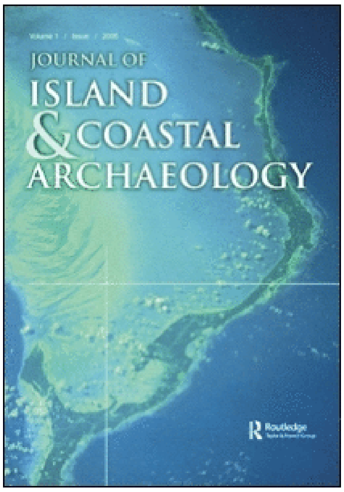

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Oceans, Islands, and Coasts: Current Perspectives on the Role of the Sea in Human Prehistory

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Oceans, Islands, and Coasts: Current Perspectives on the Role of the Sea in Human Prehistory

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ABSTRACT

Archaeological studies of island and coastal societies have advanced significantly over the years. Long marginalized as relatively recent developments, coastal, maritime, and island adaptations are now recognized as having a much longer and more complex history. Consequently, the archaeology of island and coastal societies has become increasingly relevant to a variety of important anthropological and historical topics. In this paper, we discuss some current issues in island and coastal archaeology, including: (1) the antiquity of coastal adaptations and maritime migrations; (2) variations in marine or coastal productivity; (3) the development of specialized maritime technologies and capabilities; (4) underwater archaeology and drowned terrestrial landscapes; (5) cultural responses to insularity, isolation, and circumscription; (6) cultural contacts and historical processes; (7) human impacts and historical ecology in island and coastal ecosystems; and (8) the conservation and management of island and coastal sites.

Keywords archaeology, islands, coastlines, maritime adaptations, fishing, historical ecology

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INTRODUCTION

In the anthropological and archaeological study of human prehistory, the role of oceans, islands, and coastlines has long been marginalized, with human adaptations to such environments seen as a relatively late development limited to the last 15,000 years or less (see Washburn and Lancaster 1968; Yesner 1987). For some of the most compelling issues in human history—from the evolution and geographic expansion of hominids, to the origins of agriculture, the rise of civilizations, and the ecological impacts of early humans—coastlines and oceans have been relatively peripheral to serious anthropological discussion and debate (Bailey 2004; Bailey and Milner 2003; Erlandson 2001). Just a decade or so ago, for instance, Gamble (1994) listed 10 important habitats encountered by hominids as they spread around the globe, none of which were marine, estuarine, riverine, or lacustrine. Notions about the marginal nature of aquatic habitats are deeply embedded in the history of Western thought, and were forcefully incorporated into the grand theorizing and global syntheses of processual archaeologists in the late 1900s. In the 1970s, Cohen (1977), Osborn (1977), and others argued that coastal and other aquatic habitats were relatively unproductive for human use and that marine resources were not systematically used until more productive terrestrial foods were depleted.

A number of researchers challenged such characterizations (e.g., Erlandson 1994; Glassow and Wilcoxon 1988; Moseley 1975; Perlman 1980; Quilter and Stocker 1983; Yesner 1980, 1987), but the remnants of such viewpoints are still found in many archaeological and anthropological texts. They are firmly entrenched in anthropological concepts such as the broad-spectrum revolution, where the widespread appearance of shell middens is still viewed as emblematic of a postglacial emergence of coastal economies; in optimal foraging models where the hunting of large land mammals (i.e., elk) is assumed to be more productive than harvesting smaller aquatic animals (e.g., shellfish); and in the common notion that agriculture alone is at the root of all human civilizations. Ultimately, such ideas are derived from a common body of anthropological theory that assumes that archaeological sites on land are fully representative of past human behavior—and that a global sea-level rise of 125 meters since the last glacial has not biased our understanding of human history, especially the evolution of island, coastal, and maritime adaptations.

Such assumptions are weakened by a variety of data that have emerged in recent decades, including evidence that *Homo erectus* and archaic *Homo sapiens* lived along coastlines and foraged for shellfish and other aquatic resources—and that *Homo habilis* may have, too (see Erlandson 2001; Stiner 1994). They are contradicted by the evidence for broader-based and more intensive coastal foraging by anatomically modern humans found in Middle Stone Age shell middens in southern Africa dated to at least 125,000 years ago (Klein 1999; Parkington 2004). They are also challenged by evidence for relatively sophisticated maritime voyaging by *Homo sapiens sapiens*, who used boats to colonize island southeast Asia and Australia at least 50,000 years ago, the islands of western Melanesia (Allen et al. 1989; Torrence et al. 2004; Wickler and Spriggs 1988) and Japan about 35,000 years ago (Baba 1998; Matsu'ura 1996), and possibly the Americas roughly 15,000 years ago (Erlandson 2002; Fedje et al. 2004; Fladmark 1979). They are again contradicted by a wealth of evidence from submerged terrestrial sites around the world (see below), by evidence that dense human populations and cultural complexity arose in many coastal regions when or where agriculture was not practiced but a wealth of marine resources were available (e.g., Arnold 2001; Moss and Erlandson 1995; Quilter and Stocker 1983), and by the knowledge that many early agricultural civilizations were fueled, in part, by intensive fisheries that provided crucial protein sources (Kennett and Kennett 2006; Moseley 1975). Finally, they contrast sharply with our understanding of the development of historical civilizations—from the Greeks and Romans to the Chinese to the Vikings, and the global expansion of more recent European powers—where the importance of maritime exploration, migrations, trade, and conquest has long been recognized.

As a result, the tide has turned on several decades of marginalization for coastal and island archaeology. This "sea change" places island and coastal archaeology at the forefront of many current issues in anthropology, archaeology, history, and historical ecology. We are also at something of a crossroads. By now, most island and coastal archaeologists have transcended the polarized arguments, simple dichotomies, and generic coastlines that often plagued past debates. Twenty-five years ago, Perlman (1980) described the dynamism and diversity inherent in coastal ecosystems around the world. Erlandson (1994) summarized scholarly theories on the development of coastal or maritime adaptations as ranging from "the Garden of Eden" to the "Gates of Hell," arguing that coastlines and coastal resources vary dramatically through space and time, defying their general or simplistic categorization as productive versus unproductive for human use. Numerous studies have also deconstructed the notion that all islands are simple and isolated laboratories of cultural evolution, as well as the alternate view that most island societies were constantly interacting (e.g., Rainbird 2004).

Human beings, human societies, and human history are complex entities that require a variety of data, disciplines, and perspectives to comprehend fully. In this paper, we explore the current status of eight major issues in island and coastal archaeology, topics we feel deserve further attention in the study of the archaeology, history, and historical ecology of coastlines, islands, and marine or aquatic ecosystems. These issues include: (1) the antiquity of coastal adaptations and maritime migrations; (2) spatial and temporal variations in marine or coastal productivity; (3) the development of specialized maritime technologies and capabilities; (4) the archaeology of submerged coastlines and terrestrial landscapes; (5) cultural responses to insularity, isolation, and circumscription; (6) cultural contacts and historical processes in island and coastal settings; (7) human impacts and historical ecology in island and coastal ecosystems; and (8) the conservation and management of island and coastal archaeological sites. Clearly there are other topics of importance to island and coastal scholars—and our treatment of these eight issues is illustrative rather than exhaustive—but we highlight many of the major questions that confront those interested in the role of islands, coastlines, and marine ecosystems in human history.

THE ANTIQUITY OF COASTAL AND ISLAND ADAPTATIONS

If it now seems likely that the use of marine and aquatic resources by our ancestors began much earlier than previously supposed, our knowledge of such use remains extremely sketchy. There is still considerable uncertainty about the antiquity, nature, and intensity of island and coastal adaptations in various regions around the world. For example, although it is probable that some early hominids actively collected shellfish and fish (see Greenwood and Todd 1970; Stewart 1994) or scavenged carcasses of marine mammals and birds from beaches long before the Last Interglacial, little is known about how extensive such foraging was geographically or how important it was economically. If *Homo erectus* reached the Indonesian island of Flores 800,000 years ago (Morwood et al. 1998), there is still little or no other evidence that they had significant seafaring capabilities. There is considerable evidence that some Neanderthals living along Europe's Mediterranean Coast regularly collected shellfish and scavenged along the shore (Barton et al. 1999; Garrod et al. 1928; Stiner 1994; Waechter 1964), but very limited evidence that earlier hominids did (see Erlandson 2001). If numerous Middle Stone Age shell middens demonstrate that anatomically modern humans developed an early coastal adaptation in South Africa (e.g., Deacon and Deacon 1999; Klein e al. 2004; Parkington 2004; Singer and Wymer 1982; van Andel 1989), it is not clear how intensive or extensive such marine exploitation was. Isotopic analysis of human remains from the Eurasian Middle and Upper Paleolithic suggests that anatomically modern humans consumed more fish than did Neanderthals (Richards et al. 2001), but the sample sizes on which such conclusions are drawn are still very small.

Much of the uncertainty is due to preservation problems, the selective recovery or reporting methods of early scholars, the possible non-cultural origin of remains of aquatic organisms found in early sites, and other problems. There is ample evidence that global processes related to glacial cycles, sea-level fluctuations, tectonics, and shoreline movements strongly structure the archaeological record of maritime adaptations and dispersals. There is also a strong correlation between areas of steep bathymetry and relatively early evidence for coastal or maritime adaptations (Waselkov 1987; Erlandson 2001), but the archaeological record is also mediated by local and regional processes that must be carefully considered in evaluating the evidence for coastal occupations and economies around the world.

Some uncertainty also results from semantics—different scholarly definitions of what constitute "coastal" and "maritime" adaptations, or the "systematic" use of aquatic resources. What are aquatic resources, for instance, and how do we classify seals hunted or scavenged onshore or deer and elk dispatched while swimming in the water? Without agonizing over such definitions here, we stress the importance of researchers clearly defining what they mean when using such terms. For the purposes of this paper, we define coastal adaptations as any subsistence lifestyle based along the margins of a large body of water that includes the regular use of foods from aquatic habitats. A wide range of lifestyles fit within this definition, from almost entirely terrestrial to almost exclusively marine (see Fitzhugh 1975). Here, we also define fishing broadly, as any economic activity focused on hunting, fishing, or gathering aquatic animals from the sea or shore. Within this definition, fishing includes a wide variety of activities (shoreline scavenging, shellfish gathering, fishing or hunting at sea, etc.) that require a wide range of intellectual, behavioral, or technological capabilities. We limit maritime adaptations to those cases where humans regularly used boats for travel and subsistence purposes, where voyaging away from the immediate coastline was possible, and where a majority of nutrition (calories or protein) was derived from marine resources (see Yesner 1980, 1987).

Given the inferential limits of the archaeological record—especially in the published data on Pleistocene coastal adaptations—such behavioral distinctions are not always possible. Many early archaeologists only sporadically collected, analyzed, or reported faunal remains from coastal archaeological sites, and even today it can be difficult to distinguish the remains of aquatic organisms left by humans from those left by other predators or scavengers (see Butler 1993; Erlandson and Moss 2001; Jones and Allen 1978). Given what we know (or think we know) about human and primate behavior and the nature of aquatic ecosystems and resources, however, we should be able to differentiate between general types of fishing activities of which various hominin species were capable. Virtually all hominids probably were able to scavenge carcasses from beaches, collect shellfish from intertidal or shallow waters, and dispatch some aquatic species nesting or hauling out on shore. To do so, they had only to observe and model the behavior of other animals engaged in similar activities along sea or lake shores.

COASTAL OR AQUATIC PRODUCTIVITY

Whether such activities were economically viable choices for an individual or group depended on a complex range of variables, including the relative productivity of various resources in the juxtaposed aquatic and terrestrial habitats of individual areas. Here again, knowledge of the almost endless range of variability found in coastal ecosystems around the world suggests that hominid responses would have been equally complex. Issues of when and how they used aquatic resources are intimately linked to questions about the productivity and proximity of marine, estuarine, and lacustrine resources. Global generalizations have not been particularly helpful—the overall productivity of the world's oceans may be relatively low by some standards (Osborn 1977), but the productivity of many continental-shelf ecosystems is far higher. Osborn's (1977) argument that coastal zones were universally unproductive for human settlement responded, in part, to Sauer's (1962) earlier characterization of coastlines as virtual cornucopias that attracted and nurtured human populations. Fortunately, such opposing and generic viewpoints did not prevent some middle ground from developing. Perlman (1980) pointed out that coastlines and marine productivity vary tremendously around the world. The attraction of marine or aquatic resources for humans may also be strongly influenced by the diversity, productivity, and seasonal availability of food resources in adjacent terrestrial habitats.

Trying to explain an apparently late development of coastal adaptations, Yesner (1980, 1987) proposed that coastlines and marine resources were often extremely productive and highly attractive to human foragers, but that their relative productivity may have increased significantly after the last glacial as Pleistocene megafauna became extinct and the slowing of sea-level rise after about 7,000 years ago increased the productivity of estuarine and other nearshore marine habitats. Such a scenario seems logical and may have contributed to postglacial changes in human subsistence in some regions of the world, but we know comparatively little about the productivity of terrestrial ecosystems during the late Pleistocene or the specific density of large herbivores that might have been available to humans living in coastal areas. There is also little direct evidence that marine resources were significantly less productive during the Pleistocene. Along many coastlines, in fact, estuaries may have been more extensive during the terminal Pleistocene and Early Holocene—when sea levels were rapidly rising—than they are today. Because sea levels have risen and fallen through multiple glacial cycles, moreover, estuaries and other nearshore habitats have been in a state of almost constant flux.

Instead of global generalizations about the productivity of dynamic island and coastal environments, we need specific information on the nature of local or regional ecosystems (terrestrial and marine) in coastal areas around the globe—and how they changed through time. The south coast of Beringia during the last glacial was long viewed as relatively unproductive for human hunters (e.g., Hopkins et al. 1982), for instance, but recent paleoecological data suggest that it was a relatively convoluted coastline and potentially productive for maritime peoples (Brigham-Grette et al. 2004). In another study, Kinlan et al. (2005) modeled the productivity of kelp forests off the Southern California Coast, an ecosystem that supports numerous species important to coastal peoples (Steneck et al. 2002), indicating that nearshore marine productivity around the Northern Channel Islands may have been significantly higher during the terminal Pleistocene than they were in the Late Holocene. More of these paleoecological studies are needed to understand the regional productivity of marine ecosystems for humans, along with detailed archaeological research to test the linkages between marine productivity and the development of coastal and maritime adaptations.

Even on regional scales, there is often tremendous local variation in the diversity, productivity, and availability of marine resources. Among California's coastal Chumash Indians, for instance, there were substantial differences in adaptation to marine ecosystems, depending on the nature of the coast (exposed versus protected; mudflats, sandy beach, or rocky shore), the availability of terrestrial plant and animal resources (mainland versus island, etc.), and other variables such as El Niño-Southern Oscillation (ENSO) events. The Chumash are generally portrayed as complex hunter-gatherer-fishers who had high population densities and an economy based on marine fishing and maritime adaptations for survival (Arnold 2001; Erlandson 1994; Kennett 2005). Although true, such generalizations obscure considerable adaptive diversity among the coastal and interior Chumash and their neighbors, differences conditioned by a combination of environmental variations and unique cultural histories. Because most island and coastal ecosystems are highly dynamic, studies of the Chumash and other coastal and island peoples must also carefully evaluate the nature of long-term geographic and ecological changes and how such changes affected humans.

Archaeological and paleoecological data can provide much of what we need to better understand the productivity of marine shellfish, fish, birds, and mammals for human societies organized on a variety of different levels. Understanding the economics and behaviors of coastal foragers and fishers, however, can be greatly enriched by the comparative analysis of historical, ethnographic, and modern human societies (e.g., Bigalke 1973; Bird and Bliege-Bird 1997; Meehan 1982; Moss 1993). Optimal foraging theory can provide valuable insights into the choices ancient peoples might have made in choosing what resources to utilize, but we should remember that human societies are made up of individuals (men, women, children; young and old; rich and poor) whose choices may vary for a variety of reasons (Moss 1993). Optimal foraging models often recognize such complexities, but archaeological applications of such models often fall back on simplistic truisms such as the "bigger is better" notion that large animals are more productive than smaller animals. Such assumptions ignore the fact that many smaller aquatic resources (shellfish, schooling fish, etc.) are found in highly productive and predictable aggregations that require minimal search time, risk, or technological investment to capture or process.

DEVELOPMENT OF SPECIALIZED MARITIME TECHNOLOGIES

Earlier, we suggested that nearly all hominids were probably capable of certain types of aquatic foraging or other behaviors. These abilities may have included the ability to cross many smaller bodies of water—rivers, lakes, and possibly short maritime crossings; how else could *Homo erectus* have spread through much of Africa and Eurasia? Early capabilities also probably included scavenging of stranded animals, the collection of intertidal shellfish and other resources (fish, seaweed, etc.), and the hunting of some aquatic animals when encountered on shore. Some fish could also have been harvested without specialized technologies, especially when spawning or isolated in shallow waters (Garson 1980). Other types of fishing, in contrast, would have required a more complex knowledge of local ecosystems and more sophisticated technologies that may have been beyond the capabilities of many hominids. These include fishing that required boats (rather than simple flotation devices), composite or woven technologies (nets, fishing line, etc.), fishhooks, or specialized aquatic hunting gear such as harpoons, leisters, weirs, or traps. There is little or no evidence for intensive or diversified fishing that required any of these specialized technologies prior to the appearance of anatomically modern humans (Erlandson 2001; Klein 1999).

With the appearance of *Homo sapiens sapiens*, however, we see the earliest evidence for more sophisticated boats and other aquatic technologies. There is still much to be learned about the origins and spread of the specialized skills necessary to build such technologies. The earliest examples now appear to date from the Middle Stone Age (MSA) of Africa, including the extraordinary barbed-bone harpoons from Katanda, which may be 80,000 to 90,000 years old (Yellen et al. 1995), and bone points associated with marine fish bones at Blombos Cave in South Africa (Henshilwood and Sealy 1997). Unfortunately, understanding the antiquity, origins, and geographic distribution of many early aquatic and maritime technologies is severely hampered by postglacial sea level rise and the flooding of the world's continental shelves. Archaeological sites located in freshwater settings may fill some of these gaps. A case in point is the 23,000-year-old Ohalo II site on the shores of the Sea of Galilee, where fishing peoples built houses, deposited middens rich in fish bones, and left behind netsinkers that testify to the Upper Paleolithic use of fishing nets (Nadel and Zaidner 2002).

If coastal migrations played a role in the dispersal of anatomically modern humans out of Africa (see Erlandson 2002; Stringer 2000), some of these specialized aquatic and maritime technologies (e.g., boats) may have spread around the globe as part of the cultural baggage of our coastal ancestors. It is interesting, for instance, that nearly identical bone bipoints (fish gorges) are found among Later Stone Age peoples of South Africa (Deacon and Deacon 1999), the Natufian peoples of the Levant, and the maritime Paleocoastal peoples of California (Erlandson 1994; Rick et al. 2001)—all of which date to the terminal Pleistocene or Early Holocene. Were these tools invented independently in these widely dispersed regions, are they part of an older coastal technology carried by earlier maritime peoples as they dispersed around the world, or did effective maritime technologies diffuse rapidly among coastal peoples? Stone or wood-stake fishing weirs are another widespread aquatic technology used in many places worldwide (e.g., Byram 1998; Fischer 2004). As far as we know, all known examples date to the last 6,000 to 8,000 years, but little effort has been made to search for older examples that might be submerged in deeper waters offshore. When and where were such devices invented? Were they developed independently by coastal, riverine, and lacustrine peoples around the world or did the idea rapidly diffuse along the linear information networks of coastal and riverine peoples?

Obviously, there is still a great deal to be learned about the origins and geographic spread of these new technologies along coastlines and river corridors around the world. The origins and development of boat technologies are especially obscure because boats are rarely preserved in terrestrial archaeological records. Because coastal geography has changed dramatically, moreover, identifying evidence of early seafaring traditions can be difficult. Some classes of faunal remains may provide evidence for the use of boats, or they may be recognized in parietal or portable art (pictographs, petroglyphs, effigies, etc.) found at some coastal sites (e.g., Bass 1972). One crucial and relatively clear line of evidence for the ancient use of boats can be found in the evidence for the settlement or use of offshore islands not connected to adjacent mainland masses during the Pleistocene. Evidence from the island of Flores in southeast Asia has been marshaled to suggest that *Homo erectus* was capable of some sea crossings (Bednarik 2003; Morwood et al. 1998; Sondaar et al. 1994), for instance, although no other evidence for maritime migrations by *Homo erectus* has yet emerged. With the advent of *Homo sapiens sapiens*, the evidence for early seafaring expands significantly, including the Upper Pleistocene colonization of greater Australia (Sahul; Flood 1995), western Melanesia (see Allen et al. 1989; Clark 1991), the Ryukyu Islands south of Japan (Matsu'ura 1996), and California's Northern Channel Islands (Erlandson 2001). Along many coastlines around the world, however, offshore islands are rare or absent, leaving large gaps in our understanding of early maritime dispersals.

EXPLORING SUBMERGED TERRESTRIAL LANDSCAPES

Issues related to the antiquity and evolution of aquatic, coastal, and island adaptations will not be fully resolved without a substantial investment in systematic underwater research. Vast landscapes lie submerged on continental shelves around the world, flooded by the rapid rise of sea level over the past 20,000 years (Emery and Edwards 1966; Shackleton et al. 1984; Shepard 1964), as well as tectonic and isostatic changes in some areas. These submerged landscapes include the broad plains of Beringia, northwest Europe, and the eastern and gulf coasts of North America, all of which have produced cultural artifacts and the remains of extinct terrestrial animals. Many other coastal zones around the world—especially more protected coastlines where wave energy is comparatively low—also have a high underwater research potential, particularly where ancient river courses, estuaries, caves, or tool-stone outcrops can be identified. Many submerged landscapes have been impacted by erosion, but so have most terrestrial landscapes. In contrast to many terrestrial sites some submerged sites are extraordinarily well preserved, with an abundance of wood, woven plant fibers, and other organic materials. Even in areas of relatively high wave energy, the remnants of submerged forests, soils, the bones of terrestrial megafauna, and even terrestrial archaeological sites are sometimes found (see Flemming 2004), suggesting that carefully designed underwater surveys may prove productive.

Underwater exploration is still in its infancy, but has been revolutionized by successive technological developments, from crude diving bells to diving suits, SCUBA technology, deep-sea submersibles, remote-operated vehicles (ROVs), and remote-sensing techniques. In underwater archaeology, there are well-established traditions of underwater exploration of shipwrecks, harbors, and port facilities. With significant exceptions, these fields concern themselves primarily with the historical or classical periods of the past 2,000 to 3,000 years. There is also a substantial history of underwater research on submerged terrestrial sites, with important work occurring in the Mediterranean, Scandinavian waters, and the Gulf of Mexico (see Dunbar et al. 1992; Faught 1996; Fischer 1995; Flemming 2004; Masters and Flemming 1983). In Danish waters, more than 2,000 submerged terrestrial sites have been recorded, including numerous Mesolithic shell middens (Fischer 2004). One of the best-known examples is Tybrind Vig, a submerged village site with remarkable preservation of wooden artifacts (canoes, paddles, etc.), human burials, hearths, and faunal remains (Andersen 1985). Off the coast of Israel, submerged Neolithic settlements such as Newe Yam have also been documented (Wreschner 1983).

Significant progress on the archaeology of submerged terrestrial landscapes has been made in some areas, but most continental shelves around the world remain terra incognita. So far, the vast majority of research on submerged terrestrial sites has been performed in relatively shallow waters and on sites that date to the past 8,000 years. Working in deeper waters and further from shore, where progressively older coastal sites will almost certainly be found, is more challenging logistically and technologically. Older sites have been found, however, including one that produced Lower Paleolithic hand axes excavated from below a shipwreck off the coast of South Africa (Werz and Flemming 2001). Waechter and Flemming (1962) reported intact bone-bearing deposits in possible Middle Paleolithic caves submerged along Gibraltar's coastline, where underwater research is now being directed by Nic Flemming and Geoff Bailey in association with Clive Finlayson at the Gibraltar Museum. The famous Cosquer Cave, located off the south coast of France, is an amazing submerged site where Upper Paleolithic rock art is preserved in a cave whose entrance and lower reaches were completely submerged by rising seas (Clottes and Courtin 1996).

To understand the role of oceans, islands, and coastlines in human history, we need to intensify the systematic search for submerged terrestrial sites and extend surveys into deeper water. We need careful reconstructions of coastal paleogeography and predictive modeling of human behavior to help determine the most likely locations of ancient coastal settlements as well as the places where these settlements are most likely to be preserved (see Josenhans et al. 1997). Careful planning is needed, in part because underwater work can be expensive and repeated failures may threaten the availability of future funding.

CULTURAL RESPONSES TO INSULARITY, ISOLATION, AND CIRCUMSCRIPTION

Coastal and island societies are inherently circumscribed: their members lived on the edge of a continent or large island, or on a small island completely surrounded by water. How have humans responded to such circumscription and to barriers that may be physical, social, or mental? The isolation of many island societies has, at times, been exaggerated and the permeability of such physical or cultural barriers varied tremendously through space and time. Just as clearly, cultural responses to insularity, isolation, or circumscription are not limited to island or coastal peoples—human societies can be isolated by mountain chains, deserts, cultural frontiers, and other features of natural and social landscapes. People can also choose, at times, to isolate themselves from their neighbors by strictly cultural means—resisting contact with outside groups and developing "island fortress" mentalities. History is replete with such xenophobic societies, from Japan and China in the seventeenth and eighteenth centuries, to Eastern bloc countries in the twentieth century, and North Korea today. Nonetheless, as Anderson (2006) notes, the geographic isolation of some islands is a feature that is sometimes intentionally selected for purposes of exile. The relative isolation of some island or coastal societies can also make them particularly susceptible to cultural and biological developments outside their normal sphere of influence, including the technological advances and diseases often borne by visitors from distant lands.

Although isolation is often the result of cultural decisions rather than geography (Broodbank 1999:238), environmental conditions do facilitate or constrain sea travel (Moss 2004; Rainbird 1999:23). It is important to note that territories are generally more easily circumscribed (and sometimes protected) when surrounded by water—moats built around castles in Medieval Europe clearly provided an obstacle to invaders while prisons or penal colonies on islands formed effective barriers to potential escapees. If the isolation of island or coastal societies varied widely through space and time, it is important that such cultures not be viewed as "analytical isolates" (Broodbank 1999:236, 2000), a holdover from the "island as laboratory" perspective (Evans 1973, 1977; Mead 1957). Many people living on islands did not necessarily perceive the sea as a boundary, but as a mechanism for travel and interaction (Finney 1976; Irwin 1992; Lape 2004; Moss 2004). Just because maritime societies had the technological means and desire to travel, however, does not mean that they did not recognize the hardships and dangers involved in paddling, sailing, and navigating unpredictable seas.

Clearly, the study of island and other coastal societies can illuminate the effects of geographic or social isolation and circumscription, the responses of various human groups to such conditions, and the unique historical trajectories of island and coastal cultures around the world (e.g., Memmott et al. 2004). The archaeological history of Polynesia is fascinating, in part, because of the unique cultural trajectories taken by closely related peoples who carried similar maritime and agricultural traditions as they radiated rapidly into a diverse array of Pacific Island environments (Kirch 2001).

Archaeologists and anthropologists have long attempted to analyze how isolation or distance led certain island societies to elaborate aspects of their culture (e.g., Evans 1977; Mead 1957; Vayda and Rappaport 1963; see also Anderson 2004; Renfrew 2004). Biogeography has played a particularly important theoretical role for island archaeologists to study the evolutionary and adaptive behavior of humans (Fitzhugh et al. 2004; Fitzpatrick 2004; Terrell 1977; see also Dennell 2004). The theory of island biogeography originated with the efforts of biologists (e.g., MacArthur and Wilson 1967; Whitehead and Jones 1969) to explain immigration and extinction rates (and potential equilibrium) on islands based on their size and distance from other landforms. This theory has been criticized by biologists and can be problematic when applied to human cultures, but there are elements worth exploring because isolation and remoteness clearly influenced when and how islands were colonized by humans, as well as the long-term success of such colonization.

The effects of isolation on human populations were not solely cultural, but also biological. Isolation may have caused an intriguing case of endemic dwarfism in *Homo floresiensis* on the island of Flores (Brown et al. 2004). Similar cases (as well as of gigantism) are well documented for other island species such as foxes (Cuarón et al. 2004), sloths (Anderson and Handley 2002), snakes (Keogh et al. 2005), mammoths (Agenbroad 2001), and lizards (Butler et al. 2000; Case and Schwaner 1993) to name a few (for a cautionary note on these issues, see Gould and MacFadden 2004). Long periods of isolation can also render human or other animal populations susceptible to new forms or strains of disease introduced by later immigrants.

The isolation of some islands led Sahlins (1955) to describe Easter Island's famous statues as examples of "esoteric efflorescence" where specialized knowledge by a group inhabiting a place with limited resources was channeled into a productive system. Evans (1977) and Renfrew (1973) applied a similar concept to Malta in the Temple periods. In other cases, some scholars have interpreted the effects of cultural isolation as stultifying, including claims for cultural devolution on Tasmania (see Allen 1979; Flood 1995; Jones 1978). Although Tasmania may be a case of true isolation, Terrell et al. (1997) generally contested the "myth of the primitive isolate" in which Pacific Island cultures were thought of as culturally simplistic and having little connection with the outside world. Today, archaeological, linguistic, historical, and ethnographic evidence suggests that relatively few island societies were ever truly isolated. People occupying islands or circumscribed coastal environments were often challenged, however, by natural or social forces that limited cultural interactions at different points in time (see Fitzpatrick 2004).

The colonization of most islands was purposeful and often required vessels capable of long-distance voyaging. Due to their insularity and limited terrestrial resources, however, many island groups were successfully colonized only by agricultural peoples who carried with them the "transported landscapes" of domesticated plants and animals necessary for survival (see Cherry 1981, 1990, 2004; Takamiya 2006; White 2004). Once they colonized such islands, some people also encountered circumstances that made it difficult for them to leave. When Europeans arrived in the Pacific, for instance, some groups such as those on Easter Island (Rapa Nui) and Palau no longer appear to have had the need or knowledge to continue such voyaging.

In many cases, the limited availability of arable land and other resources on islands or in circumscribed coastal areas also magnified problems associated with human overpopulation, economic intensification, and environmental impacts. Such problems often led to expressions of territoriality, hierarchically organized societies, the development of distinctive symbols of group identity, intensive craft specialization and exchange, and heightened levels of aggression (see Arnold 2001; Kennett 2005; Kennett and Kennett 2000). Many islands around the world display abundant evidence for the construction of defensive works and fortifications, including the Maori *pas* of New Zealand, hilltop forts on Rapa (Kennett et al. 2006), terraced hillsides and crown-and-brim constructions in Palau, and forts of the northwest coast of North America (Moss and Erlandson 1992). The energy invested in constructing and maintaining such fortresses clearly indicates a concern with protecting local territories and resources, wealth, and power, as well as lives. In many cases, prominent mounds, forts, cemeteries, and other conspicuous cultural features also became symbolic signs of ritualized anthropogenic landscapes (Lightfoot 1997).

CULTURAL CONTACTS AND HISTORICAL PROCESSES

The spaces between islands, straits, and coastal byways often served as corridors of communication between biologically, culturally, and linguistically distinct groups. As seafaring skills advanced, long-distance voyaging and contacts became more common. Many Lapita and later Polynesian peoples moved across vast stretches of ocean and maintained connections with other islands and islanders thousands of kilometers away (see Weisler 1998; Weisler et al. 1994; White 1996). For centuries, Viking peoples also maintained long-distance travel and trade networks that encompassed a vast area of the North Atlantic (Magnusson 1979) and similarities in artifact styles and resource exploitation suggest that interaction must have been common between groups in the Caribbean at different points in time (see Keegan 2000; Rouse 1992).

Archaeologists have invested substantial efforts to develop methods of identifying signatures of population movements, exchange systems, and cross-cultural contacts. These involve a variety of analyses, including studies of stylistic or compositional similarities among artifacts, languages, architecture, and other cultural traits. The concept of exchange and interaction has long been recognized as an important factor in the development of complex island and coastal societies (see Descantes 1998; Ericson and Earle 1982; Green 1996; Hage and Harary 1991; Kirch 1990). The type and extent of exchange taking place is typically determined through the "sourcing" of commodities, analysis of their distribution through space and time, and reconstruction of exchange organization (Earle 1982:3).

Such reconstructions often rely on identifying raw materials or production centers used to produce certain goods. The development of various mineralogical and chemical analyses (e.g., Descantes et al. 2001; Dickinson and Shutler 2000; Fitzpatrick et al. 2003;

Glascock 2002; Neff 1993; Speakman and Neff 2005) has allowed archaeologists to reconstruct the origin of raw materials or artifacts using geochemical or mineralogical fingerprints, improving the ability to examine cultural interactions through space and time. These analyses have relied primarily on the analysis of clays, tempers, or stone, but have expanded to include red ochre (Erlandson et al. 1999), marine shell (Eerkens et al. 2005), and other materials. Many important sources of raw material have been characterized (see White et al. 2006), but many sources and distribution networks have yet to be documented in island and coastal areas around the world.

Archaeologically examining items of exchange can be an effective means for determining the timing, direction, and extent of prehistoric cultural contacts, the economics of raw-material acquisition, manufacturing, and exchange, and the sociopolitical processes behind group interaction. In many cases, exchange is not only a means of initiating contact for economic gain or transferring goods, but a way for people to build or expand kin and social relations (Dalton 1977; Fitzpatrick 2003; Hunt and Graves 1990; Kirch 1990; Malinowski 1922). Environmental and economic factors are often important in developing and maintaining exchange practices, however, especially where there are limited resources in one locale and abundant or different resources in another. Anthropologists working in Oceania have suggested that exchange systems often developed because of the disparity of resources found on high volcanic islands and coral atolls (e.g., Alkire 1978, 1989; Descantes 1998).

Marine shell was one of the most widely exchanged and archaeologically visible resources used by island and coastal peoples (Trubitt 2003) as well as their interior neighbors. Historically documented cases such as the kula ring (Leach and Leach 1983; Malinowski 1922), cowrie shells in the Indian Ocean and Africa (Gregory 1996), and shell bead wampum in northeastern North America (Ceci 1982; Smith 1983), attest to the importance mollusks played in status and wealth building. Archaeologists have also studied the movement of marine shell beads from California's Channel Islands to the Great Basin (Vellanoweth 2001), and from the Gulf of Mexico and Atlantic Coast to the Great Lakes region (Brown 1983; Smith and Smith 1989), to trace population movements and examine exchange relationships over vast areas far from the coast.

Lightfoot (1995:199) noted that an important emphasis of modern archaeology is studying the cultural changes associated with colonial encounters between Europeans and indigenous peoples (see also Farnsworth 2001; Fitzhugh 1985; Hezel 1983). Islands and coastlines are particularly important to the study of cultural responses to colonialism because so many encounters took place in unique island and coastal settings around the world (see Torrence and Clarke 2000). Archaeology provides a unique opportunity to flesh out the details of colonial encounters poorly documented in historical records, including the development of multiethnic communities and increasingly global economies (Lightfoot 1995).

Many of these studies derive from the "Columbian Exchange" initiated by European contacts, in which a variety of plants, animals, people, and diseases were transferred between the Old and New Worlds (Crosby 1972). One of the more controversial areas of study in recent years involves the extent to which "old world" diseases affected indigenous peoples of the Americas, Australia, and the Pacific Islands—impacts that may have been far more devastating than previously believed (see Cook and Lovell 1991; Ramenofsky 1987; Stannard 1989). In a variety of ways, however, these colonial encounters had profound effects on cultures around the world as New World cultigens (e.g., potatoes, tomatoes, maize, tobacco) were brought to Eurasia and Africa, and others (e.g., cattle, sheep, wheat, and many others) were transported to the Americas, Australia, and many islands around the world.

HISTORICAL ECOLOGY AND HUMAN IMPACTS IN AQUATIC ECOSYSTEMS

Another major theme for island and coastal archaeologists is the contributions we can make to the rapidly emerging fields of historical ecology and conservation biology (see Lyman and Cannon 2004). Archaeological sites are rich sources of information on ancient ecosystems and human interactions with them, particularly in island or coastal settings where shell middens are generally conducive to the preservation of faunal remains and artifacts made from them. Under such conditions, the analysis of archaeological assemblages can provide invaluable information on how island or coastal environments changed over time and the nature of human impacts on such environments under a variety of demographic, technological, economic, and social circumstances. When combined with the study of fossil animal remains and modern biological surveys of marine and terrestrial ecosystems, archaeological data can contribute enormously to a greater understanding of ecological change and human impacts in terrestrial and marine ecosystems (see Erlandson et al. 2004; Steadman et al. 2002; Steadman and Martin 2003).

Once thought to be nearly inexhaustible, many fisheries around the world have collapsed or are severely depleted. Two national commissions in the United States recently concluded that the world's oceans and fisheries are in a state of crisis (Pew Oceans Commission 2003; United States Commission on Ocean Policy 2004). Pollution, habitat loss, global warming, development, and the introduction of exotic species also take an increasing toll on marine ecosystems (Carlton et al. 1999; Vitousek et al. 1997:495). We are only beginning to understand the larger ecological consequences of such impacts, including the wholesale collapse of many coral reef, kelp forest, estuarine, benthic, and other ecosystems—foundations of marine productivity that have nurtured human societies for thousands of years.

A fundamental problem with modern fisheries and ecosystem management methods is that ecological perspectives are based on systematic observations that rarely extend back more than a few decades. Pauly (1995) and Pauly et al. (1998) referred to this problem as the "shifting baselines syndrome," wherein fisheries managers use recent historical baselines to manage fisheries that are depleted or have collapsed. Such shallow historical baselines are often flawed because they fail to account for the abundance of key species prior to heavy fishing or hunting by indigenous peoples or early commercial harvests (Dayton et al. 1998; Jackson et al. 2001; Roman and Palumbi 2003). A growing number of marine scientists are calling for fundamental changes in the management of marine fisheries and ecosystems, including deeper historical analyses that use archaeological and other data sets to help develop better management plans, restoration efforts, and a more sustainable oceans policy.

A major advance in these efforts was a *Science* article by Jackson et al. (2001), who argued that human impacts on marine fisheries began relatively early, but that human fishing has evolved through three historical and geographic stages: (1) aboriginal subsistence fisheries confined to near-shore habitats with relatively simple boats and fishing technologies; (2) colonial exploitation of coastal and continental shelf ecosystems controlled by merchant powers exploiting far-flung resources in an emerging market economy; and (3) more intensive and "geographically pervasive coastal, shelf, and oceanic fisheries" integrated into a truly global economy. Thus, human impacts on marine ecosystems accelerated through time and expanded geographically as human populations grew, extraction and distribution technologies improved, and increasingly global markets emerged.

Fisheries and ocean management strategies need to consider not just shifting baselines and the historical ecology of marine ecosystems, but the shifting timelines that emerge from the knowledge that in many parts of the world, boats, maritime migrations, and fishing developed considerably earlier than once believed. Compared with terrestrial ecosystems and species (e.g., the Pleistocene megafauna), there has been only limited study of the impacts of ancient humans on aquatic ecosystems. This situation is changing, however, as ecologists and resource managers turn to archaeologists and archaeological data to help refine historical baselines for restoring fisheries and marine ecosystems.

Many islands—especially smaller ones with limited resources, low terrestrial biodiversity, and highly vulnerable terrestrial flora and fauna—provide especially good opportunities for studying human impacts on ancient and fragile ecosystems (e.g., Kirch 1997). Numerous studies on Polynesian islands have documented that human impacts on the terrestrial fauna of Pacific Islands (e.g., Anderson 1989; Kirch 1997; Kirch and Hunt 1997) and the Caribbean Islands (Carlson and Keegan 2004; Fitzpatrick and Keegan 2006; Wing 2001; Wing and Wing 2001) are relatively pervasive. The effects of ancient humans on the marine ecosystems of such islands are less well documented, but remain a fruitful topic for future research.

In studying the effects of humans on island or coastal ecosystems, we should remember that catastrophic impacts are not inevitable, as Kirch's (1997) comparison of ecological impacts and cultural consequences on Mangareva and Mangaia demonstrates. In some cases, localized impacts may also be part of a broader sustainable strategy that can persist for millennia. In other cases, early humans may have had significant local or regional impacts, then adjusted their subsistence practices to help insure a more sustainable yield.

Archaeology is developing into a key contributor to the emerging field of historical ecology. Zooarchaeological analyses have led the way in identifying possible evidence for resource depression or other human impacts in marine or aquatic ecosystems (e.g., Broughton 1999; Butler 2000; de Boer et al. 2000; Etnier 2004; Hildebrandt and Jones 1992; Jerardino 1997; Jones and Hildebrandt 1995; Klein et al. 2004). Identifying human impacts on ancient environments can be a tricky business, however, particularly in coastal ecosystems highly susceptible to natural changes associated with sea-level rise, tectonic events, coastal erosion or sedimentation, storms, and other ecological perturbations (see Claassen 1991, 1998; Mannino and Thomas 2002). So far, the most effective studies have utilized detailed data from multiple sites and long occupational sequences where there are observable changes in species size and distribution, resource switching, and other evidence of depletion. Increasingly, such studies also involve active collaboration with biologists or ecologists—or a detailed understanding of ecological concepts with which most archaeologists have not grappled: shifting baselines, fishing down food webs, regime shifts, alternative stable states, trophic cascades and trophic level analyses, ecological extinctions, and others (see Jackson et al. 2001; Pinnegar et al. 2000; Reitz 2004; Simenstad et al. 1978; Steele 1998; Steneck et al. 2002).

CONSERVATION AND PRESERVATION OF ISLAND AND COASTAL SITES

As we have shown, coastal and island archaeological sites can provide invaluable information about a variety of topics in human history and historical ecology. Unfortunately, coastal and island archaeological records are rapidly being lost to a variety of natural and cultural processes. Most prominent among these processes are coastal erosion and human development. Many of the most significant coastal sites in the world are being destroyed by erosion, and thousands more are damaged or lost each year before their significance can be evaluated. Coastal erosion can be particularly severe where sites are underlain by unconsolidated sediments; rapid erosion can be caused by earthquakes, tsunamis, hurricanes, floods and storm surges, and landslides. In other cases, coastal erosion can be a relatively gradual process, causing a slow destruction of archaeological sites. Coastal erosion is often considered to be natural and inevitable, an impact that requires no serious assessment or mitigation. There is a natural component to coastal erosion, which would occur whether humans existed or not. However, coastal erosion is often intimately linked to human actions: rising sea levels due to global warming; rapid development in coastal areas; damming of rivers and construction of harbors, jetties, and sea walls; dredging and boat traffic; mining of beach sand or coral; clearing of mangrove and other forests; overgrazing and dune destabilization; and looting or vandalism. On a global scale, the erosion of our cultural and ecological history in coastal zones is an unmitigated disaster. Archaeologists and government agencies must do more to combat such erosion. Along the Pacific Coast of North America, for example, Erlandson and Moss (1999) argued for widespread radiocarbon dating of eroding sites, noting that such chronological data can help address a variety of research questions and prioritize threatened sites for salvage work.

Coastal development represents another major threat to coastal archaeological sites. Today, a disproportionate percentage of humans live in coastal areas and the pressure to develop coastal properties is enormous. The laws of many countries provide some protection to archaeological and historical sites threatened by development, but the effectiveness of these laws varies widely between jurisdictions. In some countries around the world, moreover, archaeological sites still receive little or no effective protection, as is the case with small island nations in the Lesser Antilles such as Grenada and St. Vincent and the Grenadines. Concern about the impacts of development has traditionally been focused on land, but offshore shipwrecks, fishing structures, terrestrial sites, and other cultural resources are also increasingly threatened.

The antiquities trade and development-related tourist activities also impact island and coastal archaeological sites worldwide, a result of massive growth within these industries. From Africa (Masalu 2002; Mensah 1997) to the Pacific Islands (Hesp and Hilton 1996; Nunn 2000), the Azores (Borges et al. 2002), the Maldives (Brown and Dunne 1988), Turkey (Otay et al. n.d.), Taiwan (Hou et al. 2002), Korea (Cho 2006), and the Caribbean (Baldwin 2000; Daniel and Abkowitz 2003; Guzmán et al. 2003; Hayton 1996; Robinson 2004), tourism and infrastructure-related development has accelerated beach and coral reef mining with devastating effects.

Throughout the Caribbean, for example, people are struggling with the continued loss of coastline due to sea-level rise, development, hurricanes, sand mining, and erosion. Unfortunately, measures implemented by local governments to control human-induced erosion have been largely inadequate, despite studies showing that beach mining is one of the most pressing problems facing small islands today (see Island Resources Foundation: http://www.irf.org; UNESCO: http://www.unesco.org; UNEP 1998). Recent research at the Grand Bay archaeological site on Carriacou in the southern West Indies shows that the local coastline is eroding at a rate of roughly a meter per year (Kaye et al. 2005). The primary cause of this erosion appears to be unregulated sand mining by locals, leading to the loss of hundreds of cubic meters of archaeological soils and thousands of artifacts and ecofacts each year (Fitzpatrick et al. 2006). Two recent hurricanes have caused even greater damage.

In 2005, catastrophic destruction caused by Hurricane Katrina and the south Asian tsunami provided stunning reminders of the destructive power of nature and the sea. These cases are not unique—storms and wave action routinely cause major damage to coastal archaeological sites around the world. Sea-level changes resulting from El Nino-Southern Oscillation (ENSO) events, in conjunction with storm activity, have caused massive flooding and coastal erosion in Tarawa (Kiribati) in the central Pacific (Solomon and Forbes 1999). Marine erosion along 700 km of Colombia's coast is threatening island villages and forcing the relocation of the inhabitants to inland areas (Correa and Gonzalez 2000). The sheer scale of such problems, a complex web of jurisdictional boundaries onshore and at sea, and a paucity of archaeological research in many coastal areas, make it difficult to assess fully the impacts on coastal history and heritage. If those areas that have seen detailed studies are representative of conditions worldwide, however, the problem is pervasive, enormous, and requires a concerted global response.

SUMMARY AND CONCLUSIONS

The archaeology of islands and coastlines has moved from the margins of anthropological debate to a central place in understanding the spread of humans around the world, the origins of anatomically modern humans and modern human behavior, the evolution of seafaring and other sophisticated maritime technologies, the development of cultural complexity and human diversity around the world, the effects of colonialism and globalization on the cultures of the world, and the history of human impacts on coastal ecosystems. In recent decades, huge progress has been made in our understanding of the archaeological history of oceans, islands, and coasts, from theoretical and methodological advances to the accumulation of scientific knowledge in many areas of the world.

From a general belief that coastal adaptations were a relatively recent phenomenon, the antiquity of coastal shell middens has been pushed back substantially in many areas. *Homo erectus* now appears to have colonized the island of Flores 800,000 or more years ago; *Homo sapiens sapiens* were systematically exploiting a variety of marine resources in southern Africa at least 125,000 years ago; Australia, western Melanesia, and the Ryukyus were settled by maritime peoples between about 50,000 and 35,000 years ago; and Paleoindians colonized islands off the Alta and Baja California coasts (Des Lauriers 2005; Erlandson et al. 1996; Rick et al. 2001) at least 11,000 to 13,000 years ago. These and other discoveries allow us to consider the possibility that our ancestors colonized many coastal and island areas considerably earlier than once believed, that they often had more sophisticated maritime capabilities than previously thought, and that their impacts on coastal ecosystems were sometimes more profound than what was conceivable just a decade ago.

Despite these advances, many questions need to be resolved about the role of oceans, islands, and coasts in human history. There are still large areas of the world and long segments of time about which we know relatively little. We can hypothesize that *Homo sapiens sapiens* spread out of Africa to Greater Australia by following the southern coastlines of Asia (Stringer 2000), or used boats to migrate from island southeast Asia to the Americas, but we lack archaeological data to document such hypothetical migrations. If the MSA in Africa marks a watershed in the expansion of aquatic adaptations and hominid intellectual development (Parkington 2004), we do not know the geographic extent of that complex. If these South African MSA shell middens are linked to a more successful human adaptation and the demographic and geographic expansion of anatomically modern humans (Erlandson 2001; McBrearty and Brooks 2000), similar sites should also be found along a wider area of the African Coast. Examples reported for Mozambique (Barradas 1967) and Eritrea (Walter et al. 2000) may provide evidence for such a wider distribution, but more data are needed to document their age and cultural origin.

Even in South Africa, with its history of shell middens and coastal adaptations spanning more than 125,000 years, there is little evidence of coastal occupations dating between about 50,000 and 10,000 years ago. Around the world, similar gaps—probably related to the dramatic sea-level changes associated with the last glacial—limit our knowledge of the antiquity, origins, and spread of some of the complex maritime technologies developed by anatomically modern humans. In reconstructing the history of human occupation of any island or coastal area around the world, archaeologists should first ask the question, Is the archaeological record representative of the full range of human settlement and behavior? To understand the evidence for marine-resource use at any archaeological site, we need to know what the local environment was like and how distant the site was from coastal habitats at the time (or times) it was occupied (see Parkington 1981). We must try to understand how such distances affected the potential productivity of marine resources, or the likelihood that they would be transported to a site. We must also understand the depositional and taphonomic history of such sites.

All too often, coastal archaeologists have failed to address these basic questions or issues, relied on flawed theories, and ignored proxy records from freshwater ecosystems, the Pleistocene colonization of key islands, and submerged terrestrial sites. Ultimately, the key to understanding the role of the sea in human prehistory lies in the exploration of submerged coastal sites and landscapes around the world. In some areas, archaeologists have made great strides in documenting the presence of these sites on the continental shelves. Archaeologists in many areas of the world, however, are not fully aware of the archaeological potential of the continental margins. Even in Denmark, where more than 2,000 submerged sites have now been documented (Fischer 2004), the potential existence of archaeological sites located in deeper waters (and along older shorelines) remains largely unexplored.

Knowing that shellfish exploitation may have occurred earlier and was widespread than previously supposed raises questions about the nature of the broad-spectrum "revolution" at the end of the Pleistocene, a concept still deeply embedded in archaeological theory. Intensification and diversification of aquatic technologies and subsistence occurred during the past 15,000 years, but how rapid or revolutionary such changes were is not clear. How did postglacial environmental changes (climatic amelioration, sea-level rise, and the flooding of continental shelves) contribute to the reorganization of global ecosystems, to human demographic pressures, and to the development of agriculture (see Binford 1968)? How important was fishing as a source of protein in the emergence of various agricultural societies and how did the development of agriculture facilitate the colonization of various islands or archipelagoes?

Much research still needs to be done to document the nature of these developments through time and space, including research on technological change—how did boats, fishhooks, weirs, nets, harpoons, and other aquatic technologies evolve through time? Once humans colonized various islands and coastal areas around the world, how did their settlement, subsistence, demography, social institutions and interactions, art, and other symbolic behaviors develop? How did natural environmental changes on various temporal scales (annual, decadal, centennial, and millennial) affect such societies? What impacts did humans have on local ecosystems (marine and terrestrial), how did such impacts change through time, and what adaptive adjustments did they require? What do the earliest historical or ethnographic accounts tell us about the nature of coastal and island societies—or the effects of colonial contacts on those societies—and what do archaeological data tell us about the accuracy of such records? Finally, what can archaeology tell us about the emergence of the first truly global economies in the colonial era of European expansion and the accelerating impacts that such markets had on marine animals and ecosystems around the world?

These issues and questions are just a sample of those yet to be resolved about the history and archaeology of island and coastal cultures around the world. Fortunately, archaeologists today are armed with a battery of new or improved scientific techniques to help us reconstruct the past—accelerator mass spectrometry carbon-14 (AMS ^{14}C) dating, thermoluminesence (TL) dating, isotope and trace-element studies, sensitive geochemical measures of provenance, modern and ancient DNA analyses, remote sensing, and others. To complement these techniques, we need less global generalization and more specific ecological and archaeological data to document the diversity and dynamics of island and coastal environments over time, as well as the distinctive adaptive strategies various human populations devised to cope with such diversity. We need to examine how successful such strategies were in individual cases, and the human and ecological consequences of failure. We need greater communication and collaboration with biologists, ecologists, geologists, geographers, and other scientists who can help us interpret our data, ask and answer the appropriate questions, and understand the broader significance of our work. Finally, we must develop a new body of theory to guide us in understanding and interpreting the role of oceans, islands, and coasts in human history.

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