Economic and environmental impacts from the operation of marinas: the Greek case

A. Pardali & F. Sakellariadou

Department of Maritime Studies
University of Piraeus, Greece

Abstract

A fundamental prerequisite for the development of marine tourism is the development of the port infrastructure. Since 1993, a modernization of the institutional framework for the construction and operation of marina has been under way, along with increasing numbers of mooring position. Infrastructure is not the single prerequisite for development. Central planning for the entire country is essential to create more jobs, to increase income on a regional and national level, and to achieve a significant multiple impact on the Greek economy. The infrastructure development should not be left at the discern of local factors. These marinas must be developed with respect to the natural and cultural environment and with a view towards enhancing the region aesthetically since the deterioration of the environment will hamper the promotion of tourism in the future.

This article will attempt to: present the current situation as well as the trends for the development of marinas in Greece; identify any operational problems during their administration, and investigate the economic and environmental consequences of their operation.

1 Introduction

Lately, marinas are regarded as increasingly popular users of coastal areas, showing a tendency to spread out. This situation, in collaboration with the general growth of coastal development, as coastal zones are the sites of major urban and industrial pollutant discharges (GESAMP, [1]), leads to the growing awareness of the need to protect coastal waters as well as the entire coastal
environment. The environmental pressures of marinas construction and use cause physical, chemical and biological modifications of the coastal environment leading to the need for a coastal zone management towards sustainable tourism and development.

The development of marine tourism as well as the development of its infrastructures, mainly marinas, leads to:

- creation of new work positions, and therefore contributing significantly to the reduction of unemployment, as a following step in a decentralization policy
- coverage of currency deficit, especially in countries like Greece that face problems concerning payment balances
- income increase on a personal, regional and national level, due to multiplicative influences of income on Greek economy, that will promote a better distribution of income between urban centers and the rural ones and subsequently leading to a regional development
- income increase of certain social and vocational categories in less-favored regions (barren and isolated islands).

2 Marinas in Greece

2.1 The institutional framework operation

Until 1993, individuals were not allowed to construct, have the exclusive use or exploitation of a marina. According to law 2160/93, all responsibilities concerning marinas are handed over to the Ministry of Development and fulfilled through the Inter-ministerial Committee and the Secretariat for Marinas Support (Kamarinakis et al [2]). It provides with the possibility of assigning the marinas economic exploitation to business companies of public or private interests. This law modernizes the legal framework for the operation of marinas, reduces bureaucracy and primarily allows the private sector to be able to offer marina services. In many cases, marinas users themselves became service providers.

2.2 Marina infrastructures

The construction of marinas began in Greece in 1960 with the initiative of the Greek Tourist Organization (GTO). Until 1993, there were 12 marinas in operation, with a capacity of 4,570 places, while the exclusive operator was the State (mainly GTO). There were located in the large urban centers and particularly in Attiki. Today, there are 16 marinas in operation with 6,575 mooring positions (GTO, [3]). About 35 new marinas are planned for the coming future, with a capacity of 7,548 mooring positions. New marinas will be constructed further away from the large urban centers, their designated sites have not been selected following a national plan but approval was granted ad hoc.

The law foresees the construction of new marinas in front of various hotels in order to fulfill the guests needs. Four hotel marinas are currently in operation, with a total capacity of 90 places. The same law provides for the establishment of
marinas for shelter and anchoring of recreational vessels in protected bays with limited or basic service facilities. The designated marina shelters are 24 with estimated mooring positions up to 1,400. Also, decision will be taken for respective application forms concerning 12 more marinas, 9 sheltered ones and one hotel marina. Therefore, it seems that, in the coming future, the situation will be changed dramatically, as there will be about 50 marinas in operation with approximately 16,000 positions.

2.3 Services offered

In general, the services offered at marinas, by rank of importance, are the following:

- *Direct port services*, such as mooring and anchoring, effective markings, adequate space for vessel mooring, protection from weather conditions, a unit for refloating and launching of vessels, storage space, parking area, easy access to the inland, land areas for repairs and winter storage;
- *Indirect port services*, such as water supply, refueling, electric power, up to date systems of communication, security, waste disposal;
- *Administrative services*, including an administration office, Customs and Port Authority;
- *Repair services*, such as repair and maintenance units for vessels, technical support for electronic instruments, convenient market for marine materials, etc., and
- *Tourist and other services*, such as information about tourism, restaurants and other recreation areas, athletic facilities, hygiene and cleaning facilities (toilets, showers, laundry and dry cleaning facilities), mini-market, surgery and chemist's, banking services.

2.4 Demand analysis

Yachts arrivals in Greek ports in 1998 were estimated up to 58,217. Among them, 27,222 referred to vessels with a foreign flag and a total capacity of 1,035,443 register tons, and the remaining 30,955 to vessels with the Greek flag and a total capacity of 756,542 register tons (Division of Trade and Services, [4]).
The average capacity per vessel was 30.78 register tons. The foreign flag vessels spent 173,511 days in Greek marinas and the Greek flag ones 136,944 days. The average stay per vessel was 5 days. Finally, the number of yachts passengers were estimated up to 129,124 and the crew members to 159,945 (Division of Trade and Services, [4]).

Based on the above information, the average number of passengers and crew was 5 persons per vessel. Figures 1 and 2 show the monthly yachts arrivals at Greek ports, with foreign or the Greek flag, in 1998.

2.5 The cost price of marina services

In Greece, marina price policy is not based on any cost analysis and quite often is determined without taking into account the fixed costs. In 1998, by ministerial decision, a uniform system for calculating marina mooring fees for all types of vessels was established, based on the total length in meters at Vouliagmeni, Zea and Flisvos marinas. According to it, the mooring fees are calculated on the basis of the size of vessels, the season of the year and the duration of the stay.
2.6 Quality of services provided

Most of the marinas operating currently in Greece, are able to provide sufficiently only the direct marina services (especially mooring), whereas the remaining services can only be offered at a limited number of marinas in a rather low quality. In order to evaluate the services provided at the Attiki marinas (the large majority of those owned by GTO), a questionnaire was circulated to a percentage of 5% of the total number of users at each marina (Pardali et al, [5]). Evaluation of the information collected (Table 1) showed that, in general, Attiki marina users did not seem to be satisfied with the quality of the provided services. This can be attributed to the demand excess of these marinas.

Table 1. Quality of Provided Services at the Attiki Marinas of Greek Tourist Organization.

<table>
<thead>
<tr>
<th>Service</th>
<th>Non-existent</th>
<th>Inadequate</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Port Police</td>
<td>-</td>
<td>45%</td>
<td>41%</td>
<td>14%</td>
<td>-</td>
</tr>
<tr>
<td>2. Security</td>
<td>64%</td>
<td>23%</td>
<td>14%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3. Customs</td>
<td>32%</td>
<td>27%</td>
<td>32%</td>
<td>5%</td>
<td>-</td>
</tr>
<tr>
<td>4. Surgery-Chemist</td>
<td>100%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5. Disposal area</td>
<td>-</td>
<td>55%</td>
<td>32%</td>
<td>14%</td>
<td>-</td>
</tr>
<tr>
<td>6. Hygiene areas</td>
<td>41%</td>
<td>45%</td>
<td>14%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7. Banking services</td>
<td>100%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8. Parking area</td>
<td>-</td>
<td>59%</td>
<td>27%</td>
<td>14%</td>
<td>-</td>
</tr>
<tr>
<td>9. Storage area</td>
<td>91%</td>
<td>9%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10. Wintering Facil.</td>
<td>73%</td>
<td>18%</td>
<td>9%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11. Repair Services</td>
<td>91%</td>
<td>9%</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12. Cranes</td>
<td>86%</td>
<td>5%</td>
<td>9%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>13. Slips</td>
<td>73%</td>
<td>23%</td>
<td>4%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>14. Basic Needs</td>
<td>73%</td>
<td>14%</td>
<td>13%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>15. Electricity</td>
<td>9%</td>
<td>45%</td>
<td>46%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>16. Refueling</td>
<td>9%</td>
<td>22%</td>
<td>45%</td>
<td>18%</td>
<td>5%</td>
</tr>
<tr>
<td>17 Phone Services</td>
<td>27%</td>
<td>50%</td>
<td>14%</td>
<td>9%</td>
<td>-</td>
</tr>
</tbody>
</table>

2.7 Relation of supply with demand

Recently, it seems that an excess of demand for mooring places in the touristic Greek ports occurs. Table 2 shows supply and demand mooring figures at marinas from 1995 to 1998 (Greek Tourist Organization, [3]).
Table 2. Supply and demand mooring figures at greek marinas, 1995 to 1998.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>DEMAND</th>
<th>SUPPLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>20,000</td>
<td>10,000</td>
</tr>
<tr>
<td>1996</td>
<td>23,000</td>
<td>13,000</td>
</tr>
<tr>
<td>1997</td>
<td>26,000</td>
<td>15,000</td>
</tr>
<tr>
<td>1998</td>
<td>30,000</td>
<td>17,000</td>
</tr>
</tbody>
</table>

The excess of demand shows to be increased, as many of the marinas under construction are not in operation yet and the mooring positions available do not exceed 7,000.

2.8 Sailing zones and port competition

Recently, a strong competition for marine tourism was noticed among Mediterranean countries (Table 3). There are two centers of development, one concerning the Western Mediterranean countries and one around the Eastern Mediterranean ones. Consequently, Mediterranean Sea is divided mainly in two sailing zones for yachts. The sailing zone corresponding to Western Mediterranean includes France (Cote d'Azure), Spain and Italy. The principal features of this zone are:
- the low temperature values of seawaters,
- the large distances between the sailing points,
- the relative saturation of the area concerning the possibility of new marina positions,
- the high level of services provided,
- the high costs.

The Eastern Mediterranean sailing zone includes mainly Croatia, Greece, Turkey and Cyprus. The main features of this zone are:
- ideal seawater temperature values,
- short distances between sailing points,
- high level of archeological sites and touristic interests,
- high level of environmental quality,
- high potential to increase mooring marinas positions,
- low prices compared to those corresponding to the Western Mediterranean marinas,
- low level of current services provided.

Lately, apart from the previously mentioned countries, some South Mediterranean countries, like Morocco, Tunis, Libya and Egypt showed a participation in the marine tourism business, however, still in an embryonic stage.

According to Figure 3 (personal communication, [6], Greek prices seem to be relatively low in comparison with those of France, Italy, Croatia and Turkey and high compared with the ones of Spain and Cyprus.
Table 3. Foreign tourists arrivals, number of marinas, mooring places and total capacity of arriving vessels, 1998. (Greek Tourist Organization, [3]).

<table>
<thead>
<tr>
<th>Countries</th>
<th>Arrivals of Foreign tourists (millions)</th>
<th>Marinas (No)</th>
<th>Mooring places</th>
<th>Total Capacity of arriving vessels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greece</td>
<td>10.1</td>
<td>15</td>
<td>6400</td>
<td>633.7</td>
</tr>
<tr>
<td>Cyprus</td>
<td>2.0</td>
<td>2</td>
<td>470</td>
<td>335.0</td>
</tr>
<tr>
<td>Turkey</td>
<td>-</td>
<td>21</td>
<td>8000</td>
<td>1230.8</td>
</tr>
<tr>
<td>Spain</td>
<td>45.1</td>
<td>84</td>
<td>33000</td>
<td>731.7</td>
</tr>
<tr>
<td>France</td>
<td>60.6</td>
<td>36</td>
<td>26500</td>
<td>437.3</td>
</tr>
<tr>
<td>Italy</td>
<td>29.2</td>
<td>45</td>
<td>23900</td>
<td>818.5</td>
</tr>
</tbody>
</table>

Figure 3: Prices corresponding to various vessels in Mediterranean marinas.

2.9 Employment — results in GTO marinas

GTO marinas employ 120 persons corresponding to an approximately 740 million drachmas cost. The operation of new marinas will effect dramatically both local and national economies, not to mention the obvious employment increase. It is estimated that in the next few years marine tourism will employ more 150,000 persons.

3 Marinas and environmental issues

3.1 Need for a sustainable coastal management

The world economy depends on the natural environment in various ways. The environment is a source of energy and materials that are transformed into goods and services to meet human needs. On the other hand, the environment is a sink
for the wastes and emissions generated from the producers and consumers, and it provides a number of basic conditions for human life and economy. The carrying capacity of the world's ecosystem helps to define the sustainability of economic activities.

Coastal regions attract many human activities and as they represent fragile ecosystems, the unmanaged environmental impacts of these activities can result to a decline of the natural sites. The differences in time scale of water mixing and pollutants transport, in biological productivity and in sedimentary regimes in coastal zones, in comparison with the open sea, as well as the variety of distinctive ecosystems each of them supporting specially adapted assemblages of species in coastal areas, have to be significantly considered in an attempt towards a sustainable management of a coastal system (Sakellariadou et al [7]).

Marinas could affect the coastal zone aquatic ecosystem both directly and indirectly. The former way corresponds to land and habitat loss and impacts on water quality while the latter to the modification of water currents and sediment deposition patterns. Therefore, there is a need for such development that could proceed in an environmentally acceptable and predictable way.

3.2 Environmental impacts from the operation of marinas

Marine pollutants in marinas can derive from various sources, like activities during the vessels maintenance, sewage and wastes produced on boat and discharged to the seawater, cleaning waters discharged in boats parking areas. Bearing in mind the fact that the water circulation in marinas is limited, these pollutants in waters and sediments of marinas create a substantial problem that affects the various marine biotopes. In the above mentioned, the physical alteration of the coastline during both construction and use of marinas has to be added too.

Among the various environmental impacts of marinas, the following will be referred to (EPA, [8]):

- **Toxicity in the water column.** The various sewage s discharged from the vessels are mainly composed by organic matter, consuming therefore large amounts of dissolved oxygen to be decomposed. Marina waters can be enriched in various metals used in vessel operation, maintenance and repair. Petroleum hydrocarbons can enter marina waters during refueling activities and with bilge and fuel discharges Thus, the low concentrations of dissolved oxygen, the high metal contents and the petroleum hydrocarbon enrichment in the water column characterize its toxicity.

- **Increased pollutant contents in sediments.** Many environmental contaminants are adsorbed on suspended and settled particles. Sedimentation can lead to elevated concentrations of contaminants in the sediments and plays an important role in determining the environmental impact of the contaminants.
• Increased pollutant levels in aquatic organisms. During the various biological activities, marine organisms can accumulate high pollutant concentrations in their bodies.

• Increased levels of pathogens indicators. A number of studies have shown the presence of pathogen microorganisms in marina areas and specifically during the high boat occupancy and usage periods (Gaines and Solow, [9]).

• Disruption of sediments and habitats. Seabed sediments can be reworked with dredging and/or boats maneuvering. In the case that these sediments contain potentially harmful substances, adsorbed in the past, then, when reintroduced to the marine environment, they can affect negatively the environmental well being. Dredging and boat maneuvering can also disturb and to an extent destroy the corresponding biotopes and increase the turbidity, affecting therefore to the highly important photosynthetic mechanism. Another issue that arises from the dredging activities is related to the final deposition of the dredged material particular the potentially contaminated one.

• Erosion of the shoreline. Waves and sea currents create erosion of the shoreline. This is more pronounced in case of bigger vessels and/or higher velocities, affecting both the shoreline and the seabed.

3.3 Metal concentrations in surface sediment samples from Saronikos gulf marinas

In an attempt to estimate the concentrations of environmentally important metals in surface sediment marina samples, surface sediment samples collected from the marinas of Faliro, Kalamaki, Glyfada1, Glyfada2 (Aghios Konstantinos), Voula and Vouliagmeni (all of them in Saronikos Gulf, in spring 1998, were analyzed. The sediment samples were treated with a mixture of concentrated HNO₃-HF-HClO₄, at 300°C for several hours (UNEP, [10]). Total metal content of sediments was determined using flame and flameless atomic absorption spectrophotometry. The results are presented in Table 4.

Table 4. Total metal contents (µg/g) in surface sediments from Saronikos Gulf marinas.

<table>
<thead>
<tr>
<th>Sample Site</th>
<th>I. D.</th>
<th>Zn</th>
<th>Mn</th>
<th>Fe</th>
<th>Pb</th>
<th>Cu</th>
<th>Ni</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faliro</td>
<td>1</td>
<td>198</td>
<td>306</td>
<td>13969</td>
<td>114</td>
<td>25</td>
<td>103</td>
</tr>
<tr>
<td>Kalamaki</td>
<td>2</td>
<td>410</td>
<td>276</td>
<td>11386</td>
<td>34</td>
<td>9</td>
<td>98</td>
</tr>
<tr>
<td>Glyfada1</td>
<td>3</td>
<td>105</td>
<td>350</td>
<td>17215</td>
<td>98</td>
<td>15</td>
<td>99</td>
</tr>
<tr>
<td>Glyfada2</td>
<td>4</td>
<td>58</td>
<td>179</td>
<td>9963</td>
<td>62</td>
<td>12</td>
<td>41</td>
</tr>
<tr>
<td>Voula</td>
<td>5</td>
<td>53</td>
<td>309</td>
<td>13983</td>
<td>101</td>
<td>12</td>
<td>50</td>
</tr>
<tr>
<td>Vouliagmen</td>
<td>6</td>
<td>110</td>
<td>276</td>
<td>5473</td>
<td>92</td>
<td>9</td>
<td>43</td>
</tr>
</tbody>
</table>
The metal contents determined are significantly lower than those corresponding to surface sediment samples from the Piraeus port (Sakellariadou et al, [11]) with the exception of Mn that shows slightly higher values. In general, surface sediment samples from the marina of Faliro seem to be relatively enriched in the studied metals, that could be attributed to Kifissos river estuaries in the adjacent marine area. All sediments studied seem to be poor in total Cu.

3.4 Ways to minimize pollution from the use of marinas

Pollution can be minimized with the right adjusting of the engines, the cleaning and maintenance performance of the vessels after their removal from water, the careful refueling, the removal of water from water pipes and tanks during winter time, the selection of non toxic cleaning agents. On the other hand, the correct siting and design of a marina play a significant role. The objective of the marina siting and design management measures is to ensure that marinas and ancillary structures do not cause direct or indirect adverse water quality impacts or endanger fish, shellfish, and wildlife habitat.

3.5 Other kinds of impacts from the marinas

The construction and use of a marina may also cause loss of local traditions and way of living. Therefore, it is important to try to preserve them, especially in areas where the local character is more pronounced. The conservation of the local culture heritage and traditions, apart from protecting them for future generations, may also act as a pole of attraction for tourists, preventing from socio-cultural deterioration. In addition, an issue of socio-economic impacts, that needs to be considered, is that host populations may become over dependent on incomes from the use of a marina. It is clear that there is a need of case-by-case study for better conclusions.

Lately, it has been noticed an increased commitment to the concept of kinds of tourism based on sustainable development, resulting to various agreements on tourism and environment.

4 Conclusions

• There is a tendency in Greece for new marinas construction, as well as expansion and modernization of the pre-existing ones.
• According to the new legal framework there is an effort for marinas decentralization.
• Quality management, employees training and environmental awareness are needed for quality of services improvement.
• An acceptable competition level should be succeed through productivity increase, cost reduce and adoption of an effective pricing policy.
• It is essential that marinas provide not only marina services but adequate ones as well (ie. repairs, supplies, recreation, etc.).
• The construction and use of a marina cause many alterations to the corresponded coastal area resulting to environmental pressure on it, and changing the natural equilibrium of the environment.
Marina site and design should be a compromise of a variety of factors aiming to a kind of development combining, to the most desirable way, capacity, services provided, and access to it, with the minimum environmental impacts.

References


