

The status of beaches and shoreline development options on the French Riviera: a perspective and a prognosis

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Abstract. Beach conservation and management on the high-value French Riviera in southeastern France have had mixed fortunes in shoreline economic development strategies over the past half century. Prior to 1965, socio-economic growth related to immigration and tourism resulted in considerable pressure on the coastal zone, leading in particular to beach erosion and degradation of beach environmental quality. Between 1965 and 1980, over 20 % of the 132 km-long French Riviera was permanently altered through the implantation of yachting harbours and reclamation fill structures, while beach-based recreation had a rather low ranking as a development choice, except in the two major resorts of Cannes and Nice which exhibit a densely urbanized seafront. On this preponderantly bold rocky coast, the mediocre recreational value inherited by many of the beaches from the regional geologic setting, and from development pressures and earlier errors in coastal management, left them vulnerable to appropriation and so-called 'valorization' by yachting harbour and estate developers. Over the last decade, artificial shoreline development has virtually ceased, in response to several more or less interrelated factors. These include relative stagnation of socio-economic growth, increasing development and maintenance costs of yachting harbours, saturation of the yachting harbour market as a result of the burgeoning of new, often cheaper, resorts and of reconversion of commercial and shipbuilding ports to leisure ports in the Mediterranean, more stringent legislation, since 1986, on the implantation of residential and major engineering structures on the coastline, pressure for conservation of the cultural and environmental heritage, and greater demand for beach recreational space. This situation has forced a diversification of shore-based activities, as it has been realised that better managed beaches may balance economic aspirations while contributing to enhanced environmental quality and sensible shoreline conservation. This change in strategy has entailed considerable efforts and money on the improvement of coastal water quality, the provision of amenities for beach-goers, and especially the nourishment of eroding beaches and the creation of several artificial beaches. The extent to which beaches will continue to play a role in the sustainable development of French Riviera resorts will depend largely on the capacity of local authorities to maintain environmental quality in the face of inherited and persistent handicaps such as beach erosion.

Keywords: Artificial shoreline development; Beach conservation; Beach management; Mediterranean coast; Tourism.

Introduction

It is axiomatic to state that too much development pressure on coastal environments commonly leads to a degradation of their quality, resulting in non-sustainable use of their resources. This would negatively feedback on the economy, as short-term benefits may be outweighed by loss of revenue due to depreciation of environmental quality. Parts of the Mediterranean coast are particularly illustrative of this situation, although the same problems may be encountered throughout the coasts of Europe. Over the last three decades, touristic development has brought economic prosperity to many of the seaside resorts and former modest fishing communities of the Mediterranean, but also a host of cultural, environmental, coastal resource and shoreline management problems. As far as shoreline management goes, tourism and recreation have involved massive investments on shore-based leisure and recreational structures such as yachting harbours or marinas and on reclamation of land from the sea for various purposes such as housing and transport infrastructure. These have resulted in permanent shoreline alteration, beach erosion, degradation of coastal water quality, and pressure on coastal and near-shore fauna and flora.

The problems generated by such development on beach stability have received considerable attention in the literature, and have been comprehensively addressed (e.g. Nordstrom 1994a, b), while various workers (e.g. Moulis 1994; Breton & Esteban 1995) have described examples from the Mediterranean. Beach degradation generally results from several interrelated developments that include impingement of heavy and permanent infrastructure on the upper beaches and dunes, perturbation of beach sediment budgets by shoreline and coastal river development projects, and, finally, heavy beach protection schemes that have more or less resolved or exacerbated natural or human-induced beach erosion. In such cases, it becomes extremely difficult to reconcile sustained beach frequentation with depreciating beach quality, leading to loss of much needed revenue.

The aim of this paper is to examine the status of

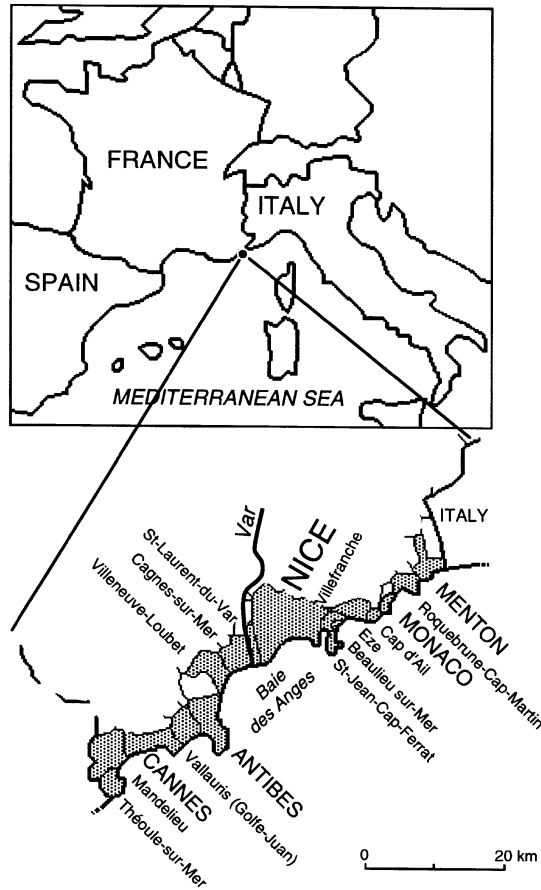


Fig. 1. The French Riviera, showing the 17 seaside resorts, including the Principality of Monaco.

beaches in shoreline economic development choices on the French Riviera (Fig. 1). The pattern of shoreline management on this coast has been somewhat different from that of other Mediterranean resort coasts. For a long time, shoreline development favoured prestigious high-value investments, notably lucrative yachting harbours and marinas. Unlike on other resort coasts of the Mediterranean, beaches, with very few exceptions, had a rather low ranking on the French Riviera as an economic alternative liable to sustain local resort economies. Today, it is not at all sure that the past development choice, hinged essentially on yachting harbours, has constituted a sustainable form of resource development, while its environmental repercussions, measured in terms of shoreline alteration or damage to near-shore flora, are long-lasting or even permanent. The development strategies of many resorts have undergone a significant change in the last 15 years, with stagnation of the yachting harbour market resulting in diversification of sources of revenue. This has involved greater efforts spent on beaches as part of a strategy of sustainable

development. The brief prospective analysis presented in this paper shows that this change has resulted from a complex combination of socio-economic and cultural criteria. The implications of this change for beach conservation and management on this high-value coast are highlighted.

The French Riviera

The French Riviera forms the maritime rim of the French Alps, and is a fetch-limited, low wave-energy, almost tideless environment bounded by a steep, narrow continental shelf. The dominant natural shoreline type is rocky or bold, and comprises resistant plunging cliffs or more or less steep rock-slopes cut into consolidated sedimentary rocks. Beaches are commonly narrow accumulations of gravel and/or sand lacking dunes.

The French Riviera is one of the favourite destinations of international tourism and has set the trend in 'riviera' development in Europe. Apart from this enviable tourist position, the Riviera has, over the last four decades, undergone a massive population boom that has resulted in the development of a quasi-continuous one to several km-wide urbanized front over close to 94 % of the 132 km-long seaboard. Because of the geology of this region, the inhabitable coastal zone is very narrow in most places. This geomorphic criterion has therefore exerted control on both patterns of settlement and development. In particular, the considerable length of rocky or bold shores, which also explain the charm of the French Riviera, has resulted in a shoreline alteration pattern that has brought considerable pressure to bear on the low beach-bound sectors of coast, which have suffered the brunt of artificial shoreline development. Artificial shores occupy stretches of shoreline that have now been completely and permanently transformed by the implantation of major engineering structures. Examples of such transformations are depicted in Fig. 2. The cumulative lengths of each natural and artificial shoreline type for the entire administrative Maritime Alps Department, which is equated with the French Riviera, are shown in Table 1. Artificial shores are associated, in decreasing

Table 1. Cumulative lengths of shore types on the French Riviera.

Type	Length in km
Rocky	69.23
Natural beach	34.43
Artificial beach	3.79
Reclamation fill	9.00
Yachting harbour	15.58



Fig. 2. Yachting harbours and reclamation fill structures on the French Riviera. Vertical photograph shows St. Laurent du Var and the Var river mouth. Much of the airport platform on the right adjacent to the river mouth consists of land reclaimed from the sea through infill of the shallow (< 30 m) submarine slopes of the Var Delta. Oblique photograph depicts yachting harbours on either side of the Cannes urban-front beach, regularly nourished since 1965. Note the small artificial beach on the lower right between two yachting harbours.

order of importance, with yachting harbours, reclamation fill and artificial beaches, all three of which occasionally occur together as marina complexes. They presently occupy a total cumulative length of 28.4 km, or 21.5 % of the Riviera shoreline. The spatial interrelationship and forms of competition between these various natural and artificial shoreline types and the geomorphic and cultural criteria underlying such competition have been treated in an earlier paper (Anthony 1994).

Shoreline development strategies

The golden age of artificial shoreline development

As stated above, the most characteristic feature of past shoreline development strategies on the French Riviera has been the heavy investment on high-value structures such as yachting harbours and marinas, rather than on more popular beach-based recreation. This was a significant choice, in terms of both impact on the coastal and near-shore environment and sustainable economic livelihood of the coastal resorts. Much of the

Table 2. Rates of artificial shoreline development on the French Riviera.

	Up to 1965	1965-80	1980-95
Overall growth (%)	23	65	12
Annual growth (%)	–	4.3	0.8

alteration of the French Riviera shoreline occurred during the period 1965-1980, which marks the golden age of artificial shoreline development on this coast (Table 2). Up to 1965, artificial shoreline implantations on the French Riviera were classic - small, often moribund fishing ports that were part of the touristic folklore and considered as part of the landscape. Artificial shoreline development schemes occurred largely through the appropriation, by developers, of beach-bound sectors of coast. At least three reasons explain this pattern: (1) uncoordinated regional coastal planning and competition between the numerous coastal resorts, (2) the considerable stretches of rocky coast (Table 1) and (3) the rather poor recreational value of most French Riviera beaches.

Massive shoreline alteration was driven by tourism and general socio-economic growth that occurred within a framework of competition between seaside resort communes, each keen on capturing readily available private investments. Virtually every one of the 17 seaside resorts (Fig. 1) wanted its own yachting harbour(s) and seafront residences, the latter sometimes built on land reclaimed from the sea. An important contributory factor in this growth was the absence of large-scale development of similar leisure and recreational structures on the neighbouring Ligurian Riviera in Italy, where legislation was much more stringent. This had the effect of diverting available private Italian investment funds (often of dubious origin!), especially from the Ligurian area, onto the French Riviera. This period was also one

Table 3. Summary of the temporal pattern of shoreline economic development on the French Riviera, and impact on beaches.

	Shoreline development and activities	Beaches
Before 1965	Small fishing harbours, winter tourism, rapid growth of resorts through increasing seafront estate development.	Impingement of developing urban fronts on beaches. Onset of beach erosion.
1965-80	Large-scale construction of yachting harbours, reclamation fill structures, and marinas.	Alteration of over 20 km of natural beaches into artificial shores.
1980-Present	Stagnation of artificial shoreline development, diversification of shore-based recreation.	Greater efforts and money on beach conservation and rehabilitation, construction of several artificial beaches.

of negligible legislative check by the French central government as far as coordinated regional shoreline resource management, environmental quality or provenance of investment capital were concerned.

In this framework of artificial shoreline development at the expense of the original, natural shoreline, rock-bound shores enjoyed relative immunity more because of the prohibitive costs involved in altering them than because of their geomorphological or lithological status. With the use of appropriate technology, stretches of rocky coast were also entirely altered, especially in the Principality of Monaco, where spatial constraints and socio-economic pressure have been particularly severe.

The impact of artificial shoreline development on beaches

75 to 85 % of natural shoreline alteration occurred at the expense of beaches. If one excludes the very limited availability of accessible shores and backshore areas other than those of natural bay beaches, two major factors that rendered beaches vulnerable sites for artificial implantations were their relatively poor to moderate recreational value (Anthony 1994) and the poor standing of most beaches in terms of the historical heritage. Recreational value and standing may be characterised in terms of several interrelated criteria that include physical characteristics (grain-size composition, length, width, stability, degree of pollution, back-beach morphology) and cultural criteria (presence of an urban seafront, historical heritage). Some of these characteristics, outlined below, were decisive disadvantages that discouraged the development of beach-based recreation. It should be noted that these disadvantages still persist (Fig. 3), (hence the use of the present tense in describing them below), and that they clearly illustrate the drawbacks still facing sound beach conservation and management on the French Riviera. 60 % of French Riviera beaches are gravelly. Beaches are of two types: 30 % of them are generally short (< 0.5 km long) stable pocket beaches fringing steep coastal slopes and requiring very little or no protective measures, and the rest (70 %) longer bay-barrier beaches fringing now reclaimed coastal wetlands that have been completely urbanized. With the exception of very short stretches, bay-barrier beaches are prone to erosion in spite of the globally low wave-energy regime (Anthony 1993). They commonly require heavy stabilization measures ranging from engineering structures such as breakwaters, groynes and block armouring (Fig. 3) to periodic artificial nourishment (Anthony et al. 1994; Anthony & Cohen 1995). Failure of such structures, sometimes due to poor maintenance as a result of rising costs, has resulted, in places, in very narrow beaches of much depreciated value. Some highly



Fig. 3. Photographs of French Riviera beaches, depicting some of their handicaps, such as narrowness, chronic erosion, dominance of gravel in their sedimentological composition, heavy and sometimes inefficient beach stabilization structures such as rock armouring, groynes and seawalls (note the vertical wall in A), and pollution of low-energy sectors by seagrass driven onshore. A. Menton; B. Villeneuve-Loubet; C. Antibes; D. Cannes.

sheltered beaches are also prone to water pollution. Protective groynes and breakwaters have a similar effect on certain beaches by hindering water circulation. French Riviera beaches are also commonly polluted by seagrass (*Posidonia oceanica*) deposits driven ashore.

With these disadvantages, transformation of beaches into yachting harbour shorelines was carried out on the strength of the argument of the necessity of so-called shoreline resource 'valorization', put forward by communal authorities strongly lured by the substantial revenues from yachting harbour dues and speculation in estate. Moreover, yachting harbour development during the 1960s and 1970s had two other advantages. It was viewed, together with the casinos that operated at the time, as a prestigious form of socio-touristic development compared to beach recreation. It also offered many jobs through the harbour construction industry and through the running and maintenance of yachts and harbours, as well as the building estates associated with the latter. The low level of investment in building, maintenance and

cleanup investments involved in the less sophisticated forms of beach-based recreation existing in that time meant that the latter did not appear as an attractive form of socio-touristic development capable of generating jobs and revenue comparable to those from yachting harbours.

Artificial shoreline development particularly affected partial or whole stretches of short gravel pocket beaches, fringing more or less steep coastal slopes and lacking space for car parks or other amenities necessary for large numbers of beach-goers. By and large, the rather mediocre recreational value of beaches on the French Riviera cannot be dissociated from past demographic and coastal development pressures. Two significant aspects of shoreline development prior to 1965 were:

1. *Impingement of housing and transport infrastructure on the seafronts.* As the century wore on, these impacts paved the way for beach erosion, insidiously preparing the conditions for the appropriation of beaches of increasingly depreciating quality by proponents of artificial shoreline development projects.

2. Deterioration of beach sediment budgets. The present erosional status of the French Riviera beaches has been shown to be an outgrowth of a number of well identified socio-economic developments since the beginning of the 20th century (Anthony 1995). Sediment supply by rivers became considerably reduced as a result of the extraction of aggregates from river beds for the construction boom that marked the development of the Riviera. The emplacement of rock dams across streams to enhance aquifer performance for both urban water supplies and horticulture have had a similar effect on fluvial sediment supply (Anthony & Julian in press). Drastic reduction of beach width also occurred as a result of the construction of various infrastructure such as coastal roads and the major rail link between France and Italy, and of protective but reflective sea walls. The artificial structures implanted on the shoreline between 1965 and 1980 have ensured virtually total stoppage of long-shore drift on the bay-barrier beaches, as no concerted provisions between resorts were made for sediment bypassing (Anthony et al. 1994).

For various reasons, solutions alternative to direct shoreline alteration, and which may have alleviated pressure on low beach-bound sectors of coast, especially from yachting harbour development, have not been feasible. These include inland marinas and 'dry harbours' for stocking boats inland. The development of inland marinas (in reality, simply one way of displacing a problem with environmental repercussions, whatever the site) is hindered in this area by the lack of major rivers and by the probabilities of extremely low or erratic river discharge. Dry harbours, a couple of which exist, face competition for space with residential estate, and their philosophy runs counter to the popular habit by many proprietors of using their boats, moored virtually throughout the year, as 'floating apartments'!

Two outstanding exceptions of resorts that maintained a good ranking of beaches in shoreline development and management schemes were Cannes and Nice, for a number of reasons. These included very early resort development to cater to high-class winter tourism. Over the years, these resorts have developed dense urban seafronts with prestigious or popular beach-fronted promenades. The bay-barrier beaches fringing these communes may in fact be considered as essential elements of the historical heritage of the French Riviera.

The necessity for diversification of shoreline development

It became clear in the very early eighties that yachting harbours and marina development could not always ensure sustainable local economies. Their development on the French Riviera has stagnated in the last 15 years as a result of several interrelated factors. These include

the possible attainment of a threshold in socio-economic development, saturation of the yachting harbour market, and legislation. It is likely that, by 1980, socio-economic development on the French Riviera had attained a sufficiently high level as to no longer necessitate some of the major shoreline implantations, such as airports, heliports, yachting harbours and housing estates, that characterized the period of rapid growth between 1965 and 1980. A spontaneous stagnation due to levelling off of socio-economic growth would not, in itself, have had any impact on the sustainable exploitation of yachting harbours and marinas. However, there are strong reasons to believe that this stagnation was not spontaneous. The economic problems related to the market for luxury yachting harbour or marina projects, which are generally the norm on the French Riviera, have had a considerable impact on the income of resorts that had heavily invested in these structures or relied strongly on them as sources of tax revenue. These problems have included the increasing costs of ventures as accessible sites on this coast became rarer, rising maintenance costs of existing harbours, leading to job cuts, and the global economic crisis that has more or less waxed and waned since the mid-seventies. The situation has been rendered more difficult for the Riviera by competition from cheaper (both in terms of development and running costs) rivieras on the more easily transformable Spanish coast, and even more recently, the North African coast.

In recent years, decentralized government and the general disengagement of the state in terms of development funding of communes have meant that French communes have had to seek other sources of revenue. On the French Riviera, stronger taxation of yachts registered with local yachting harbours has had the effect of diverting yacht owners towards cheaper harbours elsewhere. Similarly, the attempts to 'reconvert' partially or wholly, several commercial and/or shipbuilding western Mediterranean ports in financial difficulty such as Barcelona, Genoa, and in France, Marseilles and its smaller neighbours La Seyne-Sur-Mer and La Ciotat, into yachting harbours, have had the effect of further saturating the potential space for this type of shoreline development.

The French 'Law relative to the coastal zone' of 1986 has severely restricted leisure and tourism-related artificial shoreline development in France. This law states that new development projects impinging on the shore, which is part of the 'public maritime area', must be of 'public utility', a criterion most projects, other than artificial beaches, find hard to meet. This is especially the case of generally privately-funded marinas and reclamation fill structures destined for lucrative residential or commercial purposes. However, during the 1980s several small fill structures were constructed

on the French Riviera, mostly as part of seafront promenade improvement projects, all of public utility therefore. Legislation has found strong backing in mounting pressure from conservation groups alarmed at the cultural and especially environmental repercussions of irreversible shoreline alteration.

Since the early 1980s, various miscellaneous incidents have brought to the fore the necessity for a better understanding of the ecodynamics, morphodynamics and sediment dynamics of the coastal environment, and for more rigorous conservation of natural resources. Two examples are the catastrophic landslide that affected the Var river delta (Fig. 2) in October 1979, and, more recently, the anxiety caused by the massive proliferation of the sea grass *Caulerpa taxifolia*. The Var landslide was largely a product of the various human-induced transformations of the lower valley, delta plain, and especially the steep delta front of the Var River (Julian & Anthony 1996; Anthony & Julian 1997), notwithstanding the officially upheld version of a natural disaster, no doubt in order to minimise insurance claims and to avoid public outcry against human-induced alterations of the coast. This landslide led to the collapse of reclamation fill structures on the seaward edge of the delta, resulted in several casualties and millions of francs worth of material damage. The colonization of the Riviera seabed by *Caulerpa taxifolia* over the last decade has occurred to the detriment of the usual sea grass colonies of Neptune Grass (*Posidonia oceanica*) on this riviera, whose important ecological and wave-damping role has been highlighted in several studies (e.g. Blanc & Jeudy de Grissac 1978; Anon. 1985). Artificial shoreline development has been considered a major factor in the reduction of the seabed area colonized by Neptune Grass off the French Riviera (e.g. Lefèvre 1977; Meinesz et al. 1990), and although its replacement by *Caulerpa* is not directly due to human shoreline alterations, the proliferation of the latter is lumped by ecologists and environmentalists in the same bag as artificial shoreline development schemes they consider harmful to the coastal environment.

Implications of diversification for beach conservation and management

As the economic advantages to be drawn from artificial shoreline implantations have diminished, the diversification of economic development choices by resorts on the French Riviera has notably involved investing on the more popular forms of shore-based recreation. Pressure for coastal conservation has also been naturally reinforced by increasing resident populations seeking better standards of environmental quality, and by the growth of summer tourism oriented towards beach rec-

reation. Both resident populations and a steady influx of summer tourists, especially from wealthy northwestern Europe (therefore exigent in terms of quality and more responsive to a 'greener' environmental approach) require cleaner, wider beaches. Such beach environmental quality upkeep creates jobs. Legislation has also become more stringent as competition for recreational seafront and nearshore space has dramatically increased with the advent of new leisure activities such as jet-skiing.

The 'greener', more environmentally friendly approach taken by touristic development, the lesser attraction of yachting harbours as sources of revenue and the much tighter legislation on lucrative seafront development schemes such as housing estates and marinas, have forced most seaside resorts on the French Riviera into spending greater efforts and money on beach conservation, better beach management and improvement of beach-holding capacities through the creation of extra beach recreational space. The two major resorts, Nice and Cannes, had a headstart in this regard, having had the economic resources to accommodate both popular beach-fronted promenades and development schemes involving significant artificial shoreline implantations.

Enhancement of the recreational value of beaches has been done in a variety of ways. These include monitoring and improvement of beach environmental quality, notably water quality through compliance with European directives in order to meet the requirements of environmental audit systems such the 'Blue Flag' charter. Other improvements have included the provision of necessary amenities such as beach car parks, showers and bins, as well as better security through lifeguards and beach police patrols. Coastal water quality has been improved through the construction of sewage treatment plants. Six of the 11 existing sewage treatment plants on the French Riviera seaboard were constructed over the last eight years, four of them since 1992. However, the most directly visible impacts of improvement have been beach nourishment schemes, and, especially, the creation of several artificial beaches (Fig. 4).

Beach nourishment has become, over the last decade, a systematic part of the beach management strategies of several resorts, notably Nice, Cannes, Antibes and Golfe-Juan (Fig. 1). The actual practices of beach nourishment and artificial beach construction are too diverse to be treated here, and have been discussed elsewhere (Anthony & Cohen 1995; Cohen 1996; Anthony in prep.). In terms of shoreline types, artificial beaches, an example of which is depicted in Fig. 2, have had a slim advantage (35.5 %) over reclamation fill structures (35 %), and a more significant one over extension of two existing yachting harbours, in the 12 % overall rate of artificial shoreline development that occurred between 1980 and 1995 (Table 2). This is a significant result when

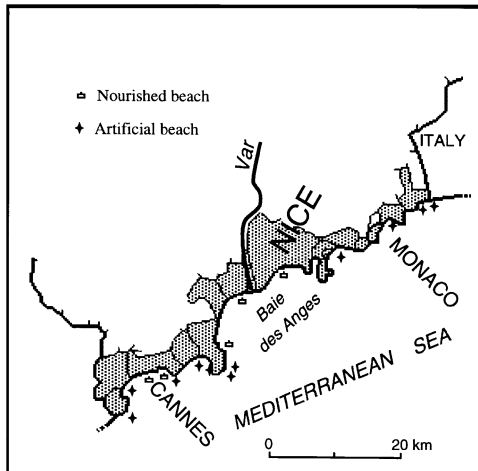


Fig. 4. Nourished and artificial beaches on the French Riviera.

viewed in the light of the competition between the three artificial shoreline types on this Riviera. It was suggested (Anthony 1994) that the rather moderate total percentage of artificial beaches among artificial shorelines (Table 1) reflected the lesser standing of such beaches in the hierarchy of shoreline development choices in the past. Beaches on the French Riviera, whether natural or artificial, were, for a long time, much less lucrative than boat moorings. This situation has now changed as beaches have proven to be a shoreline development choice capable of sustaining local resort economies while balancing environmental and conservation preoccupations.

These various improvements must not however mask the important efforts that need to be deployed to maintain beach quality, especially in view of the major physical disadvantages that still handicap beaches on the French Riviera (Fig. 3). The extent to which beach improvements have been effective has depended on the inherited physical and cultural characteristics. Although artificial beaches, for instance, blend well with natural beaches and may not be viewed as an artificial shoreline type by the public, their implantation and maintenance require heavy investments. Not surprisingly, the total length of artificial beaches has compensated for only 1 % of the estimated total length of 22 km of permanently altered natural beach. Artificial beaches are also more prone to pollution because the high density of breakwaters and groynes needed to ensure their stability hinders water circulation. On some natural beaches, beach narrowness as well as past encroachment of infrastructure leave very little space for developments such as car parks or for accommodation of beach-goers (Fig. 3). Legislation on beaches also has indirect effects on beach

management and improvement schemes. Portions of beach may be leased out by resort authorities to private concerns such as hotels and restaurants from July to October each year, this being an important source of additional revenue. The regulations on leasing stipulate that a leased portion of beach cannot exceed 100 m in length, and that for each portion of beach leased out the resort must maintain an equivalent portion of beach of free access to the public. In this regard, many pocket beaches on the French Riviera, disadvantaged in terms of their length and the lack of back-beach space for developing amenities for beach-goers, do not qualify for leasing operations, while the wide, well-kept and artificially nourished bay-barrier beaches of Nice and Cannes draw substantial revenues from leasing out portions of beach (Fig. 5).

Additional advantages from such leasing out include ensured beach clean-up operations by the tenants who also provide lifeguard facilities that may intervene in neighbouring unleased portions of beach. In return, leased portions of beach generally get the lion's share of nourishment material (Anthony & Cohen 1995). One effect of this is irregularity of beach width alongshore. It has also been shown that this nourishment practice is not necessarily the most efficient in terms of containing erosion and stabilizing beach width (Cohen 1996).

Discussion and Prognosis

The foregoing analysis of the status of beaches in the temporal pattern of shoreline development strategies on the French Riviera brings out three distinct phases, each of which crystallizes, in its own way, the rather mixed fortunes of beaches on this high-value coast (Table 3). This coast had a headstart in 'riviera'-type development in Europe. It however differs from other rivieras of the Mediterranean 'Sun Belt' in that it lacks extensive low beach-bound coasts liable to favour popular beach-based recreation and tourism such as the sand barrier-lagoon coasts of the French Languedoc-Roussillon region and much of the Spanish and Italian coasts. This, in addition to the mediocre physical qualities of the beaches (Fig. 3) and uncoordinated regional coastal management during the golden age of socio-economic growth in the 1960s and 1970s, resulted in early emphasis on prestigious ventures involving yachting harbours and marinas (Fig. 2) comprising exclusive residential estates. An early start in touristic development geared essentially to cater to the tastes of the aristocratic and the wealthy, especially during the mild, sunny winters, could also explain this trend which occurred to the detriment of natural beaches.

Over the last decade, better beach management and



Fig. 5. A. Part of Nice beach and its famous promenade. The photograph shows a wide, well kept and regularly nourished beach. **B.** A portion of Cannes beach along the famous 'Croisette'. Parts of both of these beaches are leased out to private concerns (hotel groups, restaurants and individual entrepreneurs) that commercialize additional beach facilities to their clients and to beach-goers.

conservation, wherever feasible on the French Riviera, have no doubt been a balanced alternative to coastal development schemes involving quasi-irreversible shoreline alterations. Although the massive arrival of beach-seeking tourists in summer brings with it a host of problems such as congested roads, greater water consumption and more sewage effluent, the advantages derived from adequately managed beaches are not negligible, whether they be measured in terms of beach-related jobs, revenue from leasing of beach portions to private concessions, or from touristic spending, or even in terms of the prestige associated with well managed beach-front promenades, such as those of Nice and Cannes (Fig. 5), for instance. Today, proper beach conservation and management are increasingly hinged on adherence to an environmental audit system that punishes resorts where considerable improvements still need to be done while rewarding others where improvements have raised environmental standards of quality.

The change towards greater efforts and money spent on beaches is, however, an uneven one, as the inherited physical and cultural characteristics of the beaches in each resort have more or less attenuated or reinforced the advantages to be drawn from beach-based activities. Faced with the mediocre qualities of their beaches, several communes have resorted to the construction of artificial beaches and to beach nourishment. As a result, differences in recreational

quality between beaches persist, leading to greater pressure on the 'better' beaches. Balancing such pressure, which is a potential source of problems, but also of revenue and prestige, should be done while maintaining the good environmental standards that are in turn necessary to maintain beach attractiveness.

As European directives on environmental conservation and quality and increasing influxes of beach-seeking tourists migrating to the sunny Mediterranean have both forced a 'greener' approach to shoreline management, the mutation observed on the French Riviera is interesting. It testifies to an increasingly more uniform pattern of shore-based tourism and recreation throughout the Mediterranean. Whether the French Riviera will manage to maintain its prestige, despite past errors in coastal management, will depend largely on its capacity to maintain shoreline environmental quality. The rather poor physical qualities of long stretches of beach, inherited essentially from lack of foresight in coastal planning and shoreline management (Fig. 3), together with the now common practice of beach nourishment and the abundance of artificial beaches (Fig. 4) probably show that the efforts to be deployed here are greater than on other Mediterranean resort coasts that are more advantaged in terms of natural beaches.

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