

# 20 Aquatic Man

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## SUMMARY

This chapter aims, by assessing the ability of modern humans to cope with the sea, to evaluate the plausibility of a temporarily (semi-)marine habitat in the early stages of hominid evolution. This is approached from two different angles: firstly, by discussing the physical nature of the marine environment, and secondly, by considering cultural reactions and adaptations. A short survey of oceanographic physics shows that the sea is no easy niche to invade; only a limited range of littoral areas would have been suitable dwelling places for the hypothetical aquatic apes.

As to human culture, some remarks are made about mastering the sea by floating devices, and about diving in the past and the present. Historical misinterpretations demonstrate how long it took before the physical and physiological consequences of underwater exploration were fully understood. Only in the last few decades have we acquired the technology which enables us to descend under the sea surface for more than a few minutes and at depths greater than a few metres.

References to the sea and its inhabitants in religious concepts, legends and myths indicate that, at least for the last few thousand years, mankind has been aware of the dual nature of the sea, which initially inspired mainly awe and dread of the destructive power of the sea and of its mysterious inhabitants.

## INTRODUCTION

My interest in the Aquatic Ape Theory had a threefold origin. First, over a period of several years I led a semi-aquatic lifestyle, daily spending hours in the sea, partly on the surface, partly on the seabed at a depth of several metres, for the purpose of observing and collecting fish from coral reefs, and measuring and dissecting them on the beach. Secondly, my reversal from a marine to a human biologist meant that I became professionally involved in the subject of human evolution. In the third place, Elaine Morgan's *The Descent of Woman* (1972) attracted my attention because of her discussion of the role of women in evolution.

I was therefore immediately enthusiastic when Jan Wind suggested the Aquatic Ape Theory as a topic for a joint meeting of the Dutch Association of Physical Anthropology and the European Sociobiological Society, and readily agreed to act as host at the conference to be held at Valkenburg. During personal contacts with Elaine Morgan it became apparent that she was certainly no rigid defender of the original Aquatic Ape Theory. Rather she appeared to have an open mind, receptive of any information that might elucidate the environmental conditions of the

hypothetical aquatic ape. All these circumstances led me to write this contribution.

Over geological time there have been extreme fluctuations of sea level; islands have been born and submerged again. Among the variety of scenarios that have been proposed, the hypothesis by LaLumiere (this volume, chapter 3) offers a plausible version – namely, that during the period of the Miocene drought some ex-arboreal pro-hominids became stranded on the then existing Danakil Island (now Danakil Alps). According to Hardy's Aquatic Ape Theory (AAT) (1960), aquatic features evolved as a consequence of seeking seafood. His concept has been propagated by Morgan (1982; see also 1990), and increasingly is taken seriously as an alternative scenario for the beginnings of hominid evolution (e.g. Calvin, 1986).

Most contributions to the AAT discussion focus on intrinsic physical features present in modern man, said to have been acquired during the proposed aquatic phase. The intention of this chapter is, however, to check how well-disposed the sea actually is towards us, and how easy to colonise (see Ehrlich, 1989). A short survey of current knowledge of the sea and its coasts may suggest where it would have been possible – and where impossible – for Miocene apes to turn to the sea. (Reasons for excluding freshwater wetlands are mentioned in chapters 3 and 4.)

In addition, man's methods of mastering the sea by floating devices, and hazards encountered during diving, will be discussed. Finally, religion, myth and legend may throw some light on the attitudes of (pre)historic humans towards the sea.

## SEAS AND COASTS

It is not without symbolism that the symposium on the hypothetical aquatic ancestors was held in The Netherlands, the 'Low Countries', an area largely below sea level and reclaimed from the waves by the hand of man. For many centuries, Dutchmen have had to battle against the sea, which constantly threatened to reconquer the land levied a severe toll of the lives of its fishermen and coastal dwellers. How many heraldic arms show, as our province Zeeland does, a heroic lion struggling to keep its head above the waves?

This illustrates that a life in close relation to the sea is not without danger, although some marine ecosystems offer the advantage of rich food resources (see Ellis, chapter 4). Ellis briefly mentions (page 44) the risk of wave action on rocky shores, but there are other physical properties of the sea and coasts that would have tended to inhibit pro-hominids from adopting a semi-aquatic way of living.

**The seas**

More than three-quarters of our globe – that is, in the northern hemisphere 60.5 per cent of the surface, and in the southern half 80 per cent – is covered with water. The Pacific alone covers a larger surface than all the continents put together. The average depth of the oceans is 3,800 metres. Nowadays, all the oceans and seas are mapped. But, though its surfaces may have been recorded, the world beneath the sea level is still mainly unexplored; mankind's knowledge of the ocean is still largely limited to its upper levels.

Up to the nineteenth century, the waters of the world were regarded merely as a source of sea food and a barrier to be crossed. Scientific marine knowledge remained scanty until quite recently, whereas the exploration of high mountain areas, tropical jungles and deserts, had been accomplished much earlier. Even the level of actual knowledge of the stars, first acquired thousands of years ago by the Babylonians, contrasts sharply with knowledge of the sea. Ancient writings about such phenomena as the tides, salinity of the water and storms at sea were based on guesswork and were often wildly inaccurate. Few people ever attempted to plumb the ocean depths. The Vikings, though possessing genuinely scientific knowledge about sea lanes and navigation, were not at all concerned with what went on below the surface. Throughout the Middle Ages, the knowledge of marine matters that had been acquired suffered as a result of the general eclipse of scholarship and intellectual curiosity, and during the Renaissance, although men of learning evinced a passionate interest in the underwater world, their efforts failed to produce any new insights (De Latil and Rivoire, 1956).

The first scientific study of the sea started with the investigations of such men as Rumphius (1628–1702) (Ballintijn, 1944). An important later study was the voyage of the *Beagle* (1831–1836), which was mainly a mission to study ocean currents (Darwin, 1906; Moorehead, 1969). The first general knowledge about marine physics was obtained during the voyage of the *Challenger* (1872–1876) (Colman, 1951; Reader's Digest, 1974). Only during the last few decades, with the setting up of specialised oceanographic institutes, has a thorough knowledge been amassed of the oceans and their denizens and the physical laws which control them. Yet even today the depths are not easily probed; diving deeper than 10–20 metres is hardly possible without modern equipment, and most of the earth's oceans remain unexplored.

Various factors help to explain why humans have remained at a respectful distance from the oceans for so long—obvious as well as more obscure factors, explained by simple physical and chemical laws but of paramount importance.

1 First of all, the hazards of the open sea in the shape of high waves and storms. It is true that in some coastal areas waves tend to be longer but shallower. Nevertheless, breakers dashing against the coast can render

coastal areas totally inaccessible, at least during part of the year (see further p. 311).

2 The water pressure. This increases with the depth, viz., 0.1 atmosphere/metre. The effect of this pressure on the body need not be drastic, due to the high water content of most tissues, except for the risk of the lungs collapsing (see further Patrick, Wind and Roede; chapters 14, 17 and 18 respectively). Diving without properly designed equipment can be very dangerous (see pages 315–16).

3 The fact that in water mammals tend to cool down rapidly because the thermal conduction of water is 20 times higher than that of air (Roede, chapter 18).

4 Caisson disease. Ever since people started working under high pressure, such as in tunnel construction and deep diving, they have suffered from mysterious convulsions, nausea, paralyses, and even death. In 1878 Paul Bert explained most of the symptoms of this decompression sickness. When inhaled under higher pressure, as occurs during diving to 7 metres depth or more, oxygen becomes poisonous, and nitrogen starts to dissolve in blood and body tissues. This leads to problems when the diver returns to the surface too quickly and the nitrogen is given off at a faster rate than the lungs can discharge it, causing dangerous gas bubbles in the blood. In 1905 Haldane further analysed the problem; his experiments led to the recommendation of step-by-step decompression. Moreover, at *c.* 40–50 metres depth, a dangerous nitrogen-intoxication may occur, resulting in a serious mental disorganisation; nowadays this effect is prevented by adding helium to the inhaled gas mixture (Riffaud, 1976).

5 Visibility. The fact that the depths of the sea are hidden from view has certainly added to its being perceived as a mystery. Often vision is blurred due to the turbidity of the water. In clear, still water the human eye may be able to discern objects at a few metres distance, but even in clear, shallow water it is hard to distinguish the bottom from the surface. This is explained by the fact that holds good for all aquatic animals: sub-surface visibility is limited due to a multiple scattering of light rays in all directions. Also, there is a rapid extinction of colours in water: red disappears at a depth of only 6 metres, yellow penetrates down to 90 metres, green down to 106 metres; below 245 metres most wavelengths are absorbed and only dark blue to black remains.

The blurring of visibility under water also hinders detection of undersea hazards such as poisonous jelly fishes, snakes, sharks and barracudas. Divers are advised to acquire the habit of turning around regularly to check the surrounding area.

6 Vision. A further optical complication is the different *nature* of vision in air and in water; a functional aerial eye is rarely adapted to aquatic circumstances, and the reflection and refraction of light rays at the water line pose additional problems. (The fish *Anableps anableps* has resolved

this problem by a four-eyed system, one pair for aerial, one for aquatic vision (Brown, 1957.)

7 Oxygen uptake. In most aquatic animals the respiratory uptake of oxygen consists of oxygen dissolved in water, which can, for example, be achieved by means of gills. In contrast, vertebrates with lungs have to return to the surface for air-breathing. Various sea mammal species, adapted to a permanent aquatic life for many millions of years, can stay under water for prolonged periods, but humans can do so only for a much more limited period (Roede, chapter 18).

8 Apart from the real risk of sunburn of their naked skin when swimming at the surface, humans are faced with yet another, additional, handicap compared with other mammals. Generally, in mammals, the centre of gravity of the body (G) is found to be caudal to the point of action of the upward pressure (UP); in water, therefore, a mammal's body automatically sinks until G lies exactly under UP, resulting in an oblique posture with the nostrils above the water surface. In the bipedal human, however, G is already situated directly under UP on land; so that when in water the vertical position is maintained, the nose and mouth disappear under the surface (Slijper, 1958, 1979). This can admittedly be compensated for by treading water; but the short playing time of water polo (five minutes, alternating with two-minute breaks) illustrates the exhausting nature of bodily activities in water in a vertical position. Humans, however, can easily adopt a less exhausting horizontal position, either on the back (see Patrick, chapter 14), or prone (see Wind, chapter 17).

On the other hand, the sea undoubtedly offers certain advantages. For example, oceans provide a very stable environment. Marine geochemistry indicates that on average the chemical composition has seen no changes for hundreds of millions of years (Schuiling and Van der Weijden, 1970; Postma, 1970; see also Wind, this volume, chapter 17). Although differences in climate and seasons, in temperature and water movements, do occur over space and time, such fluctuations are never as extreme as on land; diurnal differences occur only in the most superficial layers. Therefore, marine creatures do not have to adapt to such extreme ranges of environmental circumstances as land animals do.

A second advantage is a plentiful food supply (albeit in restricted areas). Differences in temperature and in salinity induce continuous circulation of the water, which contributes to the richness of available nutrients. There are, however, wide local variations, due to the presence or absence of seasonal fluctuations in surface temperatures, which affect the zoning of planktonic plants and animals. (The primary food production of the sea is mainly limited to the photic zone of 200 m. sub-surface where sunlight can penetrate, with a clear maximum at some 10 m. depth.) About a third of the oceans is barren, fruitless biological desert, especially

in the (sub)tropics, with an annual production of less than 100 mg dry organic material per  $m^3$ . Only a fifth of the world's oceans is highly productive, with an annual production of 500–1000 mg dry organic material per  $m^3$  (Korringa, 1970).

A further advantage is the buoyancy in water, compared to the burden of gravity that land animals have to sustain.

However, these considerations appear to be outweighed by the manifold advantages of terrestrial life, as may be deduced from a survey of marine species as compared to terrestrial ones. In sharp contrast to the extent of global surface covered by water is the fact that, of the roughly two million plant and animal species in the world, only a small minority lives in water (albeit often in huge numbers). Along rocky coasts relatively large brown, green and red algae occur, but 99.9 per cent of the sea flora belongs to the microscopic phytoplankton (the first link in all oceanic food chains). Most sea fauna are invertebrates; except for the fishes and a few reptiles, sea birds and sea mammals, vertebrates are preponderantly terrestrial. The total number of aquatic mammal species is about 100, a small minority within the total of some 5,000 mammalian species in general.

### **The coasts**

Generally the continents reach beyond the coast-line. The so-called continental shelf slopes gently downwards, and only beyond the edge of the shelf does the sea floor usually drop abruptly. The shelf is on average 70 km. wide and up to 135–200 m. under the surface. Consequently there is a large stretch of photic sub-surface zone, which is of the utmost ecological importance. Coastal belts, covering only one tenth of all water surface, are in general most densely populated, notwithstanding the extreme environmental demands.

Along the coast the power of battering waves can be enormous. Storm waves may reshape coastlines by displacing sand, often in huge quantities, and the forces of inrushing flood and outgoing tide may be immense. Tidal species show a variety of adaptations preventing them from being swept, drawn or whipped away. Sedentary invertebrate species may be attached firmly by a stalk or byssus filaments or by a secretion of limestone; other species brace themselves by means of a muscular foot, manifold suckers or sharp spines.

Due to the complex interactions of soil, currents, wave action and tide, there is great variety in coastal habitats. Rocky coasts may be too steep or too rough to be inhabited at all by mammalian species. Pebble and shingle beaches are in general practically barren. Sand beaches pose a constant threat of being whipped or drawn away; many species live buried in the sand, or may dig in by means of all sorts of specialised movements of shell-foot, legs or fins. A sand beach might have offered a

suitable habitat for the hypothetical aquatic apes, provided that there were places for shelter and nearby reefs as food resources.

Depending on geographical factors, tidal differences and ranges vary from less than 60 cm up to 15 m. With no fixed boundary between land and sea, the shoreline may move backwards and forwards daily over a distance of several kilometres. Species living in areas with a fairly large tidal range are exposed to extreme variations from hour to hour, from season to season. Specific adaptations are required to survive alternately total immersion and air exposure, extreme differences between cold and hot periods, large fluctuations in oxygen content and in salinity, all in combination with the often ferocious forces of the water. Numerous species resist these challenges by retiring, for example, into a protecting shell that can be closed with a horny plate. Another solution is shown by most flatfish and a number of crab and shrimp species: they draw back into gullies that do not dry up at low tide. Activity patterns of most species are synchronised to the rhythm of the tide; with low tide, activities slow down; with high tide, they restart.

The chief advantage of a littoral habitat is the large amount of water – be it salt, brackish, or fresh – of oxygen, and of nutrients. Like the open sea, tidal zones are inhabited by a relatively small number of species, but the individual numbers are large compared with those of land-dwelling species. The richness of the food supply may also attract foraging birds and mammals.

Wading mammals are confronted with insidious tidal currents and gullies; they risk being smashed against rocks by wave action, or on fringing reefs to be hurt by contact with stinging coral. Even when the seas are calm, weathered and eroded rocks may present knife-sharp edges, and be rendered abrasive by barnacles or slippery by algae.

Sea-urchins represent another worldwide hazard. Anyone who has ever stepped barefoot on their spines may agree with me that if there has been a Miocene semi-aquatic hominid phase, then echinoids – *Echinodermata* are millions of years old – would have been a serious impetus to bipedal locomotion to restrict this painful inconvenience.

Despite these aspects of various types of shoreline where primates could hardly be expected to flourish, there do exist some coastal regions that could have provided suitable habitats. For a detailed description of such highly productive coastal ecosystems, see Ellis (chapter 4).

### *HOMO SAPIENS AND THE SEA*

Whether the Miocene hominids lived in and near the water remains an open question. Whether and how their descendant, *Homo sapiens*, in his more recent past exploited the sea is somewhat more readily traceable.

The evidence for this is found in engravings, sculptures, drawings and paintings, representations on vases, coins, fighting shields, temples and houses, supplemented in later times by written tradition, poems and writings, such as those of Homer and Aristotle, and of Herodotus, who recorded a good deal of marine history. (It is not surprising that there are so many Greek writings on the subject: few other countries are so exposed to the sea. Since the early Bronze Age, and most probably before, Greece and the sea enjoyed an intimate relationship.)

### Shipping

It is a matter of conjecture how our early ancestors managed to populate so many islands. How, for example, did *Homo erectus* reach Java? There may formerly have been land-bridges that have now disappeared. Another possibility is suggested by the way small mammals are known to arrive on off-shore islands – namely, by clinging to floating tree trunks.

The use of specially constructed floating devices began some thousands of years later than the domestication of dogs and cattle and the invention of agriculture; yet water surfaces have been crossed by humans for thousands of years. There are indications that in the late Upper Pleistocene mankind was spreading to islands all over the world. The distribution over various locations in the Eastern Mediterranean of celts and chisels made of obsidian (volcanic glass) originating from the island Melos, gives evidence how widespread overseas shipping was in 7000 BC. At first, use was made of primitive papyrus rafts, animal skin boats and hollowed logs, such as the 3 m. long canoe found in the fenland of Drenthe (Netherlands), dating back to 6600 BC (Bloemers, Louwe Kooijmans and Sarfatij, 1981). They were most probably first used on rivers and lakes. An Egyptian drawing from 3400 BC shows a larger and more complex riverboat, provided with paddles. The first large boats with oars and sails were constructed in Egypt some 4,000 years BC.

In *Prometheus Bound* (452–454 BC) Aeschylus sang how 'one of the presents given by Prometheus to man, up to then living like ants in dark passages and caves, was a sailing boat'. His verses are more than just a poetic effusion; shipping was a relevant factor in the cultural development of the inhabitants of the region of the Aegean Sea (Themelis, 1987), and its importance rapidly increased. In flat earthenware from the early-Cycladic period from the third millennium BC various long ships with rows of oars are carved; the endless spirals are considered to be the first symbolic representations of the Aegean waves (Boulotis, 1987). Experts assume that these objects had a ritual meaning. Also, one of the first themes on early-Geometric vases is the ship (Andronilos, 1987).

Man first dared to venture onto the seas in search of food, next for purposes of trade, transport and migration, and later in pursuit of war and



conquest as well; in Homer's day, ships were used only for transport, but fighting ships were developed not long afterwards.

The length of voyages increased, though the sailors rarely lost sight of the coast. At about 3000 BC Egyptians were already sailing to Crete, and by about 1700 BC even to the extreme east of Africa, to purchase incense, balsam, gold and ivory. Minos, from the island of Crete, is pictured as the first ruler of the seas; Crete became the central home-port for the first real maritime forces, and at some time between 2800-2600 BC their sailors were the first to venture out of the Mediterranean. The Mycenaean naval supremacy (from 1450 BC) was probably the inspiration for the heroic poems of Homer, including the story of the famous sefarer Odysseus, as well as the legendary voyage of Jason and the Argonauts who sailed from the Aegean Sea to the Black Sea, a masterly example of skilled seamanship. From 1200 BC the highly skilled Phoenician sailors embarked on their voyages, descending like locusts on all shores of Africa; in 600 BC they went on a three-year expedition from the Red Sea all round Africa ('seeing the sun rise first on their left and then on their right' (De Latil and Rivoire, 1956, p. 32). They also sailed from what is nowadays Lebanon to England to get tin, following the continental shorelines. The later Greeks and Romans, however, limited their sailing activities mostly to the '*mare nostrum*', having been forewarned about the horrors of the 'outer sea' beyond the Strait of Gibraltar, where even Hercules turned back (Pindar; in De Latil and Rivoire, p. 33).

At a time when the Western world generally feared that sailors who ventured too far across the high seas would tumble over the edge of the world, mass migrations were taking place elsewhere, across the Pacific. In those regions people dared to sail beyond the horizon on their long maritime voyages, with the stars and the flight of birds, and knowledge about wave patterns, as their sole navigational aids. These trips are sparsely documented and more difficult to trace; but there are indications that the casualty list was long. Overpopulation provides a ruthless motive for migration and, for islanders, that must entail crossing the sea. Some 10,000 to 8,000 years ago migrants knew how to reach Australia, and later New Guinea and the Philippines. At around 6000 BC pro-Malaysians sailed the Pacific; next came the Polynesians who 3,000 years ago populated Fiji and Tonga, and at 2,000 years ago the Marquesas and farther places, finally dispersing on their huge catamarans over an area covering 18 million square kilometres.

Later, the Norsemen frequently traversed the open seas, reaching Iceland, Greenland and even North America. Elsewhere in the world, Eskimos, and Arab, Indian and Chinese traders similarly defied the aquatic elements on daring sea voyages.

## Diving

Human locomotion in water is not restricted to the surface; we can quite easily learn to swim under water and dive down a few metres to pick things up from the bottom. With practice, deeper dives can be attained, despite the handicap of not being able to stay under water longer than one minute, unless well trained. By contrast, few other terrestrial mammals practise actual dives.

Except from the supporters of AAT, this specific skill has received little attention in discussions of hominid evolution. We cannot be certain when humans first began diving. Most probably, the first motive for entering the alien waterworld was the desire to collect seafood; later came the wish to gain access to other sea resources. In an attempt to assess how well we can cope with these underwater activities, a short survey follows of the history of human diving and of the risks it may involve.

For well over three thousand years men and women have been diving to considerable depths while fishing for sponges. Even today there are commercial divers operating without any breathing tube or face mask; the length of time they stay under water is quite amazing (see also Schagatay, chapter 15). They usually descend to about 20 metres, but may go down to 30 metres, where the best sponges grow. Similar diving activities are described in the *Iliad* and the *Odyssey*. Also in classical times man was already venturing to dangerous depths to obtain other treasures of the sea, such as red (octo)corals, and the shells of *Murex brandaris* and *M. trunculus* which furnished the raw material for purple dye; 60,000 specimens produced about one pound of dye. The silk-like byssus threads of *Pinna nobilis* were harvested and used for ceremonial dresses, while pearl fishing was mainly confined to the Red Sea and the Indian Ocean.

Classical writers such as Oppian reveal that the dangers of venturing into the depths of the sea were never underestimated. The divers were subjected to rigorous training and told to abstain from drinking wine. Despite such preventive measures as having their ears filled with oil and covered by oil-soaked sponges, the divers' ear drums often became perforated by resurfacing too rapidly, and divers usually died at an early age (see, for example, De Latil and Rivoire, 1956; Riffaud, 1976). Many divers were females. Pausanias emphasised that although the pressure at great depths might cause ear drums to break, it did not affect a young woman's virginity (De Latil and Rivoire, 1956, p. 54).

In classical antiquity the underwater hunting of fish and shellfish was popular as a sport. But this must have occurred in calm, clear water, and not too far under the surface, so as to avoid the ordeals of the professional deep-sea divers.

War provided another incentive for diving. De Latil and Rivoire (1956) mention the various instances recorded by Greek and Roman historians of divers providing services in naval warfare. They penetrated the depths to bring supplies to besieged islanders (for example, at the end of the fifth century BC, during the Peloponnesian wars between Sparta and Athens); to sever anchor chains, as happened to the Persian fleet of Xerxes during the Median Wars; to pierce the hulls of enemy ships; to close a harbour's entrance, or to clear it of obstructions such as stones, or sometimes even vessels loaded with stones. Herodotus and others suspected that the tales of these exploits were often exaggerated, but the fact is that military writings of the time recommended the posting of sentries on deck armed with tridents to prevent such actions by the enemy's fighting divers. Centuries later, divers were also deployed in Moslem wars, while in the year 1000 the Swedish king Eric the Eloquent vanquished the almost unconquerable Vikings by employing unseen divers to drill holes in their ships' hulls.

Aquanauts in classical times may have used a kind of breathing tube, as described by Aristotle. There are also references to glass diving bells, like the huge one designed for Alexander the Great. Several historians relate how he was lowered into the sea because of his curiosity to observe the secrets and treasures of the underwater world. Since the air in the bell's upper part became compressed during lowering, breathing was possible for only a limited period without great risks. Special diving outfits were also used; in the fourth century Vegetius described in detail the outfit of fighting divers – the leather boots and masks, and the wine skins filled with air.

With the Renaissance, a revival of interest in classical times stimulated new explorations of the sea, and attention focused on equipment to make this possible. Leonardo da Vinci (1452–1519) designed various diving suits, including a mask, webbed gloves and flippers. His design for an underwater breathing apparatus reveals how little was really understood of the physical laws of the sea and its effects on humans during descent into an aquatic environment. His breathing tube would have worked well enough in shallow water, but in deeper water its user would have died from suffocation due to pressure on his chest.

In the eighteenth and nineteenth centuries diving equipment was increasingly based on a more realistic understanding of the physiology of diving. Attempts were made to take account of the laws of pressure, as formulated by Pascal in 1648, and the newly acquired knowledge about the chemical composition of air. But still too little was actually understood of the complex mechanisms involved, and casualties could not be prevented.

As underwater activities became increasingly popular, more effective equipment was introduced, including, in the first half of the nineteenth

century, Siebe's diving helmet and dresses, and at the end of the century the Rouquayrol-Denayrouze apparatus. An 'improved' version of their *aérophore* became famous by being used by Captain Nemo and his crew in Jules Verne's *Twenty Thousand Leagues under the Sea*. De Latil and Rivoire (1956, pp. 166-8) have pointed out that Jules Verne's scientific accuracy failed him here, when he equipped Captain Nemo with 'a copper sphere to be worn over the head'. In combination with the rest of Nemo's outfit this was physiologically impossible: localised underpressure would have turned the helmet into a suction pump, resulting in fatal haemorrhages.

At the end of the nineteenth century safer diving became possible due to new outfits with a heavy brass helmet and heavy boots, necessitating slow and clumsy movements like those of a man on the moon, and severely limiting freedom of action. But the biologists were delighted with their new ability to study life on the sea bed at close quarters.

The final understanding of the phenomenon of decompression at the turn of the century opened the way for the modern approach to diving. When, during the Second World War, fighting divers were once more brought into action, the development of diving gear progressed by leaps and bounds. Jacques Cousteau and Emile Gagnan perfected the 'aqualung', a tank of air compressed to 120 atmospheres, combined with an ingenious regulator which ensures that at every depth the pressure of the inhaled air is similar to the prevailing water pressure. This scuba diving 'put the underwater world within the reach of everyone' (De Latil and Rivoire, 1956, p. 272); the divers were now as free and agile as fishes in their underwater explorations.

However, the aqualung is not really suitable for working at great depths: its user is still confronted with the problem of decompression, and usually does not dive deeper than 80-90 metres. For instance, one hour spent at a depth of 100 metres necessitates a decompression time of 7-8 hours.

On the other hand, a need is felt to explore the deep sea further in order to facilitate, for example, the exploitation of underwater oilfields and metal deposits. Oceanauts have been lowered in bathyspheres (introduced by Beebe and Barton in 1934), deep-diving (mini)submarines and bathyscaphes; experimental underwater laboratories are being designed. But large-scale underwater communities are not yet feasible, and for the time being we have to accept that humans in general have not succeeded in colonising the depths of the sea.

In recent decades, however, in addition to the use of air supply for descending to greater depths, the simple basis gear of mask, fins and snorkel for swimming at the surface and making short dives has become very popular, and the almost insuperable difficulties of former days are

easily forgotten. But the modern snorkeller still needs to take account of temperature and radiation factors. In warmer regions, solar radiation received at the surface may keep the body sufficiently warm; some clothing is recommended to prevent sunburn of neck and shoulders. But for submergence over longer periods, even in shallow (sub)tropical waters, some protection against heat loss is needed, preferably by special 'wet suits'. The leather outfits of former days were hardly suitable; but the modern invention of new materials such as foam rubber – a cultural water adaptation which should not be underestimated – enables the human primate finally to cope satisfactorily with the problem of cooling-off.

Another physiological effect of diving has also come to be better understood. People with sensitive (allergic) mucous membranes and other airway complaints may suffer from pain, due to a relative underpressure in the paranasal sinuses and the middle ear known as 'squeeze' (Bennett and Elliott, 1982; Shilling, Carlston and Mathias, 1984). Even diving only a few metres for picking up shells or catching a fish may cause this temporary handicap. It is impossible to know whether the presumed aquatic apes from the Miocene suffered from rhinitis, but when diving they may well have been confronted with this complication.

## LEGENDS AND MYTHS

I must go down to the sea again, for the call of the running tide  
Is a wild call and a clear call that may not be denied.

(*Sea Fever*, John Masefield)

Richards, in chapter 6, has commented on our necessity for water, not only to meet the daily needs of purely physiological requirements, but also for bathing, grooming, washing, rinsing and playing, as well as for mystic uses and rites. (In this respect the distinction between sea- and freshwater is not well defined.) Wind, in chapter 17, has relegated the so-called nostalgic, archaic longings for submersion mainly to the realm of fantasy. He remarks that 'science is unable to account for the mental processes behind the back-to-the-ocean associations' and that 'the frequency of these associations is unknown'. His reasoning seems logical. Specific remembrances of an ancestral aquatic past 300 million years ago, when terrestrial life started, and even of one some 5–4 million years ago, are indeed very unlikely to exist. Yet that is not the end of the affair. A better approach might be to look for indications about attitudes towards the sea from early historical times, in order to discover whether our apparent mental affinity for water is only recently acquired, and the popularity of bathing merely a trendy fashion (Preuschoft and Preuschoft,

chapter 9), or whether these things are more deeply rooted in our species.

First, some remarks on bathing. Though for centuries bathing was indeed considered in Europe to be unhealthy, if we look beyond Western countries it becomes clear that the habit of bathing is deeply rooted in many longstanding traditions and rituals. Water is considered to possess magic healing power, to offer eternal youth, to act as a purifier from sins and to wash away evil spirits. Egyptian priests had to bathe twice a day, and both the ancient Greeks and modern Moslems perform ritual washing before devotions. For centuries Hindus have bathed in the river Ganges and the temple ponds, and Christian rituals include various forms of baptism, ranging from just a few drops to total immersion.

A possible evolutionary basis for such mores could be the tendency among birds and mammals to groom the skin, rather than a hypothetical and temporary hominid aquatic stage.

An opportunity to trace at least a reflection of innermost thoughts about the sea in the prehistorical past is offered by religion, legends and myths. According to Jung (1964), they originate in the period immediately prior to the establishment of civilisation. He introduced the concept of the collective unconscious, consisting of the mental inheritance of all mankind. Though his ideas are not generally accepted, there is a consensus among anthropologists that many folk tales contain a grain of truth. Nearly all religions owe a debt to previous beliefs by absorbing the superseded myths and legends, and thus may offer some clues to the 'archaic' ideas of earlier times (Cotterell, 1989, p. 7).

Humans cannot easily live with chaos. Inherent in the process of becoming human is a growing awareness of the cosmos and our earthly environment, and the consequent invention of theories to rationalise our individual and collective experiences, to come to terms with the complex world outside, and to suppress fears. In other words, the structure of religion is not arbitrary: it finds its origin in the need to explain and cope with a prevailing situation (Campbell, 1969; Cotterell, 1989). As a consequence, legends and myths may help us to trace how humans felt about the sea in earlier days, at a time when it was taken for granted that the world was flat and that the sea was its boundary river.

These sources as an indication of involvement in the sea among the peoples of the ancient Orient, Egypt and other parts of North Africa are well documented, as well as that of ancient Greece and Rome, and a wide range of places elsewhere. Here, only a limited selection will be given.

First, it may be asked if the relationship of Neolithic man with water can be traced. European rock paintings made 10,000 to 18,000 years ago rarely picture water; only the more recent ones depict some river fish. References to marine life are rare, though that is not surprising in inland

caves. Yet, a rock drawing of 2200 BC on the island of Roddoy, Northern Norway, shows a man in a kayak chasing a seal and two porpoises (Slijper, 1979).

Little is known about the early history of human populations south of the Sahara; among the huge diversity of their present-day traditions and local beliefs, the sea hardly plays an important part. Thousands of cave drawings discovered in the Central Sahara (Hogger, Tassili-n-Ajjer) – dating back from 6000 to 2000 years BC – reveal that the area was then green and fertile. Various cave paintings picture sun-worshipping, but the (former) rivers were also the subject of rituals (for example, Lhote, 1977). In the Orange Free State, South Africa, 300 kilometres from the shore, there are 3000-year-old drawings by Bushmen of a stranded whale and dolphins; in those days their territory was much more extensive than nowadays, they may have migrated during winter to the coast for fishing (Slijper, 1979).

Upon surveying the vast multiplicity of religions, legends and rites of our more recent ancestors some general tendencies can be distinguished.

*Creation of the world* is a universal theme. During various epochs and among divergent cultures, such as that of the Egyptians, the myth is of a universe created as an empty bubble in an endless mass of waters, of a terrestrial landscape that had its origin in the boundless primeval ocean. The Babylonians believed that for a long period the world was entirely covered by oceans, until the level of the land was raised. Other versions conceived of the land as having been hooked out of the ocean (New Zealand), or that the primordially omnipotent ocean had to be conquered by one of his or her offspring before life on earth could start (for example, De Latil and Rivoire, 1956; Hyslop, 1986; Cotterell, 1989).

*Deities.* Throughout the world it has been believed that a diversity of gods, monsters, nymphs and other aquatic creatures inhabit the depths of the seas. In spite of an obvious diversity in the contents of the tales, on the basis of standard mythological analysis two worldwide *leitmotifs* can be recognised.

1 First, the one of a *profound duality*, reflecting how suddenly and unexpectedly serene waters can turn into stormy seas. The divine characters were pictured as unpredictable like the elements.

The duality was often represented in a single figure, such as Poseidon or Neptune, who was one of the three sons of primeval Kronos who divided the world between them. Poseidon became the ruler of the seas; when angry, he could use his magic trident to make the sea rough and threatening; in a different mood, he could use it to calm the waves. He could make islands emerge or submerge, and shake the earth. When in a

cheerful mood, he rode the waters in his golden chariot – accompanied by dolphins and merry Nereids – magically transforming the boiling waves into a turquoise mirror. Like his brother Zeus, he fathered many offspring, but his children did not become deities or heroes. He only begat monsters, with the exception of his ravishing son, the horse Pegasus. But he was also worshipped in his role of revered benefactor (De Latil and Rivoire, 1956), a characteristic also found in the Babylonian amphibian god Ea, who nightly emerged from the Persian Gulf to educate humans, and in the Japanese fish-god Varuna (Hyslop, 1986).

The two opposing aspects of the sea may also be expressed by two closely related characters, as in the ancient myths about the two old men of the sea – Nereus, dispenser of universal benevolence, and the unstable and unpredictable Proteus. In Scandinavian mythology, the two contradictory aspects of Neptune are split into the noble Njord and the malevolent Aegir.

The negative side of the sea is not always portrayed as clearly as in the above examples. Some sea gods are purely benevolent, such as the primeval deity Varuna in Indian Vedic mythology, and Kumpira, guardian of Japanese sailors. In Greenland it was believed that paradise was situated somewhere in warm, calm waters. Yet, these tales are a minority, and the concept of the ocean as two-faceted is much commoner throughout the world (De Latil and Rivoire, 1956, pp. 23–26).

2 Secondly, sometimes *geographic differences* are reflected in the mythic characters populating the seas. Greek sea gods, for instance, are as capricious as the Aegean sea, one moment dazzlingly azure, the next moment threatening, but rarely losing their charm. Deities that held sway in the cold, grim Atlantic, like Aegir, are fiercer and more malevolent.

Female sea deities are also depicted with a similar duality and a similar diversity, reflecting geographic differences. The most beautiful and whimsical of all goddesses, Aphrodite, was born out of the foam of the radiantly blue Mediterranean waves. Farther North, Aegir's fierce and cruel wife Ran found pleasure in capsizing ships in order to capture the drowning sailors in her nets; but those who succeeded in paying her tribute in gold became her lovers and banquet companions.

In many widely separated regions sailors have believed that the sea harboured ravishing and treacherous sirens, bringing both death and love – such as the nymphs in the tales of the Far East, or the European wave maidens, daughters of Aegir and Ran, the Nixen, the White Ladies, the Rousalki, and similar creatures under many different names (De Latil and Rivoire, 1956, p. 26; Hyslop, 1986, pp. 111–25). More than 3,000 years ago, Odysseus's crew resisted the Mediterranean sirens' songs by stopping their ears with wax, while the Argonauts were protected by Orpheus' music. Up to 1481 in Europe serious warnings about sirens were



published. There are, no doubt, psychoanalytic explanations for these widespread fears of men concerning the deadly embraces of alluring female creatures. But the sirens also symbolise more plainly than any of the other myths and legends about the sea, how the glistening surface of the sea was mistrusted and the invisible depths feared.

*Monsters.* Here, the fear of the unknown is most outspoken. Supernatural powers were ascribed to numerous monsters and beasts of the sea, held responsible for causing shipwrecks by evoking wild waves, troughs and abysses, vortices that could draw ships down within seconds, or by raising unseen cliffs and reefs to just below sea level. Odysseus's journey is full of blood-curdling stories such as the choice he had to make between Scylla, with six screaming heads, and Charybdis, the neighbouring abyss. Up in the far North, near the Lofoten Archipelago, for centuries the fearful 'Maelstrom' was supposed to whirl ships around and at the end draw them into the maw of the sea.

The crooked serpent Leviathan produced vortices to engulf the ships, so did the fearful Tiburon, who devoured the carcasses of the drowned. There were immense octopuses dragging ships down with mile-long tentacles, and giant lobsters pulling hapless sailors out of their ship, into the depths. Centuries later and elsewhere, equally frightening stories were told, such as the medieval legend about the biggest of all sea monsters the 'Kraken' (Pliny and Bishop Olaus Magnus, 1555; see De Latil and Rivoire, 1956; Hyslop, 1986). As Lord Tennyson (1849–1892) wrote:

Below the thunders of the upper deep;  
Far, far beneath in the abysmal sea,  
His ancient, dreamless, uninvaded sleep  
The Kraken sleepeth.

In Europe up to the eighteenth century, the beasts of the sea were seriously feared. Some aspects of the dreadful encounters with fabulous animals of the deep, as described in various 'Bestiaries', may have been based on actual confrontations with the huge deep sea octopus (*Architheutis*), which can weigh up to 260 kilograms (yet according to Cousteau (1974) is basically a non-aggressive creature), or with whales. The nineteenth-century classic *Moby Dick* (1851), about Captain Ahab's vengeful hunt for the massive white whale, was inspired by Melville's personal experiences during a four-year journey on a whaling vessel, probably in combination with the sad tale of the wreck of the whaler *Essex* on November 20, 1820.

*Holy fears.* The widespread awe inspired by the ocean resulted in the solemn casting of propitiary offerings into the sea. Seafarers had to pay

tribute with bread and salt to the waves; warships would sacrifice boxes full of golden coins. How the sea was personified is illustrated by the Persian royal prince Xerxes, who had the sea punished with strokes of the lash for having destroyed his ships in the naval battle of Salamis, 484 BC (Herodotus, VII, 35; De Latil and Rivoire, p. 43). It was a daring act, since the boldest of seafarers dreaded the power of the sea. Even the notorious Norsemen paid homage to the sea god Aegir and his wife Ran.

*Aquatic creatures.* Surveys of legends and sea myths seem to indicate that the traditional reaction to the sea was chiefly one of fear. Indications of any deep-seated longing for the sea are harder to find.

There are countless fables about relatively harmless inhabitants of the sea, such as mermen and mermaids. Yet they are often said to nurse a craving to come out onto the land and stay there. There are, for instance, various Mussulman stories about half-human beings inhabiting the sea near Rosetta and Alexandria, and frequently coming to promenade along the shore. Until a few centuries ago, similar creatures were said to frequent the seaside in the north of the Netherlands.

There are some tales about human beings descending into the waves, such as the story told by Ovid about the legendary fisherman Glaucus, who was so intent upon entering the marine world that the deities turned him into a marine immortal; his body became covered with seaweed and shells, and his beard acquired the glaucous colours of the waves (Kingsley, 1855; De Latil and Rivoire, pp. 26–28) (see Figure 20.1). There is a similar legend about a Japanese fisherman transformed into a sea god by the favours of Otokimi, the goddess of the sea (De Latil and Rivoire, pp. 26–28). Bushmen believe that the dead come to rest in the sea (Allan, 1986), and ancient tribes of good fairies are said to have fled into the depths of the sea because of their fear of human beings (Phillips, 1986). Yet incidental folk tales such as these can hardly be said to add up to a general 'collective unconscious' or a folk memory of a remote aquatic phase.

More recent fairy tales, like Andersen's 'Little Mermaid' and Charles Kingsley's *The Waterbabies* (1863) can hardly be included in an analysis of traditional water stories, although the latter tale may be inspired by Kingsley's earlier work on Glaucus (1855). And advocates of the folk-memory theory may argue that the popularity of the two stories is due to the fact that they echo such primeval images.

Myths about the sea include many stories about the souls of drowned sailors, embodied in seagulls or seals, often rather hostile towards living men; another common theme features drowned cities. It was said that near Sicily, the Strait of Messina, the submerged palaces of Fata Morgana could be seen; in Sweden there is a legend about the island Gummer's

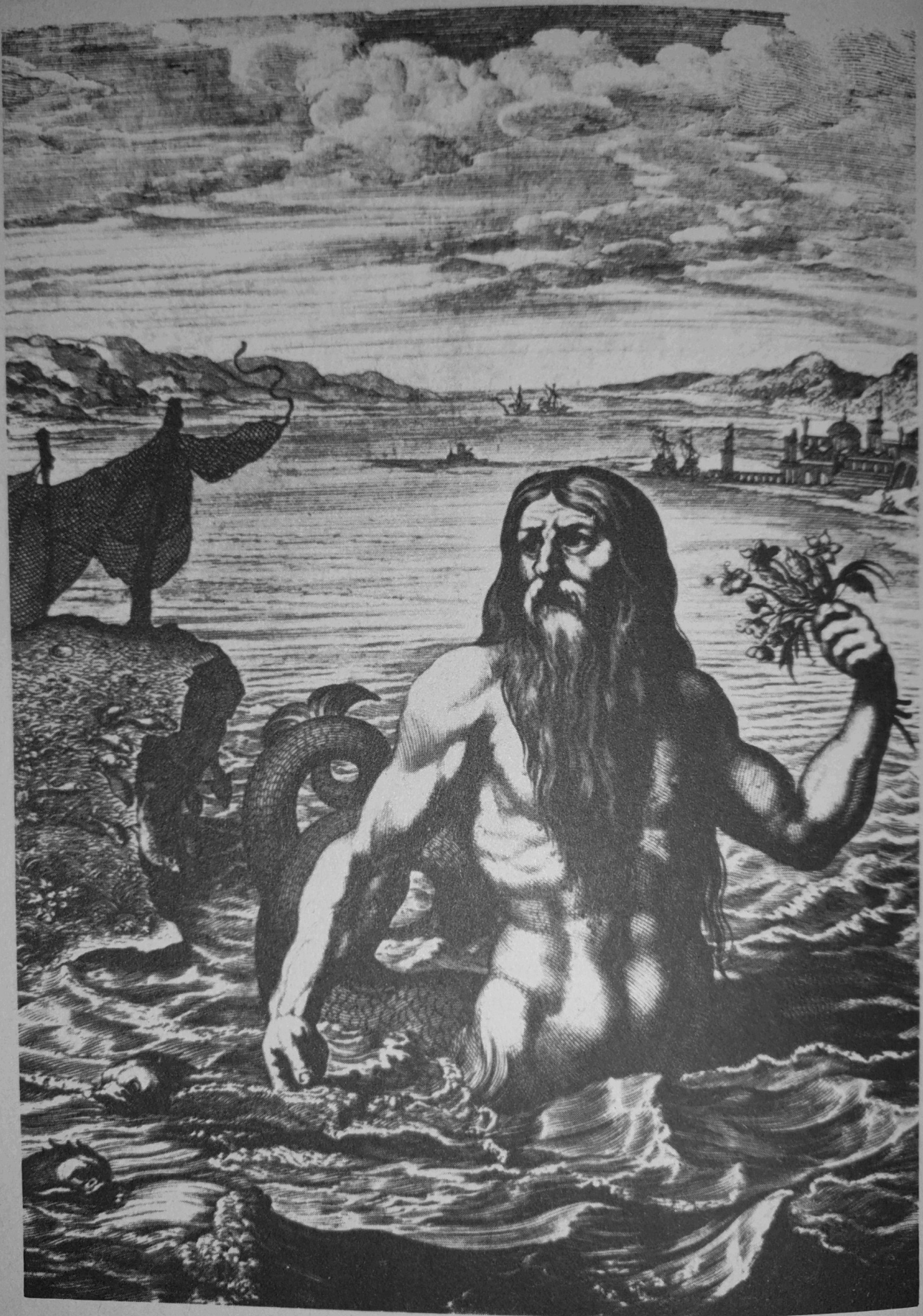


Figure 20.1 The fisherman Glaucus (after a seventeenth-century Dutch engraving).

Ore, which appears only to disappear again. Scottish people tell of Heather Bleather, near the Orkney Islands, ruled by sea people, while off the Irish west coast the old sea god Manannan Mac Lir rides on the foaming billows among fairy-like islands with glass palaces and strange monsters. Various tales tell about an engulfed town from which occasionally the sound of the church bells can still be heard. Nowadays various explanations have been formulated, such as the eruption of the former Greek island Thera around 1500 BC, which may have inspired the stories about Atlantis.

## DISCUSSION AND CONCLUSIONS

In this chapter two lines of reasoning have been followed, one focusing on the physical properties of sea and coasts, and the other on our technological and cultural relationship with the sea as evidenced by shipping and diving, and by legends and myths.

### **The physical properties of the sea**

Do the above data support the belief in the existence of an aquatic ape three million years ago? It was emphasised that, in approaching this question, it is important not to underestimate the substantial number of difficulties and impediments that would have to be overcome in embarking on an aquatic existence.

These include storms, turbulence, high waves and dangerous currents as well as the loss of body heat, hampered vision, and the need to return frequently to the surface to breathe. Deeper diving would incur further difficulties arising from water pressure, decompression sickness and the possibility of nitrogen-intoxication. It is not known how upright Miocene apes might have been, but a bipedal animal in a vertical position would also need to counteract the natural tendency to sink in the water until the nostrils were below the surface.

It is true that other mammals have successfully adapted to a permanent aquatic life, but it took them many millions of years to achieve this (Roede, chapter 18). In the period of 1-2 million years covered by the AAT, a complete adaptation to an aquatic existence cannot have occurred. Had there been any hominid ancestors who returned to a life in the sea, they could at most have been semi-aquatic coast dwellers.

However, coastal areas present divergent disadvantages, such as dangerous breakers and streams, sharp or slippery rocks, and sea urchins; tidal beaches demand special adaptations for coping with the sweeping forces of tidal streams, and wide ranges in temperature, humidity and salinity.

If a Miocene aquatic ape ever existed, it could only have survived in a very narrow range of littoral habitats, such as productive fringing reefs

with enough (mangrove) cover for protection and sleeping places (see Ellis, chapter 4).

### **Cultural relationship between humans and the sea**

Mankind was relatively late in developing the skills of making rafts, boats and, later, sailing ships. Thereafter, due to the need for expansion, trade and wars, these techniques improved rapidly, but for many centuries Western sailors, confronted with the dangerous outer waters of the North Sea and the Bay of Biscay, preferred to sail close to the shore, and even among seafaring nations there was little knowledge of the world below the sea surface.

Nevertheless, since time immemorial, humans have attempted diving for both commercial and military reasons. They had to contend with the universal fears of sea monsters, and the known physical hazards such as perforated ear drums, collapsing lungs, and drowning fatalities. Fighting divers may have suffered less than sponge, coral and pearl divers, since the naval divers did not descend as deep as the commercial ones.

They also had to cope with the problem of heat loss. Various methods were tried, but only the recent introduction of new technology has enabled humans to overcome this handicap. Without such protection we are still vulnerable, as shown during shipping disasters where, even today, most of the casualties are the result of hypothermia.

In the eighteenth and nineteenth centuries, an increasing number of instruments and equipment for diving were designed; but frequent casualties could not be prevented: divers died, or became crippled. 'Blunders' made by men like Da Vinci and Jules Verne indicate how difficult it was to understand the physical and physiological risks of diving. Only in this century has our understanding of the marine environment increased significantly, and even today the investigation of outer space seems to progress more rapidly than the investigation of those parts of our own planet which lie at the bottom of the ocean.

Legends and myths are said to reflect past attitudes towards the surrounding outer world. Thus tales about the fabulous inhabitants of the sea may well reflect the fears of our ancestors about the unknown, mysterious borders of their territory. Worldwide, legends, myths and fables reveal a general feeling that the sea is much more unpredictable and treacherous than the terrestrial world. In fact, there seems to be common awareness of the paradoxical, dual nature of the sea, resulting in conflicting feelings – namely, fear of its power combined with appreciation of its serenity. On balance, evidence of any genuine folk-memory of a remote aquatic past is hard to find. The stories about submerged towns and continents seem rather to relate to actual (pre)historical catastrophes.

To summarise, the physical properties of the seas and coasts, and the thousands of years it took modern man to become somewhat better culturally adapted to the marine world by using special equipment and clothing, suggest that our Miocene progenitors can hardly have lived permanently in the water. Only a few types of littoral areas would have qualified as possible new niches for them.

The sea has played an important part among seafaring and coastal populations. It has been seen as a cradle and a grave, both origin of life and bringer of death, benefactor and enemy. But even today human invasion into the world of the deep is still in a pioneering phase, due to physical barriers which are very hard to surmount. It can hardly be accidental that man has set foot on the moon before he has penetrated the oceans' depths. However, due to overpopulation and our demand for oil and metals, we may be forced to revise our priorities. If we seek for aquatic man, we are more likely to find him in the future than in the past.

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