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Are Non-Conventional Water Resources the Solution for the Structural Water Deficit in Mediterranean Agriculture? The Case of the Segura River Basin in Spain

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Abstract: The water sustainability of the Segura River Basin (SRB), located in southeastern Spain, is being challenged as conventional available water sources fall short of meeting the authorised demands of the basin. In recent years, non-conventional water (NCW), such as desalinated and reclaimed water, has become part of the resource pool. However, it has not yet become crucial for irrigation water supply due to its relatively high cost and lower quality compared to conventional water. The new political framework in Spain, developed in the context of ecological transition, marks a notable shift for non-conventional water as a strategic resource for agriculture. This study examines the drivers and barriers influencing its acceptance through an analysis of farmers' perceptions, conducted through interviews with twelve irrigation communities' (ICs) representatives of the basin. Discriminant analyses of the data show that the farmers' experience, along with factors pertaining to production, storage, and transportation costs, determines the acceptance and use of NCW.

Keywords: non-conventional water; irrigation; water scarcity; Segura River Basin; farmers' perceptions

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1. Introduction

The distribution of water resources in Spain is quite asymmetric, characterised by a distinct difference between the northern region (referred to as 'wet' Spain) and the remaining areas of the Iberian Peninsula (marked by water-deficient areas). Furthermore, the Mediterranean Arc benefits from more-favourable hydroclimatic conditions for agriculture, resulting in a reversal in the distribution of water use when compared to the available resources [1]. Consequently, this gives rise to significant water stress in much of the south-eastern peninsula, where certain regions experience levels of overexploitation that raise concerns about its long-term sustainability. The imperative of sustainability in these areas cannot be overstated due to the pivotal role of agriculture and tourism in their economies, as well as the jobs associated with these sectors [2].

Historically, this marked spatial and temporal misalignment between the availability of resources and the corresponding demand has led to substantial development in hydraulic infrastructure, including the interconnection of water systems and varying degrees of resource exploitation from different basins, sometimes surpassing the available resources of each respective basin [3]. This has resulted in an increase in water conflicts and significant institutional development; notable examples include the establishment of efficient institutions for collective water management, whether for irrigation (irrigation communities or ICs) or for basin management (river basins) [4].

These factors have influenced the evolution of water policy in Spain throughout the 20th century (until the 1980s). During this period, priority was given to increasing the available water supply through the construction of catchment infrastructure, such as dams, and the large-scale development of distribution systems, including water transport and irrigation canals. Moreover, important inter-basin transfer initiatives were launched—in particular, the transfer of water from the headwaters of the Tagus River (flowing into the Atlantic) to the Segura River (flowing into the Mediterranean Sea). The Tagus–Segura water transfer (TST), established in 1979, facilitated the provision of new flows to the Mediterranean area immersed in the burgeoning expansion of irrigation, fuelled mainly by the expectations generated by newly anticipated water supplies and favourable market conditions, coinciding with Spain's entry into the EU [5]. The regulations governing the TST have changed throughout its four-decade existence; the most recent change, implemented in 2023, will reduce the transferred volume by 10–20%.

Subsequently, the incorporation of the principles outlined in the Water Framework Directive (WFD) [6] into Spanish legislation has led to the consideration of an Integrated Water Management approach. This approach incorporates both environmental criteria (restoration of the favourable ecological status of water bodies) and economic criteria (recovery of costs associated with water supply). As a result, water policy has shifted its focus towards territorial and medium-to-long-term planning [7]. This shift fosters the development of various types of infrastructure dedicated to the desalination of seawater and groundwater, along with the utilisation of reclaimed water. These non-conventional water sources aim to prevent direct conflicts among different users or territories and align with the principles outlined in the WFD [8].

Recent technological advancements in wastewater treatment and desalination, as well as the implementation of various programmes (inspired by the European Green Deal and the new Circular Economy Action Plan), have led to uninterrupted growth in the production of non-conventional water (NCW) [9]. Despite this, NCW continues to constitute a marginal supply source for irrigation in Spain, with volumes below 5% of the total, except in the Segura Basin and some Spanish islands (e.g., the Balearic Islands) [10].

The Segura River Basin (SRB), located in the southeast of the Iberian Peninsula, is representative of Mediterranean agriculture and serves as an emblematic example of a mature water economy and basin closure [11]. This semi-arid region has undergone a substantial transformation since the 1970s, marked by a significant expansion in tourism and irrigated agriculture [12,13]. This has resulted in a rise in water demand, exceeding the available water resources and leading to a structural water deficit characterised by a trend towards unsustainability (decline in the water level, environmental damage, and impairment of water quality) [3,14]. Against this backdrop, NCW resources have acquired a strategic role in water planning. Moreover, the use of reclaimed water and, especially, desalinated water is expected to increase to compensate irrigators for the water cuts imposed by the regulations governing the TST.

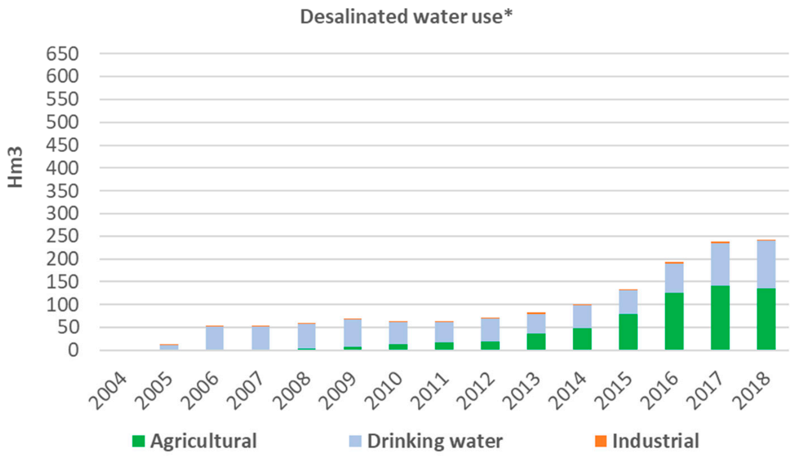
In this context, this study aims to analyse the role of NCW as a solution for increasing water security and resilience in the SRB. This paper examines the processes of implementation, development, and adaptation of NCW in the SRB and identifies the main barriers and drivers, as perceived by irrigators. To this end, semi-structured interviews were conducted with managers of twelve representative irrigation communities in the SRB. The SRB is pioneering and a major user of NCW in Spain and Europe. For years, many irrigators in this region have been partially supplied with reclaimed water and desalinated water. Therefore, gaining insights into their experiences and perceptions is imperative for a comprehensive understanding and promotion of NCW utilisation in other semi-arid areas.

The relevance of this study is twofold. Firstly, its timely execution coincides with recent regulatory developments in Spain to promote the use of NCW in response to drought conditions and rising energy costs. Secondly, it analyses the use of reclaimed and desalinated seawater from an integrated and practical perspective. Many studies have analysed the role of NCW in Spain [9,15], especially in the SRB [16,17]. However, most regard these NCWs as separate sources (reclaimed or desalinated) and do not consider the integrated management of all water resources. Only a few studies focus on the SRB and adopt a comprehensive water management approach [17,18].

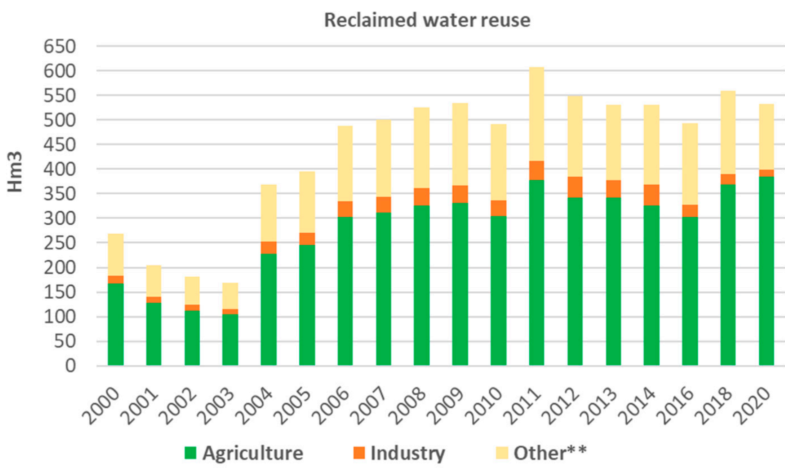
Our paper aims to bridge this research gap and complement previous studies by combining a top-down analysis of the current NCW context in Spain with a bottom-up assessment of NCW usage in the SRB. The paper is divided into seven sections. This first section outlines the study's objectives and motivations. Section 2 provides an overview of the situation and policy context of NCW in Spain through a review of recent data and regulations related to the development and implementation of NCW. Section 3 discusses the present and future outlook of NCW in the SRB within the framework of the new water policy context. Section 4 presents the material and methods used to analyse perceptions of the use of NCW in the SRB. Section 5 describes the results obtained. Finally, Section 6 discusses the main findings, and Section 7 presents the conclusions of the study.

2. Non-Conventional Water Resources in Spain

The use of non-conventional water resources in Spain commenced in the early 1970s and has gradually spread to the Mediterranean coastal areas and archipelagos, prompted by the development of the tourism sector, the expansion of irrigated agriculture, and the severe impacts of extreme droughts at the end of the 20th century. Figure 1 shows the evolution of NCW use (desalinated and reclaimed water) in Spain over the last two decades.



Note 1: (*) Includes only water desalinated operated by the national public company ACUAMED.



Note 2: (**) Includes municipal garden watering, cleaning and other.

Figure 1. Volume of desalinated water (**top**) and reclaimed water reused (**bottom**) by type of water use. Source: Own elaboration based on data from ACUAMED [19] and Instituto Nacional de Estadística [20].

2.1. Desalinated Water

Desalination in Spain commenced with small-scale private initiatives for brackish water desalinisation in the 1990s, gaining relevance with the implementation of the AGUA Program between 2004 and 2011. Currently, Spain's total desalination capacity stands at 409 hm^3/year, managed by 19 seawater desalination plants (SWDPs) operated by the national public company ACUAMED, along with additional plants funded and managed by regional governments. In total, there are 765 desalination plants in the country, comprising 405 brackish desalination plants and 360 seawater desalination plants, each with a production exceeding 100 m^3/day. However, this production is limited by the elevated cost of water, insufficient investment, and a lack of coordination [21].

Desalinated water represents a mere 2% of the total water used in Spain. The agricultural sector is the largest consumer of desalinated water, accounting for 55% of the total volume produced by ACUAMED (249 hm^3/year) (Figure 1).

In Spain, the average cost of desalinated water fluctuates between EUR 0.31/m^3 and EUR 1.01/m^3, averaging at EUR 0.56/m^3 [19], from which 67% corresponds to desalinated water production and the remaining 33% to investment and distribution costs [22]. The costs associated with brackish water are significantly lower, and they vary based on salinity, typically ranging from EUR 0.15 to 0.3/m^3 due to lower energy consumption. Operating costs are influenced by facility size (economies of scale), distances between collection points, plant and distribution centres, and energy prices [23].

Desalinated water prices are higher than other water resources. However, state subsidies maintain low desalinated water prices for irrigation—around EUR 0.35/m^3 in the eastern region of Spain. Thus, prices do not cover the total cost of desalinated water, including environmental and resource costs. To comply with the WFD regulations [6], there is a need for gradual adjustment in the irrigation tariff to incorporate these additional costs.

The environmental concerns associated with desalination include the extraction of salts during the process, which must be returned to the sea, raising concerns regarding potential toxicity or adverse effects on the marine environment. Managing brine discharge is particularly challenging for inland plants, where technical constraints lead to the injection of brine into deep aquifers or its discharge into natural streams or sewer networks. Additionally, the high reliance on conventional electricity sources makes desalination a significant contributor to emissions [24].

The administrative and legal procedures to authorise the use of desalinated water are complex. They are regulated by the Spanish Water Law [25] and differ based on whether the desalination initiative is public or private. Using desalinated water from public or private plants requires an exploitation agreement with user communities, administered through a water concession for private use. In cases where the plant owner and the water user are different entities, regulatory authorities oversee the pricing of desalinated water, establishing maximum and minimum values that include infrastructure amortisation fees. The Spanish Water Law also considers incorporating desalinated water into regulated water exchanges.

As of today, the challenges faced by desalinated water in Spain present a hopeful outlook. The reduction in energy costs has become a reality thanks to renewable energy plants dedicated to producing energy for desalination. At the same time, the prevailing water scarcity situation and the surge in energy costs during 2023 prompted the Spanish Ministry for the Ecological Transition and the Demographic Challenge (MITECO) to temporarily suspend the implementation of the cost recovery principle in the plants of general interest. Instead, they have established a political price of around EUR 0.34/m^3, depending on the SWDP, until 2026, with the possibility of extending it for an additional 10 years.

Moreover, recent drought conditions in Spain have prompted the enactment of Royal Decree-Law 6/2022 [26], amending the Spanish Water Law to consider electricity generation facilities as part of the investment for hydraulic works declared of general interest, such as ACUAMED SWDPs. In this regard, ACUAMED is developing a strategic plan to increase its desalination capacity by 109 hm^3 by acquiring more energy for its SWDPs through the promotion of self-consumption of photovoltaic energy.

Finally, private desalination projects along the Mediterranean coast are expected to provide additional resources for agricultural use, calling for greater flexibility in water concessions and the expeditious implementation of water exchange mechanisms to alleviate the increasing pressure on water resources.

2.2. Reclaimed Water

Planned water reuse began in the early 1970s in the Canary and Balearic Islands and rapidly extended to southeastern Spain to facilitate the development of irrigation [27].

Over the last two decades, the volume of water reused for all purposes has increased significantly: from 268 hm^3 in 2000 to 532 hm^3 in 2020 (see Figure 1). However, this increase has fallen short of initial expectations [28]. Current figures significantly deviate from the targets set by the 2012 National Water Reuse Plan, which estimated an annual reuse volume of 1403 hm^3 in 2021.

Despite this, Spain currently stands out as the country with the largest annual volume of reclaimed water in the EU (constituting one-third of the total volume). It exhibits the highest rates of treated wastewater reuse (11%, well above the EU average of 2.4%). Globally, Spain ranks fifth in terms of installed capacity. It boasts more than 2000 wastewater treatment plants (WWTPs), 27% of which are equipped with tertiary treatments and advanced technologies (membranes, advanced oxidation, disinfection, etc.) [17]. Similar to other countries, agricultural irrigation in Spain is the primary end-user of reclaimed water, followed by landscape irrigation (e.g., parks and golf courses). In 2020, agriculture accounted for 72.4% of all water reused in Spain (385 hm^3) (see Figure 1) [20].

In addition, water reuse in Spain exhibits marked territorial differences. Its use is practically irrelevant in the northern basins while highly significant in the Mediterranean coastal areas and the islands, with Murcia having the highest reuse rate (close to 90% of treated wastewater). Reclaimed water reuse plays a strategic role in these regions and is carefully considered in river basin management plans [10].

The elevated cost of reclaimed water compared to conventional water resources constitutes one of the main challenges associated with water reuse [29]. The cost of reclaimed water is highly variable and highly contingent on the type of treatment applied and the distance from the WWTP to the irrigation area. A recent study estimates a reference value for reclaimed water in Spain of EUR 0.4/m^3 (excluding storage), from which 37% corresponds to investment and operational costs of treatment while 62% is for transport and distribution from the reclamation plant to the irrigated agricultural fields (considering energy costs and optimal location) [30]. This pricing renders reclaimed water unappealing to farmers [31]. For this reason, in water-scarce regions such as Murcia or the Valencian Community, the cost of reclaimed water is subsidised, ranging between EUR 0.05 and 0.1/m^3. This pricing strategy is competitive with conventional water sources.

The quality of reclaimed water and its associated environmental and health risks are also a major concern. The European Urban Waste Water Treatment Directive (91/271/EEC) [32] is currently undergoing a revision process to expand the list of restricted contaminants [33]. In addition, the new EU Water Reuse Regulation 2020/741 [34], applicable from June 2023, aims to increase confidence in the agricultural use of reclaimed water and mitigate potential risks by establishing common high-quality requirements across the EU and prioritising risk management in water reuse practices.

In order to facilitate the incorporation of reclaimed water into river basin management plans, the Spanish government has recently approved the National Plan for Sanitation, Efficiency, Saving and Reuse of Wastewater (DSEAR Plan) [35]. The DSEAR Plan evaluates the strategies and actions defining water policy in wastewater treatment, sanitation, and reclaimed water reuse, aligning them with the new European Green Deal and Circular Economy Action Plan policies. Recent drought episodes have given new impetus to water reuse. The Spanish Water Law has been recently modified by Royal Decree-Law

4/2023 [36] to clear legal impediments associated with water reuse, including the funding of new projects and the issuance of new authorisations, and opens the door for public administrations to cover the costs when water reuse replaces conventional water and contributes to achieving the good ecological status of water bodies. In light of all these changes, the Spanish government aims to reach 1000 hm^3/year of water reuse by 2027.

3. Non-Conventional Water Resources in the Segura River Basin

The process of the implementation and development of NCW use in the SRB since the early 2000s has marked significant milestones, influenced by economic and political changes driven by drought episodes or heightened energy costs. This section presents this evolutionary trajectory and the regulatory update pertaining to NCW in the basin.

3.1. Background

The Segura River Basin (SRB) is located in the southeast of Spain (see Figure 2). It extends over an area of 19,025 km^2 across the regions of Murcia (59%), Castilla-La Mancha (25%), Andalusia (9%), and the Valencian Community (7%). The basin is home to 2.5 million people (3.5 million during the summer season) and is one of the driest regions in Europe (the annual rainfall is 365 mm) [37].

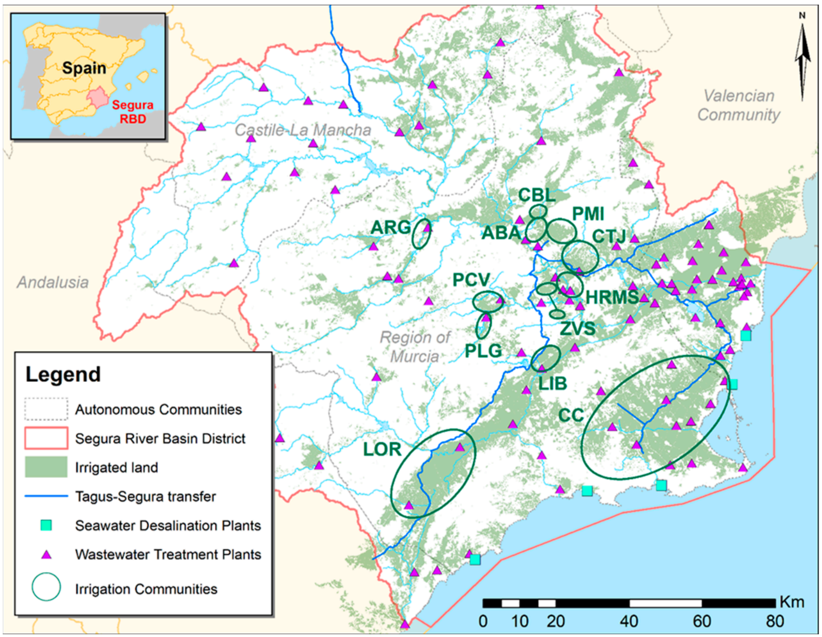


Figure 2. Location of the studied ICs in the Segura River Basin and their related WWTPs and SWDPs. Notes: LIB: TTS Librilla; CBL: Casablanca; CTJ: Campotéjar; ARG: Embalse de Argos; LOR: Lorca; CC: Campo de Cartagena; PCV: Pantano de la Cierva; PMI: Pozos Menorca e Ibiza; ZVS: Zona Sector I y II; PLG: Pliego; HRMS: H.R. Molina de Segura; ABA: Abarán. Source: Own elaboration.

Irrigated agriculture is vital to the socio-economic well-being of the region and is the primary use of water. Currently, 261,626 ha are irrigated, consuming 1522.5 hm^3/year (85% of the basin's total annual water demand) [38]. The value of agricultural production is contingent upon irrigated agriculture. The agri-food sector in the SRB represents about 2% of the Spanish gross value added and 11.4% of national agri-food exports [38].

The irrigated area has grown significantly in recent decades due to the construction of multiple dams, the widespread adoption of pumping techniques, and the implementation of the TST (a 300 km channel that transports water from the Upper Tagus River Basin to the Segura Basin) [5,39]. Irrigation expansion and the transition from rainfed crops (mainly cereals) to more lucrative irrigated crops (such as vegetables and fruit trees) have brought wealth and recognition to the region. However, this transformation has also intensified the demand for water and generated significant environmental problems [40].

Currently, the available renewable resources within the SRB fail to meet the existing water demand, exceeding it by 311 hm^3/year. The water deficit is compensated by pumping non-renewable groundwater (214.1 hm^3/year), water exchanges, and a deficient allocation of water to crops [41].

As shown in Table 1, conventional water sources are expected to decrease in the coming years. On the one hand, the availability of surface water and renewable groundwater will fall, and no more non-renewable groundwater pumping will be permitted from 2027 onwards [38]. On the other hand, the volume of water supplied by the TST is going to be reduced by about 70–110 hm^3/year due to the environmental flows recently established for the Tagus River [42], as well as the effects of climate change on the Tagus Basin (expected reductions of 11% to 15% of surface water runoff for 2040–2070) [43,44]. This imminent reduction in the water transferred from the Tagus Basin has recently precipitated a strong protest movement and social unrest in the SRB [45].

Table 1. Evolution of water resources and water demand in the SRB (in hm^3).

Year	Surface Water [1]	Ground-Water	Non-Renewable Ground-Water	Water Transfers [2]	Reclaimed Water	Desalinated Water	Total Renewable Water Resources [3]	Total Water Demand	Deficit [4]
2010	518.6	281.1	273.8	337	135.4	82	1354.1	1873	245.1
2015	506	281	231	322	140	158	1407	1841	203
2021	509.4	255.3	214.1	312	141.7	301.5	1519.9	1830.6	311.3
2027	508.1	248	0	202	146	346.1	1450.2	1844.7	394.5
2039	500.7	224.8	0	202	159.8	361.8	1449.1	1858.8	409.7

Notes: [1] 'Surface water' comprises both surface water and water from irrigation ditches carrying irrigation returns. [2] 'Water transfers' include the Tagus–Segura and Negratín–Segura transfers. [3] 'Total renewable water resources' include all water sources, excluding non-renewable groundwater. [4] 'Deficit' indicates the disparity between the total water demand and the sum of total renewable water resources and non-renewable groundwater. Source: Own elaboration based on data from SRB Management Plan 2009–2015 [46]; 2015–2021 [47]; 2022–2027 [38]; and Garrido and Garrote [42].

In response to the expected cuts in the TST, the Water Authority is planning to increase the use of NCW (especially desalinated water). However, the expansion of the NCW will be insufficient to offset the decline in conventional water resources, which will lead to an increase in the basin's water deficit in the coming years (Table 1).

3.2. The Present and Future of NCW in SRB

The implementation of NCW in the basin has occurred gradually to offset the structural deficit [17]. The use of desalinated seawater for agricultural irrigation, initially promoted through the AGUA program, did not reach its total capacity until 2022 in response to the drought situation and was facilitated by the implementation of renewable energies in their production and transport phase. Currently, seven SWDPs supply desalinated water for irrigation within the SRB (three public, four private), with a total capacity of 248 hm^3/year. The three public plants (ACUAMED-owned) (Valdelentisco, Águilas and Torrevieja) make the largest contribution in terms of water supply and irrigated areas, accounting for 94,410 ha of the total 120,081 ha irrigated with desalinated water (see Table 2). In 2017, only 74% of the full capacity was used [16].

Similarly, the use of reclaimed water in the region has been progressively increasing over the last two decades, propelled by the regional company ESAMUR, which promoted and financed its use in agriculture through sanitation and purification plans. According to the data from the SRB Management Plan (2022–2027) [38], the number of WWTPs in the basin is 162, and the annual volume of treated wastewater is 144 hm^3 (Table 2).

Table 2. Main parameters related to desalinated water and reclaimed water in the SRB.

Parameters	Desalinated Water	Reclaimed Water
Institution in charge of the construction of infrastructure and management	ACUAMED (National scope)	ESAMUR (Regional scope: Region of Murcia)
Plants (No.)	7 (3 public and 4 private) [16]	162 (all built and financed by ESAMUR)
Capacity (hm^3 per year)	Total: 248 Irrigation: 49 [19]	Total treatment: 144 Directly to agriculture: 87 [16,48]
Weight over total irrigation water use (%)	15.6% SRB Management Plan 2022–2027 [38]	9.5% SRB Management Plan 2022–2027 [38]
Production cost (EUR/m^3) [1]	0.55–0.70 [16]	0.44
The price paid by irrigators (EUR/m^3)	0.57 (private plants) 0.37 (public plant) [16]	0.05–0.10 [48]
New Parameters: Horizon (2023–2030)	Projected capacity: 346.1 hm^3 (2027); 361.8 hm^3 (2039) Projection for agricultural use: 257 hm^3 (2027) Photovoltaic capacity: 2700 MW Objective: 25% electricity consumption from self-consumption New irrigation water tariff: 0.34 EUR/m^3 (2023–2027) Regulation framework: Order TED 157/2023: Art 2 water Law photovoltaic self-consumption plants integrated with SWDPs. ACUAMED. Strategic Plans to acquire energy	Total reclaimed water: 146 hm^3 (2027); 159.8 hm^3 (2039) Direct reuse in agriculture: 91.2 hm^3 (2027); 102.1 hm^3 (2039) Installation of photovoltaic energy on pumping equipment for RW in ICs partially financed by ESAMUR. Regulation framework: Law 3/2000 on Sanitation and Wastewater Treatment; Second Plan for Sanitation, Purification and Reuse in the Region of Murcia (Horizon 2035)

Notes: [1] This cost does not include conveyance costs linked to energy costs. Source: Own elaboration.

Murcia is the province with the highest number of WWTPs (97) and the most substantial volume of treated wastewater (109.29 hm^3). The case of Murcia is of particular interest because it reuses more wastewater than any other area of Spain (nearly 90% of treated wastewater). The efficiency of the system is designed to discharge into the sea only those volumes considered unfeasible for reuse due to technical or economic reasons.

The poor condition of many water bodies and the complex water system in the Murcia region (characterised by multiple ramifications for the different water users) prompted the decision to establish stricter standards (compared to other Spanish regions) and their widespread application to all treatment plants. As a result, 90% of the WWTPs in the region are currently equipped with a reclamation treatment process, complying with the guidelines in Directive 91/271/EEC [32].

Table 2 presents the main technical–economic parameters characterising the use of NCW in the basin, along with its projection by the end of this decade, according to the SRB Management Plan 2022–2027 [38] and ESAMUR's Second Sanitation and Purification Plan (Horizon 2030).

The SRB Management Plan for 2022–2027 [38] anticipates a rise in the utilisation of desalinated water, increasing from 301.5 hm^3/year in 2021 to 346 hm^3/year in 2027. The new investments are directed towards the Valdelentisco, Torrevieja, and Águilas plants, as well as an investment in photovoltaic plants, both for self-consumption and for supplying water in the pumping and transportation phases. The prospective outlook for the medium and long term suggests that desalinated water could play a crucial role in maintaining competitive agriculture.

In addition, it is estimated that reclaimed water use could increase from 141.7 in 2021 to 146 hm^3/year in 2027. These additional resources will be sourced from poor-quality water currently being discharged into the sea and collected in stormwater tanks. A distinctive aspect of water reuse in Murcia is that the regional government covers the costs of reclaimed water (treatment, conveyance, and storage infrastructure for irrigators) through a sanitation fee incorporated into the water bills of urban users. Despite this, not every irrigation community can access this resource due to factors such as distance from a wastewater treatment plant and elevated energy needs for pumping the water to irrigation plots due to topography or salinity issues.

Another crucial aspect is that the production regime of treated urban waters does not align temporally with the agricultural water demand, so regulation infrastructure is needed. This implies additional investments and maintenance compared to conventional resources. The irregular hydrological regime in the basin has intensified the need for additional infrastructures, such as storm tanks, to regulate and store water from torrential rains for irrigation.

The Second Sanitation and Purification Plan is contingent upon its contribution to the costs associated with the operation and maintenance of water reuse infrastructure, incorporating storm tanks as an additional water source for irrigation. Regarding the infrastructure funding, the objective is to ensure that all irrigators, as end-users, contribute no less than EUR 0.05/m^3, totalling a final contribution of EUR 2.39 million/year to the infrastructure plan and its operational and maintenance costs. The remaining required annual investment is sourced from ESAMUR budgets, funded by the collection of sanitation fees (EUR 4.1 million/year), connections of new populations (EUR 0.68 million/year), and public funds (EUR 22.14 million/year).

4. Material and Methods

This section presents the data and methods used to analyse the perceptions of different irrigation communities (ICs) within the SRB regarding the use of NCW and the strategies developed to adapt to water scarcity. Data were collected through semi-structured interviews. Specifically, two rounds of interviews were conducted with managers of twelve ICs representative of the SRB in terms of year of establishment, crop distribution, water sources, size, and management. They are located in the province of Murcia (see Figure 2). The selection was made in consultation with regional experts, including technicians from the SRB Authority, ESAMUR, and the National Federation of Irrigation Communities of Spain (FENACORE), in the framework of the RECLAMO project ('The contribution of water REuse to a resourCe-efficient and sustainabLe wAter manageMent for irrigatiOn', RECLAMO, https://blogs.upm.es/reclamo/, accessed on 20 June 2023). The selected sample of ICs covers the three geographical areas of the region (coast, Guadalentín Valley, and mountainous interior), all size strata in terms of irrigable area (small, medium, and large), different types of crops (vegetables and woody), and different combinations of water mixes within the possible pool of available water resources (surface water, groundwater, transfers, and non-conventional).

The first round of interviews was carried out during May and June 2023. The interviews lasted about 1 h each and were used to gather information regarding the salient attributes of the ICs (size, main crops, water sources, energy costs, etc.). The second round of interviews took place in July 2023, during which the interviewees filled out an ad hoc questionnaire, which asked them about: (1) their preference among the available irrigation water sources in their communities—conventional water sources such as surface water (SW), groundwater (GW), and Tagus–Segura transfer (TST), and NCW sources, such as reclaimed water (RW) and desalinated water (DW)—based on criteria such as their guarantee, quality, cost, and environmental impact; and (2) their preferences for different adaptation strategies to cope with the expected reduction in conventional water sources in the short–medium term, due to the recently announced Tagus–Segura transfer restrictions and the effects of climate change (see Section 4). These strategies included crop change, irrigated surface reduction, increased storage capacity (including anti-evaporation measures), enhanced efficiency, increased access to desalinated water, increased access to reclaimed water, and purchase of water rights. They emerged from previous SRB management plans and engagements with key stakeholders related to irrigation water management in the basin within the context of the RECLAMO project [49].

The interviewees participated voluntarily in the process, and verbal consent was sought and obtained.

The data from the second round of interviews were processed and analysed using different methods. Concerning the first question ('How would you rate the different water sources available in your IC, according to their guarantee of supply, water quality, water cost, environmental impact, and what would be your preference for each of them?), quantified from 1 (low evaluation/preference) to 5 (high evaluation/preference)', the

1–5 scores for each water source (and each criterion) were averaged, assuming equal weights for every irrigation community.

The data collected in interviews regarding the second question (‘What strategies would you prefer for your IC to cope with the expected decrease in conventional water resources? Rate them from 1 (low preference/suitability) to 5 (high preference/suitability)’) were graphically represented and analysed using a biplot graph, which is a multivariate generalisation of a scatter plot with multiple variables. The biplot was obtained using principal component analysis (PCA), a multivariate statistical technique that facilitates the analysis of a multidimensional phenomenon when some or many of the variables in the study are correlated [50]. PCA identifies new derived and uncorrelated variables called ‘principal components’ (PCs) as linear combinations of the original variables.

The biplot graph illustrates the spatial distribution of ICs (rows) around a set of vectors representing adaptation strategies (columns). Each element of the data matrix is approximated as the scalar product of the row by the vector score of each strategy. Since we typically have centred data, points projected in the positive direction of the arrow are above the mean, and those projected in the opposite direction have values below the mean, as the origin represents the variable means. The further the projection is from the origin, the greater the magnitude of the difference from the mean.

The spatial distribution of ICs around adaptation strategies allows for the identification of significantly different groups. Conducting a one-way ANOVA on these groups helps to identify which attributes associated with them are statistically significant and may determine preference for desalinated and reclaimed water.

5. Results

The characterisation of the 12 irrigation communities, derived from the first round of interviews, is presented in Table 3.

As can be seen, the majority of these ICs are medium-sized in terms of irrigable surface (around 1000–3000 ha). However, there are also instances of larger communities (in fact, Campo de Cartagena and Lorca are the two biggest ICs in the studied area) and smaller ones (under 1000 ha). The annual volume of irrigation water usage ranges from 1 to 10 hm^3, except for Lorca (41 hm^3) and Campo de Cartagena (75 hm^3). Most of them use several types of water sources, incorporating at least one type of NCW; however, a small number of ICs reliant solely on conventional water were also included in the selection as not every IC in the SRB has access to NCW. However, these ICs are considering the potential to access NCW in the future. In addition, the selected ICs usually cultivate vegetables, fruit trees, or citrus (or a mix of these three) as their main crops, with a lower presence of olives and vineyards in some cases. Finally, although it is not shown in the table, most ICs use pressurised remote-control distribution networks and drip irrigation systems on 90–99% of their irrigated surfaces.

The mean values and standard deviation for each water source are detailed in Table 4. Based on various criteria, the results of interviewees’ preference for each water source (5 being the best) were aggregated.

According to the results presented in Table 4, surface water (4.88) was the preferred option among irrigators, receiving good evaluations for every criterion (each criterion scored 3.7 or higher). On a different level, the following preferred options were the Tagus–Segura transfer (3.75) and reclaimed water (3.30). In the case of the TST, all criteria received favourable evaluations except guarantee, which scored very poorly (1.43), as expected. On the other hand, reclaimed water received one of the highest scores for guarantee of supply (3.89) (together with desalinated water, the other NCW). However, due to salinity issues, reclaimed water scored slightly lower concerning its quality (2.8). Following these, groundwater preference (3.00) was mainly hampered by its quality (2.29) and cost (2.43) due to salinity problems and pumping requirements, respectively. Finally, desalinated water (1.88) was the least preferred option, primarily due to its elevated cost (2.50), despite being perceived as the most secure water option (4.29).

Table 3. Main attributes of the studied irrigation communities.

IC (Code)	Year of Establishment	Irrigators (No.)	Irrigated Surface (ha)	Main Crops (% Area)	Total Water Supplied (hm^3)	Water Sources (% Volume)	Water Cost (EUR/m^3)	Storage Capacity (hm^3)	Energy Costs (k EUR/y)	Photovoltaic Energy
TTS Librilla (LIB)	1979	1980	2500	Citrus (90) Other (10)	4.93	SW (5.1) TST (65.9) RW (3.6) [1] DW (25.4) [2]	SW (0.06) TST (0.22) RW (0.20) DW (0.47)	0.40	40	Yes
Casablanca (CBL)	1985	300	838	Fruit tree (85) Other (15)	4.60	GW (87) RW (13) [3]	GW (0.17) RW (0.26)	0.14	650	Projected
Campotéjar (CTJ)	1979	1049	3336	Citrus (60) Fruit tree (40)	9.50	SW (52.6) TST (26.3) RW (15.8) [4] DW (5.3) [5]	SW (0.12) TST (0.30) RW (0.15) DW (0.70)	0.50	700	Yes
Embalse de Argos (ARG)	1976	1448	1084	Vegetables (60) Olive (40)	5.54	SW (100)	SW (0.10)	7.50	25	No
Lorca (LOR)	1978	12,000	23,500	Vegetables (80) Citrus (15) Olive (5)	42.35	SW (22.9) GW (4.2) TST (28.6) RW (5.3) [6] DW (29) [7]	SW (0.06) GW (0.20) TST (0.12) RW (0.11) DW (0.43)	1.20	800	Projected
Campo de Cartagena (CC)	1979	9699	42,255	Vegetables (66) Citrus (22) Other (12)	75.42	SW (4.9) GW* (10.5) TST (71) RW (4.8) [8] DW (8.8) [9]	SW (0.03) GW (0.14) TST (0.16) RW (0.08) DW (0.58)	2.50	n.a.	Projected
Pantano de la Cierva (PCV)	1966	1700	2000	Citrus (65) Fruit tree (35)	1.00	TST (100)	TST (0.32)	0.50	250	Projected
Pozos Menorca e Ibiza (PMI)	2001	315	2060	Fruit tree (80) Citrus (15) Vineyard (5)	3.00	GW (100)	GW (0.53)	-	800	Yes
Zona V—Sector I y II (ZVS)	1997	600	1635	Fruit tree (60) Citrus (40)	4.30	TST (81.4) RW (14) [10] DW (4.6) [11]	TST (0.17) RW (0.07) DW (0.42)	0.40	n.a.	No

Table 3. *Cont.*

IC (Code)	Year of Establishment	Irrigators (No.)	Irrigated Surface (ha)	Main Crops (% Area)	Total Water Supplied (hm^3)	Water Sources (% Volume)	Water Cost (EUR/m^3)	Storage Capacity (hm^3)	Energy Costs (k EUR/y)	Photovoltaic Energy
Pliego (PLG)	1997	1450	818	Fruit tree (75) Citrus (20) Olive (5)	3.06	GW (75.2) TST (19.6) RW (5.2) [12]	GW (0.14) TST (0.25) RW (0.10)	0.64	500	Yes
H.R. Molina de Segura (HRMS)	1607	3000	1884	Fruit tree (46)Vegetables (34) Citrus (19)	2.25	SW (100) RW (0) [13]	n.a.	0.75	n.a.	Yes
Abarán (ABA)	1912	1200	1500	Fruit tree (85) Citrus (15)	4.80	SW (77.9) TST (22.9) DW (4.2) [14]	SW (0.20) TST (0.20) DW (0.44)	0.55	500	Projected

Note 1: SW is surface water; GW is groundwater; TST is Tagus–Segura transfer; RW is reclaimed water; DW is desalinated water. GW* (in Campo de Cartagena) includes groundwater from strategic wells only used during drought periods and water from water rights exchanges. Note 2: (1) [1] Librilla WWTP; [2] Torrevieja SWDP; [3]Abarán WWTP; [4] Molina Norte WWTP; [5] Torrevieja SWDP; [6] Lorca WWTP; [7] Águilas and Torrevieja SWDPs; [8] Fuente Álamo, La Aljorra, Torre-Pacheco, Balsicas-Roldán, Los Alcázares, San Javier and San Pedro del Pinatar WWTPs; [9] Escombreras and Torrevieja SWDPs; [10] Torres de Cotillas WWTP; [11] Torrevieja SWDP; [12] Pliego WWTP; [13] Molina Norte WWTP; [14] Torrevieja SWDP. Source: Own elaboration.

Table 4. Interviewees' preference for each water source.

Water Source	Guarantee of Supply		Water Quality		Water Cost		Environmental Impact		Preference	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Surface water	3.71	(±1.38)	4.38	(±1.41)	3.75	(±1.75)	3.83	(±1.83)	4.88	(±0.35)
Groundwater	3.00	(±1.67)	2.29	(±1.38)	2.43	(±1.40)	3.50	(±1.38)	3.00	(±1.41)
TS Transfer	1.43	(±0.79)	4.38	(±1.19)	3.38	(±1.41)	4.00	(±1.53)	3.75	(±1.49)
Desalinated water	4.29	(±1.50)	2.14	(±0.69)	2.50	(±2.07)	2.43	(±1.62)	1.88	(±0.83)
Reclaimed water	3.89	(±1.27)	2.80	(±1.48)	3.20	(±1.48)	3.30	(±1.70)	3.30	(±1.57)

Notes: SD is the standard deviation. Source: Own elaboration.

Table 5 and Figure 3 show the results of the principal component analysis (PCA) and the biplot graph based on 12 observations (ICs) and 7 variables (strategies). The two selected factors account for 69% of the total variance. The first factor shows two significant loadings related to crop change and water rights acquisition strategies, explaining 48% of the total variance. The second factor emphasises the increase in the use of desalinated water, explaining 20% of the total variance.

Table 5. Loading of adaptation strategies in two dimensions (D1 and D2).

Adaptation Strategies	D1	D2
Crop change	17,973	10,163
Surface reduction	0.2345	0.293
Storage cap increase	0.0237	−0.1978
Efficiency increase	−10,717	−0.6716
Desalinated water increase	−0.8722	16,859
Reclaimed water increase	−0.6334	0.7528
Water rights acquisition	−15,626	0.4243

Note: Source: Own elaboration.

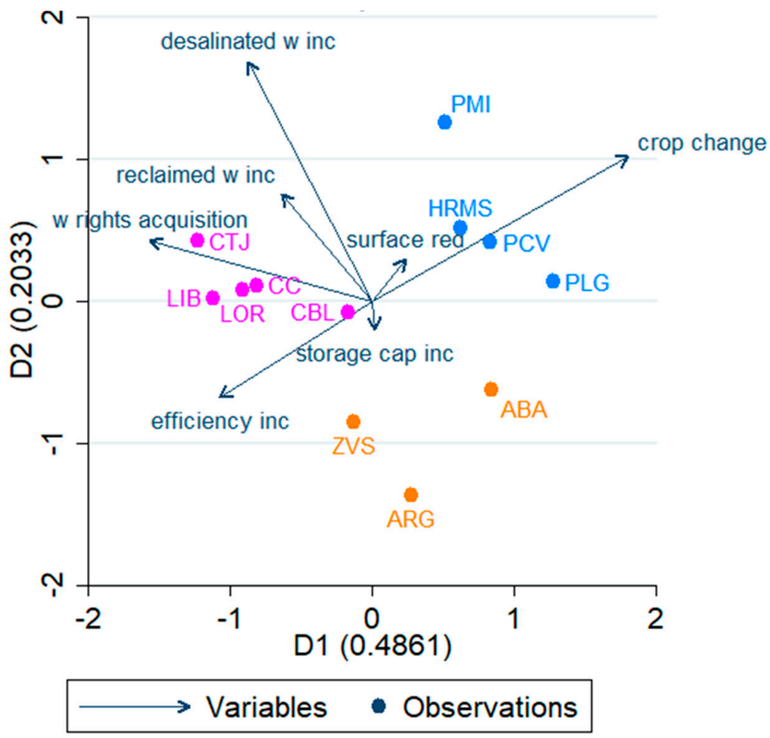


Figure 3. Biplot graph overlaying the coping strategies and measures (loading vectors) with the irrigation communities (score plot). Source: Own elaboration.

After analysing the relative positioning of each irrigation community in the biplot graph, three different groups were identified (and coloured in blue, orange and pink) to facilitate result interpretation (Figure 3).

All irrigation communities (except one) rejected the option of reducing the irrigated surface to cope with potential impending water shortages, while they were all usually in favour of expanding the storage capacity of their communities, including measures to mitigate evaporation losses in storage ponds, as mentioned by several participants.

The first group (blue) includes the irrigation communities of Pliego (PLG), Pantano de la Cierva (PCV), Heredamiento Regante de Molina de Segura (HRMS), and Pozos Menorca e Ibiza (PMI). These communities are the most inclined to change crops to adapt to new water availability scenarios (together with Abarán), while they do not see much more potential for enhancing efficiency. Regarding the use of NCW, they perceive potential in augmenting their access to both reclaimed and desalinated water resources, if possible. However, they express reservations about the possibilities that acquiring water rights may offer, as they fear such endeavours might be hampered by water shortages.

The second group (orange) consists of Abarán (ABA), Embalse de Argos (ARG) Zona V and Sectores I y II (ZVS). Except for ABA, communities in this group consider that there are more feasible options to cope with water scarcity than changing crops. For example, they prefer improving the efficiency of their irrigation systems, with some suggesting that more research and development are necessary in the desalination field to reduce energy needs by substituting reverse osmosis with other processes. Like the previous group, they do not see acquiring water rights as solving their communities' potential water supply problems. Also, they are a little less enthusiastic about obtaining reclaimed water, while they entirely discard the possibility of accessing more desalinated water.

The third and final group (pink) includes the communities of Campotéjar (CTJ), TTS Librilla (LIB), Lorca (LOR), Campo de Cartagena (CC), and Casablanca (CBL). Like the second group, these communities do not consider changing crops as the best alternative to cope with water scarcity. However, in this case, they find the rest of the options more appealing, including improving efficiency in their installations, the choice of acquiring water rights, as well as trying to increase access to NCW, with a slight preference for reclaimed water.

Table 6 presents the results obtained from the factor analysis of variance (ANOVA) to detect whether significant differences exist between the mean attributes of IC and the degree of preference regarding desalinated and reclaimed water.

Table 6. One factor ANOVA results.

Attributes	**Preference for Desalinated Water**		**Preference for Reclaimed Water**	
	F	*Sig*	*F*	*Sig*
Group	4	0.080 *	-	-
Number of irrigators	4.46	0.065 *	10.945	0.012 *
Total irrigation water supplied per irrigator per water supply	9.605	0.014 *	12.205	0.010 *
Use of reclaimed water	4.672	0.082 *	5.987	0.058 *
Use of desalinated water	5.238	0.049 *	6.739	0.033 *
The price paid by desalinated water	53.944	0.096 *	-	-
Storage capacity	45.522	0.001 **	-	-

Notes: * significance 90%; ** significance 95%. Source: Own elaboration.

The results indicate that the size of the ICs in relation to the number of irrigators, the total availability of water for irrigation, and the presence of reclaimed or desalinated water in the IC are correlated with a higher preference for both types of NCW. In addition, the variables 'group', the price paid for desalinated water and, above all, the storage capacity in the IC are associated with a preference for desalinated waters.

In summary, larger ICs and those already utilising NCW evaluate these waters more favourably. Desalinated water is more highly valued by ICs that already pay a higher price for it and possess storage infrastructure.

6. Discussion

In the Segura River Basin (SRB), as in many other Mediterranean basins, non-conventional water sources (NCW) have become an important component of the water mix and a promising alternative for agricultural irrigation (the largest water consumer) [51]. Recently, numerous regulations and policy strategies have been developed to promote the use of these water resources, setting very ambitious targets [30]. In line with Ricart et al. [52], our study suggests that increasing the use of reclaimed water and, more significantly, desalinated water will be key to alleviating water scarcity in the SRB. However, it will not suffice to offset reductions in conventional water sources (mainly the cuts in the Tajo–Segura water transfer), and the water deficit in the region will continue to increase.

This study also reveals that desalinated water is the water source least preferred by farmers, followed by groundwater and reclaimed water. The two preferred water supply alternatives are surface water and transferred water. These findings are in line with those obtained by Aznar-Sánchez et al. [53] and Hurlimann and Dolnicar [54] in arid basins of Spain and Australia and suggest that replacing freshwater with NCW may not be readily accepted by farmers.

Examining the various factors associated with the use of NCW for irrigation, we note that farmers perceive both advantages and disadvantages. As reported by Aznar-Sánchez et al. [15], we found that NCWs are highly appreciated by farmers due to their stability and guarantee of supply. NCWs can be used at any time throughout the year, irrespective of climatic variations, thereby reducing the risk of crop failure [55]. However, there are often technical difficulties related to the distribution and storage of NCWs. Several studies indicate that improving storage infrastructures, mainly at the irrigation community (IC) level, is key to optimising the use of the supplied volumes [28]. This is consistent with our results, which show greater receptivity to NCW in the ICs with greater storage capacity.

Farmers also perceive significant barriers related to the use of NCW. These include the low quality and high prices of NCWs [40]. Our results reveal that desalinated water is the least preferred water source by farmers in terms of water quality. According to Martínez-Álvarez et al. [56], the lack of essential minerals (calcium, magnesium, etc.) and the presence of phytotoxic isotopes (such as Boron) in desalinated water can negatively affect crop yields. Furthermore, farmers consider the quality of reclaimed water to be better than desalinated water [57]. Nevertheless, reclaimed water generally has an elevated salt concentration, making it less preferable than surface and transferred water [53].

Desalinated water is also the least desirable option among farmers in terms of cost. This result was expected, given that the average price of desalinated water in the study area is EUR 0.51/m^3, more than twice the price of transferred water (EUR 0.22/m^3) and groundwater (EUR 0.24/m^3) and five times higher than that of surface water (EUR 0.09/m^3). Other works, such as March et al. [21] and Ricart et al. [52], also identify the elevated cost of desalinated water as a major obstacle to its development. In contrast, the low price of reclaimed water (EUR 0.13/m^3, partly covered by ESAMUR) is considered an advantage. Navarro [51] and Petousi et al. [58], among others, argue that the competitive price of reclaimed water is one of the main factors encouraging its use.

In line with Alcon et al. [59], our study reveals that in many ICs in the SRB, the technical feasibility of supplying desalinated and reclaimed water after blending it with freshwater makes water quality and prices acceptable and affordable for farmers. However, sizeable increases in input costs (mainly energy costs) in recent years are putting pressure on farm profit margins and increasing the need to find new measures to reduce water costs.

The new subsidised price for desalinated water, established by the national government for irrigators in the SRB (EUR 0.34/m^3), is more competitive but remains expensive compared to the TST water source. Cabrera et al. [60] contend that optimising the operation of existing desalination plants by making them work at full capacity would significantly reduce the production costs associated with desalinated water. Other studies, such as García-López et al. [61] and Nasrollahi et al. [62], indicate that operating plants with renewable energy sources, such as photovoltaics, would make desalinated water cost-effective and less harmful to the environment. Along these lines, our analysis reveals that significant efforts are being made in the region to increase the share of renewable energy in desalinated and reclaimed water plants (most of the studied ICs already have a photovoltaic plant or are in the planning phase). National policies also point in this direction.

In addition, most studies indicate that farmers' knowledge of the environmental impacts of NCW use is limited. In contrast with Aznar-Sánchez et al. [15], our study reveals that farmers in the SRB are aware of the negative environmental effects of NCW and consider them to be greater than those associated with conventional water sources. Such impacts include greenhouse gas emissions and brine discharge in desalinated water [63] and the effects of ecological flows in reclaimed water [49]. Farmers' perceptions, however, seem biased in favour of conventional water sources, as the environmental impact of water transfers and overexploitation of aquifers is largely ignored.

Upon analysing the strategies to cope with the expected reduction in conventional water resources, we note differences among the ICs. Larger ICs specialising in high-value-added horticulture and situated near the coast are more willing to purchase water rights or use NCW (desalinated and reclaimed water). In contrast, ICs located in the inland regions of the basin, where woody crops predominate, are more likely to adopt crop shifts and, when feasible, to increase the use of reclaimed water as a critical water source for emergency irrigation of permanent crops [64]. Smaller ICs prefer to enhance irrigation efficiency, as they still have room for improvement. The viability of NCW in these irrigation communities is questionable. Their use is costly and would require subsidies, access to renewable energy technologies or a shift towards more profitable crops [40].

Finally, our findings are consistent with a growing body of evidence suggesting that farmers who have previous experience with desalinated and reclaimed water for irrigation tend to develop positive attitudes towards these water sources (e.g., Owusu et al. [65] and Aznar-Sánchez et al. [15]). In some experienced ICs, such as Lorca, the use of NCW has transitioned from being a complement to a strategic resource in response to water shortages [64]. Raising awareness and educating both farmers and society at large about the need for and benefits of using NCWs is key to improving the sustainability and acceptance of these new water sources. Sharing the burden (cost) of developing NCW (e.g., through an environmental tax paid by citizens) may be an option to explore. Taxes are less popular than subsidies but can be more effective (see the case of reclaimed water in Murcia, financed by sanitary fees paid by urban users).

The new water policy context offers a great opportunity to expand NCW by establishing criteria for prioritising allocation between agricultural uses [28]. This will be critical in the coming years if the projected trends are confirmed. Factors related to preferences for woody crops (already included in the allocation rules), water productivity, and consumption efficiency could be taken into account, but there are also considerations such as long-term sustainability, the integration of agronomic criteria (i.e., potential crop adaptation to scarcity), or criteria related to environmental and social costs. Consequently, efforts to establish benchmarking analyses of irrigated areas are essential to promote more equitable prioritisation criteria.

In any case, the integration of NCW water into SRB water planning will not be sufficient to address the long-standing structural deficit. As in many other water-stressed Mediterranean regions, water scarcity in the SRB is largely the result of excess demand, with efficiency improvements and technological advances reaching their limits. In these regions, water use is often regulated through water quotas, which are adjusted or reduced in case of drought. Greater flexibility and the further exploration of water markets could help mitigate the effects of drought and improve water management.

7. Conclusions

Water management in the semi-arid SRB has encountered prolonged challenges due to excess demand exceeding the availability of water resources. In addition, the tangible effects of climate change are exacerbating this situation, causing not only a reduction in conventional resources, especially in the donor basin (Tagus Basin), but also negative impacts on ecosystems and water quality. This scenario underscores the need to reorient demand (rethink the current approach of intensive irrigation) and reassess the role of NCWs as crucial water supply sources.

Detecting the diversity of experiences and perceptions within ICs concerning desalinated and reclaimed water is critical to advancing the development of NCW. Interventions are more likely to succeed when they incorporate the views of target groups. A limitation of the study is that the sample is relatively small for statistical analysis. Therefore, it would be advisable to include more irrigation communities (even individual farmers) in future research. In addition, it would be advisable to replicate this study in the future to observe how irrigators in the region are adapting to a scenario featuring increased use of non-conventional water resources, and whether this new situation affects irrigators' perceptions of these non-conventional waters.

The results indicate that the main challenge for the development of NCW in the SRB, as in many other parts of the world, is addressing farmers' concerns about the quality and cost of these water sources. However, such concerns are mitigated when farmers possess prior experience with NWC and are aware of potential water shortages. Localised studies, taking into account the differences between ICs, would be needed to address the allocation of NCW resources based on the establishment of sustainability criteria.

In addition, efforts to increase the acceptability and competitiveness of NCWs are crucial to encouraging the use of these resources. Exploiting economies of scale through collaboration between stakeholders, switching to renewable energy, and taking advantage of the new water policy context and EU's green transition plan will be vital to making NCW production cleaner and cheaper. Ultimately, innovation, cooperation, and tailor-made strategies will be essential to sustain agricultural production and promote NCW both in the SRB and globally.

Increasing awareness of the use of NCWs requires not only greater institutional support to fund infrastructure and management but also the involvement of society at large by promoting the use of economic instruments such as environmental taxes or subsidies to make them more accessible for agricultural purposes.

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Abbreviations

List of abbreviations	
ABA	Abarán
ARG	Embalse de Argos
CBL	Casablanca
CC	Campo de Cartagena
CTJ	Campotéjar
DSEAR Plan	National Plan for Sanitation, Efficiency, Saving and Reuse of Wastewater
DW	Desalinated water
EU	European Union
FENACORE	National Federation of Irrigation Communities of Spain
GW	Groundwater
HRMS	H.R. Molina de Segura
IC	Irrigation community
LIB	TTS Librilla
LOR	Lorca
MITECO	Ministry for the Ecological Transition and the Demographic Challenge
NCW	Non-conventional water
PC	Principal Component
PCA	Principal Component Analysis
PCV	Pantano de la Cierva
PLG	Pliego
PMI	Pozos Menorca e Ibiza
RW	Reclaimed water
SRB	Segura River Basin
SW	Surface water
SWDP	Seawater desalination plant
TST	Tagus–Segura water transfer
WFD	Water Framework Directive
WWTP	Wastewater treatment plant
ZVS	Zona V—Sector I y II

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