Estimation of the equivalent tourist population trough indirect methods

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Abstract

Purpose – This proposal represents four main advantages: the immediate availability of the relevant information to the local manager; its potential application to any municipality regardless of its size; its reduced economic cost both in terms of information and calculation; and the possibility of obtaining information for very short periods (monthly or even daily) which is very important in areas where the population varies significantly throughout the year.

Design/methodology/approach – The authors present an indirect estimation method based on extrapolating the equivalent tourist population from the monthly variations in the production of solid urban waste.

Findings – It would also be desirable to compare the estimates made by using other indirect indicators such as electricity or water consumption, which could also provide relevant information on the degree of use of second homes.

Originality/value – These advantages turn this indicator into a practical and accessible estimation tool, which can be directly applied to the planning and management of all types of services and facilities provided by municipalities.

Keywords Equivalent population, Linked population, Tourist municipality, Urban waste

Paper type Research paper

1. Introduction

One of the key problems facing service planning at the local level is how to get to know the distribution of the population in space and time, especially in those territories where tourist activity is relevant (Mendizabal and Sánchez, 1997). For decades, the massification of demand and the seasonality of tourist flows have generated important management problems at a local scale, regarding both tourist destinations in the development phase as well as already consolidated ones. Nowadays, few locations for leisure and tourism have at their disposal an effective tool that can accurately collect or classify its population's demands and the corresponding tourist flows. Lack of information in this regard generates uncertainty and limits the strategic and tactical planning of the public and private sectors alike, in turn giving rise to inefficacy in the local government, and social and economic inefficiency more broadly (Voltes-Dorta *et al.*, 2014). Authors such as Román (2011) or

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Salinas *et al.* (2012) contend that many tourist destinations are forced to provide inefficient public services, as they are designed for a legal local population which can double in the summer months. Meeting the needs of the population as a whole during these months means incurring into extraordinary costs, which municipalities ought to bear for the services offered owing to their tourist status, but without the possibility of obtaining compensatory financial contributions via municipal taxes or fees (Bull, 1996; Suarez, 1988; Solé 2000; Fluvià *et al.*, 2001).

Although a definitive methodological response[1] has not been achieved, a consensus has been reached regarding the need to know, with maximum accuracy, the population linked to each tourist area, as that is the real burden of inhabitants to which the local administration must respond. This population demanding public and private services in the territory includes legal residents (when they are not outside the municipality) as well as all people who come to the municipality either for work, study or leisure (therefore, hikers, "traditional" tourists and all those who frequent secondary residences are counted, Hernández, 2007). In other words, to determine the population load that each territory really bears, one must know both the effective resident population and the floating population (the one that uses one territory, but whose habitual place of residence is another). Both population groups are virtually invisible to official statistics, an issue the large majority of small rural municipalities can hardly throw some light upon, in turn making the work of regional and urban planners much more complicated.

Currently, there is neither an agreed upon solution regarding how to monitor unknown mobility nor any reliable method to accurately estimate the *floating population*, especially in the case of smaller municipalities. Nonetheless, existing attempts to understand it, modulate it and anticipate its effects (positive and negative) are numerous and mostly based on the elaboration of mobility surveys as well as the use of statistical information regarding variables associated to population inflows and outflows (indirect indicators such as, for instance, data on electricity and water consumption, vehicle traffic, retail sales data and hotel occupancy rates).

So far, the main tool to estimate tourist activity has been available official information on tourist demand (Occupational Surveys). However, this alternative is not adequate for many of the coastal destinations that have opted to focus their tourism promotion on the acquisition of second homes linked to sun and beach tourism, prioritising the promotion of residential tourism (Fuentes, 2009), which makes it much more difficult to calculate the *seasonal population*. The development of residential tourism has further aggravated the massification of demand at specific peak times throughout the year, as local governments need to design their basic services by considering a population that, without being a legal resident, demands exactly the same services as actual residents, unlike what happens to tourists who spend the night in one of the traditional accommodation options. In addition, it is necessary to know in more detail its distribution over the year, since its seasonality patterns are very different from those relative to more conventional tourists. In any case, for many small tourist municipalities it is the mobility of the population that which ultimately determines the "actual" population load and, therefore, the spatial–temporal distribution of the demand for public and private goods and services: sanitation, water, electricity, public transport, restaurants, banks, pharmacies, hotels [. . .]. Knowing the actual demographic load facilitates the correct planning and management of all those resources dedicated to satisfying the social needs of its population.

The objective of this paper is to estimate the number of people who make up the service user population of a small coastal tourist municipality from available indirect information. In other words, we intend to offer an estimate of the number of people *(assisted population)*

who use each territory by using variables statistically associated with population changes affecting a delimited space such as the generation of "Urban Solid Waste (USW)". The budgetary restrictions of small municipalities require an efficient administration of existing resources and, to this extent, it is essential to have an accurate estimate of the actual population to which services must be provided, with the greatest possible temporal detail (if, as occurs in municipalities with a tourist vocation, the variability of this population is very significant throughout the year). The method used is based on the compilation and quantification of data linked to the USW of the municipality table by month, and to the characterisation of the indicators of accommodation supply of the latter, which does not require new and, on many occasions, costly statistical activities to gather additional information on the demand for existing services. Given the importance of being able to monitor all the factors linked to local tourism management (Crouch and Ritchie, 1999), we provide an analytical tool that facilitates the estimation of the population burden of each territory while avoiding isolated institutional efforts, which, more often than not, yield contradictory results and constitute unnecessarily high economic cost.

In this work, we apply such estimation methodology to the coastal municipality of Fisterra, insofar as it constitutes an excellent example of the difficulties in estimating real population flows. Fisterra is a small rural municipality (4,734 inhabitants, Population Register 2017), where official statistics do not provide disaggregated information on tourist occupancy, which has experienced in recent years the highest relative growth of regulated tourist accommodation places in Galicia (which requires urgent planning and planning) and, moreover, is characterised by a typology of visitors whose accounting is especially complex and has given rise to the concept of *Unobserved Tourism,* (De Cantis *et al.*, 2015), which, in the case studied, is basically made up of hikers who visit the Lighthouse, pilgrims who complete their pilgrimage to Fisterra and residential tourists from nearby areas.

The following sections describe the concepts used, develop the proposed methodology, show the results obtained in its application and summarise the main conclusions derived.

2. Actual population load

Estimating the population burden borne by each municipality is crucial to make decisions regarding local planning. Responding to this lack of information requires important additional efforts from the public administration, since both the Census and the Municipal Register contain incomplete information about the population that actually lives in a municipality, either on a regular or temporary basis, as they do not collect variables that affect the real burden borne by a territory, such as visitors (workers, students or tourists) or the second home population. In the 2001, *Population Census*, the new concept of *linked population* was created "as an estimate of the real population burden borne by each municipality". However, in its definition as a "group of people registered in the census (that is, with habitual residence in Spain) who have some type of habitual link with the municipality in question, either because they reside there, because they work or study there, or because, not being their habitual residence, they usually spend certain periods of time there, although not exclusively for holiday reasons (summers, long weekends, weekends, etc.)" (INE, 2001), any reference to tourist activity was eliminated, which severely limits its application to municipalities with a significant presence of tourists or with a population in second homes not accounted for as residents in Spain. The *linked population* tries to differentiate the effect of the three main factors of spatial mobility: work, studies and second residence, but explicitly excluding any other type of circumstances, such as shopping, tourism or holidays. Therefore, from the point of view of a tourist municipality, the linked population does not provide a good approximation to the potential users of its services as:

- it underestimates the real load (it does not include the population that spends 14 or fewer nights a year in a municipality other than the municipality of residence, it does not take into account all international tourists and neither does it take into account the occupation of second homes by non-resident foreigners, Dubón *et al.*, 2006);
- it does not consider possible seasonal differences (this is a punctual estimate at the reference date of the Census); and
- it is only available every 10 years (with the same periodicity of the Census).

The concern for estimating the user population of a given territorial unit has led to the elaboration of several criteria to define seasonal or temporary populations, trying to improve the estimation of the population burden that municipalities actually support (Módenes, 2006; Vinuesa, 2005; Alberich 2009). The practical application of these estimates in local planning has meant that different administrations have decided to carry out their own calculations. *The* Institut d'Estadística de Catalunya has implemented the calculation of the *ETCA Population*, a full-time equivalent population year from the use of the information available in the Statistics of tourist establishments and the Occupation Surveys (Costa and Rovira, 2001). Achieving these estimates on a municipal scale requires the application of complex mathematical models and small area estimation methods[2]. For its part, the Ministry of Public Administrations includes, in its Survey of Infrastructures and Local Equipment, a so-called *"maximum seasonal population"*, actually a total potential for overnight stays that can be used as a population's upper limit regarding the provision of services on a local scale. Recently, the Instituto Galego de Estadística has published the seasonal population load of the Galician municipalities from the weighted sum of the population load that sleeps in the municipality and the daytime population load. As in the case of Catalonia, this is a very complex statistical operation that provides quarterly data with a significant time lag[3]. The Andalusian proposal is much simpler. The *assisted tourist population* is obtained from the total number of overnight stays and the supply of second residence housing.

Population load is directly related to another complex concept, load capacity. While the term load capacity is a difficult concept to define in absolute terms, this does not exempt it from figuring as a crucial element in the process of planning and controlling of the impact produced by tourism, being materialised in visitor flows' management techniques (García Hernández, 2000). This lack of definition has led the scientific community to load capacity's different conceptualizations. Almeida (2006) regards it as the key concept regarding the management of tourism activity itself and the impacts it may generate, while Echamendi (2001) states that, although there is a certain consensus among experts when it comes to defining the load capacity, there is still no agreement on the measurement and quantification methods to be used, and even less regarding the permissibility thresholds to be considered adequate in each case. Faced with this scenario, one of the main factors slowing down the operationalisation of the load capacity is the proliferation of secondary dwellings. Although we have estimates of the number of secondary dwellings provided by the census and, also, we can obtain indicators such as the proportion of secondary residences over the main ones (Hernández, 2007), the degree of use of these dwellings throughout the year is generally not considered, which would be directly related to the estimate of the linked population. While having data on secondary dwellings facilitates the calculation of potential load capacity, approximating the actual population using the services of a municipality (knowing the users of these dwellings and the intensity of their use) requires additional information.

3. Methodology and data

3.1 Method

There has been ample discussion in the academic literature regarding the best method to estimate tourist flows (Massieu, 2008), from direct methods based on the application of direct surveys, the use of different administrative records or the application of new technologies, to the use of indirect measures based on the computation of different consumptions related to the presence in the territory. Each has advantages and disadvantages. For small municipalities, the use of indirect measures has important advantages due to its high territorial disaggregation, its easy calculation and its high temporal disaggregation and no less important due to its immediacy. Among its main disadvantages, one must cite that it is not possible to disaggregate between the different types of floating population, and that, if there is not a high seasonality in the floating population, indirect models may easily underestimate the actual population[4]. Among the indirect methods, it has been argued that the use of monthly USW generation numbers offers the most precise results to quantitatively determine the floating population (Perea-Milla *et al.*, 2007; Sajani *et al.*, 2005; Mateu i Lladó, 2003; Sanchez-Galiano *et al.*, 2017).

3.2 Area of study description

The proposed methodology has been applied to the territory of the Galician municipalities of Fisterra and Corcubión. Located about one hundred kilometres from the main urban centres of the province (A Coruña and Santiago de Compostela), Fisterra and Corcubión form part of the Costa da Morte "*geodestino*" and both belong to the region of Fisterra. They are two small size municipalities size, in a peripheral and depressed area that has turned to the tourist activity as a model of sustainable development (Herrero, 2009). In 2017, from data from the Municipal Register, the population of Fisterra was estimated at 4,734 inhabitants, representing 21 per cent of the population of the region to which it belongs. On the other hand, Corcubión has 1,592 inhabitants. Despite the fact that demographic decline there is not as severe as it is in other municipalities in rural Galicia, it should be noted that the loss of population is slow, but constant nonetheless (Tables I and II).

The demographic behaviour of both municipalities is very similar. The evolution of the age structure reflects the process of population ageing affecting the whole of Europe to a greater or lesser extent. Faced with a significant decrease in the population under the age of 16, the older population is increasing at a much faster rate, while there is a moderate decrease in the number of working age people. It is important to point out that, although these are sparsely populated municipalities, their territorial dimension is also small, both municipalities being among the most densely populated in Galicia outside urban areas[5].

	Fisterra			Corcubion		
Population	1998	2017	TCAA (1998-2017) (%)	1998	2017	TCAA (1998-2017) (%)
Under 16	889	522	−2,76	297	164	−3,08
16-64	3.642	3.025	−0,97	1.317	1.035	−1,26
Older than 64	764	1.187	2,35	335	393	0,84
Total	5.295	4.734	−0,59	1.949	1.592	−1,06

Note: TCCA: Cumulative annual growth rate
Source: IGE-INE, Municipal register of inhabitants

Table I. Demographic variation of Fisterra-Corcubion (1998-2017)

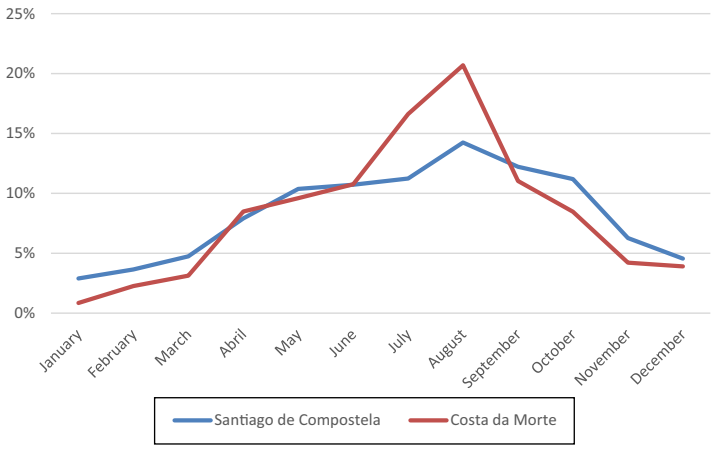
At the moment, both municipalities are granted the category of tourist municipality by the Xunta de Galicia[6]. The main products that characterise the tourist model of both localities are sun and beach tourism and the Jacobean route of Fisterra, an extension of the Way of Saint James. Sun and beach tourism has always been an incentive to promote seasonality and the overcrowding of many coastal tourist destinations. The Camino de Santiago also plays an important role in the local tourist structure, the municipality being the last stage of the Santiago-Fisterra route. The route's success has turned it into a decisive tourist phenomenon to the places through which it passes (Montes, 2015), becoming a basic element in its socio-economic development and a very important source of income, which clearly encourages its transforming capacity[7] (Figure 1).

On the other hand, the available official statistical information shows that the growth of the supply of tourist places in Fisterra is being much higher than in all the tourist municipalities of Galicia (while, in Corcubión, the supply has been reduced). Between 2012 and 2019, Fisterra is the municipality with the greatest relative growth in the number of regulated accommodation places. Accompanying it at the head of this classification are municipalities related to the expansion in recent years of the Camino de Santiago. In the cases of Fisterra, Padrón and Portomarín, the growth of places is concentrated in the typology of hostels, that is, a modality that has less capacity to generate direct employment[8].

Municipality	Cumulative annual growth 2012-2019 (%)
Fisterra	6.06
Padrón	4.71
Portomarín	4.15
Cangas	3.88
Sanxenxo	2.62
Santiago de Compostela	1.94
O Grove	1.73

Sources: IGE, Galician tourism agency; data referring to 1st of January of each year

Table II.
Cumulative annual growth in regulated accommodation places (2012-2019)



Fuente: IGE-INE. Encuesta de ocupación hotelera y elaboración propia

Figure 1.
Distribución mensual de la Ocupación hotelera en los Geodestinos Costa da Morte y Santiago de Compostela (2017)

The type of accommodation on offer in Fisterra and Corcubión (Table III) is characterised by a growing weight of beds in hostels and tourist apartments. If we understand the hotels as establishments of superior category relative to the rest, we can observe that, in Fisterra, this type of lodging only represents a 35 per cent of the total accommodation supply, the majority corresponding to pensions and hostels.

Finally, it is important to note that the linked population data provided by the 2001 and 2011 Censuses reflect a constant increase in the total population using services in both municipalities (Table IV). In a context where the resident population decreases sharply, the linked population has multiplied by almost 5. The result is a territory where the collection potential approximated by the resident population has decreased more than 3 per cent between 2001 and 2011, while the expenditure needs (the demands of the users to which the municipality must respond) have apparently increased by at least 40 per cent. The apparent contradiction between these numbers reflects the effects of mobility on the traditional inhabitant-resident-place relationship.

Nowadays, the flows related to the way of life of people in developed societies involve a growing volume of inhabitants leaving their "official" home for periods of time of different duration: a few hours of the day, certain days of the week or a time of the year. These are trips that respond to different motivations: carrying out a work activity, going to places of study, shopping, doing leisure and recreation practices, etc. In the case of Fisterra in 2011, 92 per cent of the linked population is linked to spending more than 14 nights a year in the municipality, without studying or working in it, which reflects the accelerated transformation of the municipality into a residential tourist area. The official demographic decline is not accompanied by a drop in the service user population but exactly the opposite is the case. Apprehending this situation and obtaining an estimate of the real population is not a trivial issue. The results and diagnoses obtained, in case these factors are obliterated in the demographic analysis of a territory, and only the census (or registered) population is considered, can lead to very significant errors when making a proper diagnosis of the situation.

Compilation of information: The proposed methodology requires detailed information on waste collection and population data. Given the numbers for monthly USW generation, as long as we know the ratio of daily generation of USW per capita , we can estimate the total

	Hotel	Pensions	Hostels	Tourist apartment	Rural tourism	Total places
Fisterra	419 (35%)	201 (17%)	427 (36%)	136 (11%)	8 (1%)	1.191
Corcubión	44 (41%)	16 (15%)	0	48 (44%)	0	108

Sources: IGE, Galician Tourism Agency. Data referring to 1 January of each year

Table III. Type of regulated accommodation offered 2019

	Fisterra			Corcubión		
Census/type of population	Total population	Resident population	Non-resident related population	Total population	Resident population	Non-resident related population
2001	5,755	5,132 (89%)	623 (11%)	2,574	1,966 (76%)	608 (24%)
2011	8,016	4,958 (61%)	3,058 (39%)	2,938	1,720 (58%)	1,218 (42%)

Source: INE/IGE

Table IV. Resident population and related non-resident population

equivalent population[9] that has generated them, assuming a stable behaviour in the generation of waste throughout the year. That is to say, assuming a constant linear relationship between population and USW generation ("normal" USW), it is relatively simple to calculate how a population grows thanks to effect of external visitors by comparing total USW each month.

The analysis of the monthly evolution (as a percentage of the total) of the USW of Fisterra and Corcubión in 2017 shows pronounced increases during the summer months, which cannot be explained by possible changes in the habits of the resident population (Figure 2) and which, moreover, differ considerably from the typical evolution in large urban municipalities, where the minimum collection is reached in August, when residents enjoy their holidays in other territories (Figure 3).

The main methodological issue involved in this approach is how to determine the normal USW (amount of waste expressed in kilograms that each person generates as an average per day) when in any month there may be a floating population (positive or negative). In this approximation, the figure for RSUPC for the month of January has been used as the reference figure. To carry out this calculation, we should have the real equivalent population. Given that, in January, the volume of overnight stays in the "*geodestino*" is not very relevant (2,482 nights have been estimated in January 2017, which is equivalent to 80

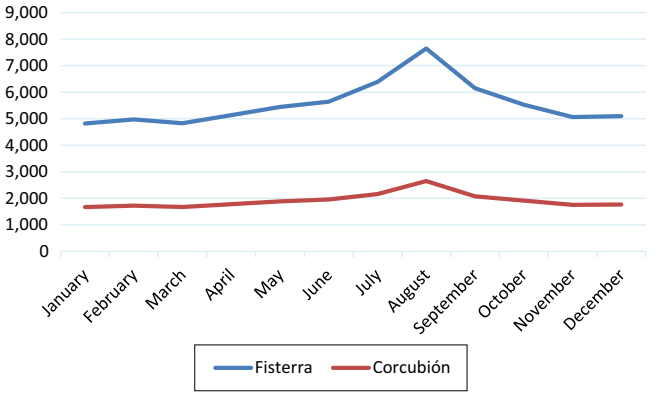


Figure 2.
RSU Fisterra - Corcubión. Evolución mensual año 2017 en kilos y día

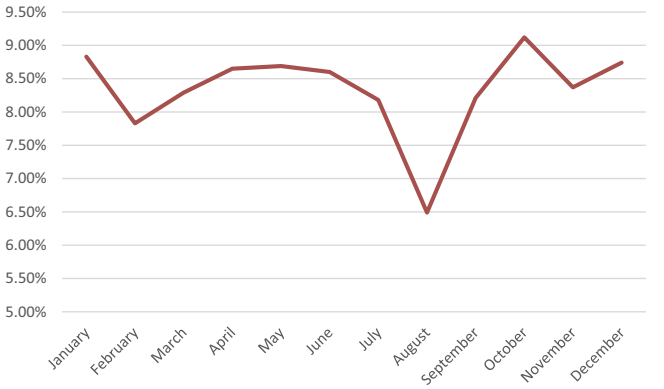


Figure 3.
RSU Madrid. Evolución mensual año 2013 en porcentaje

equivalent persons for the total of municipalities in the region), the population linked by work and study is very small according to the Census of 2011, and hiking is also not very significant in January, calculations have been made using the officially register population as the actual population[10]. The monthly evolution of total USW and per official resident (numbers from the 2017 Register) in both municipalities is almost identical, which seems to indicate a similar weight of the non-resident population throughout the year. Confirmation in both municipalities of a similar monthly daily average in relation to the resident population facilitates the use of data from the month of least value to establish the ratio per real resident of "normal" USW (in our case, that observed in the month of January, Table V). The figure of 1.02 kilos per inhabitant will allow us to estimate the number of inhabitants' equivalent to those existing in the reference month in the rest of the months[11].

4. Results: estimation of the total equivalent population based on monthly MSW generation numbers

If we divide the total USW for each month by the calculated USRPC for the month of January, we get the monthly full-time equivalent population. The result of this operation is shown in Table VI. In the month of August, the floating equivalent population would be around 2,700 people in the case of Fisterra and over 900 people in the case of Corcubión. These data reveal an increase of more than 55 per cent over the official population of the census. From this result, it is simple to calculate the annual equivalent population, which would be 5,470 in the case of Fisterra, and 1,846 in the case of Corcubión, which is about 15 per cent more than the population registered in the census.

The next issue would be to check the validity of these simple calculations using available alternative information. According to the 2011 census, Fisterra and Corcubión had a total linked population of 8,016 and 2,938 inhabitants, respectively (Figure 4),. of which 35 per cent were because of spending more than 14 nights a year in the municipality. Is this data consistent with the estimates provided?

From the linked population characterised by typology, an estimate of the annual equivalent population can be obtained by assuming different rates of permanence in the municipality[12]. The results are shown in Table VII. In the case of Fisterra, the annual

	Monthly USW kilograms		Percentage of waste per month		Kilograms of USW per inhabitant per day 2017 Census	
	Fisterra	Corcubión	Fisterra (%)	Corcubión (%)	Fisterra	Corcubión
January	149,410	51,790	7.4	7.4	1.02	1.04
February	139,231	48260	6.9	6.9	1.05	1.07
March	149,756	51910	7.4	7.4	1.02	1.04
April	154,074	53410	7.6	7.6	1.08	1.11
May	168,740	58490	8.3	8.3	1.15	1.17
June	169,274	58680	8.3	8.4	1.19	1,22
July	198,031	67000	9.7	9.6	1.35	1.35
August	237,042	82170	11.7	11.7	1.61	1.65
September	184,459	62260	9.1	8.9	1.30	1.29
October	171,413	59420	8.4	8.5	1.17	1.19
November	151,894	52650	7.5	7.5	1.07	1.09
December	158,053	54790	7.8	7.8	1.08	1.10

Source: Elaborated by the authors using the information supplied directly by the Town Councils of Fisterra and Corcubión

Tabla V. USW collected in Fisterra and Corcubión during 2017

Table VI.
Estimation of the total population in the municipalities of Fisterra and Corcubión during the year 2017

	Fisterra	Corcubión
January	4,737	1,606
February	4,887	1,657
March	4,748	1,610
April	5,048	1,711
May	5,350	1,814
June	5,546	1,880
July	6,279	2,078
August	7,515	2,548
September	6,043	1,995
October	5,435	1,843
November	4,976	1,687
December	5,011	1,699

Source: Prepared by the authors using the information supplied directly by the Town Councils of Fisterra and Corcubión

equivalent population in 2011 would be 5,487 inhabitants, a figure consistent with the estimates made (keeping the percentages constant with respect to the population of the census and taking into account the evolution until 2016, the equivalent population would be 5,242). On the other hand, the annual equivalent population of Corcubión in 2011 would be set at 1,933 inhabitants. Once the difference with respect to the 2016 Register is applied, the equivalent population would be 1,819.

Considering the capacity of regulated tourist places in both of the municipalities and the degree of occupation (Costa da Morte area), the annual full-time equivalent tourist population of Fisterra and Corcubión (in 2017) could be estimated at 327 and 55 people, respectively[13]. Adding the tourist estimate to the previous figure would give us slightly less than 5,600 people for Fisterra and 1,874 in Corcubión. These numbers are perfectly consistent with the total annual equivalent population estimates obtained from the RSUPC (5,470 and 1,846, respectively, a difference of less than 2 per cent).

5. Discussion and conclusions

Having consistent estimates of the actual population load of a municipality is a key variable when defining and monitoring any territorial planning (Módenes, 2006; Almeida, 2006). Owing to the fact that, as mentioned in previous sections, the concept of linked population does not include most of the tourist flow, municipalities with a marked touristic character, and with small or medium population size, have enormous difficulties in obtaining an accurate calculation of the real user population of the municipal territory. Another aggravating factor that makes it difficult to estimate is the scarcity of available statistics (both regarding population and, above all, tourism) at the local level, relying instead upon regional or "*geodestino*" data that tend to distort the true situation of the municipality due to the divergent dynamics of the various municipalities they contain.

Although the invisibility of the floating population makes it difficult to estimate the real population burden and slows down the analysis of the spatial–temporal distribution of the demand for public services, the simple model presented has managed to estimate a numerical approximation of real users of a territory consistent with the numbers estimated by the official institutes without investing large amounts of resources. According to the results of the study, the municipality of Fisterra receives between 10 and 20 per cent more annual users than the data offered by the Municipal Register (reference for the distribution

	Local population: only resides	Local population: works and resides	Local population: studies and resides	Non-resident linked population: only resides	Non-resident linked population: works there	Non-resident linked population: studies there	Total population: (local + linked)
Fisterra's population	3,348	1,018	592	204	30	2,824	8,016
Full-time equivalent population of Fisterra	3,348	1,018	592	4,284	57	48,008	5,487
Population of Corcubión	1,307	247	166	171	15	1,032	2,938
Full-time equivalent population of Corcubión	1,307	247	166	3,591	2,85	17,444	1,933
Annual permanence ratio	1	1	1	0,21	0.19	0.17	

Source: IGE and elaborated by the authors

Table VII.
Linked population and equivalent population in Fisterra and Corcubión 2011

of transfers for the financing of services and for most of the own tax revenues) which, in turn, has enormous repercussions on its capacity to finance services for this entire population. In addition, this increase in population is not equally distributed over the year but, instead, tends to be concentrated in the summer months (we can place the maximum potential reception in August next to 10,000 people, more than twice the population of the census)[14], which puts at risk the quality of goods and services in the municipal inventory. In other words, despite the fact that the effective resident population (census/registered) is experiencing a continuous decline, the linked population (non-resident) together with the tourist flow is subject to a remarkable growth, which places the real burden of population in Fisterra far above the "official" data of the municipal census, a situation that is replicated point by point in the case of Corcubión.

There are four main advantages to this proposal:

(1) the immediate availability by the local manager of the relevant information;

(2) its application to any municipality regardless of its size;

(3) its reduced economic cost both in terms of information and calculation; and

(4) the possibility of obtaining information for very short periods (monthly or even daily), which is very important in areas where the population varies significantly throughout the year.

For the vast majority of local services, 365 users in one day is not the same as a daily user throughout the year, which is why it is crucial to have additional monthly information on hiking, short-stay tourist flows and the use of second homes. This population is not considered in the estimates of the linked population made by the INE from census information and is difficult to estimate from the rest of the official statistical operations, so that, if this information is to be obtained directly, a large investment of resources would be required, something that not all municipalities will be able to do. However, all municipalities will be able to obtain an estimate of their real population burden immediately from the simple model proposed using the daily information available on USW collection. These advantages turn this indicator into a practical and accessible estimation tool, with direct application in the planning and management of all types of services and endowments carried out by municipalities.

It should be noted that the proposed methodology has ample room for improvement regarding the accuracy of its results. There are numerous assumptions included in the development of the estimates presented, which make it essential to study the robustness of the proposed methodology with the incorporation of information and estimates from other municipalities in the same region or "*geodestino*" with both similar and clearly differentiated characteristics. It would also be desirable to compare the estimates made using other indirect indicators such as electricity or water consumption, which could also provide relevant information on the degree of use of second homes, a crucial element in municipalities such as Fisterra. Nevertheless, the existing empirical evidence (Perea-Milla *et al.*, 2007; Sajani *et al.*, 2005; Mateu i Lladó 2003; Sanchez-Galiano *et al.*, 2017 and Marï *et al.*, 2003) confirms the validity of the proposed method in other contexts, in which, as in the case of Fisterra and Corcubión, the seasonality of tourist activity is very high.

Notes

1. Numerous attempts have been made to define and estimate the real population burden of the different territories. Researchers, official statistical bodies and even local governments

themselves have carried out different approaches *(Linked Population, Assisted Tourist Population, Seasonal Population, Floating Population, Effective Resident Population, Full-Time Equivalent Population Year, Maximum Seasonal Population and Human Pressure Indicator)* which, with different nuances and significant differences in cost and estimation difficulty, have tried to respond to this need not covered by any of the official statistics.

2. This is a complex proposal that only provides estimates of the annual full-time equivalent population of municipalities with more than 5,000 residents. In addition, its time reference is annual or quarterly, which may not be sufficient for small municipalities with seasonal behaviours with significant monthly differences. We must bear in mind that in many incipient or rural tourist municipalities the floating population is usually concentrated in very short time periods.
3. The latest available data, published in July 2018, refer to the year 2016, IGE (2018).
4. In other words, where there is a floating population for all or most of the year, such as in metropolitan areas or regional service centres, it is difficult to obtain the base per capita consumption data for extrapolation.
5. While the Galician population density is 92 inhabitants per square kilometre and the county of 67, in the municipality of Fisterra there are 167 inhabitants per square kilometre and in Corcubión there are 246 inhabitants. In both cases there are more than 150 inhabitants per square kilometre (a reference figure for the degree of urbanisation).
6. The Decree 32/2015 in its article 5 lists the requirements that must meet tourist municipalities in Galicia: a) That the annual weighted average tourist population is greater than 25 per cent of the number of neighbours b) That the number of tourist accommodation places and second residence places is greater than 50 per cent of the number of neighbours and c) That accredits having, within its territory with some tourist resource or service capable of producing a tourist attraction that generates a number of visitors five times greater than its population, computed over a year and distributed, at least in more than thirty days.
7. In 2017, the number of Fisterranas (document proving that they have made the route Santiago-Fisterra fulfilling certain conditions) delivered to the public hostel of Fisterra exceeded 25,000. The number of visitors to Fisterra linked to the Camiño de Santiago can easily exceed double as many pilgrims, do not pass through the hostel, do not collect the accreditation or do not meet the conditions to obtain the credential.
8. www.turismo.gal/espazo-profesional/directorio-de-empresas-e-establecementos-turisticos?langId=es_ES&langId=gl_ES
9. Annual full-time equivalents are a more appropriate measure than the linked population for estimating the population using services in a territory. Each day that a person is present in a municipality is equivalent to 1/365 full-time equivalent persons per year. Thus, for example, a person who spends a week on holiday in a municipality is equivalent to 0.02 full-time annual equivalents.
10. This assumption seems to be confirmed by the recent publication of the equivalent population load of the municipalities of Galicia. According to these estimates, in the first quarter of 2016 the real equivalent population of Fisterra was slightly lower than the official resident population, the same as in the case of Corcubión. To be precise there were 24 fewer equivalent inhabitants in Fisterra and 43 in Corcubión. IGE, *Load of seasonal population of the municipalities of Galicia, (06-07-2018)*.
11. This figure is similar to that estimated for Spain as a whole in 2013 (INE, 2016) and that used by Munizaga and Lobo (2011). There are many other calculations that could be used as a reference figure. For example, in the Waste Master Plan of Andalusia, it is estimated that the amount of USW generated per inhabitant per day is 0.95 kilograms. Applying this figure to our estimates would raise the estimated population figure equivalent to around 8 per cent.

12. To be more precise, the rates are: 0.21 for the non-resident population working (working day, 11 months per year); 0.19 for the non-resident population studying (working day, 10 months per year); 0.17 for the non-resident population due to second residence (it is considered that they stay in Fisterra/Corcubión two months per year when adding up all the holiday periods and weekends).
13. Although the number may seem low, reaching this annual full-time equivalent population with pilgrims whose average stay was two days would require a total number of pilgrims in excess of 54,000.
14. If we simply add the accommodation capacity (1,055 places) to the total linked population (8,016) and add seasonal passing visitors (hikers), it is possible to reach this figure on specific days in August.

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