UNITED NATIONS ENVIRONMENT PROGRAMME

Management and conservation of renewable marine resources in the Kuwait Action Plan region

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PREFACE

The United Nations Conference on the Human Environment (Stockholm, 5-16 June 1972) adopted the Action Plan for the Human Environment, including the General Principles for Assessment and Control of Marine Pollution. In the light of the results of the Stockholm Conference, the United Nations General Assembly decided to establish the United Nations Environment Programme (UNEP) to "serve as a focal point for environmental action and co-ordination within the United Nations system" (General Assembly resolution 2997(XXVII) of 15 December 1972). The organisations of the United Nations system were invited "to adopt the measures that may be required to undertake concerted and co-ordinated programmes with regard to international environmental problems", and the "intergovernmental and non-governmental organisations that have an interest in the field of the environment" were also invited "to lend their full support and collaboration to the United Nations with a view to achieving the largest possible degree of co-operation and co-ordination". Subsequently, the Governing Council of UNEP chose "Oceans" as one of the priority areas in which it would focus efforts to fulfil its catalytic and organising role.

The Regional Seas Programme was initiated by UNEP in 1974. At present, it includes eleven regions[1/] and has over 120 coastal States participating in it. It is conceived as an action-oriented programme having concern not only for the consequences but also for the causes of environmental degradation and encompassing a comprehensive approach to controlling environmental problems through the management of marine and coastal areas. Each regional action plan is formulated according to the needs of the region as perceived by the Governments concerned. It is designed to link assessment of the quality of the marine environment and the causes of its deterioration with activities for the management and development of the marine and coastal environment. The action plans promote the parallel development of regional legal agreements and of action-oriented programme activities[2/].

The Regional Seas Programme has always been recognised as a global programme implemented through regional components. Interregional co-operation among the various sea areas on common problems is an important element in assuming the compatibility of the different regional components.

1/ Mediterranean Region, Kuwait Action Plan Region, West and Central African Region, Wider Caribbean Region, East Asian Seas Region, South-East Pacific Region, South-West Pacific Region, Red Sea and Gulf of Aden Region, Eastern African Region, South-West Atlantic Region and South Asian Seas Region.

2/ UNEP: Achievements and planned development of UNEP's Regional Seas Programme and comparable programmes sponsored by other bodies. UNEP Regional Seas Reports and Studies No. 1. UNEP, 1982.

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This document reviews past and on-going conservation activities relevant to the Kuwait Action Plan region at the regional and national levels, identifies priority concerns of the Governments bordering the region, and contains recommendations for interregional and regional projects to be undertaken to address these concerns. The assistance of A.R.G. Price in the preparation of this document is gratefully acknowledged. In addition, the sections concerned with fishery aspects of conservation have been prepared by J. Beddington and J.A. Gulland. The report has been compiled and edited by the Tropical Marine Research Unit, University of York, UK.

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INTRODUCTION

Area Covered

The Kuwait Action Plan (KAP) region comprises eight countries, namely: Iran, Iraq, Kuwait, Saudi Arabia, Bahrain, Qatar, the United Arab Emirates (UAE) and the Sultanate of Oman. The first seven countries border the Inner Gulf, while the shoreline of the Sultanate of Oman borders the Gulf of Oman and the Arabian Sea, both of which differ appreciably from the Inner Gulf. The southeastern geographical boundary of the KAP region is determined by rhumb lines from Ras Dharbat Ali (16°39'N,53°3.5'E) to a position 16°00'N,53°25'E; thence through the following positions: 17°00'N,56°30'E and 20°30'N,60°00'E to Ras Al-Fasteh (25°04'N,61°25'E). The northern boundary is the head of the Inner Gulf at latitude 30°30'N.

Long before the advent of the oil industry, the KAP region was important as a major artery of seafaring. It functioned as a trading route, which before the tenth century extended even as far as China. However, the wealth generated by the development of oil industry in the 1930's and 40's brought rapid changes and modernisation within these States.

Numerous accounts and reviews of the physical and general characteristics of the Inner Gulf region are available in the literature (e.g. Purser, 1973; Kuronuma, 1974; Unesco, 1976, 1984; Basson et al., 1977; UNEP, 1980a,b,c,d,e; 1984a; Price et al., 1982; Nelson-Smith, 1984), whereas the coastal region of Oman has received less attention. However, useful environmental information on Oman is given by UNEP (1980e), and the results of a recent ecological study are presented by Barratt (1984). A number of useful bibliographies covering the whole of the KAP region have also been compiled (Paldi, 1968; Rahim, 1979; Farmer & Docksey, 1983; UNEP, 1984b). The account below merely highlights the main physical and general features.

Since the Inner Gulf probably formed during the Miocene it is, geologically, a young sea. Following a world-wide lowering of sea level during the subsequent Pleistocene glacial periods, the basin dried up completely. The marine biota would therefore have been destroyed, an event which may well have influenced the present day distribution of marine life.

The Inner Gulf is now a semi-enclosed sea measuring c. 1000 km by 200-300 km. The average depth is only 35 m, and the maximum 100 m near the 111 km wide Strait of Hormuz; this constricted entrance provides the only connection with the outside Gulf of Oman and Arabian Sea. The basin in southern and western parts is covered with biogenic and evaporitic sediments derived from sea water, The northeastern area is deeper and the deposits are mostly of terrestrial origin carried by streams and rivers, e.g. the Tigris and Euphrates. Biological habitats in the region are represented by at least 3 critical marine habitats: intertidal flats/marshes, sometimes containing mangroves; coral reefs and seagrass beds. The paramount importance, but widespread demise, of these habitats in the area is well documented (see Basson et al., 1977; Price, 1982a; TMRU, 1982; Price et al., 1983). A great variety of other intertidal and sublittoral marine habitats are also available to marine biota.

The land movements which formed the Inner Gulf also created the physical environment of the Oman coastline. However, in contrast to the Inner Gulf, the coastal waters of Oman (i.e. Gulf of Oman & Arabian Sea) are much deeper, and the conditions prevailing resemble more closely those of the Indian Ocean. Intertidal habitats of Oman are represented by sandy and various types of rocky beaches, as well as mangrove-fringed bays. Of the sublittoral habitats coral

reefs are not widespread. However, of particular significance and interest are the dense sublittoral kelp beds, which appear to support unique biological communities (Barratt, 1984).

Climate

Knowledge of climate within the KAP region is of great significance, since it strongly influences oceanographic conditions within coastal waters of the various countries.

The Inner Gulf is a nearly enclosed, subtropical sea lying between the arid land masses of Iran and the Arabian peninsula. The climate of the bordering countries is therefore essentially continental rather than maritime. Summer months are characterised by searing heat (45-50°C), lack of rain and at times strong NW shamal winds. During this period humidity may be high, approaching 100% RH in autumn. In the winter months of December - February air temperatures may descend to nearly 0°C. Strong winds, some rain and thunderstorms, interrupted by milder weather, are characteristic features of this season. The combined effects of generally high temperatures, strong winds and limited freshwater input results in abnormally high salinities (see below).

The climate of Oman differs appreciably from that of the Inner Gulf, and the country is affected by two different climatic zones: a Mediterranean zone to the north, and a tropical zone from the Indian Ocean to the south. On the north coast, June temperatures average 38°C but may even reach 50°C, whereas at Salalah on the south coast the temperature is a modest 32°C during the hottest month (May). Winter temperatures typically descend to below 25°C on both the north and south coasts. The monsoon regime of the Arabian Sea strongly influences the climate of southern Oman. During November - April the NE monsoon prevails, whereas from April - October the system reverses and the SW monsoon predominates. The latter, in particular, is of great significance as it results in water movements that create cold-water upwelling and notably high productivity (see below). Rainfall within Oman is erratic and unevenly distributed. The annual average is 104.3 mm, though there are considerable regional differences (Whelan, 1981).

Oceanography

Oceanographic information for the Inner Gulf is available in a number of reports (e.g. Enomoto, 1971; Kuronuma, 1974; Unesco, 1976, 1984; Hughes & Hunter, 1979; Hunter, 1980; Price, 1982b). Less has been published on the oceanography of Omani waters, though basic data are provided by several authors (e.g Sewell, 1934; Wyrtki, 1971,1973; Currie et al., 1973; McGill, 1973). Oceanographic measurements have also been made recently (1983) from r/v DR FRIDTJOF NANSEN (unpublished data).

Surface and coastal waters of the Inner Gulf are subject to wide temperature changes in response to daily and seasonal climatic variations. In contrast to other seas, these fluctuations generally affect the entire water column and are not buffered by any deeper body of oceanic water. Actual surface water temperatures range from less than 15°C to more than 30°C. In the Gulf of Oman (at Mina al Fahal) surface temperatures range from 20-30°C (Edwards, 1984), whereas on the south coast they may fall to 16°C during periods of upwelling. However, there is considerable local variability.

Salinities within the Inner Gulf are high, averaging c. 40°/oo, but increasing to more than 70°/oo at the southern end of the Gulf of Salwah. In hypersaline lagoons, salinities exceeding 70°/oo have been recorded and still support more than 40 species of plants and animals (Basson et al., 1977). Salinities along the Oman coast are less severe than within the Inner Gulf. During February, the salinity is >37°/oo in the Gulf of Oman and 36-37°/oo on the south coast, whereas in August values are generally 36-37°/oo and 35-36°/oo respectively (Couper, 1983).

Data on nutrient levels in the area are given by various authors (e.g. Brettschneider et al., 1970; Rabsch, 1972; Unesco, 1976; Basson et al., 1977; Price, 1982b). In western areas of the KAP region, nutrient concentrations fluctuate considerably, but are generally higher in interior bays than in nearshore and offshore waters. Nutrient concentrations around Oman vary seasonally according to the monsoon system. For example, in areas of intensive upwelling during the SW monsoon inorganic phosphate levels may rise to >2.0 mic.g.at.l^{-1} (Currie et al., 1973).

Information on oxygen levels within the Inner Gulf is limited, although Unesco (1976) and Basson et al. (1977) provide some data. In general, oxygen seems not to act as a limiting factor to marine life except in certain localised areas. Little published information on oxygen levels is available for Oman, and the results from the survey of r/v DR FRIDTJOF NANSEN have yet to be fully evaluated. However, it appears that the waters of Oman are mostly well oxygenated, though critically low levels have been observed below 100 m off the Gulf of Oman (Unesco, 1976).

Primary (phytoplankton) and secondary (zooplankton) productivity in the Inner Gulf vary seasonally and spatially. Nevertheless, there is evidence that it is among the most productive water bodies in the world (see Couper, 1983). Recent studies also suggest that primary productivity from seagrass and shallow-water benthic algae may be of even greater importance than the contribution from phytoplankton (Basson et al., 1977; Price et al., 1983). In Oman, phytoplankton and zooplankton levels are influenced by the monsoon. Chlorophyll (phytoplankton) standing crop values within the Gulf of Oman range from 0.18 mg m^{-3} during August to 1.01 mg m^{-3} in May (Jones, 1984). A recent survey of southern Oman has also shown the importance of benthic algal (kelp) productivity to the coastal ecology of the area (Barratt, 1984). According to Rao (1973) the (southern) Arabian coast is the richest area for secondary production in the north Indian Ocean.

The tidal regime in the Inner Gulf as a whole is complex, with an overall counter-clockwise current. There is a general flow westwards into the water body along the Iranian coast of magnitude c. 0.1 m/sec (Unesco, 1984). Tides are diurnal, semi-diurnal and mixed - in which a large "diurnal inequality" exists between the two high tides and two low tides. In the north of Kuwait tidal range varies from 3.5-4.0 m, while south of Al Khobar in Saudi Arabia the range is less than 1 m. However, because of the gentle slope of the intertidal zone, the ebbing tide may expose an expanse of tidal flats several kilometres wide. It is of biological significance that in Kuwait most spring tides occur at night during the summer, and during the daytime in winter (Collins et al., 1984). Consequently, the whole intertidal zone is seldom exposed to strong insolation during summer months. In Saudi Arabia, by contrast, tidal flats are sometimes exposed during the summer in the daytime.

The water circulation around Oman is greatly affected by the reversing monsoons. From November - April the NE monsoon results in water movements from east to west at velocities up to 1 knot. In contrast, during the SW monsoon, particularly during July and August, the direction of water flow reverses,

creating net water movement in an easterly or north easterly direction. Details of wind patterns and water circulation are of great importance to all countries of the KAP region. The track of oil slicks, for example, is highly dependent on wind and water movement.

In summary, the Inner Gulf represents a highly stressful environment, characterised by large seasonal temperature variations, fluctuating nutrient levels and high salinities. This limits the variety of organisms compared to the adjacent Indian Ocean. Whilst the resulting rather impoverished fauna is commonly referred to as "restricted", recent studies have shown that it contains a richer biota than generally acknowledged. The shallow depth and modest rate of water exchange also make the area particularly vulnerable to damage from oil spills, dispersants and other pollution. In contrast, the marine environment of Oman provides conditions more favourable to marine life, although the cold-water upwelling limits the distribution of certain organisms such as corals.