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ARTIFICIAL PENINSULAS AND PSEUDO-ISLANDS OF CROATIA

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ABSTRACT

The paper discusses the artificial peninsulas and pseudo-islands of Croatia, i.e. technically bridged islands, which are linked to the neighbouring mainland or a larger island by means of a dike, bridge or both dike and bridge. Whereas artificial peninsulas are entirely incorporated into the mainland by means of dikes, pseudo-islands are connected to the mainland via bridges, thus losing some of their insular characteristics, particularly in terms of their functional link to the mainland.

Croatian bridged islands played a vital role in the past as in times of war they represented refuges or places of permanent settlement. Nowadays, in times of marked littoralisation, these islands have experienced a dramatic change in function and physical appearance, mostly due to their transport connections with the mainland, which has naturally resulted in their inclusion in the tourist valorisation of natural and cultural heritage. On the one hand, this has contributed to the slowing down of the depopulation process, which is a basic social characteristic of most Croatian islands, but on the other hand, it has led to the spontaneous, uncoordinated, excessive building of apartments and other constructions which in size and shape have ruined the authentic cultural appearance of the islands.

Key words: islands, artificial peninsulas, pseudo-islands, Croatian islands, Croatia, Adriatic

PENISOLE ARTIFICIALI E PSEUDO ISOLE DELLA CROAZIA

SINTESI

Il saggio prende in esame l'argomento delle penisole artificiali e delle pseudo isole della Croazia, cioè le isole che tecnicamente non sono isole perché sono legate alla terraferma o a un'isola più grande da una diga o da un ponte, oppure da ambedue, diga e ponte. Mentre le penisole artificiali sono completamente incorporate alla terraferma tramite le dige, le pseudo-isole sono collegate alla terraferma da ponti, perdendo in tal modo alcune delle loro particolarità insulari, in particolare quando si parla del collegamento funzionale alla terraferma.

Le isole croate collegate alla terraferma da ponti giocarono un ruolo vitale nel passato, rappresentando in tempi di guerra rifugi o luoghi di stabilimento permanente. Oggi, nel periodo della marcata litoralizzazione, queste isole subiscono radicali cambiamenti nel funzionamento e nell'aspetto fisico, grazie maggiormente al collegamento di trasporto con la terraferma, il che naturalmente ha avuto come conseguenza la valorizzazione del loro patrimonio naturale e culturale a fini turistici. Da una parte ciò ha contribuito al rallentamento del processo dello spopolamento, che è la fondamentale caratteristica sociale della maggior parte delle isole croate, però d'altra parte ha portato alla spontanea, non coordinata, ed eccessiva costruzione di appartamenti, case da affitto e altre costruzioni che con le loro dimensioni e con la loro forma hanno rovinato l'autentico aspetto culturale delle isole.

Parole chiave: isole, penisole artificiali, pseudo isole, isole croate, Croazia, Adriatico

INTRODUCTION

The frontal Croatian coastline, which encompasses most of the north-eastern Adriatic, consists of more than a thousand islands (Stražičić, 1997, Duplančić Leder et al., 2004). These islands form a complex area in which the sea, karst relief, Mediterranean climate, and rich flora and fauna mingle and co-exist with human activity and life in general. The islands are individual geographic microsystems, but also a basic natural, geographic and socioeconomic developmental resource, with great potential, along with the limitations of economic exploitation. Since the Croatian islands are geographically quite fragmented and dispersed, this results in problems related to transport connections with the mainland, which is one of the most prominent limiting factors for insular development (Stražičić, 1987). In this respect, certain Croatian bridged islands, or those linked to the neighbouring mainland by means of a dike, are the prominent ones.

The literature, both international and Croatian, contains many different insular typologies based upon various criteria, depending on the aims and methodologies of particular authors (Haila, 1990, King, 1933, Ratter and Sandner, 1996, Royle, 2001, Rubić, 1952, Magaš, 2008, Faričić et al., 2010). In this respect, Croatian insular typology is no exception, and it represents a basis for numerous scientific discussions. The research focus of this paper are islands linked to the neighbouring mainland by dike, bridge or both dike and bridge (Fig. 1). Connecting islands to the neighbouring mainland by means of a permanent construction contributes to natural and socioeconomic changes. Therefore, the aim of this paper is to discuss the problems of defining and categorising these Croatian islands and to determine the fundamental characteristics of their socioeconomic development after being linked to the mainland. The paper singles out several types of such islands according to the way in which they were connected to the mainland, and when, along with the implications. The typological division of Croatian bridged islands is based upon two main criteria:

a) type of connection

b) impact of mainland connection on the socioeconomic insular development.

In order to achieve the aim of the research, a comparative analysis of different sources of geographical data was carried out, including archival and cartographic sources and various demographic databases. The available literature was studied, including mostly reviews of the historical development and geographic features of particular islands, with no particular emphasis on the type and implications of their connection with the mainland. In addition, field observations and terrestrial and aerial photographs were used.

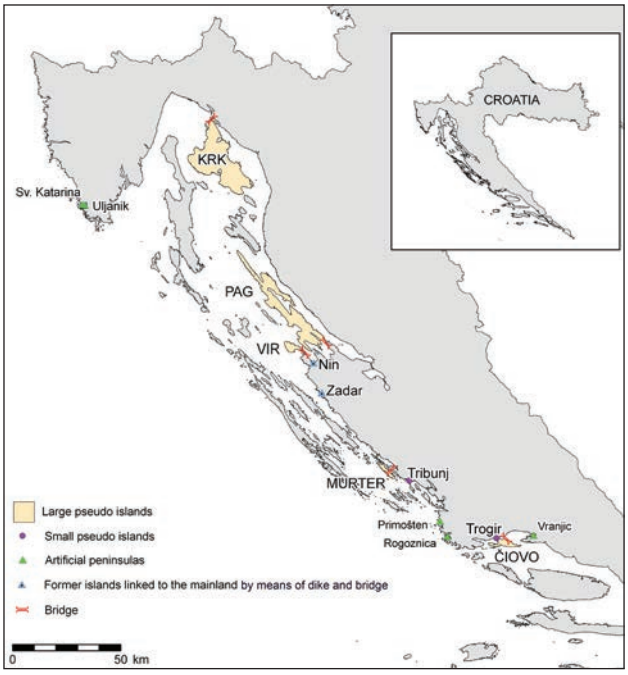

Figure 1 Artificial peninsulas and pseudo-islands of Croatia

ARTIFICIAL PENINSULAS AND PSEUDO-ISLANDS OF CROATIA

Geography dictionaries generally define islands as areas of land surrounded by sea, river or lake water (Dudley Stamp, 1961, Whittow, 1984, Mayhew, Penny, 1992, Clark, 1993, Cvitanović, 2002). The legal definition given by *United Nations Convention on the Law of the Sea* is also important. Article 121 Paragraph 1 of the Convention defines an island as a naturally formed area of land, surrounded by water, which is above water at high tide (UN, 1982). According to these definitions it seems that islands should represent easily identifiable areas, since the natural borderline between mainland and sea is absolutely clear. However, these definitions do not specify possible changes regarding insular connection to the mainland. Namely, insular features change significantly when permanent transport connections, bridges, tunnels or dikes replace occasional transport communications such as maritime or air traffic (Baldacchino, 2007). Due to their newly acquired physical changes, such islands can be difficult to categorise and conceptualise (Barthon, 2007). There are three elementary types of such islands in Croatia, which differ in the way they are linked to the mainland:

a) islands linked to the mainland by means of dikes

b) islands linked to the mainland by means of bridges

c) islands linked to the mainland by means of dikes and bridges

If connected to the mainland by means of a dike, an island loses its physical and functional insular features entirely. Moreover, the natural characteristics of the island and its surrounding waters undergo considerable

Figure 2 Tied island of Lopata (a) with its tombolo (b), Sakarun Bay, island of Dugi Otok

modifications. For example, dikes prevent the flow of sea water between islands and the sea, along with the mixing of physical and chemical sea water characteristics, the exchange of nutritive elements and the migration of marine organisms, etc. At the same time, dikes enable animal migration and the spread of flora from the mainland to the (former) island and vice versa.

A *tombolo* is a phenomenon that is in appearance quite similar to an artificial dike, but it is in fact a natural landform, a narrow bar of land composed of sand or gravel, by which an island is attached to the mainland (Haslett, 2003). An island linked to the mainland by a *tombolo* is called a tied island, i.e. a land-tied island. The phenomenon is very common all over the world, including Croatia (e.g. Lopata near Sakarun Bay on the island of Dugi Otok; Fig. 2). Unlike artificial dikes, which are built to resist all possible weather and oceanographic conditions, naturally linked islands are mostly connected by deposits of sand and gravel that are easily disrupted by wind and waves. *Tombolos* are therefore less stable shore features. For example, the *tombolo* that connected Artina with the small island of Vrgada in the Zadar archipelago until the 20th century, as recorded on the first modern cadastral plan made by the Austrian government in Dalmatia in 1824 (Fig. 3), was completely destroyed. The same *tombolo* was mapped on a

Figure 3 Artina off the island of Vrgada: a) tombolo recorded on the 1824 cadastral plan (SAZ, Cadastral Maps, Vrgada, Sign. 434); b) present condition (Google Earth 2012)

topographic map (Zaravecchia und Stretto sheet) made for the Military Geographical Institute in Vienna in 1884 (SAZ, Geographic and Topographic Maps of Dalmatia and Neighbouring Districts, Call number 153). Today, there is a shallow underwater reef in its place (Faričić, Magaš, 2009).

An island linked to the mainland by a natural or artificial dike is no longer surrounded solely by water, so it is actually a peninsula, and in such cases, *tombolos* and artificial dikes are actually *isthmuses*. If an isthmus belongs to a tied island, then the peninsula which it forms could be called an artificial peninsula. In Croatia this is the case with many former smaller islands, among which the best known are Nin (before the dike was built, Nin was connected to the mainland via two bridges), Primošten (from the Croatian verb *premostiti,* to bridge over), Rogoznica, Vranjic and Uljanik, and there are

Figure 4 Sveti Pelegrin in Savar on the island of Dugi Otok, recorded around 1925 (Iveković, 1928)

smaller ones like Sveta Katarina in the Bay of Pula, Sveti Andrija (Jadrija) and Sveti Nikola at the entrance of Sveti Ante Channel near Šibenik, Sveti Pelegrin in Savar on the island of Dugi Otok (Fig. 4), Sveti Duh in Novigrad Sea, Školjić[1] near Murter, Sveti Klement in Bregdeti Bay in Zadar, and others.

Unlike artificial peninsulas, islands that are linked to the mainland by a bridge have managed to preserve their physical and geographical insular characteristics. In Croatia, the largest are the islands of Krk, Pag, Vir, Murter and Čiovo, but there are some smaller islands that have developed into settlements of significant socioeconomic importance, such as Trogir and Tribunj. Regardless of their surface area and importance, these islands all have one thing in common; having been bridged, they are still entirely surrounded by water at sea level. Yet they are more or less integrated into the mainland, which has many socioeconomic implications.

Inter-island bridging is similar, but if the islands have no direct link to the mainland, they retain their insular characteristics. Nonetheless, bridging leads to the functional linking of two (or more) islands in a connected unit. In Croatia, such islands are Cres and Lošinj, and Ugljan and Pašman[2].

While islands linked to the mainland by dike are *de facto* peninsulas, bridged islands are not as easily defined geographically. Most references regard these islands as *pseudo-islands*[3] (Kelman, 2005) or *quasi-islands* [4] (Lajić, 2010) thus emphasising the loss of their insular features.

After being linked to the mainland, *artificial peninsulas* and *pseudo-islands* largely lose their insular features, among which isolation[5] in relation to the mainland was a prevalent factor. The need to establish the best possible transport connections was in most cases fulfilled by maritime transport. Up to the 19th century, sea routes were formed spontaneously, used when needed, mostly the result of individual initiative. Later, regular state shipping lines were introduced for the transport of goods and passengers and in the mid-20th century, ferry lines for transporting passengers and vehicles were introduced (Antić, 1962, Kos, 1962, Stražičić, 1989, Opačić, 2002). Even though transport connections between the islands and the mainland have improved continuously, they are still subject to many limiting factors, especially bad weather and oceanographic conditions.

Bridging the islands has represented a great change for insular socio-economic systems, along with changes to the insular landscape. Since these islands have lost their primary insular characteristics and have become parts of the mainland in terms of transport, whether by means of a dike, bridge or both dike and bridge, the question arises as to whether they can be still regarded as islands. Should they be treated as such in geography, education, lexicography and, most importantly, in the legislature (taking into account their specific insular status in Croatian legal, tax and environmental and spatial planning systems)? According to the latest research, the Republic of Croatia has 1,246 islands, islets and rocks (Duplančić Leder et al., 2004), and all the larger bridged islands are listed by name (Krk, Pag, Vir et al.), along with the socioeconomically important small Island of Trogir; yet smaller islands like Tribunj have not been listed. Neither does the list contain any islands linked to the mainland by means of a dike (e.g. Uljanik, Nin, Rogoznica, Vranjic etc.).

Transport connections enjoyed by artificial peninsulas and pseudo-islands have resulted in the channelling of various dynamic social interactions between the islands and the mainland. Thus the initial connection,

1 After the building of a dike (in mid-20th century) that linked it to Murter, which is a pseudo-island, Školjić retained its geographical name, even though it is etymologically derived from the fact that it was a very small island (Italian *scoglio* = small island).

2 These islands are still treated as independent relief entities; however, in the case of Cres and Lošinj, the issue of the bridge and artificial canal which divides the island of Lošinj near Mali Lošinj into two parts is still rather dubious. Since the width and length of the natural Osor Strait and the artificially excavated Privlaka Strait in Mali Lošinj are roughly equal, as are the lengths bridging them, certain scientists (Duplančić, Leder et al., 2004) consider that instead of two distinct islands (Rubić, 1952, Lajić, Mišetić, 2006) the area includes *de facto* three islands: Cres, Veliki Lošinj and Mali Lošinj. The names of the last two islands suggest an artificial construction made by a team of authors who recommended this division of Lošinj (Duplančić Leder et al., 2004) considering the surface areas of the "new" insular entities. This could result in potential confusion since there are two settlements on the island of Lošinj, named Mali and Veli Lošinj, which are both situated on the "new" Island of Mali Lošinj according to the above-mentioned division.

3 From the Greek ψευδής (pseudes) i.e. not genuine; false or pretended.

4 From the Latin *quasi* i.e. partly, almost.

5 Symbolic play on words connected to the term *insulation* which derives from Latin word *insula* = island, i.e. *isolation* which comes from Italian word *isola* = island.

apart from providing physical integration, gradually affects other aspects of the fusion of the island with the neighbouring mainland, especially in the case of smaller islands, whose integration has been much faster. This is probably why such islands were excluded from the list of islands, islets and rocks in the most recent research conducted on the number, area and coastline length of the Croatian islands (Duplančić Leder et al., 2004).

Larger bridged islands, primarily owing to their size and geographical indentedness, are not entirely fused with the mainland, even though bridging has contributed to their transport connections, as well as their economic and demographic development.

This is the main reason why research papers, development programmes, the environmental and spatial planning systems of coastal counties, and legislative regulations governing certain privileges enjoyed by island populations, refer to them as islands. For instance, they have been included in fundamental provisions which deal with insular development issues – the *National Island Development Programme* (Starc et al., 1997) and *Islands Act* (Zakon o otocima, 1999). In regard to the physical appearance of these islands, it is possible to determine differences in the degree to which they are integrated with the mainland in terms of the distance of island settlements from the mainland.

ARTIFICIAL PENINSULAS

Small islands are usually connected to the mainland by means of dikes (and sometimes to neighbouring larger islands). Although the connection is artificial, such islands have the physical appearance of peninsulas. In the past, they played an important role, because they served as refuges from perils and threats from the mainland, especially the Ottoman invasions on the north-eastern Adriatic coast. Compact settlements with houses, narrow streets, small town squares and a narrow shoreline sprang up. The best examples are Nin, Primošten, Rogoznica and Vranjic.

Among the bridged islands, Nin was the first to establish a mainland connection, which dates back to ancient times, when it was a prominent Liburnian centre and later the Roman municipality of *Aenona* (Magaš, 1995). In the Middle Ages, Nin was inhabited by Croats who soon established a ducal residence and the bishop's see in the town. The Ottoman invasions and destruction of the town by its Venetian governors, to prevent it from falling into the hands of the Ottomans, halted the development of Nin, which had lasted for centuries. Despite the enormous devastation, many items of cultural and historical heritage were preserved on the pseudo-island of Nin, ranging from Roman archaeological remains (an ancient temple, the remains of houses, mosaic floors etc.) to several medieval sacred sites, ramparts and towers. Linked to the mainland via two small stone bridges, the South or Duchess Bridge and the North Bridge, Nin operated

Figure 5 Nin: a) depiction in Marković's Carta Topographica del Territorio della Citta di Nona, 1849 (SAZ, Geographic and Topographic Maps of Dalmatia and Neighbouring Districts, Call number 4), b) aerial photography taken in 2009 (photo by Velid Jakupović)

as a pseudo-island for centuries. Both bridges, used only by pedestrians today, have been preserved in a slightly different form (Fig. 5). East of the islet of Nin itself, in the shallow Nin lagoon, a dike was built with a modern road, thus connecting Nin to the mainland by a dike in addition to the two bridges Thus the geographical transformation of Nin from an island to a pseudo-island and finally to an artificial peninsula was completed. Today, it is a unique tourist destination with a rich cultural heritage.

In the 15th century, the Šibenik islets of Primošten and Rogoznica (Kopara) were inhabited by refugees from the neighbouring mainland who established settlements there. As the military and political situation on the northeast Adriatic coast and in the immediate hinterland stabilised, in the 19th century these settlements spread to the mainland and a reverse process of spatial development was initiated. During the 20th century, a large number of houses were built on the mainland and the majority of the residents of Primošten and Rogoznica still live there today. However, the historical island cen-

Figure 6 Primošten (Šibenik-Knin County Tourist Board Photograph Collection)

tres are still important as centres of local administration, where the parish church, commercial buildings and docks, etc., are located .

Primošten was linked to the mainland between 1542 and 1564 in accordance with a decree issued by the Šibenik municipal authorities. In documents from the early modern age Primošten was referred to as an island, but in the Renaissance manner it was identified by a classical name (after the Greek mythological hero Diomedes)[6], and sometimes the Venetian toponym *Capo Cesto* (*Chauo Cesto*) was used. In 1517, for example, it was mentioned that *Bartholus Miglanouich de insula Diomedis* was selling a vineyard *in Cremi in contrata dicta Chamenica* (SAZ, ŠNA, box 30/I (Frane and Dunat Tranquillo), bundle 1514-1517, 140v), and in 1518 a certain *Antonius Stogchouich de insula Diomedis vulgariter dicta Chauo Cesta* is mentioned (SAZ, ŠNA, box 30/I (Frane and Dunat Tranquillo) bundle 1517-1519, 250v). In the report of the Prince of Šibenik to Jakov Bold dated 7 May 1542 there was a note recording the need to build an enclosure wall and a drawbridge, as well as another small tower like the one already there (Stošić 1941). This was done, and in the archival documents of 1564 the toponym Primošten is mentioned (Stošić, 1941). It is not clear when the bridge was replaced by the dike that still connects the former island to the mainland (Fig. 6), but the place name reflects the fact that the island used to be connected to the mainland via a bridge (in Croatian, *premostiti* means "to bridge over").

The construction of the dike which linked Rogoznica (Kopara) to the mainland came much later, because Rogoznica was further from the mainland than Primošten (the closest point is about 290 metres away). Construction of the dike began in 1874 and it was finished in 1912 (Fig. 7). Afterwards, the connection to the mainland was widened and raised several times in order to

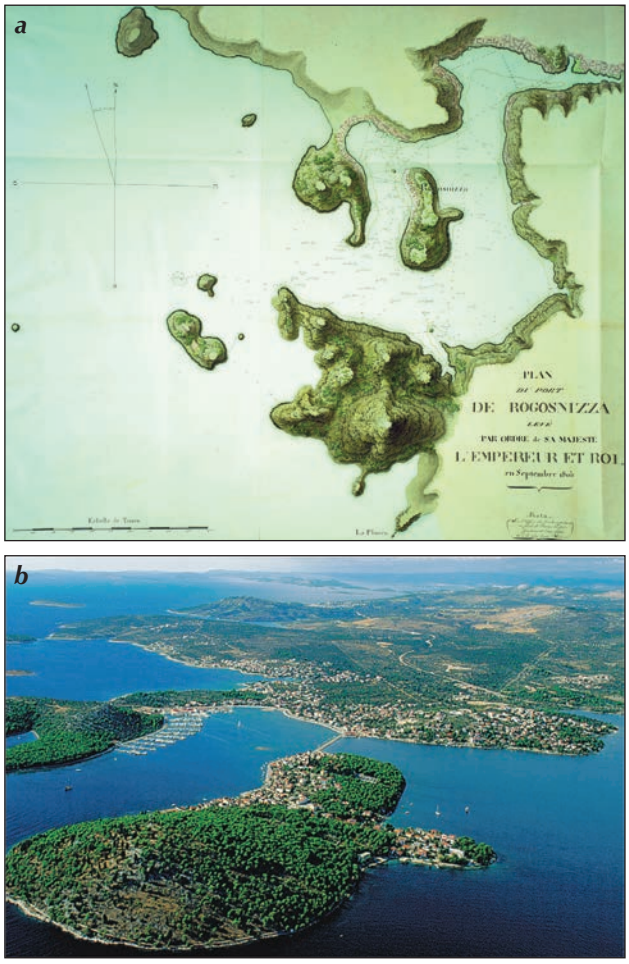

Figure 7 Rogoznica: a) Beautemps-Beaupre Nautical Chart of Rogoznica, 1806 (NULZ, Geographic Maps Collection, Call number A III – S18-9), b) aerial photograph taken in 2005 (Šibenik-Knin County Tourist Board Photograph Collection)

minimize the effect of the waves (Stošić, 1941). Also, a completely new pseudo-island was built by filling in the Bay of Rogoznica in the mid 1990s; the reception area and other facilities of the large *Frapa* Marina are situated on this entirely artificial island, which is connected to the mainland by two small bridges.

The development of the islet of Vranjic in the eastern part of Kaštela Bay is quite remarkable. The settlement dates back to prehistoric and Roman times, but encouraged by the Venetian administration, this former medieval settlement was inhabited by people from Dalmatian Zagora (the Drniš area, in particular) after the Ottoman retreat in the 17th century. Having colonised the islet, the new residents linked it to the mainland by means of

6 In classical times the name Diomedes was used to identify Ploča Point near Rogoznica (Čače, 1997), which means that 16th century notaries from Šibenik mistakenly identified this point as Primošten. Their mistake was later repeated by other writers, like K. Stošić, who provided a detailed preview of the historical and geographical development of the Šibenik rural area in 1941.

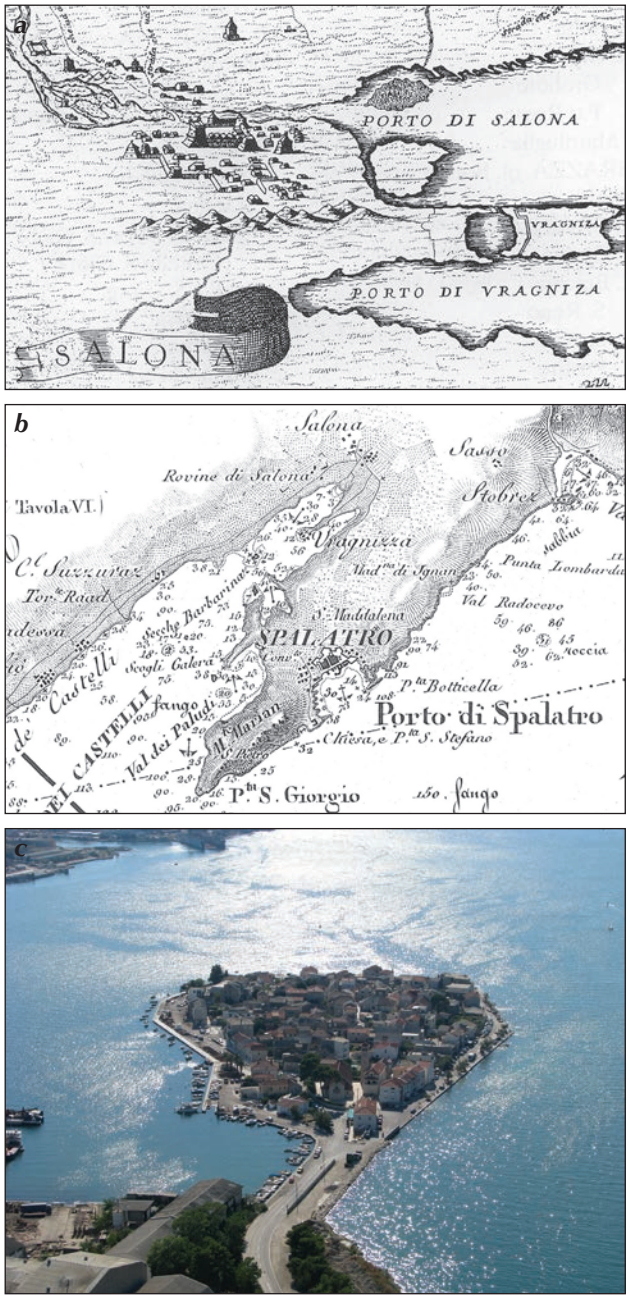

Figure 8 Vranjic: a) depiction of the island of Vranjic on Coronelli's map of Solin, 1688 (SAZ, Call number 784/II.E.12.); b) depiction of Vranjic (Vragnizza) on Nautical Chart IX from the Carta di cabotaggio del Mare Adriatico edition, 1822 (SAZ, Geographic and Topographic Maps of Dalmatia and Neighbouring Districts, Call number 76A); c) aerial photograph taken in 2008 (photo by Joško Uvodić)

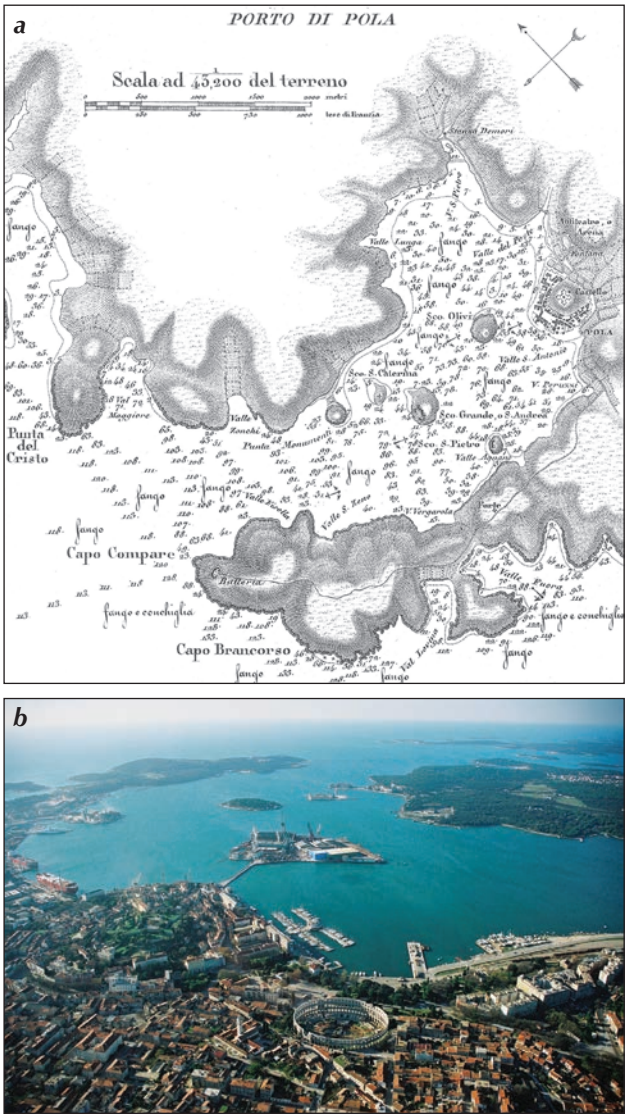

Figure 9 Uljanik and Sveta Katarina: a) depiction on Nautical Chart III from Carta di cabotaggio del Mare Adriatico edition, 1822 (SAZ, Geographic and Topographic Maps of Dalmatia and Neighbouring Districts, Call number 76A); b) aerial photograph taken in 2007. (photo by David Orlović)

a dike in order to ease communication with the neighbouring towns of Split and Solin (Kečkemet, Javorčić, 1984). However, this had not happened by 1688, the year in which a Venetian cartographer, Vicenzo Maria Coronelli, mapped Vranjic on a map of the Solin area as an island with no connection to the mainland (Fig. 8).

Throughout the 20th century, the artificial peninsula and densely built settlement of Vranjic (administratively still part of the town of Solin) were integrated into the Split metropolis (Fig. 8). Terminals for the commercial port of Split and a shipyard were built on the Vranjic shoreline, which was once a fertile fishing ground, well known for oyster and mussel farming. The adjacent factories and port facilities have greatly disfigured the landscape of this settlement which is also known as "Little Venice" among its inhabitants.

Figure 10 Zadar: a) Degli Oddi's cartographic depiction of Zadar, 1584 (BAU, Call number F0 6-IV-6); b) depiction of the historical core on Nautical Chart VII from Carta di cabotaggio del Mare Adriatico edition, 1822 (SAZ, Geographic and Topographic Maps of Dalmatia and Neighbouring Districts, Call number 76A); c) the layout of the historical core today (Google Earth 2012)

Uljanik, in the Bay of Pula, is also linked to the adjoining mainland by a dike. The Uljanik Shipyard occupies the entire surface area of this artificial peninsula. Of all the olive trees that used to cover the surface of the islet, and after which it was probably named (the Croatian word for oil is *ulje*), only one has been preserved as a symbol of the former cultural landscape, and it is stands among the concrete and steel constructions of the leading Croatian shipyard. There is another artificial peninsula in the Bay of Pula, called Sveta Katarina, which is linked to the neighbouring mainland by a dike. It was once a part of the Monumenti naval military complex. Both these artificial peninsulas reflect the littoralisation of Pula, especially the naval-military and military-industrial features of the Austro-Hungarian administration and later the Italian and Yugoslav military and naval systems (Fig. 9).

Artificial peninsulas also evolved from former islands, where important Croatian Adriatic cities like Zadar, Dubrovnik and Rovinj developed. Their historical cores originated on the islands which were later linked to the mainland by dikes. Zadar has the longest island history and is the best example. It was fully linked to the mainland at the end of the 19th century (Petricioli, 1962, Faričić, 2006). In fact, for centuries, Zadar was separated from the mainland by a canal, which was bridged over. From the beginning of the 16th century until the end of the 19th century, the historical centre consisted of two islands (Fig 10). Since classical times, all the main urban facilities were situated on the larger island, while the great fortress (*Forte*) was erected on the smaller one in the 16th century and was separated from the mainland by a canal. When the canal that separated the city from the mainland was filled in, an artificial peninsula was formed. Only the small harbour of Foša (from the Italian word *fossa,* meaning *trench*) remained. It is interesting to note that in official odonymy the old part of Zadar is called Poluotok (Peninsula), but the population of Zadar and its region use the odonym Grad (Town) in everyday communication this part of the town, which might have to do with the concentration of various urban functions there. As well as dike, the former island of Zadar also had a pedestrian bridge linking it to the mainland. Built in 1929, it shortened the route from the historical core to the Voštarnica district. The bridge was destroyed in British air raids during the Second World War, and was temporarily replaced by a pontoon bridge (on iron barrels) from 1949 to 1961, then the new bridge was built in 1962 (Petricioli, 1962, Dragić, 2009).

PSEUDO-ISLANDS

Small pseudo-islands

Pseudo-islands are defined as bridged islands connected to the mainland by at least one bridge. At sea level, their physical appearance corresponds to the sim-

Figure 11 Tribunj (Šibenik-Knin County Tourist Board Photograph Collection)

ple geographical definition of islands, even after being bridged over. From a functional point of view, these islands include small islands which have been fully incorporated into the mainland and whose historical cores have spread to the mainland, where most residential, commercial and other buildings and communal infrastructure are located, and where most of the population lives. Unfortunately, there are no precise statistical data that can be used to determine the ratio between the number of housing units and population on pseudo-islands and on the mainland. Nevertheless, on the basis of original archival and cartographic documentation and the available data, it is possible to reconstruct the historical and geographical development of Croatia's most important small pseudo-islands – Tribunj and Trogir.

The islet of Tribunj is linked to the mainland by a bridge whose date of construction is unknown. This bridge was mapped on the map of Zadar and Šibenik region made by Martin Rota Kolunić in 1570 (BNF, Paris, Call number GEDD-1140(41RES)) and then on the maps of the Zadar and Šibenik region published by Giovanni Francesco Camocio in 1571 and Simone Pinargenti in 1573 (Kozličić, 1995). Also, this bridge was mentioned in the works of the Venetian scientist and travel writer Alberto Fortis (1774). Most of the present-day settlement of Tribunj is situated on the neighbouring mainland, whilst the old core, located on the islet, has partly lost its residential function and been taken over by the tourist and catering industry (Fig. 11).

Trogir has a long tradition of being connected to the mainland and has two bridges. Its settlement dates back to prehistoric times, but the basic structure of the urban core of Trogir started developing in the 3rd century BC, when Greek colonists from Issa founded a settlement that developed continuously during classical and medieval times (Klaić, 1985).

On the Governance of the Empire (*De administrando imperio)*, a historical source written by the Byzantine Emperor Constantine VII Porphyrogenitus in the mid-10th century, describes Trogir as an islet linked to the mainland by *a narrow bridge-like corridor, used by the population to cross into the city.* However, whether Trogir was then connected to the mainland by a natural link or whether the Byzantine emperor meant a dike remains uncertain. Historians generally agree that Trogir was originally a natural peninsula, and the canal (Foša) was dug later for protective purposes. Eventually, the canal was bridged in medieval times (Babić, 2006).

During the 13th century, when Trogir was recognised as a prominent episcopal and municipal centre on the north-eastern Adriatic coast[7], bridges were built to link it to the mainland (*Porta pontis* or *Vrata od mosta*) and the neighbouring island of Čiovo (Benyovsky, 2009). In 1420, Trogir and much of the north-eastern Adriatic coast came under Venetian rule (Raukar, 1997). Considering the strategic importance of their overseas possessions and the dangers of the Ottoman conquest, the Venetians tried to strengthen the fortification systems of all their north-eastern Adriatic towns. Consequently, many fortresses, towers and bulwarks were built or restored (Fig. 12). The former stone bridge *Porta pontis* was also restored in that period. Unlike the old one, the new one was built as a drawbridge with a wooden deck. The other bridge was also renovated, connecting the island of Trogir to the neighbouring island of Čiovo. It was known as *Ponte Bue* (Čiovo Bridge), and could be raised to allow ships to pass under it (Benyovsky, 2002). This marked the beginning of a period of intense settlement on the island of Čiovo, which had been previously forbidden (the Statute of Trogir defined Čiovo as a contemplative oasis for religious hermits). Nonetheless, due to increasingly frequent Ottoman incursions into Venetian possessions on the north-eastern Adriatic coast, the Venetian authorities decided to allow refugees from the hinterland to colonise Čiovo in 1451. This act symbolised the beginning of Trogir's expansion onto the neighbouring island of Čiovo, a trend which continued through history, especially after the Ottoman occupation of Klis (1537) which resulted in more intense colonisation of the entire island (Andreis, 1977). After the Second World War, new bridges were built to accommodate modern road traffic: *Mali most (Little Bridge)* connects Trogir to the mainland, while *Čiovski most (Čiovo Bridge)* connects Trogir to the island of Čiovo (Babić, 2006).

Large pseudo-islands

A particular group of Croatian pseudo-islands consists of larger bridged islands. Besides Čiovo, which be-

7 After the fall of neighbouring Salona, Trogir became one of the most important Byzantine strongholds on the eastern Adriatic coast; it flourished as a municipal and episcopal centre that dominated the area of present-day Trogir Zagora, the islands of Čiovo, Drvenik and Ploča (Drvenik Mali), a large part of the south-eastern hinterland of Split and the western Split hinterland. As Trogir experienced characteristic urban and geographical development between the mainland and the island of Čiovo creating a rich cultural and historical heritage, it is only natural that the historic centre of Trogir has been included in the UNESCO World Heritage List.

Figure 12 Trogir: a) depiction of the city on Coronelli's map, 1688 (SAZ, Call number 784/II.E.12.); b) the layout of the historic centre today (Google Earth 2012)

longs to the Central Dalmatian islands and is connected to the mainland indirectly, via Trogir, this group of large pseudo-islands also includes (from NW to SE) Krk in the Kvarner group (bridged in 1980), Pag (bridged in 1968), Vir (in 1976) and Murter (in 1832) in the North Dalmatian group of islands. Considering their size, indentedness and the distance of their settlements from the mainland, it is obvious that these islands, unlike the smaller ones, have not yet been entirely incorporated into the mainland. Their connections are actually only partial and apply only to some aspects of integration with the mainland (primarily transport and direct communications). However, Tisno has become completely integrated into the mainland since it has a direct road link. Tisno used to be an exclusively insular settlement situated on the island of Murter, which spread to the mainland in the 19th century and has functioned as a dual insular-mainland settlement since the mid-20th century. As a municipal centre, Tisno covers only a small part of the island of Murter and a significantly larger mainland area.

The island of Čiovo shares a similar situation, but is administratively more complex. That is to say, part of the town of Trogir is situated on this island. The settlements of Mastrinka, Arbanija and Žedno, which are located on the island of Čiovo, belong administratively to Trogir. As far as the other settlements on Čiovo are concerned, it is difficult to determine their level of connection with the mainland, since they belong to other administrative units – Okrug Gornji and Okrug Donji belong to the Municipality of Okrug, whilst Slatina belongs to the City of Split. This type of administrative and territorial division makes it rather difficult for the island to develop fully in socioeconomic terms, since the synergy required is thwarted by particular municipal interests. Consequently, the island of Čiovo is not fully linked functionally to the closest mainland and indeed, part of it is largely orientated toward Split rather than Trogir. The administrative and territorial divisions of Krk, Pag and Vir have no connection with the mainland, so their island-mainland integration is much less than parts of Murter and Čiovo. Apart from this, only two years have passed since Vir was connected to the Zadar water supply, despite its closeness to the mainland (the sewage system and water supply are not yet complete). In comparison, settlements close by on the mainland have been connected up for decades (Nin in 1969 and Privlaka in 1971).

Despite the fact that the integration of bridged islands with the mainland is only partial, it has had a positive influence on demographic indicators (Tables 1, 2, 3). Accordingly, there is the potential for these pseudo-islands to become largely integrated into coastal socioeconomic systems on the mainland. This developmental trend (Krk, Pag, Vir, Murter and Čiovo) could be referred to as *functional deinsularisation*.

Bridging increases population mobility which is best seen in the large number of people who commute on a daily basis and the reduction in the number of people who commute weekly. Daily commuting is particularly prominent on the islands of Krk and Čiovo, which is understandable, due to the vicinity and influence of Rijeka and Split. On the other hand, the larger pseudo-island of Pag is farthest from its regional centre, Zadar, and this reduces the need for daily communication with the mainland in comparison to other, similar islands. However, weekly commuting is above the average level for the group of North Dalmatian Islands to which this island belongs (Table 2).

Demographic growth influences demographic structures, particularly age and economic structures. This is in sharp contrast to other Croatian islands that are mostly characterised by extreme depopulation and the resulting unfavourable demographic structures (the prevalence of elderly and economically inactive inhabitants). For instance, there are more economically active and young people living on the islands of Pag, Vir and Murter compared to the average for the North Dalmatian regional group of islands to which they belong (Table 3).

Table 1 Number of residents on Croatian larger bridged islands from 1948 to 2001 (after-bridging data are in bold)

Islands	1948	1953	1961	1971	1981	1991	2001	2011	Change index	
									2001/1948 1948=100	2001/1981 1981=100
Krk (SA = 405.21 km²)	17,689	16,820	14,548	13,110	**13,334**	**16,402**	**17,860**	**19,383**	109,6	145,4
Pag (SA = 284.18 km²)	9,188	9,160	8,568	**7,896**	**7,504**	**7,969**	**8,398**	**9,059**	98,6	120,7
Vir (SA = 22.07 km²)	1,072	1,120	1,069	959	**866**	**860**	**1,608**	**3,000**	279,9	346,4
Murter (SA = 17.58 km²)	**6,026**	**5,989**	**5,444**	**5,588**	**4,618**	**5,092**	**5,060**	**4,895**	81,2	106,0
Čiovo* (SA = 28.13 km²)	**2,281**	**2,409**	**2,532**	**2,196**	**2,223**	**3,142**	**5,387**	**5,908**	259,0	265,8
In comparison with										
Kvarner Islands	39,841	37,085	34,351	31,140	32,191	37,403	38,687	39,706	99,7	123,3
North Dalmatian Islands	48,421	47,560	43,321	39,872	29,611	31,976	28,865	30,678	63,4	103,6
Central Dalmatian Islands	41,290	41,921	39,647	34,284	32,096	34,428	34,927	36,338	880,1	113,2
South Dalmatian Islands	23,285	24,463	22,866	22,497	19,575	20,499	19,007	18,233	78,3	93,1
CROATIAN ISLANDS	152,837	151,029	140,185	127,793	113,473	124,306	121,486	124,955	81,8	110,1

* without Čiovo district, part of the settlement of Trogir, which was not possible to single out statistically
SA – surface area
Source: CBS, *Settlements and Population of the Republic of Croatia – Retrospect 1987-2001,* Zagreb, 2005; CBS, *Census of Population, Households and Dwellings 2011,* Zagreb, 2012.

In accordance with the littoralisation process, bridged islands have relatively strong economic vitality, which is best represented by the development of tourism, maritime affairs, industry and intense residential construction. For instance, there is a large oil terminal in Omišalj on Krk, a large shipyard on Čiovo, and a small one on Murter, while all the bridged islands have plenty of tourist facilities. There is also the international Rijeka Airport on Krk near Omišalj, a unique example in Croatia of an international airport being located on an island.

However, increasing accessibility has led to uncoordinated, spontaneous development, which has had a negative effect on the pseudo-islands. The island of Vir has been affected by the excessive construction of second homes, and its shoreline is extremely built up, especially in comparison to the relative proportion of the

Table 2 Daily and weekly commuters on Croatian larger bridged islands in 2001

Islands	Daily commuters		Weekly commuters	
	Number	Total proportion (%)	Number	Total proportion (%)
Krk	3,864	21.63	430	2.41
Pag	700	8.34	196	2.33
Vir	171	10.63	14	0.87
Murter	569	11.25	52	1.03
Čiovo*	1,419	26.34	84	1.56
In comparison with				
Kvarner islands	6,566	16.97	737	1.91
North Dalmatian islands	3,071	10.64	552	1.91
Central Dalmatian islands	4,048	11.59	1,048	3.00
South Dalmatian islands	1,830	9.63	305	1.60
Croatian Islands	15,515	12.77	2,660	2.19

* without Čiovo district, part of Trogir, which was statistically not possible to single out
Source: CBS, *Census of Population, Households and Dwellings 2001,* Daily and weekly commuters, Zagreb, 2005.

Table 3 Age and economic structures of populations on bridged islands according to the 2001 population census (in %)

Islands	Age structure (by age groups)			Economic structure	
	0-19	20-59	60 and over	Active	Inactive
Krk	22.82	45.19	38.46	42.59	57.41
Pag	22.20	50.18	27.44	41.33	58.67
Vir	21.21	54.98	23.01	39.12	60.88
Murter	21.86	48.36	29.29	39.07	60.93
Čiovo*	24.06	53.70	21.50	38.70	61.30
Kvarner islands	22.71	53.83	22.81	43.96	56.04
North Dalmatian islands	19.70	47.90	32.40	35.50	64.50
Central Dalmatian islands	22.30	51.30	26.40	42.46	57.54
South Dalmatian islands	22.91	50.81	26.01	41.70	58.30
Croatian islands; Total	21.92	50.94	26.63	40.86	59.14

* omitting part of Trogir situated on Čiovo, which was statistically not possible to single out
Source: CBS, *Census of Population, Households and Dwellings 2001*, Population according to Age and Sex, Zagreb, 2005; CBS, *Census of Population, Households and Dwellings 2001*, Population according to Activity, Zagreb, 2005.

total number of housing units. Even though the intensive construction of second homes has been happening along the entire Adriatic coast since the 1970s, Vir has become a prime example of a mistake that should never be repeated. It is true that the current situation is a direct result of the 1970s Yugoslav government policy which, at one point, considered building a nuclear power plant on the Island of Vir. This resulted in low real-estate prices; however the nuclear plant was never built and consequently the result was excessive building of second homes. According to the 1971 Population Census, Vir had only 253 housing units, and 3.6% of them were second homes. The result of excessive and spontaneous construction was that by 2001, Vir had 6,573 housing units, 90.1% of which were second homes (Table 4). Finally, the total number of housing units increased 25 times between 1971 and 2001 while the number of second homes increased 661 times; at the same time, the number of permanent residents increased only by 67.7%! Second homes on the island of Vir account for up to 30% of all second homes on the North Dalmatian islands. Despite bans and warnings that illegal buildings would be demolished, construction continued on the island of Vir, and according to the first, incomplete data of the 2011 Census of Population, Households and Dwellings, there were 12,750 dwellings on the island. However, only 1,297 of them were permanently inhabited, which means that approximately 11,000 of them were used as second homes (the number of dwellings used for other purposes was unknown). If we multiply the number of housing units by 4, which is the average number of tenants/tourists that reside in them during the tourist season, we arrive at the figure of 44,000 tourists and only 3,000 local residents (14.7:1)!

Bridging Vir to the mainland has affected the increase in the number of residents as well as tourist development on the island. However, the excessive building of second homes was neither well planned nor coordinated. It was not supported by an adequate municipal infrastructure (sewage and water supply, roads etc.), and

Table 4 Comparison of total number of housing units and second homes on North Dalmatian islands in 1971 and 2001

Settlement	1971						2001					
	Total number of housing units		Second homes				Total number of housing units		Second homes			
	Number	SA (m^2)	Number	Total proportion (%)	SA (m^2)	Total proportion (%)	Number	SA (m^2)	Number	Total proportion (%)	SA (m^2)	Total proportion (%)
Pag	2,096	150,092	325	15.5	19,153	12.8	12,065	828,355	5,572	46.2	364,313	44.0
Vir	253	13,997	9	3.6	385	2.8	6,573	566,036	5,960	90.7	503,594	89.0
Murter	1,701	133,162	630	37.0	37,710	28.3	4,688	349,627	2,042	43.6	147,559	42.2
Total	11,291	785,656	2,008	17.8	118,872	15.1	37,095	2,766,918	19,762	53.3	1,438,337	52.0

Sources: FIS, *Population and Housing Census 1971*, Dwellings – Size, ownership, households and persons, Bk. II, Belgrade, 1972; FIS, *Population and housing census 1971*, Vacation and Recreation Dwellings, Bk. VI, Federal Institute for Statistics, Belgrade, 1973; CBS, *Population, Housing and Dwelling Census 2001*, Dwellings by Occupancy, Zagreb, 2002.

the aesthetics of the old island settlements were spoiled. Valuable parts of the coastline that attracted investors became overcrowded, as the many buildings erected along the coastline actually exhausted coastal resources. To a certain extent, a similar thing has happened on parts of Krk, Pag, Murter and Čiovo.

CONCLUSION

Bridged islands, i.e. islands linked to the mainland by means of a dike or bridge, form a particular group of islands. Artificial peninsulas are created in cases of insular connection to the mainland by means of a dike (Uljanik, Nin, Primošten, Rogoznica, Vranjic etc.) whereas pseudo-islands are the result of insular connection to the mainland by means of a bridge. They have lost some of their insular characteristics, especially in terms of transport connections to the mainland, and this contributes to multiple functional ties. Due to the diversity of their historical and geographical bridging, two categories of islands can be determined.

The first category of pseudo-islands includes generally smaller islands which have both physically as well as functionally fused with the neighbouring mainland (Tribunj and Trogir).

The other category, from the Croatian point of view, comprises larger islands functionally marked by partial *deinsularisation* (Pag, Krk, Vir, Murter and Čiovo). This typological classification is based on an analysis of demographic and economic data and on the results of field research.

The research results show that pseudo-islands tend to have more favourable demographic trends and structures, and the mobility of their population is stronger than on non-bridged islands. In fact, pseudo-islands are more actively involved in the processes of littoralisation, characterised by the intense concentration of social and economic activities along the narrow coastline, while the hinterland and small and distant islands in particular are characterised by depopulation processes and economic depression. Of course, littoralisation, as a comprehensive process in coastal regions, also affects many other Croatian islands, particularly the larger ones located close to the mainland. On these islands, unlike artificial peninsulas and pseudo-islands, the process has been mostly local in character (social and economic activities are concentrated in the narrow coastal strip, while the interior of the islands has become depopulated and marked by economic stagnation or regression).

HRVATSKI UMJETNI POLUOTOCI I PSEUDO-OTOCI

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SAŽETAK

U radu se razmatraju hrvatski umjetni poluotoci i pseudo-otoci. Radi se o otocima koji su tehničkim zahvatima premošteni, tj. spojeni sa susjednim kopnom ili susjednim većim otokom putem nasipa, putem mosta te putem nasipa i mosta. U slučaju spajanja otoka s kopnom putem nasipa oblikuju se umjetni poluotoci (Uljanik, Nin, Primošten, Rogoznica, Vranjic i dr.), a u slučaju spajanja s kopnom putem mosta stvaraju se pseudo-otoci. Takvi otoci izgubili su dio svojih inzularnih obilježja osobito u pogledu prometnog povezivanja s kopnom što pridonosi višestrukim funkcionalnim vezama. Zbog njihova različitog povijesno-geografskog okvira premoštavanja, osobito onih otoka povezanih putem mosta s kopnom, moguće je razlikovati dvije kategorije takvih otoka. Prvu kategoriju pseudo-otoka čine uglavnom manji otoci, koji su u potpunosti fizionomski i funkcionalno srasli sa susjednim kopnom (Tribunj i Trogir). Druga kategorija su, u hrvatskim razmjerima, veći otoci koji u funkcionalnom smislu obilježava parcijalna deinzularizacija (Pag, Krk, Vir, Murter i Čiovo).

Hrvatski umjetni poluotoci i pseudo-otoci tijekom prošlosti imali su veliko značenje jer su u vrijeme ratnih sukoba na susjednom kopnu često imali ulogu utočišta ili mjesta trajnijeg nastanjivanja. U suvremeno doba ti otoci se fizionomski i funkcionalno znatno preobražavaju, uglavnom poradi činjenice da su prometno integrirani sa susjednim kopnom te, sukladno tome, intenzivno uključeni u turističko vrjednovanje prirodne i kulturne baštine. To je s jedne strane pridonijelo ublažavanju procesa depopulacije, temeljnoga društvenog obilježja većine hrvatskih otoka, a s druge strane spontanoj i nekoordinarnoj prekomjernoj izgradnji stanova za odmor te drugih graditeljskih zahvata koji svojim dimenzijama i oblikom narušavaju izvorni otočni kulturni ambijent.

Istraživanjem je utvrđeno da pseudo-otoci imaju povoljnije demografske trendove i odgovarajuće demografske strukture te da je veća mobilnost na relaciji otok – kopno u odnosu na otoke koji nisu premošteni. Zapravo, pseudo-otoci su u većoj mjeri uključeni u litoralizacijske procese koje u hrvatskim prilikama obilježava intenzivno okupljanje društvenih i gospodarskih aktivnosti uz uski obalni pojas dok zaobalni prostor te najveći dio otočnog prostora (posebno mali i od kopna udaljeni otoci) obilježava depopulacija i gospodarska depresija. Naravno, litoralizacija je kao sveobuhvatan proces u obalnim regijama zahvatila i brojne druge hrvatske otoke, osobito veće i bliže kopnu, s time da je, za razliku od umjetnih poluotoka i pseudo-otoka, na tim otocima taj proces uglavnom lokalnih razmjera (društvene i gospodarske aktivnosti okupljaju se uz uski obalni rub otoka, dok je unutrašnjost otoka depopulirala i gospodarski stagnirala ili nazadovala).

Ključne riječi: otoci, umjetni poluotoci, pseudo otoci, hrvatski otoci, Hrvatska, Jadran

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