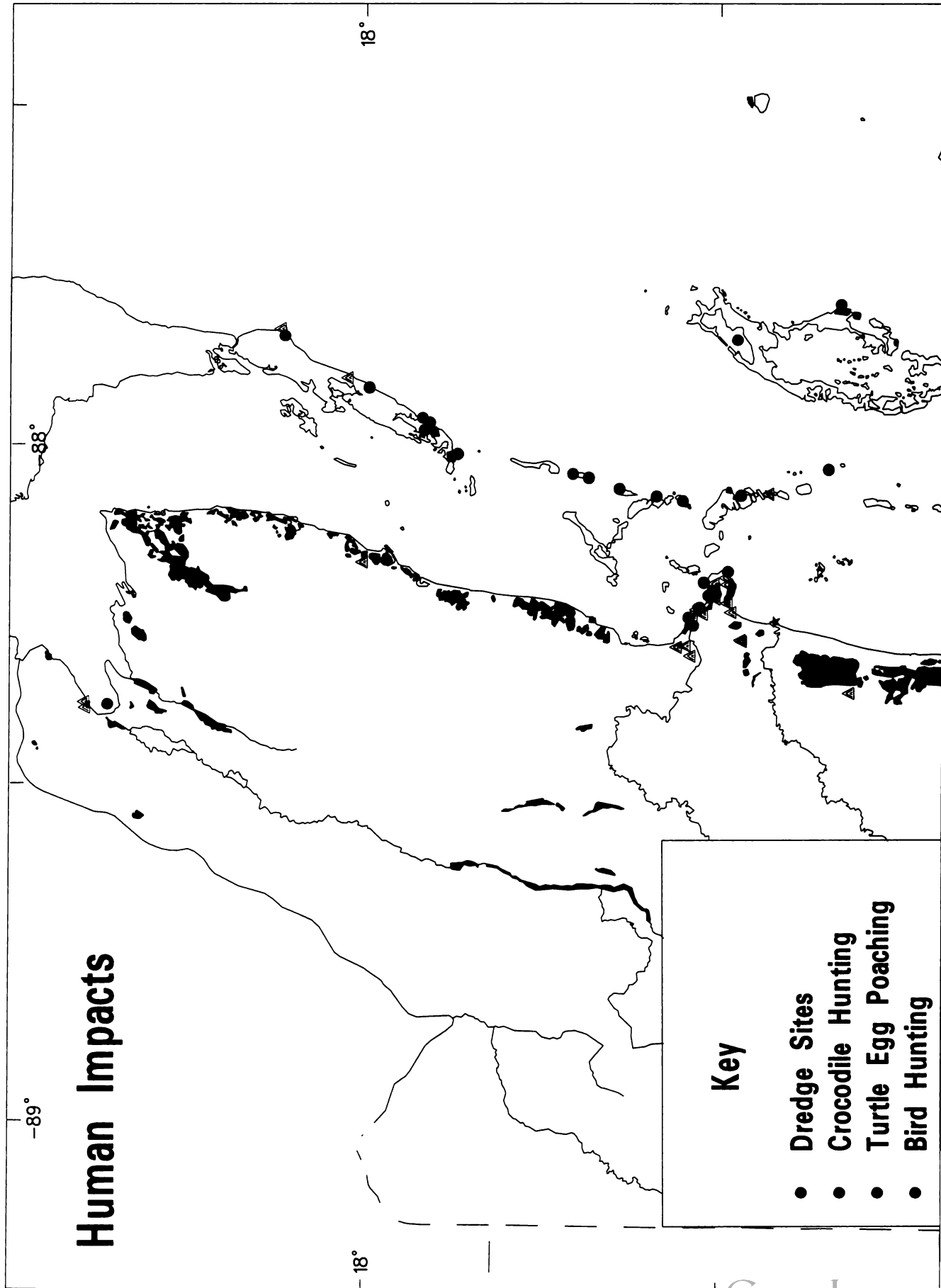
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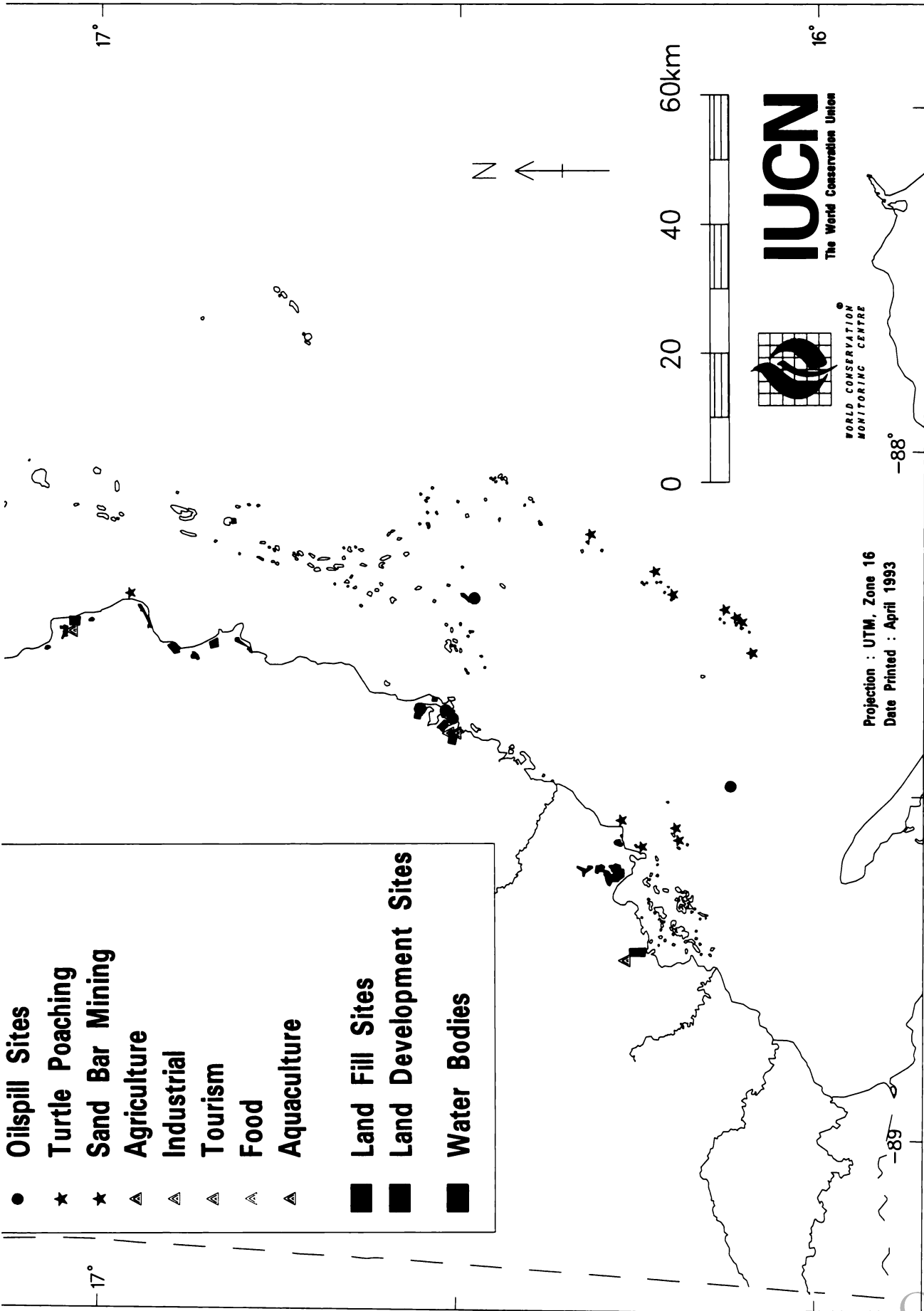
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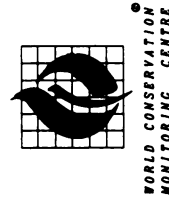
Map 7





- Oilspill Sites
- ★ Turtle Poaching
- ★ Sand Bar Mining
- ▲ Agriculture
- ▲ Industrial
- ▲ Tourism
- ▲ Food
- ▲ Aquaculture
- Land Fill Sites
- Land Development Sites
- Water Bodies

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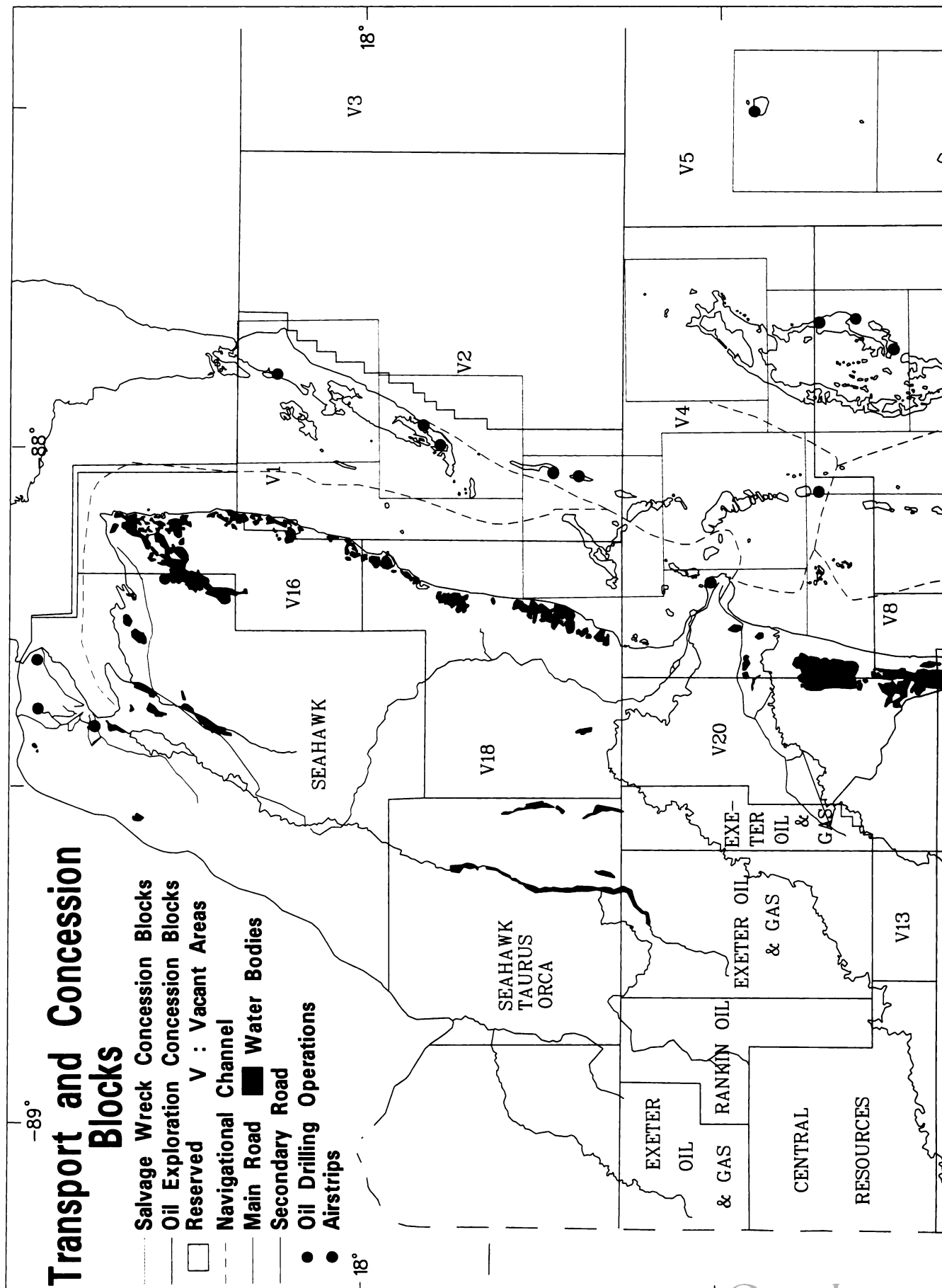
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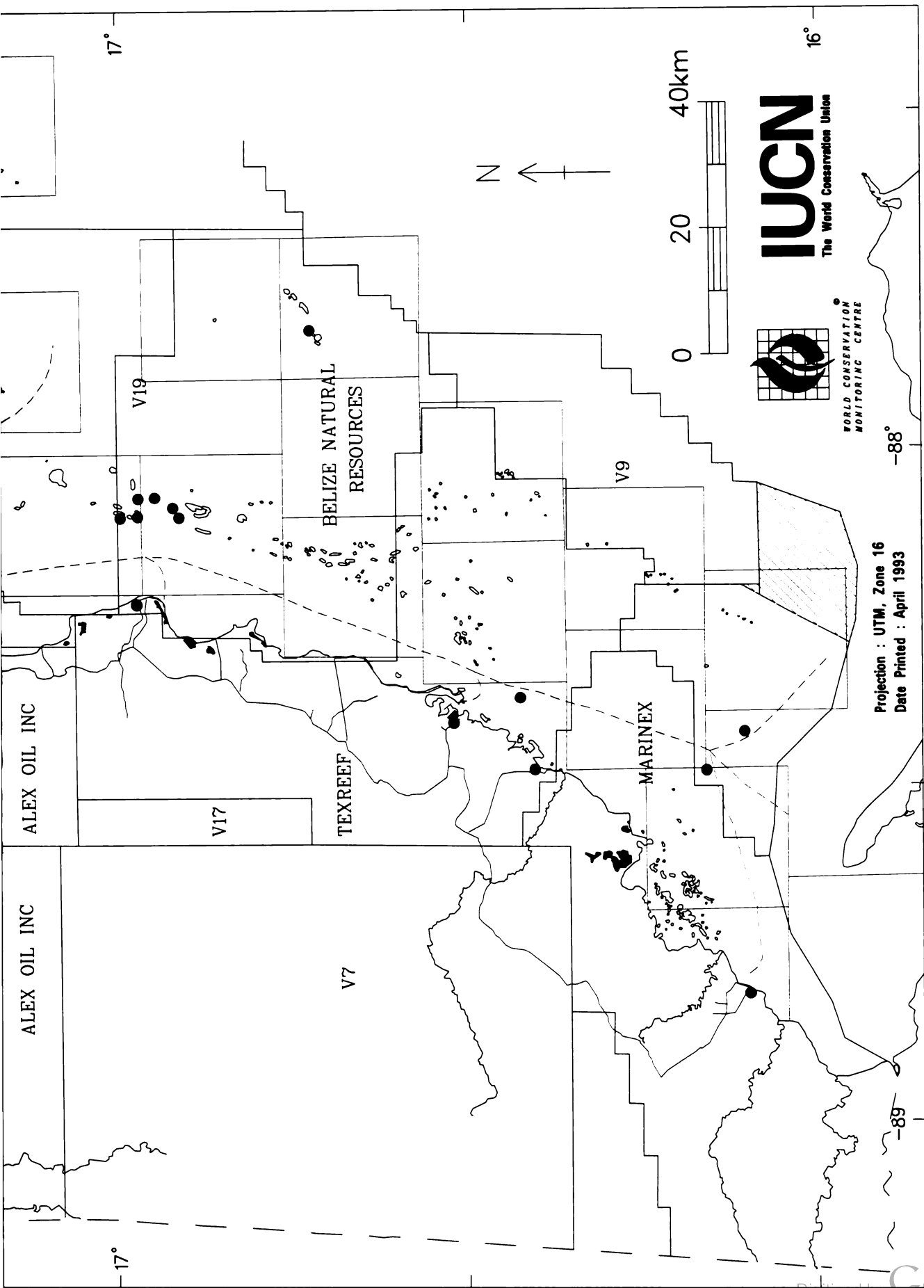
Map 7

Map 8

Transport and Concession Blocks

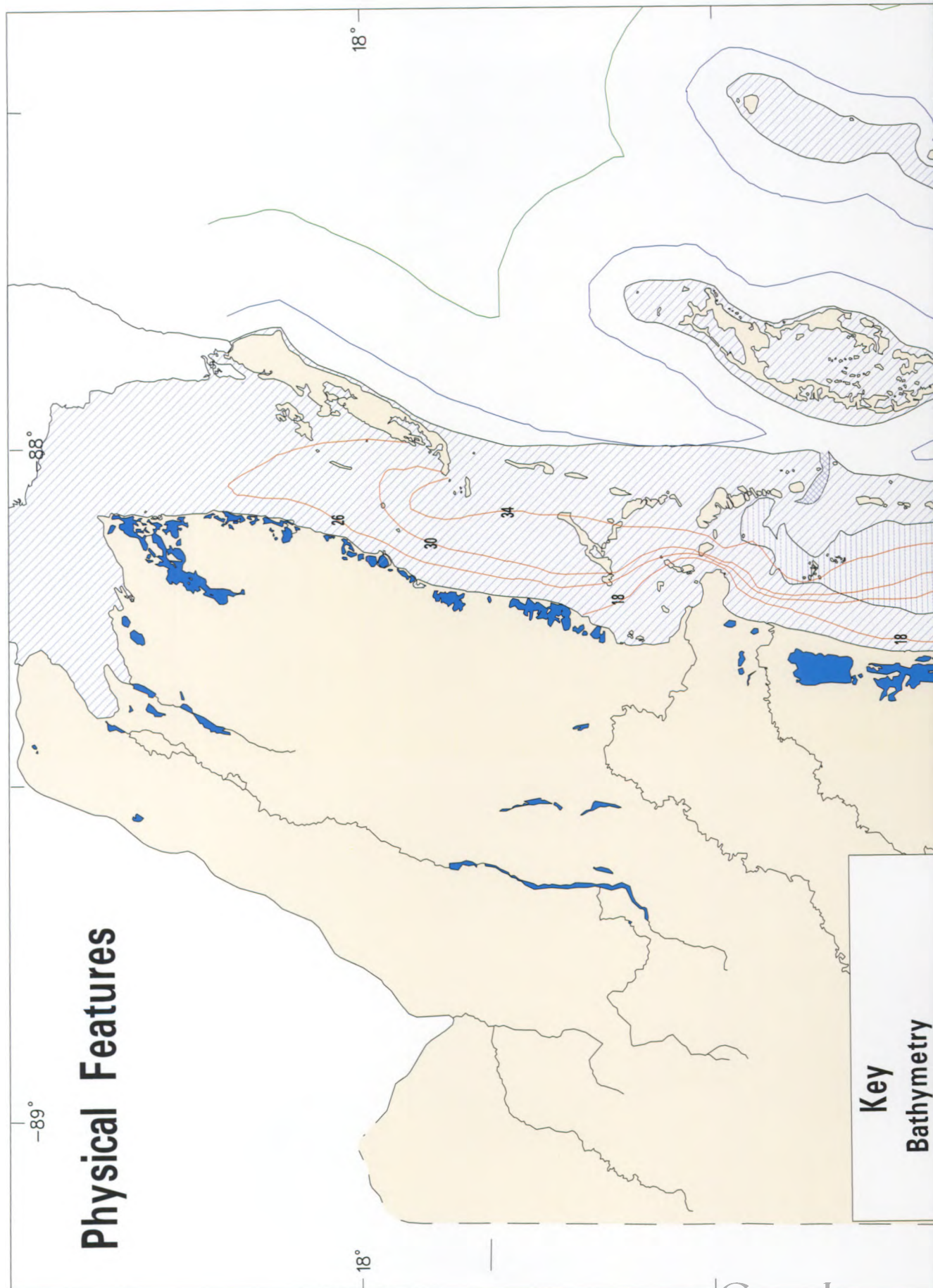
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- Oil Exploration Concession Blocks
- Reserved V : Vacant Areas
- Navigation Channel
- Main Road Water Bodies
- Secondary Road
- Oil Drilling Operations
- Airstrips

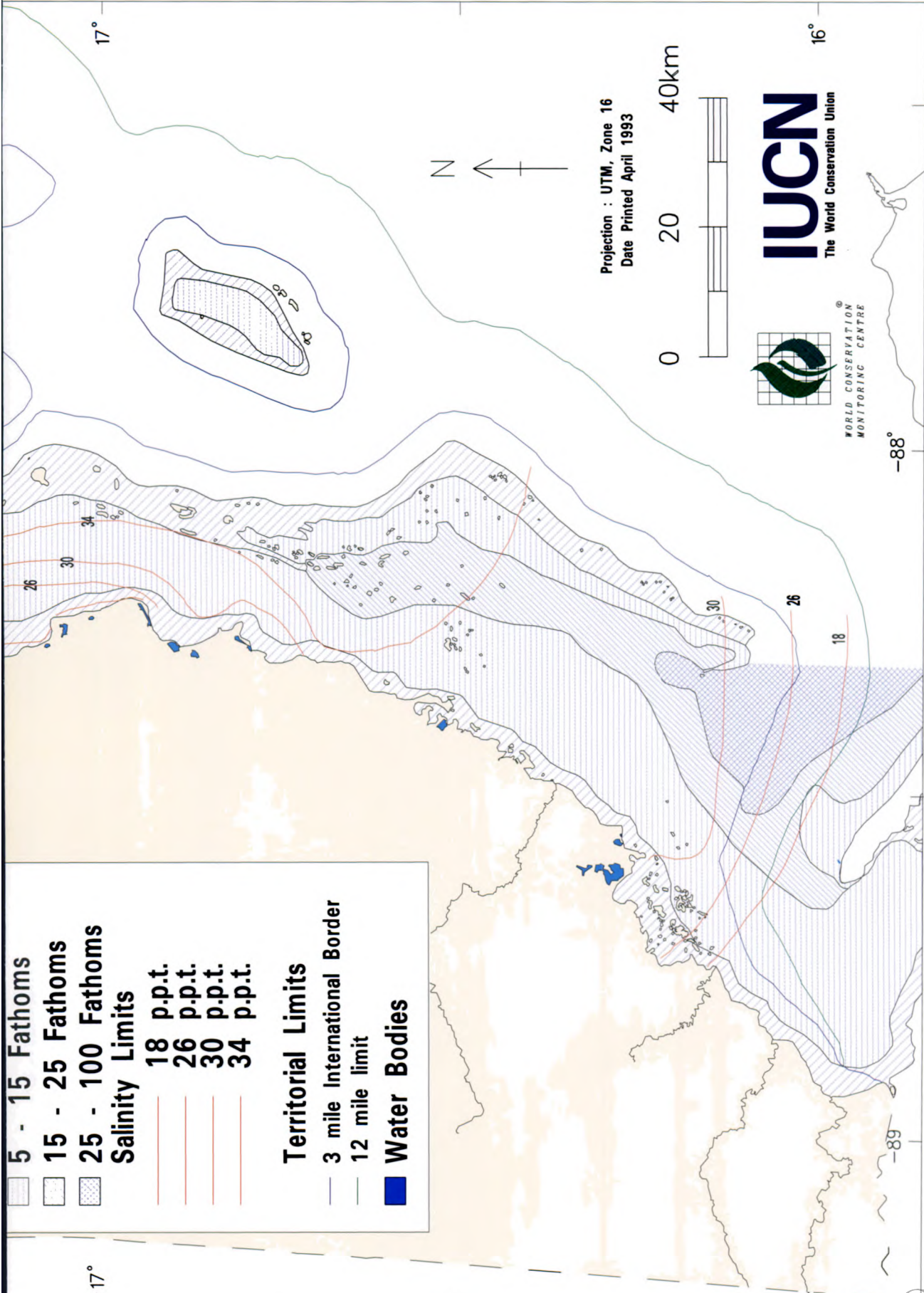




Map 8

Map 9





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