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TOURISM IMPACT ON WATER CONSUMPTION IN MALTA

*Eman Mangion**

Abstract.

Islands attract tourists who spend money on goods and services and therefore generate income and employment in the host country. However the tourist industry also generates demand for natural resources such as water which is very limited and very precious to small islands, especially in the Mediterranean islands, where precipitation rates are very low. This paper identifies the factors which influence the demand and supply of water and what can be done to economise on the use of water, particularly in the tourist sector, in Malta. This study reports on the results of surveys conducted purposely by the present author to assess water consumption among tourists and local residents. The results indicate that the average tourist consumes more water when compared to the local resident. This paper suggests that the tourism industry in small Mediterranean islands should develop methods to economise on water, through appropriate water management strategies.

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Introduction

Many small islands rely heavily on tourism to generate income and employment (Briguglio, 2008). Yet this industry has environmental and infrastructural costs which are not often taken into account when discussing the effects of tourism. One such cost relates to the high rate of water consumption by the tourist industry. In Mediterranean islands, where reliance on the tourism industry is high, the problem is of major importance as they have limited water resources and experience water scarcity during the dry summer months.

The demand for water varies between tourists and local residents. Residential water demand depends on several factors such as the number and size of households, their income, the cost of water, the availability and quality of services, and the availability of alternative water sources. Tourists need to consume water, possibly at a higher rate than local residents, due to their frequent washing, and use of toilets, spas and swimming pools. Fresh water is also needed to maintain hotel gardens, golf courses and is embodied in tourism infrastructure and development, laundry, food and fuel production (Chapagain and Hoekstra, 2008: 23).

This paper looks at the impact of tourism on the water consumption in Malta utilising responses to a survey conducted by the present author, where the 400 respondents were tourists and local residents. The survey was carried out during summer and winter of 2012. The paper will also put forward a number of proposals relating to the reduction of water consumption by tourists.

Factors Affecting the Demand and Supply for Potable Water

Demand for Water

Water demand is defined as the total volume of water requested by people to satisfy their own needs (Wallingford, 2003: 3). Potable water supplies are often associated with different activities such as cooking, drinking, personal hygiene, toilet flushing, washing and other ancillary uses. There may also be demand for such water for economic production, such as the beverage industry and agriculture.

There are several factors which affect the demand for water, including the price of water, population growth, household size and household income. In addition, as stated, there may be increased demand as a result of water used for agriculture, manufacturing, tourism and other industries. Small islands tend to have high population densities.

Malta's population density was about 1300 persons per square kilometre in 2012, which is the highest when compared to other Mediterranean island destinations that compete with Malta for tourism.

The negative impacts of tourism are thought to occur mainly when the number of visitors exceeds the carrying capacity, and this is relevant particularly in small islands. Mass tourism poses potential threats to many natural areas and resources, and puts a strain on water resources, intensifying the water shortage problem (Wall and Mathieson, 2006: 48).

According to EEA (2010), in Cyprus, a tourist staying in a hotel consumes, on average, one third more water than the local resident. According to Eurostat (2009: 25) water consumption by hotels is far higher than the household consumption. This is because holiday makers have a 'pleasure' approach and therefore tend to have a bath or shower more frequently than residents and they generally use more water than they would normally use when they are at home. It was estimated that a tourist in Europe consumes an average of 300 litres per day (direct water use), when compared with consumption at home (160 litres per day). This indicates that tourism increases global water use (Eurostat, 2009: 23).

According to Coccossis and Mexa (2004: 253), an average tourist visiting Mallorca requires around 180 litres of waste water a day. During summer, the amount of waste water will be higher with the result that there will be a large volume of sewage discharge, with ancillary costs relating to sewage treatment plants, or more sea or river pollution. If water is not treated, recycled or disposed of properly, it will cause pollution or environmental deterioration which in turn will influence the tourism industry negatively.

Apart from this, water is needed for landscaping, swimming pools, water parks and golf courses, which are typical tourist facilities. Tourism, therefore demand for water and as a result, small Mediterranean islands, which already face water shortages, find themselves in a trade-off situation where tourism increases their income and employment but creates a number of environmental concerns, including those relating to an increase in demand for water.

Various studies, as shown in Table 1, produce estimates of water usage relating to tourism. It appears that there are various factors that affect such demand such as geographical location of accommodation establishments (climate zone, urban/rural) as well as the hotel structure (high-rise, resort style) and the comfort standard (e.g. Campsite, 1-5 star hotel).

Table 1
Water Use According to the Accommodation Type

| Country/Region | Accommodation Type | Water use per Tourist per Day (litres) | Reference |
|--------------------|--------------------------|--|-------------------------------|
| Mediterranean | Two to three star hotels | 250 | Grenon and Batisse (1991) |
| Mediterranean | Campsites | 145 | WWF(2004) |
| Mediterranean | All Accommodation | 440-880 | WWF(2004) |
| Spain | Four Star Hotel | 361 | Rico-Amoros (2009) |
| Morocco | Four Star Hotel | 400 | Rico- Amoros (2009) |
| Zanzibar, Tanzania | Hotels | 931 | Gossling (2001) |
| Las Vegas, USA | Hotels | 382 | Cooley <i>et al.</i> , (2007) |

Various tourism activities add to water use. Extensive landscaping water parks, swimming pools and golf courses are typical tourist facilities that require considerable water supply, especially in dry seasons.

There are planning requests in Malta for increasing the number of golf-courses on the islands. This would exacerbate the water problem. In Cyprus a golf courses require 10,000 to 15,000 cubic meters per hectare per year (Delia, 2008). The consumption of water by golf courses varies considerably, depending on soils, climate and golf course size (Ballon and Ceron, 1991: 18). For instance, a standard golf course may have an annual consumption of 80,000 to 100,000 cubic meters in North of France and 150,000 to 200,000 cubic meters in Southern France. The reason for this is that the Southern part of France experiences higher temperatures than the northern part. Much higher values can be found in dry and warm climates. Van Der Meulen and Salaman (1996: 30) pointed out that an 18 hole golf course in the Mediterranean is sprinkled with 0.5 to 1 million cubic meters of fresh water per year. High amounts of water are also embodied in food consumption. For example, it takes between 400-2,000 litres of water to produce one kilogram of wheat or 1,000 to 20,000 litres of water to produce one kilogram of meat, depending on animal, feed and management (UNESCO, 2009: 107). Of importance in the context of tourism is the fact that tourists may consume a greater share of higher order, protein rich foods with greater water footprints, while also requiring additional energy for transport by air over large distances, for instance, in the case of small islands (Gossling *et al.*, 2011: 3).

Schemes to Reduce the Demand for Water in the Tourism Industry

There have been different tourist resorts which implemented certain measures to reduce the consumption of water. The Pacific Institute and Western Resource Advocates (2007),

estimate that if hotels install water efficient fixtures, they will reduce their consumption by 30 per cent. Smith (2009), suggests that hotels with gardens can minimise water consumption by 30 to 50 per cent. To achieve this, Smith pointed out that there are several measures that can be taken to reduce water usage including the selection of special plants (drought resistant plants), installation of water meters to monitor water use, mulching of garden beds to reduce evaporation, installation of drip irrigation systems with electronic controllers and moisture sensors, and the use of rain or grey water for irrigation. Carmody (2007: 237) affirmed that many locations use indigenous plants for landscaping purposes along with appropriate garden designs to reduce the need for irrigation.

Many hotels have pools and these are responsible for a considerable amount of water consumption. Smith (2009: 65) pointed out that in order to reduce water consumption it is important to reduce the pool size so that a large pool landscape should be avoided.¹ Apart from this, installing drainage barriers can collect overflows and direct them back to the pool. All tourist facilities and accommodation guest rooms should have efficient water fixtures. The use of dual flush, reduce flush and dry composting toilets can significantly reduce water usage (Carmody, 2007: 238). Efficient and low showerheads can use less than seven litres per minute, compared to the thirteen litres used by older models.

A positive strategy that can reduce water consumption in hotels and which is currently implemented in many hotels across the Mediterranean is awareness programmes, ranging from educational campaigns for staff to the installation of informative signs on how to save water.

Apart from awareness, greater use of recycled water for non-potable uses is also a way of reducing pressure on water supplies. The use of recycled water is attracting more interest from water management authorities and tourism businesses (Hills *et al.*, 2003).

Supply of Water

Fresh water availability is unevenly distributed among different countries. Water availability can also vary, with for instance, watersheds and degree of precipitation resulting in water-scarce or water-abundant regions. Water supply depends on the amount of precipitation, the amount of surface and underground water, the amount of water being produced by desalination plants. Desalination has become of major importance in many small islands and island states (Black and King, 2009: 40). Some countries, in particular islands, such as Bahamas, Antigua, Mallorca and the Greek Islands import fresh water on tank ships (UNESCO, 2009: 25).

The amount of precipitation varies from one country to another even within the Mediterranean region. On average the rainy season over the Mediterranean Sea extends from October to March but the maximum rainfall occurring during the rainy season is between November and December. Over the Mediterranean Sea the average rain rate of

¹ It should be noted however that pool water is sometimes recycled and treated to avoid wastage.

one to two millimetres a day is observed, but during the rainfall season the amount of rain is twenty per cent higher over the western Mediterranean Sea than that over the Eastern Mediterranean Sea (Mehta and Yangs, 2008: 87).

The large irregularity and unevenness of the distribution of rainfall in space and time, partly determines the irregularity, inequality, scarcity and fragility of water resources. Strong seasonality in combination with tourist arrival peaks during dry season might put considerable strain on available water resources particularly in dry regions.

Various technical options are available in order to increase available water capacities. One method could be the prospecting and extracting of groundwater that can lead to further supply of additional water (Lazarova *et al.*, 2003). In the case of small islands, abstraction of water from aquifers should be held inland, whilst the distribution of water to coastal zones should be affected through leak-proof networks to avoid wastage. However, groundwater is extremely vulnerable to water pollution as a result of poor sewage and water treatment infrastructure. Many aquifers are also increasingly vulnerable to salinification due to excessive extraction of groundwater and as a result of sea-level rise often associated with ground subsidence (Gossling, 2001: 45). Over-exploitation of ground water occurs when the volume of abstracted groundwater exceeds the average annual renewal of the groundwater body. According to Blue Plan (1999: 22), aquifer overexploitation is encountered in many Mediterranean countries: 13 per cent in Cyprus,² 29 per cent in Gaza, 32 per cent in Israel (in 1994) and 20 per cent in Spain. In Malta only 23 million cubic meters of groundwater are sustainably available for extraction, but it is conservatively estimated that 34 million cubic meters are being extracted.

This over-extraction is of serious concern as it lowers the quality of the remaining groundwater. To make matter worse trends in fertilizing fields over the past few decades have led to excessive nitrates coming into contact with rainwater. Due to the excessive salinity due to over-extraction and the excessive nitrates 90 per cent of Malta's aquifers no longer meets the Maltese and EU standards for safe drinking water (EU LIFE+, 2012).

When drinking water quality deteriorates it might require additional treatment or possibly substitution by alternative sources, namely desalination. Salinity intrusion is the main cause of quality deterioration of groundwater which can also lead to soil salinisation and loss of good agricultural land (Blue Plan, 1999: 22).

One major problem is that of over-pumping of water through illegal boreholes is a common activity practised in several countries in the Mediterranean region, and is rampant in Malta. This activity has a detrimental effect on the quality of groundwater since it increases sea intrusion in coastal aquifers in several islands. With regards to this issue Helmer, (1997) stated that in Cyprus, due to the numerous illegal boreholes and uncontrolled water withdrawals, salt water intrusion has become a serious problem,

² A recent study held in Cyprus in 2012 indicate that the sustainable yield of ground water is around 23 Mm³/yr whilst the current rate of abstraction is around 34mm³/yr

where underground water in certain areas such as Larnaca are so salty that water is not even suitable to irrigate salt-tolerant crops. Although the use of illegal bore holes is widely used by the agricultural sector, illegal boreholes are used by several other industries such as the tourism industry. Such extraction is forcing water authorities in several islands to rely heavily on desalination plants which require a lot of energy to run.

Balancing Supply and Demand

There are different ways in which water can be allocated taking into account supply and demand. However water provision is generally considered as a merit good and is therefore often subsidised. Excess demand is not normally corrected through the price mechanism although many authorities try to do so by rendering water not excessively cheap.

Finding solutions to water scarcity can be complex, since a large number of parameters have to be considered both on the supply and the demand side. As already explained, increased urbanisation and population growth, extended irrigation and tourism, particularly in coastal areas and islands, exert large pressures on the water resources of the Mediterranean. To be able to overcome these challenges there must be:

- Water demand management policies to reduce loss and misuse;
- A strong partnership among water management bodies and local water users;
- Awareness raising campaigns to save water (UNEP, 2005: 28).

Measures that can improve resource availability and conservation:

- Constructing dams and other methods to reduce run-off into the sea;
- Treating and recycling wastewater to increase the supply of water;
- Promote rain water harvesting both at domestic and municipal scale;
- Educational campaigns to save water;
- Leak detection and control.

The Survey

To identify whether the tourists consumes more water than the local residents in Malta, two surveys were conducted by the present author to obtain information relating to water consumption by tourists and local residents. The survey was carried out by face-to-face interviews during the winter and summer months of the year 2012. Hundred local residents and hundred tourists were surveyed in winter and a similar amount in summer.

The respondents were selected randomly. Most tourists were living in accommodations in tourism 'hotspots' in Sliema, St Julians and Bugibba as shown in Table 2. Local residents, also chosen randomly, lived in several localities in Malta as shown in Table 3.

Table 2
Localities where Responding Tourists Resided

| | Sliema/ St Julians/ Paceville | Valletta | Bugibba | Mellieha |
|----------------------|----------------------------------|----------|---------|----------|
| Tourists residing at | 70 | 23 | 82 | 30 |

Table 3
Districts where the Responding Local Residents Resided

| | North | Central | South |
|-----------------|-------|---------|-------|
| Local residents | 18 | 43 | 139 |

The questions included in the questionnaire related to the amount of water used for certain activities, including the number of times the respondent flushed the toilet, took either a bath or a shower, washed his/her hands and other activities which involved the consumption of water.

After collecting this data conversion measures were used to estimate the amount of water usage for these activities, based on Cremona and Saliba (2012) as can be seen in Table 4.

Table 4
Criteria Used for the Amount of Water Consumed by Several Activities*

| Water Consuming Activities | Standard Flow Rate | Standardized Time/Flow Rate for Surveyed Activities |
|----------------------------|--------------------|---|
| Flushing cistern volume | 6 litres | 6 litres |
| Shower flow rate | 7 litres/minute | 49 litres |
| Wash hand basin | 5 litres/minute | 0.833 litres |
| Bath | Standard | 80 litres |

* Current consumption patterns obtained from audits in Malta as reported in Cremona and Saliba (2012)

The respondents were also asked to give their views on water usage in Malta.

Results: Total Water Consumption by Tourists and Local Residents

To assess water consumption by tourists and local residents, the amount of times for several activities which include the use of the flushing, shower/ bath and wash hand basin, were translated into litres using the rates described Table 4.

The results, shown in Figure 1 and Table 5, indicate that tourists, on average, consume almost twice as much water for personal use as local residents, taking into account the summer and winter season. As expected, the lowest amount of water is consumed by the local residents during the winter months, while the largest amount of water is consumed by tourists during summer months.

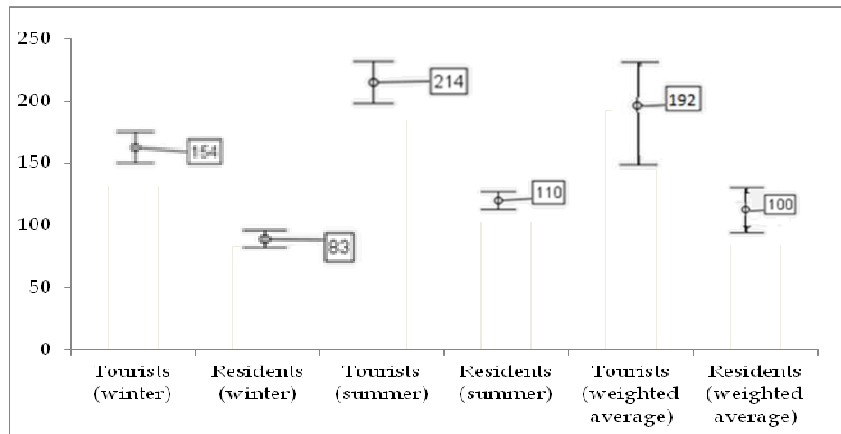
Table 5 and Figure 1 show the seasonality effects on the consumption of water, indicating that water consumption increases during the summer months.

Table 5
Total Mean Daily Consumption of Water for Personal Use

| | Winter Months | | Summer Months | | Weighted Average* | |
|--------------------|---------------|---------|---------------|---------|-------------------|---------|
| | Resident | Tourist | Resident | Tourist | Resident | Tourist |
| Per person per day | 83 | 154 | 110 | 214 | 100 | 192 |
| Standard deviation | 19 | 39 | 24 | 51 | 35 | 47 |

* The weights are 33 per cent for the winter months and 66 per cent for the summer months reflecting the inflow of tourists during these two periods.

Figure 1
Total Mean Daily Consumption of Water (Litres)
(Estimate and 95 per cent confidence interval for daily water Consumption)



Source: European Commission (2012).

Showers

Results obtained from questionnaires show that most of the respondents, irrespective of whether they are tourists or local residents, prefer to have a shower rather than a bath. There were 258 respondents who took a shower rather than a bath every day and 142 respondents who took a bath.

During the winter months, most tourists opted for having two or three showers a day (95 per cent), while the relative percentage for local residents was lower (88 per cent).

Likewise, in the summer months tourists took more showers than the local residents. In summer, the majority of local residents pointed out that they had one or two showers each day (99 per cent), while the majority of the tourists pointed out that they had three or four showers a day (83 per cent).

One reason why tourists shower more than local residents could be the fact that tourists do not normally live in a Mediterranean climate and thus the high temperatures makes them feel uncomfortable and they feel the need to shower more often than the local residents. Another reason is that tourists may seek to obtain the highest value for their money during their vacation, thus maximising the use of their room facilities, bathing included. Contrary to this, locals are more cautious on the use of water knowing that their bill will reflect their consumption.

Baths

Among those who preferred to take a bath, results indicate that there were more tourists who took two baths per day (80 per cent) while the respective percentage of local residents only took one bath per day.

Toilet flushing

Respondents were asked to state the number of times each day they use the flushing. Results for winter indicate that the majority of the tourists (69 per cent) use the flushing more than four times a day. Also, during the same season there were 51 per cent of the local residents who used the flushing up to three times a day. The same pattern also occurred during summer months when 77 per cent of tourists used the flushing four times a day or more, while 55 per cent of the local residents used the flushing less than four times a day. Therefore, the daily water consumption of tourists for toilet flushing was higher in this regard.

Washing of Hands

Respondents were also asked to mention the number of times the respondents washed their hands. Results show that during winter 70 per cent of the tourists wash their hands more than four times a day, while 77 per cent of the local residents wash three times daily. The same pattern occurred during the summer months, but tourists washed their hands more often.

Frequency of Use

The frequency of use of the above-mentioned activities were changed into litre-equivalent. Table 6 shows that the tourist consumption of water is much higher in all activities especially those which are carried out in summer.

Table 6
Total Mean Daily Consumption of Water for
Personal Use per Person per Day

| | Winter Months | | Summer Months | | Weighted Average | |
|---------------|---------------|------------|---------------|------------|------------------|------------|
| | Resident | Tourist | Resident | Tourist | Resident | Tourist |
| Showers | 42 | 70 | 70 | 60 | 60 | 62 |
| Baths | 18 | 55 | 16 | 122 | 17 | 99 |
| Flushing | 21 | 26 | 22 | 28 | 21 | 27 |
| Washing hands | 2 | 3 | 2 | 4 | 2 | 4 |
| Total | 83 | 154 | 110 | 214 | 100 | 192 |

* The weights are 33 per cent for the winter months and 66 per cent for the summer months reflecting the inflow of tourists during these two periods.

Other Forms of Water Consumption Activities

Respondents were asked to mention any other practices which consume water.

A water consumption practice that was mentioned as “other” by respondents was brushing of teeth. Other domestic water uses were for cooking, cleaning the house and washing clothes. Some tourists, particularly those who did not stay in hotels, used water for cooking and cleaning the apartment.

Figure 2 and Figure 3 show the average consumption of water during the winter and summer months segmented by type of usage.

Figure 2
Local Residents' "Other" Daily Water Consumption

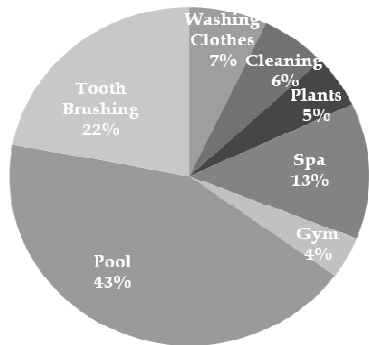
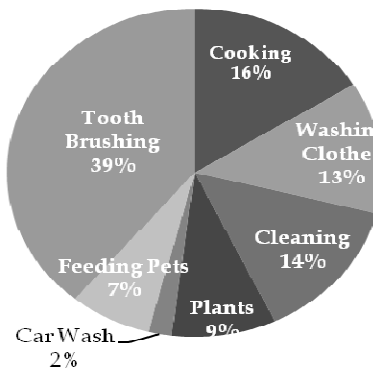


Figure 3
Tourists' "Other" Daily Water Consumption



Tourists Total Daily Water Consumption

Activities which are quite common with the tourists and which consume a considerable amount of water relate to the use of swimming pools and spas as shown by Fig.3. To maintain a swimming pool a large amount of water is required not only for the initial filling of water but pools have to be topped up to maintain the water level. Water loss in pools can be due to several factors such as evaporation, leakages and splashing of water by people. It is very difficult to generalize how much water is being used for swimming pools as they differ in size and depth. The condition of the climate and the individual maintenance trends also influence the amount of water being consumed by pools.

It can be assumed, following Cremona and Saliba (2012) that water consumption for personal use, namely for (i) toilets; (ii) wash hand basins; and (iii) showers or baths and others amount to about 38 per cent of the total consumption in five star hotels with the remaining percentage relates to other usage such as swimming pools and spas. In lower rated hotels and other accommodations, Cremona and Saliba (2012) estimates that consumption of water used for these activities accounts for 86 per cent. Hence, with the aid of these figures, an average of 62 per cent can be allocated for the activities monitored in this survey.³

Results in Table 7, indicate that the average amount of water consumed by the tourists that were surveyed amounts to 296 litres per person per day. This figure is close to the one proposed by WRR (2006: 60) which stated that a tourist in Malta consumes 311 litres per person per day.

Table 7
Total Amount of Water Consumed by Tourists in Malta
(Litres per person per day)

| Tourist Water Consumption | Winter | Summer | Weighted Average |
|--|---------------|---------------|-------------------------|
| Average total amount of water consumed per person (62%) | 154 | 214 | 184 |
| Average consumption relating to pools, spas, and other (38%) | 94 | 131 | 112 |
| Total amount of water consumed (100%) | 248 | 345 | 296 |

Local Residents' Daily Water Consumption

Pullicino (2011) pointed out that the average consumption of water per local resident in Malta accounts to 150 litres per day while Sapiano (2007), stated that consumption per local resident was 136 litres per day. The result given by Sapiano (2007) differs from the

³ This figure (62 per cent) is the simple average amount of water used for the activities which were monitored in five-star hotels (38 per cent) and in lower levels accommodations (86 per cent). The figure only includes water used for having a bath/shower, flushings and water used for hand washing.

results obtained in the questionnaires due to the fact that his results included other activities which consume water.

The extra activities which were added by Sapiano (2007) results were the following: water used for drinking and cooking (7 litres); dishwashing (16 litres); and the water used for washing clothes (20 litres). If these figures are added to the results obtained from questionnaires (100 litres) an average of 143 litres per person per day would be obtained. Therefore, one can conclude that the results obtained from the questionnaire (including the extra activities proposed by Sapiano (2007) lie between the results obtained by Sapiano (2007) and those by Pullicino (2011) as shown in Table 8.

Table 8
Results Obtained from Surveys and from
Previous Studies Showing the Consumption of Water per Person per Day

| | Surveys (2012) | Weighted Average | Survey (2012)** | Sapiano (2007) | Pullicino (2011) |
|--|--|------------------|-----------------|----------------|------------------|
| Consumption (Litres per person per day) | 83 Litres (Winter) 110 litres* (Summer) | 100 litres | 143 litres | 136 litres | 150 litres |

* Figures only include the amount of water consumed for the specific activities which were surveyed.

** Figures include the weighted average obtained from survey and the extra activities proposed by Sapiano (2007).

The Issue of Water Conservation

Respondents were asked to state whether they were aware that water in Malta is scarce. The responses indicated that the majority of Maltese residents and the majority of tourists were aware of water shortage in Malta and that water conservation was essential. As expected, there were relatively more local residents (96.5 per cent) who thought that water should be conserved when compared with tourists (64.5 per cent). Lack of awareness among 35 per cent of tourists points to the need for educating tourists on this issue of water conservation in Malta.

Respondents were also asked to give reasons as to why water should be conserved. Results show that Maltese residents thought that conservation of water is important due to: (i) the importance of this resource; (ii) the energy required to supply potable water; and (iii) the expenses which have to be paid for the production of potable water. Most tourists thought that conservation of water was required due to several physical characteristics of Malta, which limit this resource such as the dry climate and the limited size of the Maltese islands.

The respondents were asked to express their perception as to whether the consumption of water by local residents was higher or lower than that by tourists. Results show that both local residents and tourists think that tourists consume more water than local residents,

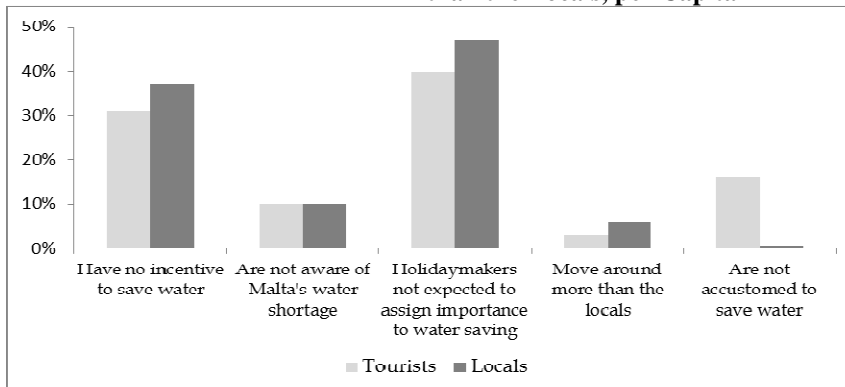
but there were more local residents (69.5 per cent) than tourists (52 per cent) who thought so.

The main reasons for these perceptions, as indicated by the respondents themselves, were the following:

- Tourists are not charged for water consumption and therefore they do not have an incentive to economise on water usage;
- Tourists are not aware that there is water shortage in Malta and they would economise if they knew this before arriving in Malta;
- Tourists visit Malta to enjoy themselves, and one should not expect them to bother about economising on water;
- Tourists exert themselves more than locals during their stay and move more often from place to place, and therefore need to wash more often;
- Tourists are not as accustomed to save water in their country of residence, whereas local residents are.

These perceptions are summarised in Figure 4, where the percentages refer to the number of local residents/tourists holding that particular perception in relation to the total local resident/tourist respondents.

Figure 4
Reasons for the Perceptions that Tourist Consume more Water than the Locals, per Capita



Water consumption in Other Mediterranean Islands

Several other studies which compared water consumption between tourists and local residents were carried out in different islands within the Mediterranean region. In all cases, results obtained indicate that tourists consume more water per capita than the local residents as shown by Table 9.

One can conclude that results obtained from the surveys carried out by the present author and those obtained from different studies held in Crete, Cyprus and Mallorca follow a similar pattern. In all cases the consumption of water by tourists was found to be higher than that of local residents.

An interesting factor which can be observed from Table 9 is that the total amount of water consumed by tourists visiting Malta would seem to be lower when compared to consumption of water by tourists in other islands.

Table 9
Total Daily Water Consumption by Tourists and Local Residents
in Islands under Study (Litres per Person, per Day)

| Daily Water Consumption | Local Residents | Tourists |
|--|-----------------|----------|
| Malta (Survey by the present author) | 143 | 296 |
| Malta (WRR, 2006: 60) | 136 | 312 |
| Mallorca (Coccossis and Mexa, 2004: 253) | 195 | 440 |
| Cyprus (Techneau , 2009: 12) | 198 | 465 |
| Crete (Manios, 2005: 248) | 220 | 440 |

One particular reason for this could be that certain leisure structures such as golf courses are not as available in Malta as in the other islands. In addition the total figures refer to potable water used within the precincts of the hotel for potable consumption and for personal reasons only. Other uses like irrigation were not taken into account – hence the lower figure for Malta.

Conclusion

This paper has attempted to show that in Malta the demand for water by tourists is higher than that of local residents, per capita and that demand for water is higher in the summer season when compared to the winter season. This pattern of water consumption is also observed in other Mediterranean islands.

The main problem associated with this finding is that in Malta, as in many Mediterranean islands, there is heavy reliance on tourism for the generation of income and employment, but in these islands precipitation is relatively low, so that a high rate of water consumption could result in heavy cost of producing water. Such a situation, if remained unchecked, could lead to water degradation, and will have social and health repercussions as well as a negative impact on this industry itself. This reality is not compatible with sustainable tourism, and measures should be taken to reduce water consumption and possibly increase supply, taking costs into consideration.

As indicated above, there are methods of increasing water supply to meet the increasing demand. The installation of desalination plants, dams and sewage treatment plants are measures often adopted in this regard. Dams and water reservoirs can also help reduce the runoff rainwater into the sea. Households may also be encouraged to store water in cisterns. These methods, though useful to alleviate water shortage, are often associated with relatively high costs of installation, maintenance and usage. In the case of Malta, for example, it is known that the reverse osmosis plants are costly to install, maintain and to use due to the high energy costs of producing and distributing potable water.

Many authors propose that water demand management policies are more sustainable than increasing supply, and the water authorities should encourage and support water saving practices including utilisation of fixtures that economise on water consumption, water leakage detection and educational campaigns to foster appreciation of the value of water.

In hotels, managers should be induced by education, command and control schemes, and economic instruments such as water prices, to economise on water usage, keeping in mind that managers of the hotels have to find a delicate balance between water management policies and the comfort of their guests. Installing several fixtures in hotels and in catering outlets can bring a significant reduction in water demand and there could be the possibility of accommodating more tourists without increasing water supply. With the use of water saving devices, shown in Table 10, one can save up to 50 per cent of water and these include several water saving fixtures shown in Table 10 (EEA, 2010).

Based on a survey carried out by Mangion (2012), involving fifteen hotels in Malta, it was found that hotels in Malta do implement measures relating to water management aimed at reducing the water consumption, with the practice occurring mostly in three-star hotels. Some measures adopted in Maltese hotels were:

- reduction of the flushing cistern size;
- reduction of water flow passing through shower heads;
- use of the dual flushing;
- and recycling of waste-water.

Table 10
Fixtures that can Reduce the Flow of Water

| Fixture | Flow Rate | |
|-------------------------------|-------------------------------------|--------------------|
| | Available in Malta | Available Abroad |
| Toilets | | |
| Standard flush | 9 litres/flush | 18-22 litres/flush |
| Half flush | 4.5 litres/flush | |
| Low flush | 6 litres/flush | 6-11 litres/flush |
| Very low flush | 3 litres/flush | 1-6 litres/flush |
| Showers | | |
| Aerator Restrictor heads- USA | 2 litres/minute | |
| Low volume heads-UK | Consumption reduction of up to 50 % | |
| Taps | | |
| Aerator Taps | <10 litres/minute | |
| Spray Taps | Consumption reduction of up to 50 % | |
| Others | | |
| Clothes washers | 105 litres/ full load, normal cycle | |
| Grey water heat recovery | Payback period of 5-10 years | |

Source: Grech (2000)

Projects targeted to save water in hotels can have important positive outcomes. For example, in Cyprus, a project called ‘Water and Energy Saving in the Hotel Industry’ was launched in 2008, where 106 hotels joined this project with the aim to reduce their water demand (CSTI, 2008).

Some saving measures which had to be implemented by all hotels participating in this project are the following:

- installation of low flow showers and tap output reducers;
- reduction of the volume of water in the toilet cistern;
- installation of water valves in bathrooms;
- auto-cut units for pool showers;
- installation of water treatment plants and the use of recycled water for irrigation (CSTI, 2008: 6).

The results obtained from this project after four months were that water saved among hotels amounted to 131,883m³, the consumption decreased by ten per cent and the savings amounted to €239,000 (CSTI, 2008:6).

Water savings projects are also common in hotels in Mallorca especially in the municipality of Calvia. These projects focused on water conservation in swimming pools and gardens (Hof *et al.*,(2011). The use of native plants and the covering of pools in hotels are two main issues measures that could be promoted in this regard.

Unless appropriate water conservation measures are adopted, the water issue will be more critical in the future as the amount of tourists is set to increase. The implementation of good water management strategies with a balance between water demand and water supply strategies can help this industry to achieve sustainability with regards to this resource. If the tourism industry uses less water without compromising the comfort of the tourist, then the possibility of expansion of this industry could continue without exacerbating the stress on water resources.

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