

## PROTECTION OF ARID KARSTLANDS ON THE CAPE RANGE PENINSULA, WESTERN AUSTRALIA.

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### INTRODUCTION

The broad coverage of the conservation issues in Australian cave communities, mostly karst, has been prepared by Hamilton-Smith and Eberhard (in press). Here I address a single area in detail that epitomises some general problems facing karst conservation under even the most favourable circumstances — the important Cape Range karst province of Western Australia.

Cape Range (elevation 314 m) lies within the arid tropics (fig. 1) and comprises Tertiary orogenic limestones, one of which is highly cavernous. It is bordered by Quaternary deposits overlying the coastal plain and within which the groundwater forms a Ghyben-Herzberg system in which a freshwater lens floats on sea water. A coral reef follows the west coast and Barrow Island lies 170 km to the north-east on the shallow North West Shelf.

The subterranean fauna of the Cape Range peninsula is amongst the most diverse in the world. The fauna, with that of Barrow I., is entirely endemic, often at the generic level, and comprises 6.2% of the troglifauna of the World's tropics (aquatic 5.5%, terrestrial 6.6%; based on Peck and Finston, 1993). The fauna has various origins and habitats.

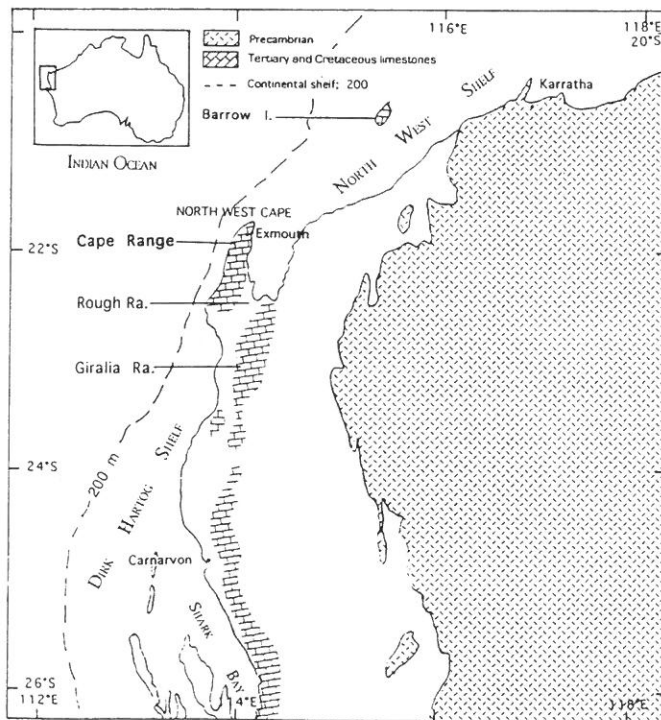


Figure 1: Geographical context of the Cape Range karst province.

A diverse, regionally differentiated, troglifauna with lowland rainforest affinities occurs in the humid caves of the range itself, while a distinct, but closely related, troglifauna inhabits the coastal plain and, in part, Barrow Island. Stygo fauna within the range is limited to the four caves containing standing water and is not diverse. A diverse stygo fauna inhabits the

foothills and coastal plain and represents, in part, a relict tethyan community inhabiting both anchialine and limnic waterways — many species are far removed from congeners in the North Atlantic. The fauna includes marine (e.g. polychaetes), anchialine (e.g. *Thermosbaenacea* and *Remipedia*), and freshwater (e.g. bogidiellid amphipods and syncarids) lineages.

While such communities may be expected to be resilient to major climatic change, anchialine systems in particular are considered highly vulnerable to organic pollution and elsewhere are the subject of widespread conservation assessment.

In the context of karst conservation Cape Range is possibly unique in that human impacts to date have been minimal for a number of reasons:

- *Low human impact regionally:* Aboriginal Australians having a marine economy inhabited the area for >30,000 (Morse, 1993) but Exmouth (pop. c. 2500), the only town in the region was established recently (1966) giving an average density of <1 person km<sup>-2</sup> still primarily focused on the sea. Arid zone pastoralism has not resulted in land clearance.
- *Difficulty of access:* only three tracks penetrate the arid range and the closest major Australian cities are 1200 km and 2900 km distant.
- *Low caving impact:* remoteness and lack of a vertical caving tradition in W.A. has meant that most cave discovery has been concurrent with biospeleological work: from 1987 and 1996 the number of items in the Cape Range karst index rose from 112 to >580, predominantly caves in Cape Range itself but with an increasing number of coastal sites.
- *Incorporation into the conservation estate:* although only recognized recently as a major troglofauna province, c. 33% (506 km<sup>2</sup>) of the area was incorporated into a conservation reserve between 1964-69. From 1974 to 1996 several recommendations (1974-1996) were made to more than double the size of Cape Range National Park (CRNP) to include most of the physiographic unit — an area inscribed in the Register of the National Estate (RNE) since 1978 and the entire peninsula nominated for inclusion. Expansion of the park was endorsed by the State Cabinet (1975) but later rescinded (1979) on account of mineral interests. In 1975, starting a process that hemmed-in the park, most of the eastern part of the CRNP and the proposed extensions, were incorporated into a Temporary Reserve for Limestone (namely for mining), while the southern boundary was acquired by the Australian Commonwealth Government as a bombing range. The eastern coastal plain is rapidly being alienated from potential conservation estate.

Ningaloo reef is within Ningaloo Marine Park (est. 1987 and extended into Commonwealth waters to the edge of the continental shelf from 1987 and 1992) that incorporates the maritime carbonate province totaling 4566 km<sup>2</sup> abutting the western side of CRNP and southwards for 260 km.

#### Threatened?

With low population and large areas already within the conservation estate, is there a real threat to the karst and its contents? Despite the advantages discussed above there are sufficient other interests — predominantly concerning mining tenements (limestone and petroleum), water resources, and local government interested in its resource base — such that it has not yet proved possible to have the area managed as a major karst province.

- In only two years, seven of nine sites — recommended for inclusion in the register of the National Estate owing to cave fauna (Humphreys, 1995: Table 34) — have been

destroyed, their long-term viability severely compromised, or they have had close calls. These include C-361 (deliberately destroyed) and C-452 (unique location for several troglobite species).

- In the last several years considerable pressure has arisen to exploit the many opportunities for development of the Cape Range peninsula. About 200 projects have been signaled to the EPA (M. Blackwell, pers. comm. 1996) ranging from ecotourism through to petroleum and mineral extraction and processing, and the associated infrastructure — particular note should be made of the water abstraction and waste disposal — mostly centred on the east coast of the peninsula. As late as September 1996 a large, unsewered, rural subdivision was approved in this arid area listed on the RNE, which incorporates the coastal karst and primary dunes and does not preclude use of groundwater from the anchialine system (EPA, 1996), despite the protected fauna and a prior recommendation, by the EPA itself, to include the area within CRNP.

## RESPONSE

### Education

Renewed development interest in the early 1990's stimulated the first symposium on Cape Range which, while somewhat premature because few concentrated studies had focused on the peninsula, specifically attempted to attain a synthesis in the context of a meeting on biogeography. The more wide ranging resource and conservation debate is much needed now that there is a better balance between the information available on the geological and biological resources of the area *vis-à-vis* other areas with similar geological resources (Humphreys 1993: ix). This latter debate has not been adequately aired.

Sparse, but sufficient groundwork had been done on the karst and cave fauna (Humphreys, 1993, 1994) to signal a warning that unconstrained development could heavily impact the karst system within the range. However, the greatest pressure for development undoubtedly lies on the coastal plain owing both to its geomorphology and its proximity to the sea. The area is now recognised to be important for the conservation of subterranean fauna, as well as of tropical karst. I want to explore what is being done and what is possible under current Australian legislation.

### Recognition of its general importance

In 1996 Australia successfully sponsored that karst should be included within the Ramsar Convention's wetland classification system. The Cape Range peninsula is now recognised to contain ancient relict fauna of the highest conservation status (Morton et al., 1995), for its subterranean wetlands (ANCA, 1996), and its geological (Carter, 1987), geomorphological and biological (both epigean and hypogean: papers in Humphreys, 1993) resources. Several reports recognise the importance and vulnerability of the western seaboard and Ningaloo Reef and recommend extensions to the National Park (Legislative Council, 1995; Gascoyne Coast Regional Strategy, 1996). Hamilton-Smith et al. (1996) considered that Cape Range "would be of world significance even if there was no subterranean fauna; given the existence of the fauna, it can only be rated as one of the more significant natural heritage areas of the world" [their emphases]. They recommend that the area be nominated for World Heritage status.

### Specific protection

The protection of fauna and flora in Australia is the responsibility of the States, save on Commonwealth land or where international agreements are involved. In Western Australia environmental protection lies under the auspices of the Environmental Protection Authority,

while the protection of biota lies with the Department of Conservation and Land Management, which includes *inter alia* management of the conservation estate which is vested in the National Parks and Nature Conservation Authority. These Authorities are ministerial appointments, and while various interest groups are represented, as laid down by legislation, they inevitably respond to political reality so that consistency is difficult to achieve, as is evident herein from the changes to the proposed extensions to the CRNP.

W.A. has legislative protection for endangered species but none for ecological communities (a formal system is under development but it has no legislative status); ten troglobite species from Cape Range are currently so protected which, save for two fishes, are invertebrates (five aquatic and five terrestrial species, two in the range and eight from the coastal plain). Most troglobitic species could be protected under the same legislation but it is a blunt instrument, providing no protection from habitat destruction.

Nomination under Commonwealth legislation is limited to Commonwealth land (i.e. the military facilities), but it is potentially much more powerful for it covers both species and communities and such recognition binds the Commonwealth to take cognisance of it in all areas of its responsibility (export licences, international agreements, etc.). One species (*Lasioneetes exleyi*) and a community (Thermosbaenacea-Remipedia) have been nominated under the Commonwealth Endangered Species Protection Act 1992 — implementation of nominations under the Act is in abeyance.

#### Renegotiation

In recognition that utilization of the limestone resources within the Temporary Limestone Reserve would remove a large proportion of caves known from Cape Range, the boundaries of the reserve have been renegotiated to exclude the known cavernous areas and clear the way for the park to be doubled in size by eastern and southern extensions. It proved remarkably straight forward to pursue this limited objective — the wider issue, as to why the limestone reserve has to be in highly karstic Cape Range, remains largely unaddressed — as proper assessment determined the best quality limestone for mining to be in the south where it is thought that the genetically rather homogeneous troglobite populations (Adams and Humphreys, 1993) are less vulnerable — unique species are a more common occurrence in caves to the north. Preexisting mining tenements in the north of the range — currently the subject of a major limestone mining proposals, for cement and lime manufacture — preclude this type of discussion, and the parties have not been prepared to trade-off the existing tenements — known to contain caves, troglobites and archaeological sites (Hamilton-Smith et al., 1996) — against the extensive high quality resource identified to the south and which are proposed to be reserved for mining and conservation.

#### Water resources

All the water for development in this arid region needs to be drawn from the karst aquifer that is home to, or upstream of, at least some of the stygofauna. The water supply authority took cognisance early of the presence of stygofauna in the water supply and undertook studies to determine the likely impact of water abstraction on the stygofauna. The EPA has set tight monitoring procedures for the stygofauna in the water supply and a number of dedicated monitoring bores have been established.

#### CURRENT POSITION

About a quarter of the overall distribution of the subterranean fauna lies within the Cape Range National Park. When the proposed extensions have been implemented the known terrestrial and aquatic fauna found in Cape Range proper will be well represented within

CRNP but there will be significant elements in the northern end of the range that are not included in conservation reserves. No extensions to the conservation estate affecting the coastal plain — containing the most vulnerable and poorly represented components — have been accepted. Discussions on a regional development plan and a karst management policy are evolving slowly but there is no moratorium on developments that could restrict the options.

#### KEY REFERENCES

- Adams, M. and Humphreys, W.F. 1993. Patterns of genetic diversity within selected subterranean fauna of the North West Cape peninsula, Western Australia: systematic and biogeographic implications. *Records of the Western Australian Museum, Supplement 45*: 145-164.
- EPA, 1996. Special residential development, Lyndon locations 222 and 223, Exmouth. Bulletin 829. W.A. Environmental Protection Authority, Perth.
- Hamilton-Smith, E. and Eberhard, S., in press. Conservation of cave communities in Australia. in H. Wilkens, D.C. Culver and W.F. Humphreys (eds). *Ecosystems of the World, vol. 30. Subterranean Biota*. Elsevier, Amsterdam.
- Hamilton-Smith, E., Kiernan, K., and Spate, A., 1996, Karst management considerations for the Cape Range karst province, Western Australia. A report prepared for the Department of Environmental Protection, August 1996.
- Humphreys, W.F. (Ed.) 1993. The biogeography of Cape Range, Western Australia. *Records of the Western Australian Museum, Supplement 45*:1-248.
- Humphreys, W.F. 1994. *The subterranean fauna of the Cape Range coastal plain, northwestern Australia*. Report to the Australian Heritage Commission and the Western Australian Heritage Committee. 202 pp. Unpublished.
- Peck, S. B. and Finston, T. L., 1993. Galapagos Island troglobites: the question of tropical troglobites, parapatric distributions with eyed sister species, and their origin by parapatric speciation. *Mémoires de Biospéologie*, 20: 19-37.
- Yager, J. and Humphreys, W.F. 1996. *Lasionectes exleyi*, sp. nov., the first remipede crustacean recorded from Australia and the Indian Ocean, with a key to the world species. *Invertebrate Taxonomy* 10: 171-187. [details the anchialine system]

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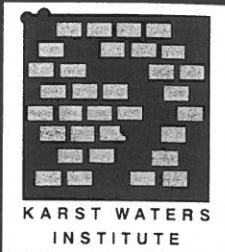
## PROTECTING THE HABITAT: STATE LAWS AND ENDANGERED CAVE SPECIES

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This is the third in a proposed series of survey projects and ultimately articles the use of the legal system for cave habitat protection. The first (Huppert, 1995) was a general survey of federal and state laws that could be specifically directed toward cave protection. The second (Huppert, 1996) was devoted to liability statutes and their effect on caves, cavers, and conservation.

Since the passage of the federal Endangered Species Act in 1973 a number of states have enacted their own law to protect specific species that did not meet the national standards required by the federal act. These state laws are directed at species that may be endangered in the state, but not nationally. The federal act in most cases requires protection of habitat for endangered species. State laws vary in this requirement. Also, some state laws apply only on state and, usually, on federal land. A listing of laws and species is presented for informational purposes.



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Special Publication 3

*D. Humphrey*

**Conservation and Protection of the  
Biota of Karst**

Extended Abstracts and Field-Trip Guide  
for the symposium held  
February 13 through 16, 1997  
Nashville, Tennessee

Edited by Ira D. Sasowsky, Daniel W. Fong, and Elizabeth L. White

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