11. Köycegiz-Dalyan Specially Protected Area (Turkey)

Section 1. Basic features of Köycegiz-Dalyan Specially Protected Area

Köycegiz-Dalyan SPA is located in the Province of Mugla and at the southern Aegean coast of Turkey (Figure 1). It is one of the first three SPAs declared in July 1988, as a consequence of the Genoa Declaration (1985) of the Mediterranean Action Plan.

Figure 1: Location of Köycegiz – Dalyan Specially Protected Area

Köycegiz – Dalyan SPA is one of the relatively smaller SPAs of Turkey with a surface area 461.5 km2 and containing very important natural features including a fresh water lake (Köycegiz Lake), rivers (Dalyan Channel and several creeks), a gorgeous delta with lagoons and wetlands, sandy beaches (Dalyanagzi-Iztuzu Beach and Ekincik Beach), sloping hills covered with basically pine forest (Figure 2). The coordinates of the SPA territory are given in Table 2. Although four towns (Köycegiz, Toparlar, Dalyan and Beyobası) and several villages are housed within the SPA, a majority of the area is still highly valuable pristine sites. The main part of the SPA is land-based, including a small marine part with a coastline of about 12 kilometers. However, the fresh and brackish water bodies including the Köycegiz Lake, Dalyan Channel and the delta comprise very important features of the SPA. Köyceğiz-Dalyan SPA is more or less surrounded by a mountainous terrain with elevations varying from 50 m to more than 1,450 m.

One can identify rich ecotones of different ecosystems all over the SPA's dry and wet areas. The sand spit that serves as the divider between the sea and the system of estuary, lagoons and wetlands one of the top nesting beaches of the loggerhead turtle

(caretta caretta) in the whole Mediterranean. Protection of this flagship marine species is of international concern and has been a major activity under the Mediterranean Action Plan since the early 1980s.

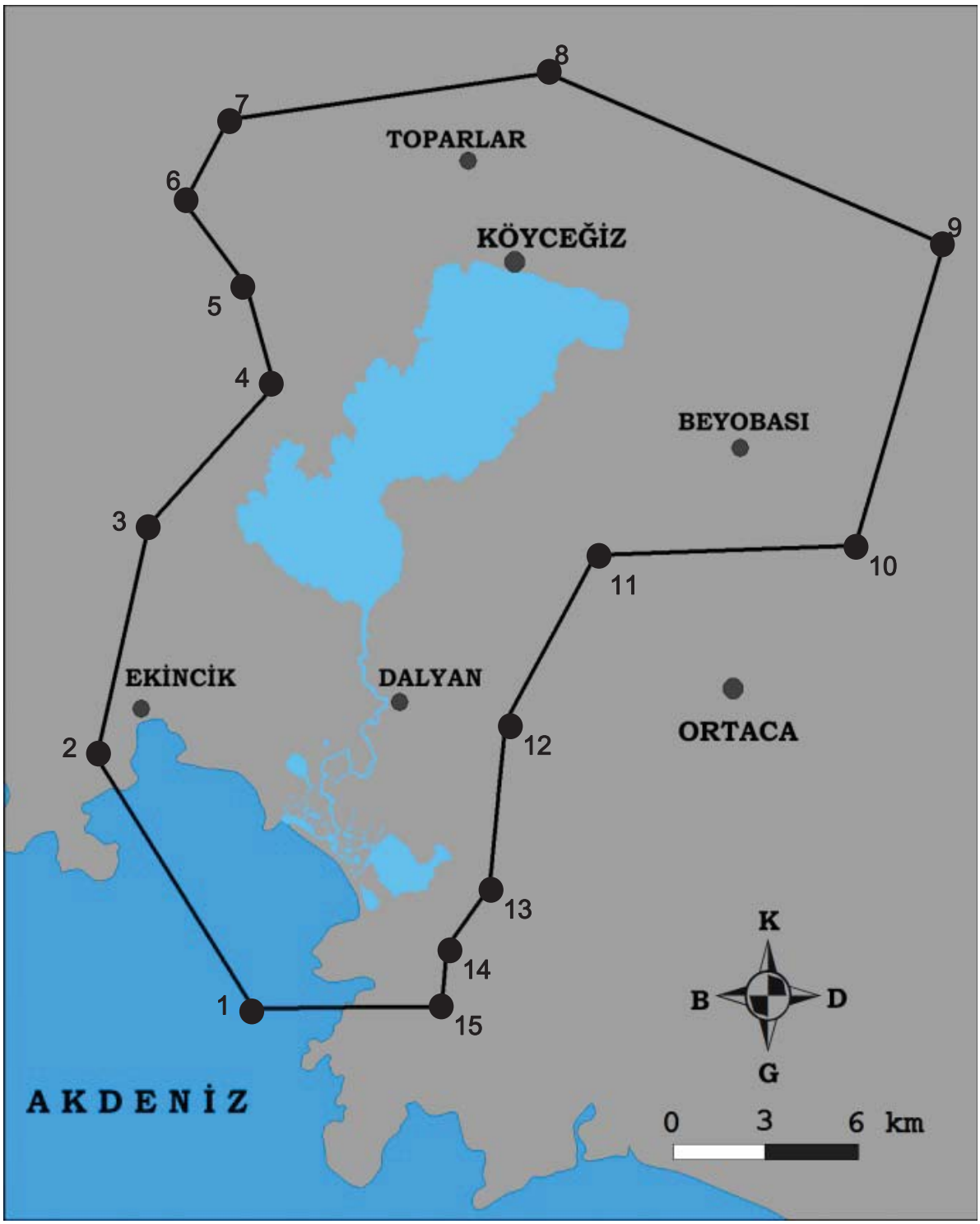

Figure 2: Main features and borders of Köycegiz-Dalyan Specially Protected Area

Table 1. Coordinates of the Köycegiz-Dalyan SPA boundaries.

Point No:	Longitude	Latitude	Point No:	Longitude	Latitude
1	28° 35' 28"	36° 45' 07"	9	28° 50' 50"	36° 57' 44"
2	28° 32' 05"	36° 49' 20"	10	28° 48' 49"	36° 52' 40"
3	28° 33' 21"	36° 53' 16"	11	28° 43' 08"	36° 52' 36"
4	28° 36' 08"	36° 55' 32"	12	28° 41' 04"	36° 49' 49"
5	28° 35' 33"	36° 57' 13"	13	28° 40' 39"	36° 46' 59"
6	28° 34' 11"	36° 58' 39"	14	28° 39' 45"	36° 46' 04"
7	28° 35' 10"	37° 00' 03"	15	28° 39' 34"	36° 45' 03"
8	28° 42' 16"	37° 00' 46"			

In fact, the nesting of the loggerhead turtle was the main the reason for the start of the process that lead to deceleration of the site as one of the first three Specially Protected Areas (SPAs) of Turkey in July 1988 in accordance with the Genoa Declaration (1985) of the Mediterranean Action Plan. One end of the beach where the Iztuzu Lake is located had been leased to an international consortium for and extensive tourism development project. The opposition to this project that continued for over a year (from April 1987 to July 1988) and led to cancellation of the development project is recognized as a milestone for coastal management concerns and the growth of environmentalism in Turkey (Özhan, 1990).

A special public agency (Agency for Specially Protected Areas) was created in 1989 for management of SPAs as a central organisation located in the Capital City of Ankara. Some years later, as the number of SPAs increased, a few field offices, one being in Köycegiz, were opened. However, since there were four municipalities and several villages within the SPA, a hybrid type of management system had to be adopted.

Section 2. Coastal Issues

2.1 The main coastal issues considered

Water quality management: Köycegiz Lake and Dalyan Lagoon are highly enclosed water systems receiving significant amounts of nutrients from natural and

anthropogenic sources. The system is close to being eutrophic.

Climate change impacts: The delta and the land areas surrounding the river and the lake are all low-laying areas. A significant part of the area covered by the Case and the rich ecosystem will be seriously affected by the climate change.

Management of recreational activities and boat traffic in the Delta: The area attracts large number of daily visitors from the nearby tourism centres (like Marmaris) in summer months. Many tourist boats carry the visitors daily from the Town of Dalyan to the turtle beach through the river and the delta. This creates a significant pressure on the ecosystem (juvenile fish) and the surrounding lands (bank erosion).

Nature conservation: The area that is still largely pristine presents a congregation of several ecosystems (marine, estuarine, freshwater lake, forested hills, agricultural land). The attractive land and seascapes and rich ecosystems call for high degrees of nature and landscape conservation.

Management of habitats of endangered species (marine turtles): The five kilometres long sand spit between the delta and the sea is one of the most important breeding grounds of loggerhead (caretta caretta) marine turtles in the Mediterranean. Turtle nesting along the spit has been regularly monitored (since 1986) and managed collaboratively by experts and the Dalyan Municipality. The only marine turtle rescue centre in Turkey is located at one end of the beach.

Fisheries: The system of lake, river and lagoons supports the most productive fishery along the Aegean coast of Turkey. The annual catch is about 300 tons. The fishery is managed by a cooperative formed by the residents of Dalyan and Köycegiz towns. Better fisheries management will contribute to nature conservation on one hand and will produce greater incomes to the locals on the other.

Urban sprawl: Residential development at non-urban areas poses serious threats to nature conservation and agricultural lands.

2.2 The social, political, environmental and economical relevance of the identified coastal issues

Köycegiz-Dalyan SPA is a unique coastal system having different sub-units such as the sea; freshwater lake; estuary, lagoons and wetlands; sand spit; agricultural land, hills and forest. One can identify rich ecotones of different ecosystems all over the

SPA's dry and wet areas. The sand spit that serves as the divider between the sea and the estuary, lagoon and wetland system is one of the top nesting beaches of the loggerhead turtle (caretta caretta) in the whole Mediterranean. Protection of this flagship marine species is of international concern and has been a major activity under the Mediterranean Action Plan since the early 1980s. Therefore, it is not only and ecological issue, a political one as well.

Tourism, fisheries and agriculture are the major economic activities in the SPA. All of the identified issues are significant for productivity and sustainability of these sectors.

Section 3. Relations between coastal issues and ICZM Protocol and principles

3.1 How do the selected coastal issues relate to the ICZM principles and protocol?

When possible and appropriate, refer to the relevant Articles of the Protocol.

The following GENERAL PRINCIPLES OF INTEGRATED COASTAL ZONE MANAGEMENT (listed in *Article 6* of the Protocol) are relevant for the work carried out in our CASE.

(b) All elements relating to hydrological, geomorphological, climatic, ecological, socio-economic and cultural systems shall be taken into account in an integrated manner, so as not to exceed the carrying capacity of the coastal zone and to prevent the negative effects of natural disasters and of development.
(d) Appropriate governance allowing adequate and timely participation in a transparent decision-making process by local populations and stakeholders in civil society concerned with coastal zones shall be ensured.
(h) The allocation of uses throughout the entire coastal zone should be balanced and unnecessary concentration and urban sprawl should be avoided.
(j) Damage to the coastal environment shall be prevented and, where it occurs, appropriate restoration shall be effected.

Also, the following articles of the Protocol are related to the coastal issues and the project work carried out in our CASE:

Article 9 : Economic activities

Article 10 : Special coastal ecosystems

Article 14 : Participation

Article 15 : Awareness raising,

Article 22 : Natural Hazards

Section 4. Policy issues and ICZM principles and approaches

4.1 So far, how have been the coastal issues addressed by the local/regional/national government?

There exists detailed national legislation for addressing water pollution. The Agency for Special Protection Areas (now the General Directorate for Protection of Natural Assets), Min. of Environment and Urbanism have been conducting systematic water quality monitoring at number of stations over the water system (Köycegiz Lake, Dalyan Canal, lagoons, recreational waters in front of beaches). Köycegiz and Dalyan Municipalities are the enforcing authorities for the related legislation.

A specific set of regulations like the type and size of boats, maximum speed etc. exists for boat traffic in water areas from Köycegiz Lake to the Aegean Sea. This legislation was enacted by the regional (provincial) administration in the 1990s. The enforcement of this legislation is also with the municipal authorities and this has not been much effective. The number of commercially operating tourist boats has increased considerably over the last 20 years. The number of boats licensed by Köycegiz and Dalyan Municipalities in 2013 is nearly five hundred. Enforcement of this type of protective legislation is not effectively practiced in Turkey.

The 5 km long Dalyan spit, being an important nesting beach for loggerhead marine turtles at the Mediterranean scale, has been monitored and managed since late 1980s. Due to geographical setting, the level of management at the Dalyan spit, which is also used as a recreational beach, has been rather high and effective. Monitoring of the nests and hatchlings has been sponsored by the Ministry of Environment and Urbanism on yearly project basis since 1988 and the monitoring is carried out by teams belonging to Universities or specialized companies. Management of the recreational use of the beach has been carried out by Dalyan Municipality through a special period leasing from the Ministry.

Fisheries at Dalyan canals and lagoons have been managed by a public cooperative since 1970s. Most of the natives of Dalyan Town and some of those from the Köycegiz Town are share holders of the Fisheries Cooperative called DALKO and

they receive a share from then annual income. Protection of the water areas from poaching has been effectively carried out by the cooperative patrols. However, industrial utilization of the fish caught and marketing are the areas where significant progress can be made for increasing the yearly profit. The annual fish catch has been rather stable until 2009. In this year, the annual catch almost tripled. The cooperative has to follow the national fisheries legislation.

Nature conservation is a management issue that needs significant improvement. Although a nature management plan for the SPA was prepared after a comprehensive study and published at the end of 2007 (Cinar Muhendislik, 2007), the plan is not enforced due to several reasons. Consequently, there are not special enforcement efforts other than those that come from national legislation. There is not a specialized authority for nature conservation to look after enforcement of rules and regulations. In the summer of 2012, the Agency for Specially Protected Areas, which was an independent institution under the Ministry of Environment, was dissolved and the unit was placed within the General Directorate for Protection of Natural Wealth. This was a serious blow to the management efforts that existed for the specially protected areas.

Urban sprawl is a critical issue due to two reasons. One of these is the large residential populations and therefore extensive land areas being taken by the town development plans. In mid 1980s, the number of Dalyan residents was just over 2 000 people. The town development plan that was prepared in 1986 envisaged a residential population of 19 600 people. After 26 years, the population grew to less than 5 000 people. The Town of Dalyan has been developing at dispersed manner due to the size of the town development plan of 1986. Another problem is construction of houses over agricultural land, which is much cheaper to buy compared to the residential plots within the town plans. According to a law that **aims to protect** agricultural land, one cannot occupy more than 5 per cent (this is further decreased by a recent law) of the agricultural land by buildings, assuming that 95 per cent will continue to be used for agricultural practices. However, what actually occurs is that 5 per cent is used for building a villa and the rest of the land is for a lawn, for growing exotic trees, for a swimming pool and for play grounds.

4.2. At which spatial scale?

Regional or local legislation is very scarce in Turkey. All basic legislation is at national scale. However, the practice of management, as it was described in earlier paragraphs, is usually at local level with inputs from the regional and national levels.

4.3. On the basis of the ICZM principles (as they are expressed by the Protocol), do you think that the coastal issues were addressed with an integrated approach (in terms of organization, politics, sectors/thematic, tools, etc)?

No. There exist good national legislation addressing coastal sectors but their interactive functioning is not usually the practice. At the concluding chapter of a comprehensive report devoted to coastal area management in Turkey (Özhan, E., 2005), Coastal Area Management in Turkey, A report published by UNEP MAP, PAP RAC, 2005, Split, Croatia, 69 pages), the following findings and opinions are presented:

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"The review of coastal management in Turkey presented in the earlier parts of this report reveals the accruement of a significant level of experience in coastal management in Turkey, particularly over the last 20 years. Several tools and instruments that are generally utilised in the process of coastal management have been in use for a significant period of time. The following findings present the important features of the prevailing situation:

a. A comprehensive legal framework has been in force since the 1980s to address important coastal issues. This legal system however is sectorially structured. Although interaction between ministries with different (sometimes conflicting) interests in the development of the coastal areas is required in some of the laws, this is usually through a weak mechanism such as asking for an "opinion" or the "consent" of the relevant institutions (ministries). The present mechanism has not achieved sufficient levels of discussion and negotiation in the past among the parties involved, levels which are essential to integrated management.

b. Although numerous public institutions are involved in the management of coastal areas from their own perspective, institutionalised coordination mechanisms for the integration of management efforts by different organisations do not exist.
c. Following the traditional administrative structure of Turkey, the management system for coastal areas has been highly centralised. The existing system does not provide many opportunities for local management (e.g. management by local authorities) and for public participation.
d. The development of a single sector (i.e. tourism) has overshadowed that of the others in the coastal areas of the Aegean and the western Mediterranean since the mid-1980s. Although this trend has lost its momentum to some extent in recent

years, the extremely favourable environment provided by the Tourism Incentives Law has triggered the rapid development of tourism sectors in extensive coastal areas that were designated as “tourism areas” or “tourism centres”. This process has curbed and slowed down the development of the integrated management concept. In several cases, the rapid development of coastal tourism has been accompanied by the insufficient care and protection of natural and cultural wealth in these areas, and has thus caused significant damage to natural and cultural resources.

e. Several important tools and instruments such as land use planning, sectoral development planning, environmental impact assessment, specially protected areas, The Shore Law, and restrictions and penalties brought by other sectoral legislation have been utilised in Turkey in tandem with coastal management for a considerable period. However, the effectiveness in applying these instruments in practice needs to be improved in order to reap expected results and benefits.
f. The concept and use of “management plans” for guiding coastal management in Turkey is relatively new. This very important instrument does not yet have widespread and efficient application.
g. The available data and information about physical and ecological coastal processes, and the natural and cultural resources present in coastal areas is not sufficient to support rational managerial decisions. Research programmes on coastal issues and the monitoring of the impacts of anthropogenic activities on the coastal environment and resources are not yet given sufficient importance and priority.”

4.4. Is there an on-going National ICZM Strategy in your country?

No. A call for tenders was issued and proposals were collected for preparation of National Strategy and Action Plan for ICZM in line with the ICZM Protocol for the Mediterranean first in early 2011. At the end of the tender evaluation process however, it was decided to postpone the project to the following year. However, there was a significant reorganisation of the ministries in late 2011 following the national parliamentary elections. The new call for tenders could be issued in May 2012 and this second effort was also not successful. The duration of the project was set as 140 days net. Looking at the project documents, it looks that the vision of the project highlights “integrated planning” rather than “integrated management”.

Section 5. PEGASO in relation to ICZM processes & initiatives

5.1 Do you think your work is relevant for the ICZM process of your country? Why and how?

There have been several ICZM projects carried out by different teams for various segments of the Turkish coast. One of these is the Gökova ICZM Project (2006-08) financially supported by the SMAP scheme (3rd cycle) of the European Union. This was an ICZM implementation project at a pilot site and the goal was to arrive at recommendations for governance at national level. Since mid 2000s, integrated coastal area planning and management projects for important coastal segments have been prepared by planning companies that won them through bidding process called by the relevant ministry (currently the Ministry of Environment and Urbanism). These projects are still ongoing. Finally, bidding for a project entitled "Integrated Coastal Area Management Strategy and Action Plan" has been opened twice by the Ministry of Environment and Urbanism. This project, which has not yet started, was initiated to comply with the ICZM Protocol for the Mediterranean.

As it is clear from the above paragraph, there has been significant interest in Turkey over the last years in integrated coastal management. However, the real process for setting up the governance system that will ensure "integration" of coastal management is yet to be seen. In this climate, the PEGASO work in Köycegiz-Dalyan CASE will contribute to progress of the ICZM in two ways:

a. by illustrating the approaches to cope with important coastal issues that are dealt in our case;
b. by illustrating two important tools for ICM, e.g. public participation and the use of indicators for monitoring the state of coastal environment and resources on one hand, and the process of coastal management on the other.

Section 6. Stakeholders involvement

Several individual acquaintance meetings with the key stakeholders have been organized. The purpose and the scope of PEGASO Project and the related case study in Köycegiz-Dalyan region have been introduced in detail. After all individual acquaintance meetings with the stakeholders, the first general stakeholders meeting for Köycegiz-Dalyan CASE took place on 19 January 2012, the second general stakeholder meeting was organised on 20 February 2013, and the last stakeholders meeting was organised on 6 November 2013. The list of key stakeholders for the CASE and the representative participants to the meetings are presented in the following tables (Table 2, Table 3 and Table 4). From these tables, it is readily observed that the governmental representatives showed limited interest to the meetings, where the participation of NGOs were satisfactory. Although fisheries and boat transport

cooperatives are in direct economical and ecological interaction with the region, they did not participate at the meetings. Authority vs. Interest plot for this situation would reveal a typical pattern illustrating a problem commonly encountered in participatory methods for ICZM implementation, i.e. those having authority for making decision have very little or no interest in the process of participation, and vice versa. The recent outcomes of our CASE study, which will be presented through the following pages of this report, were shared during the second and the third (last) meeting and feedbacks were asked from the stakeholders.

Table 2. The key stakeholders in Köycegiz-Dalyan SPA and the representatives participated in the first stakeholder meeting on 19.01.2012.

	Institute / Organization	Participants
1	Governorate of Mugla Province	-
2	Sub governorate of Köycegiz	-
3	Sub governorate of Dalyan	-
4	Köycegiz Municipality	The mayor
5	Dalyan Municipality	The president and 2 members of the city council
6	Provincial Directorate of the Ministry Environment and Urbanism	Departmental chief of Köycegiz-Dalyan Specially Protected Area
7	Rectorate of Mugla University	Vice Rector
8	Mugla Sıtkı Koçman University, Faculty of Engineering	The head of department of Civil Engineering and 3 professors
9	Mugla Sıtkı Koçman University, Faculty of Fisheries	2 professors
10	Pamukkale University, Department of Biology	1 professor
11	Turkish Marine Environment Protection Association	Ortaca rep.
12	Sea Turtle Research, Rescue and Rehabilitation Centre	2 members
13	DALKO - Dalyan Fisheries Cooperative	-
14	Dalyan Motor Boat Transport Cooperative	-
15	Dalyan Association	The president and 1 member
16	Köycegiz Nature and Environment Conservation Association	2 members
17	Köycegiz Culture Solidarity Association	1 member
18	Nature and Animal Protection Association	3 members
19	Köycegiz Amateur Angling Association	1 member
20	Özalp Junior Hotel	The manager
21	Mandalinn Hotel	The manager

Table 3. The key stakeholders in Köycegiz-Dalyan SPA and the representatives participated in the second stakeholder meeting on 20.02.2013.

	Institute / Organization	Participants
1	Governorate of Mugla Province	-
2	Sub governorate of Köycegiz	-
3	Sub governorate of Dalyan	-
4	Köycegiz Municipality	-
5	Dalyan Municipality	The mayor and 3 members of the city council
6	General Directorate of Nature Conservation	Project coordinator and project field expert
7	Rectorate of Mugla University	-
8	Mugla Sıtkı Koçman University, Faculty of Engineering	1 professor
9	Mugla Sıtkı Koçman University, Faculty of Fisheries	Head of the department of fisheries engineering
10	Mugla Sıtkı Koçman University, Ortaca Vocational School	Director
11	Pamukkale University, Department of Biology	-
12	Turkish Marine Environment Protection Association	-
13	Sea Turtle Research, Rescue and Rehabilitation Centre	3 members
14	DALKO - Dalyan Fisheries Cooperative	-
15	Dalyan Motor Boat Transport Cooperative	-
16	Dalyan Association	1 member
17	Köycegiz Dalyan Environmental Protection Association	2 members
18	Köycegiz Nature and Environment Conservation Association	-
19	Köycegiz Culture Solidarity Association	-
20	Nature and Animal Protection Association	1 member
21	Köycegiz Amateur Angling Association	-
22	Özalp Junior Hotel	The manager
23	Keskin Hotel	The manager
24	Göcek Port Authority	Expert
25	Turkish Radio and Television Corporation	Reporter

Table 4. The key stakeholders in Köycegiz-Dalyan SPA and the representatives participated in the third stakeholder meeting on 06.11.2013.

	Institute / Organization	Participants
1	Governorate of Mugla Province	-
2	Sub governorate of Köycegiz	-
3	Sub governorate of Dalyan	-
4	Köycegiz Municipality	-
5	Dalyan Municipality	3 members of the city council, 1 environmental engineer, 1 officer
6	Provincial Directorate of the Ministry Environment and Urbanism	-
7	UNDP	-
8	Göcek Port Authority	-
9	Rectorate of Mugla University	-
10	Turkish Marine Environment Protection Association	Ortaca rep.
11	Sea Turtle Research, Rescue and Rehabilitation Centre	-
12	Kaptan June Sea Turtle Conversation Foundation	3 members
13	DALKO - Dalyan Fisheries Cooperative	-
14	Dalyan Motor Boat Transport Cooperative	-
15	Dalyan Association	The president and 2 member
16	Nature and Animal Protection Association	3 members
17	Mediterranean Development Association	The president
18	Dalaman Environment and Tourism Association	The president
19	Private sector	1 hotel owner, 3 hotel managers
20	Local Media	1 member
21	Local people	15 local people

Stake stakeholder meetings were covered satisfactorily by the local/provincial media. The reports (in Turkish) about the first meeting can be found at the following web sites:

http://www.sondakika.com/haber-koycegiz-dalyan-da-alan-calismasi-basliyor-3279801/
http://www.ege-haberleri.com/haber/sira-koycegiz-dalyan-da_34324399
http://www.haber3.com/koycegiz-dalyanda-alan-calismasi-basliyor-1155150h.htm
http://www.azhaberler.com/haber/koycegiz-dalyan-alan-calismasi_34329673
http://www.kayserihaberim.com/mugla/koycegiz-dalyan--da-alan-calismasi-basliyor--h18343.html

The reports (in Turkish) about the second meeting can be found at the following addresses:

http://dalamangazetesi.com/tr/akdeniz-kiyi-vakfindan-degerlendirme-toplantisi.html
http://www.gazete5.com/haber/dalyan-kanali-tekne-trafigi-izleniyor-294745.htm
http://www.mugladevrim.com.tr/index.php?option=com_content&view=article&id=14526:dalyan-kanal-tekne-trafii-izleniyor-&catid=1:son-haberler
http://dalamangazetesi.com/tr/dalyan-kanalinda-tekne-trafigi-cok-yuksek.html
http://www.gundemgazetesi.net/dalyan-kanali-tekne-trafigi-izleniyor-akdeniz-kiyi-vakfi-baskani-prof-dr-ozhan-t-11621h.htm
http://www.haberler.com/dalyan-kanali-tekne-trafigi-izleniyor-4356028-haberi/
http://www.marmarismanset.com/haber/marmaris_1/-dalyan-kanali-tekne-trafigi-izleniyor/17331.html
http://www.marmarismanset.com/haber/marmaris_1/-akdeniz-kiyi-vakfindan-degerlendirme-toplantisi-dalyanda/16682.html

The reports (in Turkish) about the third meeting can be found at the following addresses:

http://dalyanhaber.net/haber-1576-dalyan-ve-koycegiz-sular-altinda-kalabilir.html
http://www.guneyege.net/?Fid=3&Id=1487&gy=1&cat=1&subcat=4&Pagex=0
http://www.guneyege.net/bdf%5Cegazete%5Cguneyege-31.pdf
http://gundem.milliyet.com.tr/dalyan-kanali-tehlike-altinda/gundem/detay/1790053/default.htm
http://www.gazetesah.com/2013/12/20/dalyan-kanallarini-koruma-calismalari/
http://dalamangazetesi.com/tr/dalyan-kanallarini-koruma-calismalari.html
http://www.yeniasir.com.tr/Yasam/2013/12/18/dalyan-tehlike-altinda
http://www.sondakika.com/haber/haber-dalyan-kanali-tehlike-altinda-5442366/
http://www.haber365.com/Video/Dalyan_Kanali_Tehlike_Altinda/

Bayesian Belief Network (BBN) Exercise Meetings

In addition to the stakeholder meetings Bayesian Belief Network (BBN) for Koycegiz – Dalyan CASE with the theme of Preserving and Enhancing Natural Capital has been carried out in Dalyan. Three workshops were organized with the stakeholders for the BBN study. The first BBN meeting took place on 6 November 2013 in Dalyan and it was attended by 38 local stakeholders. The second meeting was organised on 17 December 2013 with 19 stakeholders and local media members and the last on 7 January 2014. The affiliations of the participants of the three BBN workshops are listed in the Table 5.

Table 5: Participants of BBN workshops

Institute / Organization	Participants (06.11.2013)	Participants (17.12.2013)	Participants (07.01.2014)
Governorate of Mugla Province	-	-	-
Sub governorate of Köycegiz	-	-	-
Sub governorate of Dalyan	-	-	-
Köycegiz Municipality	-	-	-
Dalyan Municipality	3 members of the city council, 1 environmental engineer, 1 officer	-	1 municipal security officer
Provincial Directorate of the Ministry Environment and Urbanism	-	-	-
UNDP	-	Field supervisor	-
Göcek Port Authority	-	1 officer	1 officer
Rectorate of Mugla University	-	-	-
Turkish Marine Environment Protection Association	Ortaca representative	-	-
Sea Turtle Research, Rescue and Rehabilitation Centre	-	-	-
Kaptan June Sea Turtle Conversation Foundation	3 members	The president and 3 member	1 member
DALKO - Dalyan Fisheries Cooperative	-	-	-
Dalyan Motor Boat Transport Cooperative	-	-	-
Dalyan Association	The president and 2 member	-	1 member
Nature and Animal Protection Association	3 members	1 member	2 member
Mediterranean Development Association	The president	The president	-
Dalaman Environment and Tourism Association	The president	The president	The president
The Turkish Foundation for Combating Soil Erosion for Reforestation and the Protection of Natural Habitats	-	-	Mugla province representative
Private sector	1 hotel owner, 3 hotel managers	-	1 hotel owner
Local Media	1 member	3 members	-
Local people	15 local people	7 local people	4 local people

Table 6: Elements contributing to Natural Capital, impacts, and variables

Elements contributing to Natural Capital	Impacts	Variables
Agricultural Lands	• Deterioration of the quality of agricultural lands • Decrease in the agricultural land quantity	• Improper use of fertilizers • Excessive use of chemicals • Wild irrigation • Conservation policies of the State and legal regulations • Urban sprawl on agricultural land • Increase of tourism activities • Educational level of agricultural workers
Sea Lagoon Wetland Dalyan Canal Köycegiz Lake	• Water quality deterioration • Damage on ecosystems • Degradation of landscapes • Areal losses	• Existence of fish farm • Boat traffic along the Canal • Agricultural activities • Urban growth • Recreational use
Fishery Fauna Vegetation Endemic species	• Decrease in abundance • Species loss	• Water quality deterioration • Overfishing • Boat traffic along the Canal • Presence of invasive species
The beach Turtles	• Decrease in number of sea turtle nests • Damage on the beach ecosystem	• Excessive recreational use • Efficiency of spatial management • Conservation policies of the State and legal regulations
Clean air Clean water	• Water quality deterioration • Increase of air pollution	• Agricultural activities • Urban growth • Boat traffic and other recreational uses • Heating of buildings in winter • Industrial facilities • Climate change
Forests Landscape	• Shrinking of forest areas • Degradation of landscape	• Urban growth • Forest fires • Other natural disasters • Climate change • Conservation policies of the State and legal regulations
Ground water sources	• Water pollution • Decrease in water yield	• Hydro electric power plants • Agricultural activities • Urban growth • Climate change • Industrial facilities • Conservation policies of the State and legal regulations

In the first BBN session the elements contributing the natural capital of Köycegiz – Dalyan SPA were identified by the participants through a collaborative approach and this was followed by identifying the negative impacts on the elements and the variables that cause them. As the first step, participants were asked to suggest how the impacts and variables were related. At this part of the meeting, causal relationships were discussed and identified between the variables and the impacts (Table 6).

The BBN questionnaire was introduced to the participants in the second session of the BBN Workshop and they were asked to provide their individual inputs. The questionnaire was designed by using the elements of natural capital, negative impacts and the variables that were already identified during the first BBN meeting.

The final meeting was the culmination of the BBN workshops that allowed participants to view the predictions under different scenarios. The BBN was built using the free version of the NETICA Software. A complex BBN could not be prepared due to limitations of the free version which allows only 15 nodes. For that reason, BBN structure was created separately for each natural capital element.

The participants were able to view the use of BBN to create different scenarios through the presentation of the two BBN examples based on the causal networks prepared in the previous BBN session (Figure 4 and Figure 5). The software also provided a better understanding for the participants to see the results instantly. The participants were very interested with the results as they instantly came out by changing the level of the negative impacts.

At the end of the session, a new questionnaire was given to the participants for the improvement of the BBN of Köycegiz – Dalyan Case area. The questionnaire was also sent to all stakeholders who were not able to participate at the session. A total of 17 responses were received. According to the results of the questionnaire responses, participants believe that most of the elements contributing to the natural capital of Dalyan and environs carry very high significance (Figure 6). The sea, wetlands, lagoons, Dalyan Channel, Köycegiz Lake, Dalyanagzı and Iztuzu beach, groundwater resources, clean water, clean air are seen to have been picked up by all respondents as being very significant. Fisheries potential, natural scenery, eco-agro tourism potential and climatic features are given less importance compared to the other elements.

For the question related to the negative impacts (Figure 7), high significance indicates the greatest negative impacts. The most important impacts identified were: “wrong agricultural practices” and “illegal practices of the administrators” since all of the participants chose them as much significant for their negative impact on the

natural capital of Dalyan and environs. Fish farming practices in Sulungur Lagoon has the lowest significance. The contribution of fisheries potential on Natural Capital was also identified as less significant among others. The gap between administrators and the scientific community was identified as of medium significance.


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Figure 3: Discussions and questionnaire exercise in the BBN workshops.

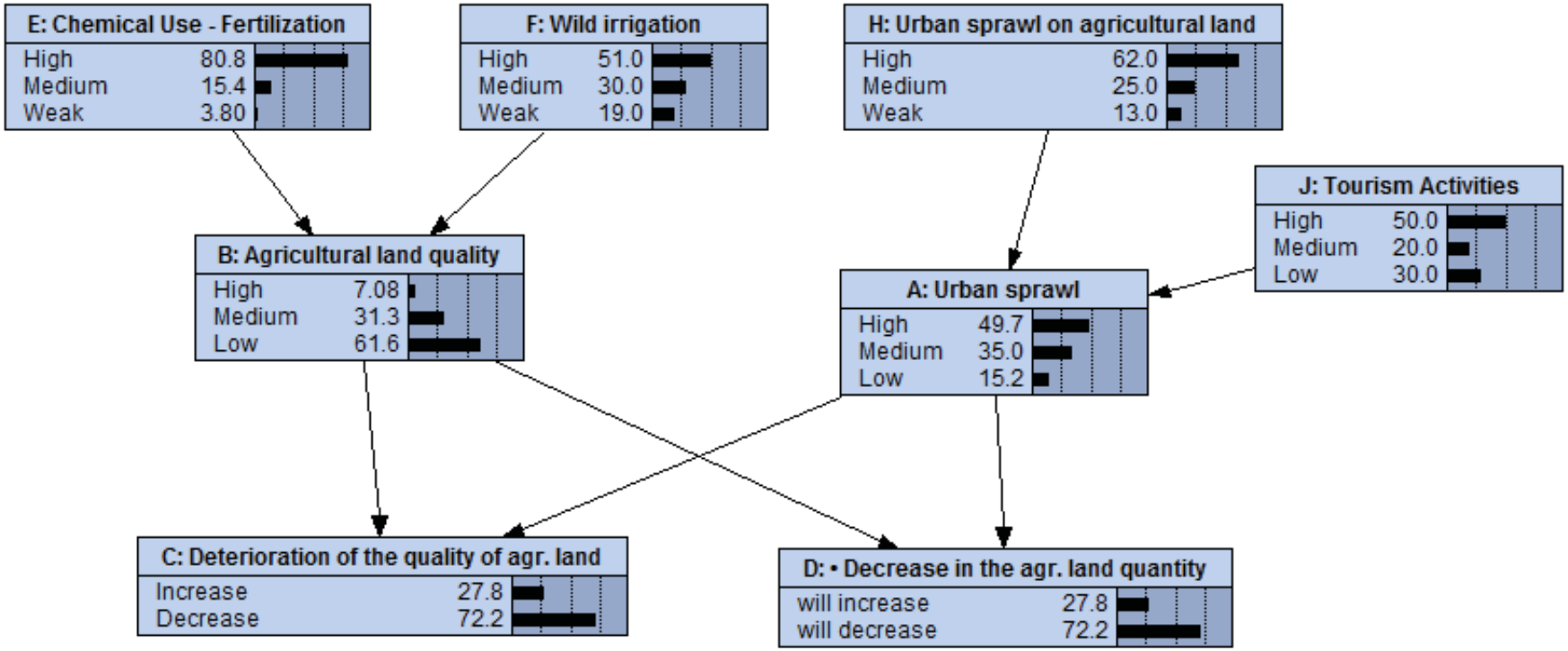

Figure 4: BBN for agricultural land in Köycegiz – Dalyan CASE

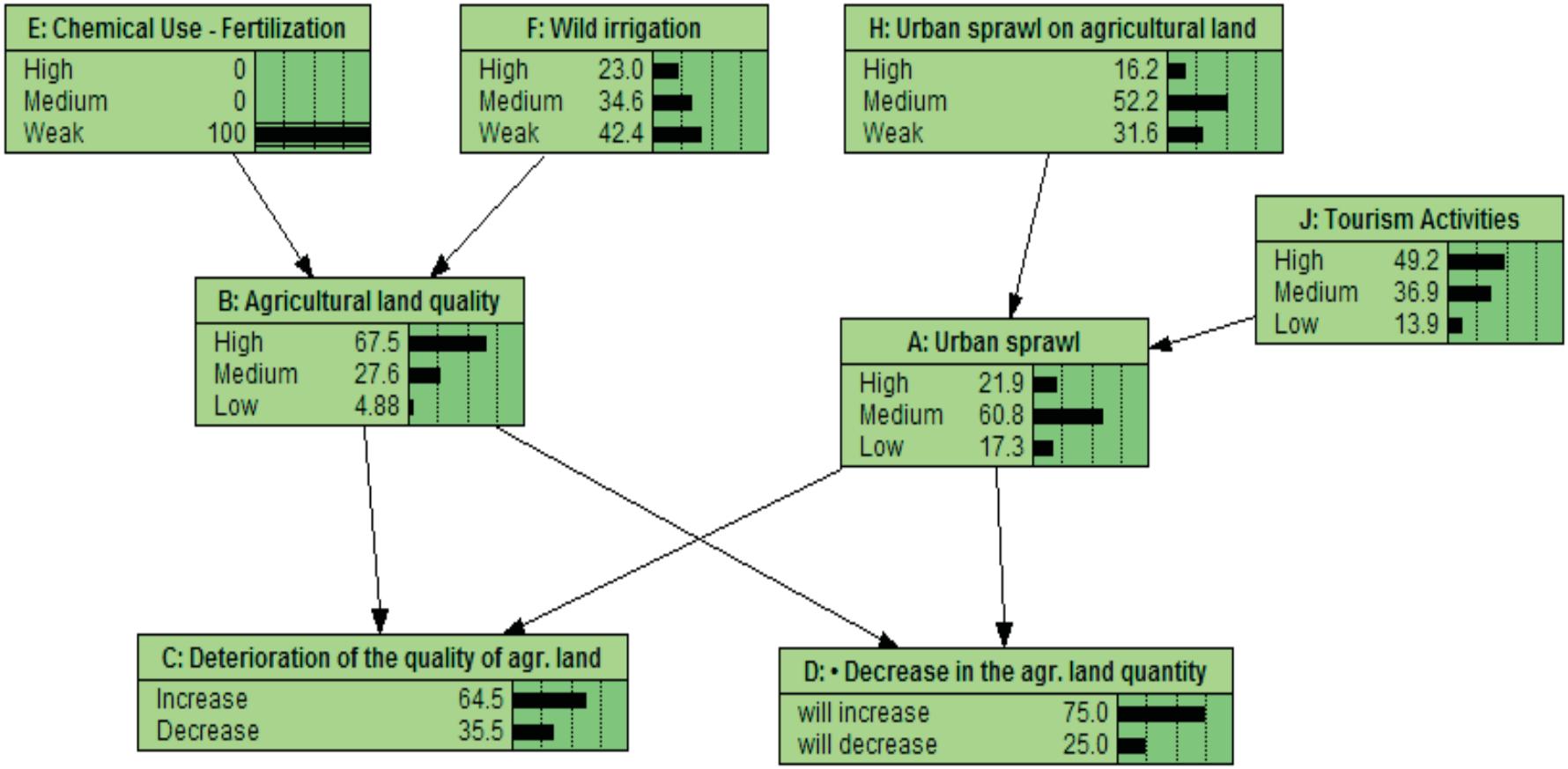

Figure 5: BBN after changing the values of the influences.

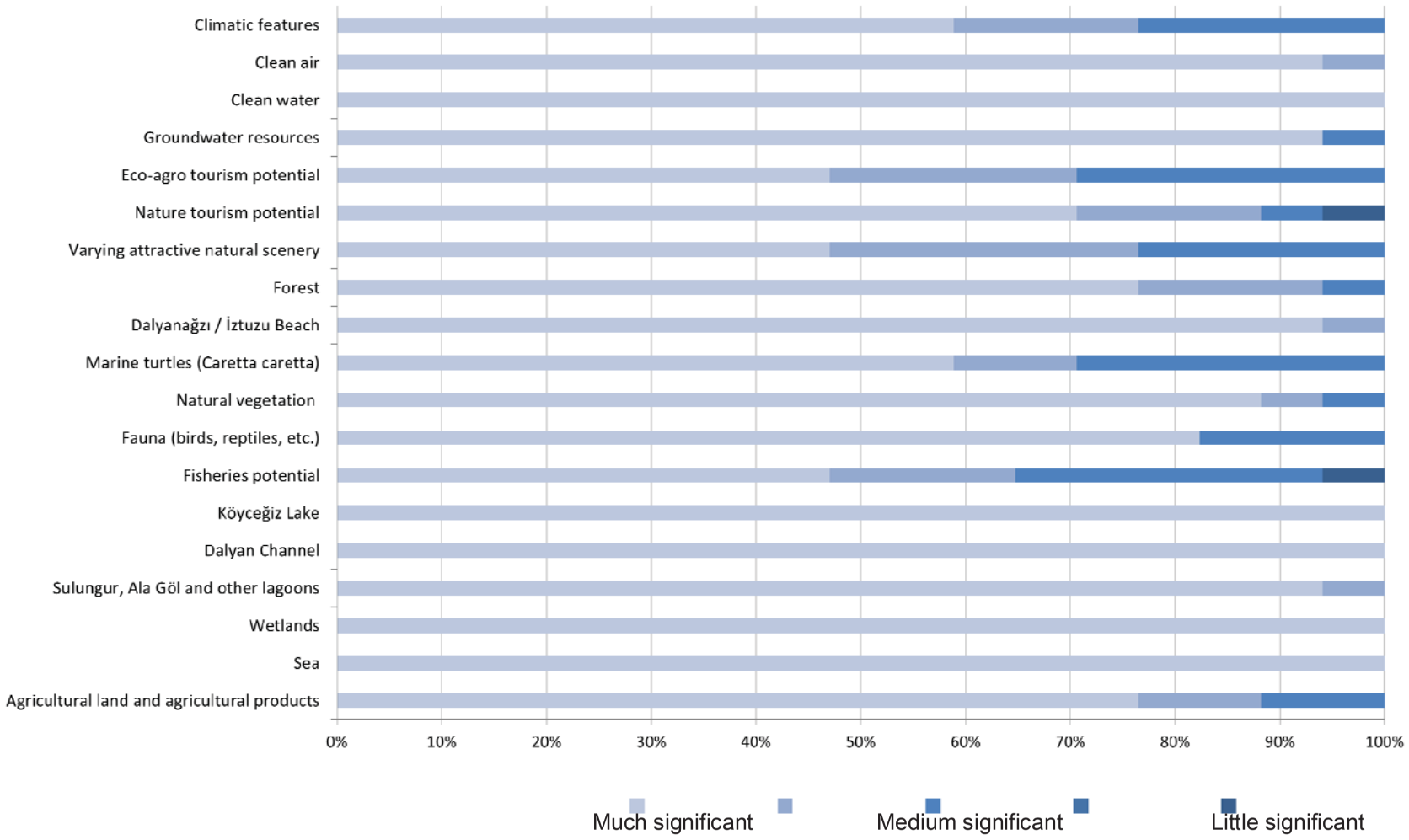

Figure 6: The level of significance of elements that constitute the Natural Capital of Dalyan and environs

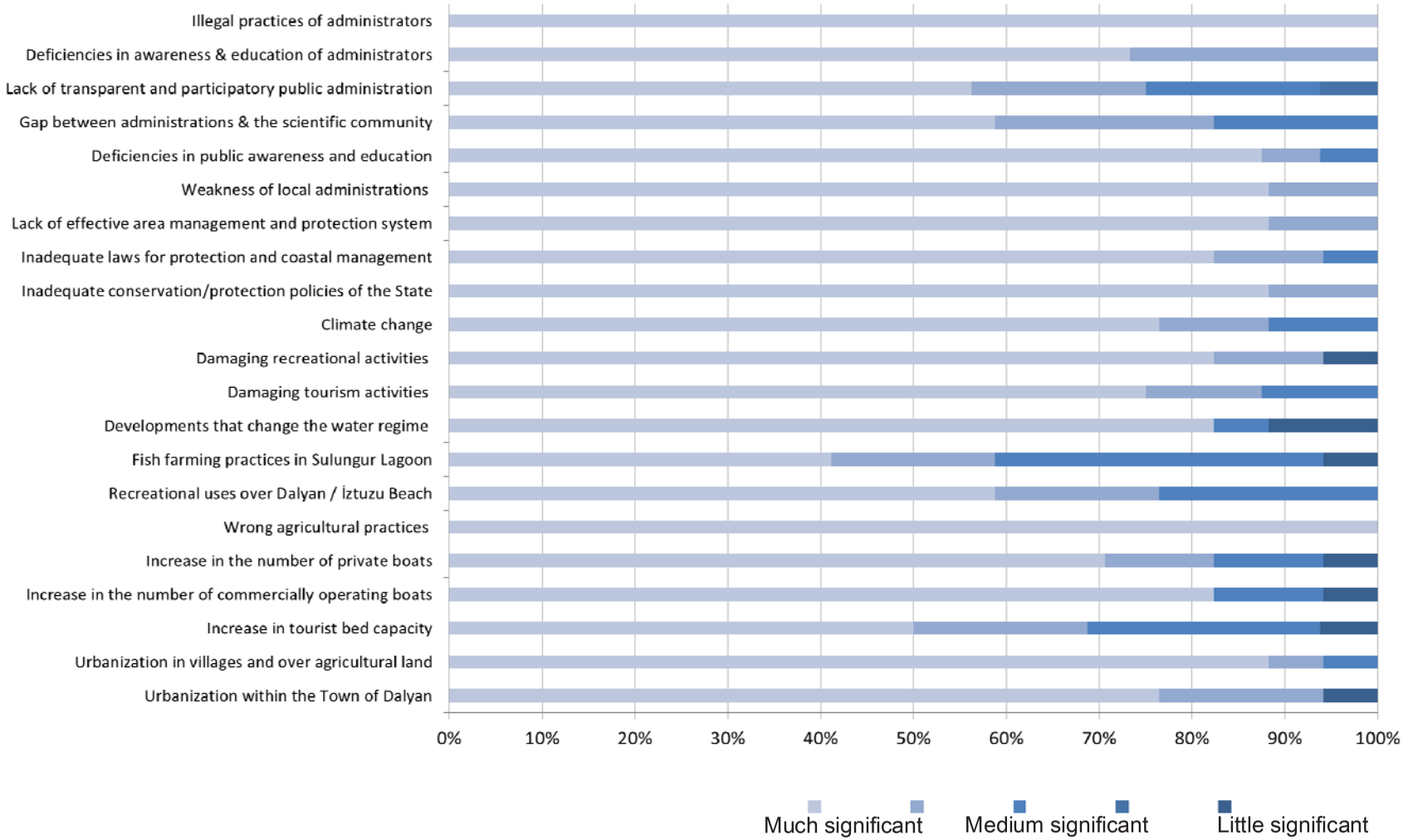

Figure 7: Indication of the significance levels of the human activities, natural processes and administrative weknesses that negatively impact the natural capital of Dalyan and environs.

Although the time available was limited for practising and organizing the BBN workshops, it proved to be an important experience as a participatory method for increasing the awareness of the stakeholders and for leading people to focus on particular issues in an interactive way. Influence diagrams and questionnaires (or an alternative way for data gathering) prepared with further studies will be helpful to provide more reliable scenarios from BBN which could be a useful vehicle for decision making and gathering stakeholders to discuss about the future.

National Workshop on ICM

A national workshop entitled "Coastal Management in Turkey: Recent Developments", was organized during 25-26 April 2013 in Marmaris, Turkey as an activity of the Pegaso project. This workshop provided an important occasion to disseminate the results and experience gained during our CASE, including the assessment of the stakeholders' involvement and public participation. A presentation was made on the PEGASO Project and the Koycegiz – Dalyan SPA CASE. 35 participants representing the Ministries, Regional Governmental Offices, the host Municipality (Marmaris), universities, research institutes, planning companies and NGOs reviewed the PEGASO project and other recent research and development projects dealing with coastal management in Turkey.

International Congress on ICM

Global Congress on ICM: Lessons Learned to Address New Challenges, the joint meeting of the Eleventh bi-annual MEDCOAST Conference and the Tenth EMECS Conference, was organized during 30 October – 3 November in Marmaris, Turkey. More than 300 people participated from 40 countries of Europe, North Africa, Asia, North America, and Australia. There were two special sessions dedicated to PEGASO project where partners presented the results of the PEGASO Project. One oral and one poster presentations were made on the Koycegiz – Dalyan SPA with the following titles:

- Monitoring of Boat Navigation in the Dalyan Channel. Nesrin Tufekci, Ulas Avsar, Erdal Ozhan
- Management Issues of Koycegiz-Dalyan SPA (Turkey). Erdal Ozhan, Ulas Avsar, Nesrin Tufekci, Serdar Ozuslu, Sinem Onder, Deniz Konakli, Nurdan Kanl.

Monitoring of Boat Navigation in the Dalyan Channel

Nesrin Tüfekçi[1,2], Ulaş Avşar[3,4] and Erdal Özhan[2,3,5]

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Introduction

Dalyan channel:

- is within a SPA zone
- embraces several natural beauties within its habitat
- is major transportation way to ancient city Caunos

➢ Recreational boat traffic is one of the main factors affecting the channel's environment.

➢ Monitoring the motor boat traffic in Dalyan channel is a crucial for evaluating the pressure exerted by on the deltaic-lagoonal ecosystem .

➢ The on-going and return routes followed by the motor boats in the lagoon are indicated in Figure 1. Along an important part of the designated route, two-direction navigation is allowed.

➢ This decision was taken to decrease the pressure on the ecosystem and to prevent motor boats from accidents due to heavy traffic.

Fig. 1: The route taken by motor boats in Dalyan Lagoon.

Within the scope of FP7- ENV.2009.2.2.1.4 Integrated Coastal Zone Management PEGASO (People for Ecosystem-based Governance in Assessing Sustainable development of Ocean and coast) project, Mediterranean Coastal Foundation (MEDCOAST) being a partner of this project, has developed an automated script to count the boats passing through the Dalyan channel in order to evaluate the pressure exerted on the ecosystem.

Methodology

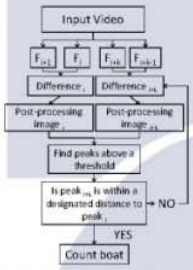


Fig. 2: Flowchart of the algorithm architecture

➢ A simplified moving object detection algorithm is proposed to count the boats passing through Dalyan Channel.

➢ The system uses a single security camera installed on the highest possible point in front of the MEDCOAST Office (blue dot in Fig. 1) looking to the main boat passage window of the channel.

➢ The images captured from the video are processed in an automated manner following certain steps (Fig. 2).

Accordingly:
i) the video is read and converted to frames;
ii) the differences of two consecutive image pairs, which are three frames (k=3) apart from each other, are calculated;
iii) the difference images are processed and compared;
iv) a certain thresholds are applied to avoid counting one boat twice and waves generated by propellers;
v) peaks satisfying threshold constraints are counted.

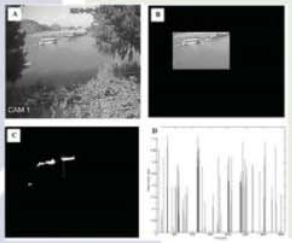


Fig. 3: The main procedure of the boat counting algorithm.

The security camera captures the scene in RGB format. The video images are processed following the steps explained below:

- Each RGB image is converted to grayscale (Fig. 3A)
- The area out of interest is masked (Fig. 3B).
- The difference between two consecutive masked greyscale images (F_{i+1} - F_i) is obtained
- The resulting image is converted to binary image where no-motion and motion pixels have value of "0" and "1" respectively.
- Morphological closing is performed on the binary image to connect disconnected neighbourhood pixels and form the approximate shape of the moving object (Fig. 3C).
- The mean of the pixel values falling within a reference rectangle is calculated and plotted against time (Fig. 3D).
- After analysing several peaks under different scenarios the thresholds for peak height (0.05) and distance (25 fps) between two peaks are selected.
- In order to eliminate the possibility of counting one boat several times, the distance between peaks is selected as 25 fps.
- Hence the number of all peaks within a video gives the number of boats passing in that video.

Results

- The results of boat counting covers the period of 03 March 2012 to 31 May 2013.
- The accuracy of the algorithm is evaluated by comparing manually counted boat numbers to the results of the automated counting system (Fig. 4).
- The scattering is mostly within 10% error range (Fig. 4a) and count/day based scattering is less than 5% (Fig. 4b), which can be considered as acceptable accuracy for this study.

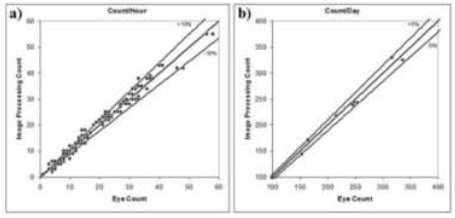


Fig. 4: The accuracy of image processing counts.

According to daily boat count graphs (Figures 5 & 7):

- The traffic in the channel during the low tourism season (November-March) is about 50-150 boats per day
- July and August are the busiest months, with approximately 700 counts per day.
- At the end of April 2013, the number of the boats start increasing rapidly again reaching up to 400 boats per day at the end of May 2013.
- The religious and national holidays correspond to distinct peaks, with the one in the high tourism season reaching the maximum of 950 counts per day (21 August 2012).

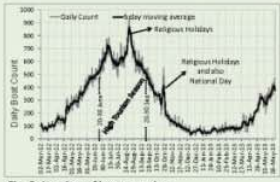


Fig. 5: Number of boats per day.

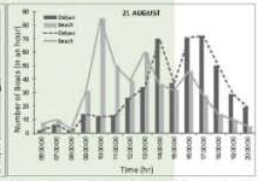


Fig. 6: Boat number per hour in different directions

- The videos with the highest number of boat passages (in 21 August 2012, count=950) were visually studied to separate the boats going to the beach or going to the towns (Dalyan).
- As a result, tourists are carried to the beach in the morning (9:00-11:00), and also in smaller numbers after the lunch break. A part of the tourists return back to the town early in the afternoon (at 14:00 hrs) and the remaining larger part returns later in the afternoon during 16:00 and 18:00.

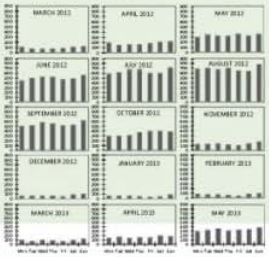


Fig. 7: The number of average daily boat count per the days of week

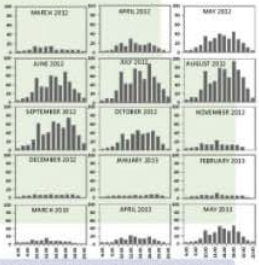


Fig. 8: The number of average hourly boat count per hours of a day.

Conclusion

The accuracy of the method is sound and its applicable for any location with camera installed in a side-view angle. The side by side boat passage during high season is the main source of errors; however, this error does not exceed 5% of the total daily boat counts. Thus, it can be accounted for during management process. The number of boats passing through Dalyan channel follows a seasonal pattern throughout a year, clearly indicating the tourism season. Monitoring the boat navigation for longer time period would provide a valuable input for management purposes of the area

Figure 8: Poster presentation of Köycegiz – Dalyan SPA CASE in Global Congress on ICM.

Section 7. Tools

Two “PEGASO tools”, indicators and participatory methods, have been used for Köycegiz-Dalyan SPA CASE. As mentioned in the previous section, public participation is one of our main goals. Three stakeholder meeting and three BBN workshops revealed the typical constraint in terms of authority vs. interest relation where the ones having authority for decision making do not show enough interest for participation. According to the consensus at the stakeholders meetings, increasing the public awareness and participation would be crucial in achieving successful management of Köycegiz-Dalyan SPA. Within this context, during this second phase, preliminary preparations have been carried out to increase the interest of the decision making stakeholders. In order to convince such stakeholders (like the Governorate of Mugla Province), it looks that it is first necessary to highlight the coastal issues based on scientific evidence. This is also useful for increasing public and media awareness as we have experienced during and after the second consultation meeting. For enhancing public participation, it is aimed to establishing a web-based forum as a part of the Turkish version of our web site about the coastal management issues of Köycegiz-Dalyan SPA.

Section 8. Main results of the CASE

8.1 Public participation

The achievements regarding the stakeholders meeting were mentioned in Section 5. The discussions have highly leaded us to proceed through the evaluation of coastal issues.

The minutes of the stakeholders meetings can be summarized as follows;

- The control and regulation of the motor boat traffic should be immediately improved in the Dalyan channel.
- Protection of sea turtles and their natural living space should be continued and improved. There are two main crucial problems to be solved; 1) injury of sea turtles by motor boats exceeding the speed limit, 2) local people and tourists feed turtles, which results in changes of feeding behaviour of the turtles.

- A web-based forum will be designed and available to the public in order to increase the participation and contribution of any parties, who are interested in the management of Köycegiz-Dalyan Specially Protected Area.
- Participation of some key stakeholders who did not attend the meeting (e.g. governmental representatives, fisheries and motor boat transport cooperatives) should be highly encouraged.

In the light of these statements, the data collection and compilation have been carried out to evaluate nature conservation and climate change impacts under the following main titles:

GIS Applications: Aerial photographs of the region, which were taken in 2004, 1992 and 1974, were compiled. Based on these photographs, it is evaluated whether there is a significant spatial change in the extent of reeds in Dalyan Lagoon through time or not. In addition, maps showing the buildings out of the town plans have been created in order to evaluate the urban sprawl in terms of both the number and spatial distribution of buildings in Köycegiz-Dalyan SPA through time. Shuttle Radar Topography Mission (SRTM) images of the region are used to evaluate the flooding risk in case of sea level rise due to climate change.

Motor Boat Traffic: Motor boat traffic creates a significant level of pressure on the ecosystem in the region. In order to evaluate the mode and level of boat traffic, a security camera system was set up looking at the Dalyan Channel and a computer code was written to automatically count the boats passing through the channel.

Fisheries: In Köycegiz-Dalyan SPA, evaluation of fisheries production data is another important duty in order to assess the sustainable development and integrated coastal zone management applications in the region. Fishing activities are mainly carried out by SS DALKO Fishery Products Cooperative which was established in 1971. Presently, the cooperative provided data covering the period of 2003 - 2012.

Water Quality: Water quality monitoring has been carried out in the SPA for some years by the ex-Authority for SPAs. Water quality data covering the years of 2006 to 2012 were obtained from the General Directorate of Protection of Natural Asses (Min. of Environment and Urbanism) and analysed.

Sea Turtle Nesting: Monitoring of the nests and hatchlings has been sponsored by the Ministry of Environment and Urbanism on yearly project basis since 1988 and the monitoring is carried out by teams belonging to Universities or specialized companies.

8.2. GIS Applications for changes in the natural system and housing development in rural areas

In Figure 9, a general Google Earth view of Köycegiz-Dalyan Specially Protected Area is presented. The locations of security camera system and the water quality measurement stations are shown on the image.

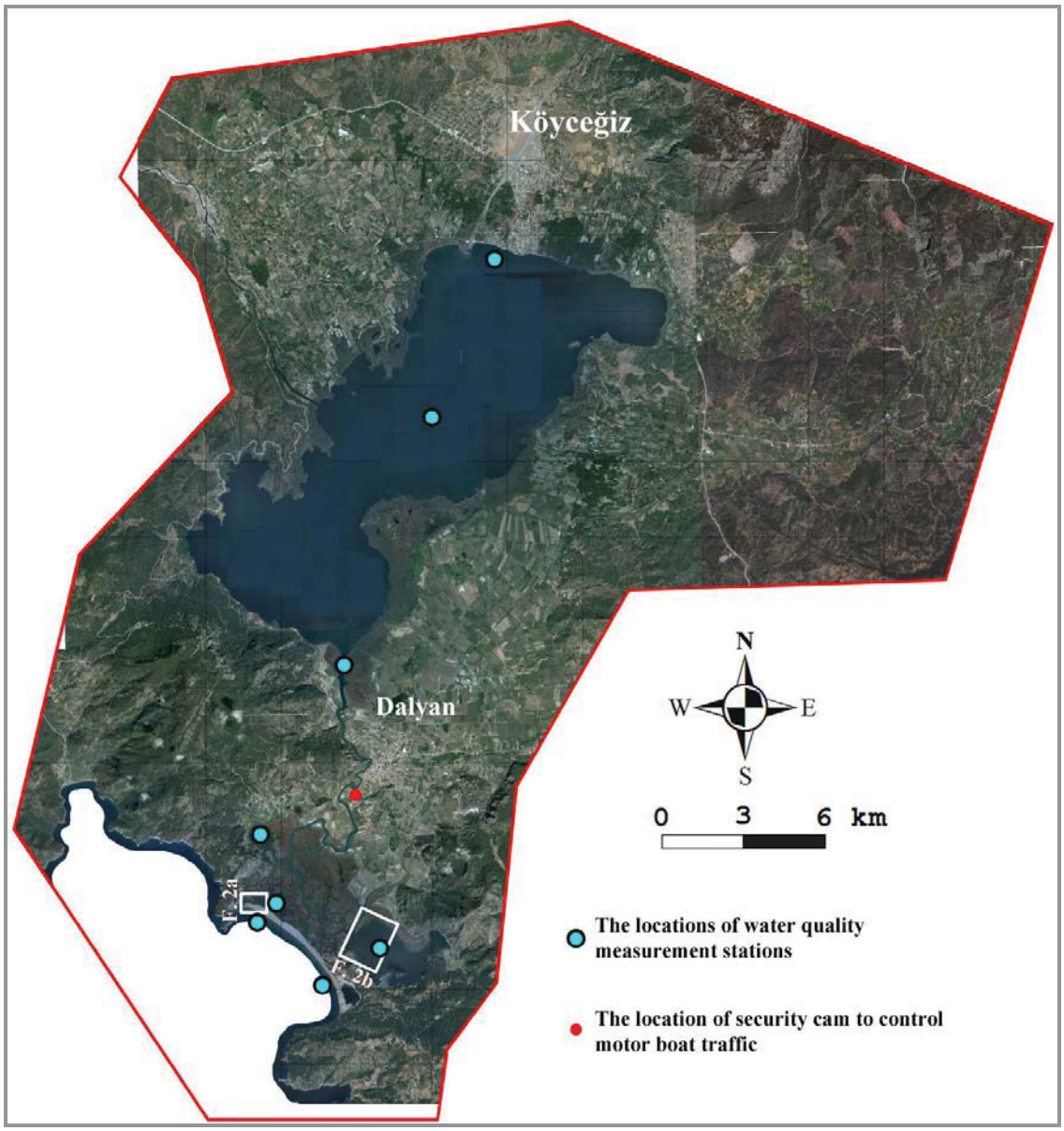


Figure 9. Google Earth 2004 image of Köycegiz-Dalyan SPA. The locations of the security camera and the water quality measurement stations are shown. The locations of Figure 8a and 8b can also be seen as white rectangles.

8.2.1 Areal Extend of Reeds in the Lagoon

Figure 10 illustrates two locations in Dalyan lagoon; where there are slight changes in the areal extend of reeds between 1974 and 2004. In the rest of the lagoon, no significant areal change is detected.

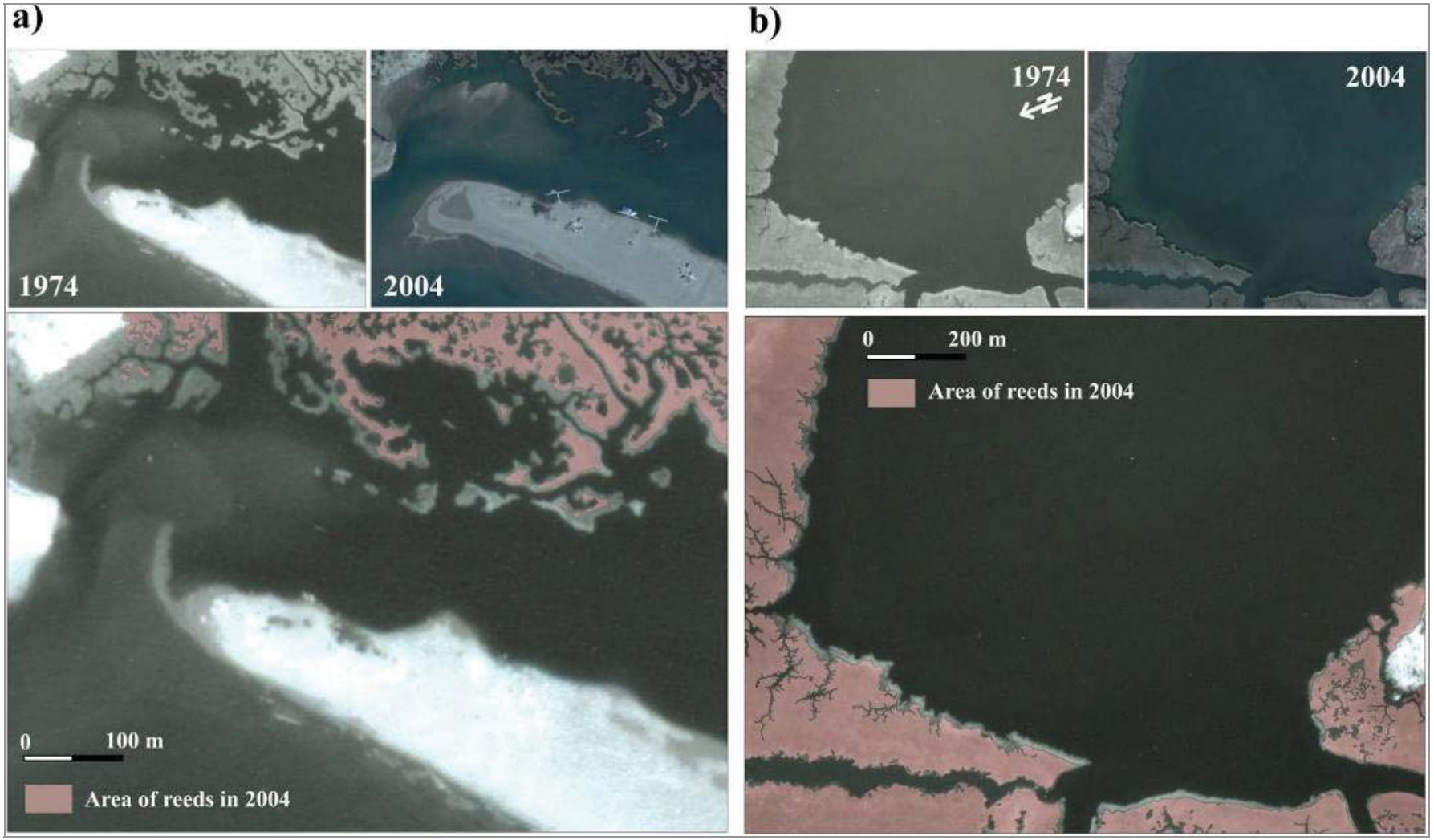


Figure 10. Examples of changes in the areal extend of reeds in Dalyan Lagoon.

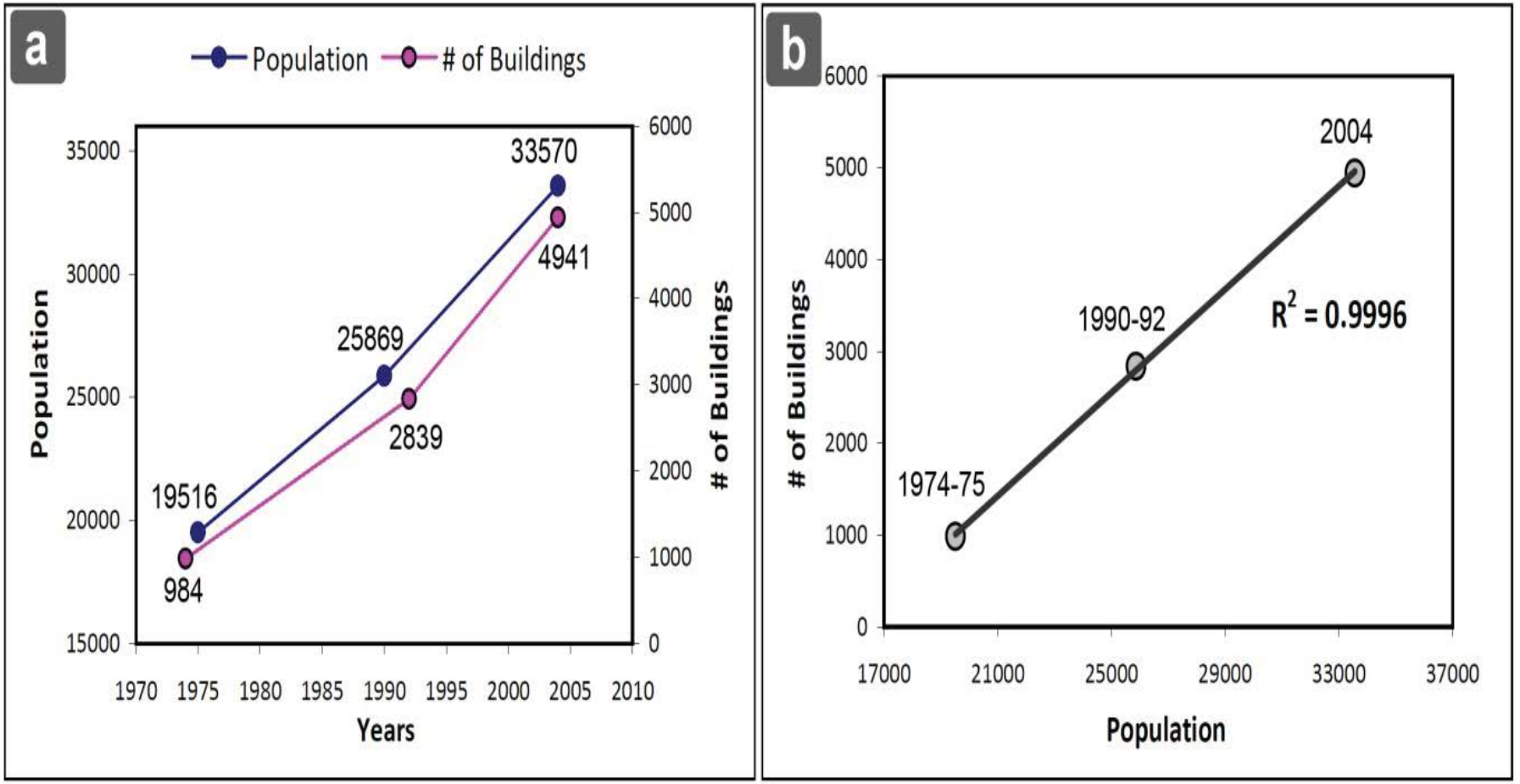


Figure 11: a) Number of buildings out of the town plans and rural settlements based on aerial photographs taken in 1974, 1992 and 2004, and the population in 1975, 1990 and 2004. b) Correlation between number of buildings and the population.

8.2.2 Housing Development in Rural Areas

GIS techniques were also employed to evaluate housing development in rural areas that do not have an urban development plan. Figure 11a shows the comparison between the change in the number of new buildings in rural areas and the total population of the region. The number of buildings seems to increase proportional to the total population (Figure 11b). The spatial distribution of the buildings based on their construction period is illustrated in Figure 12. The distribution of buildings detected in 1974, 1992 and 2004 are presented in Figure 13, 14 and 15, respectively. Spatial distribution of 1855 buildings constructed between 1974 and 1992, and 2102 buildings constructed between 1992 and 2004 are presented in Figure 16 and 17, respectively.

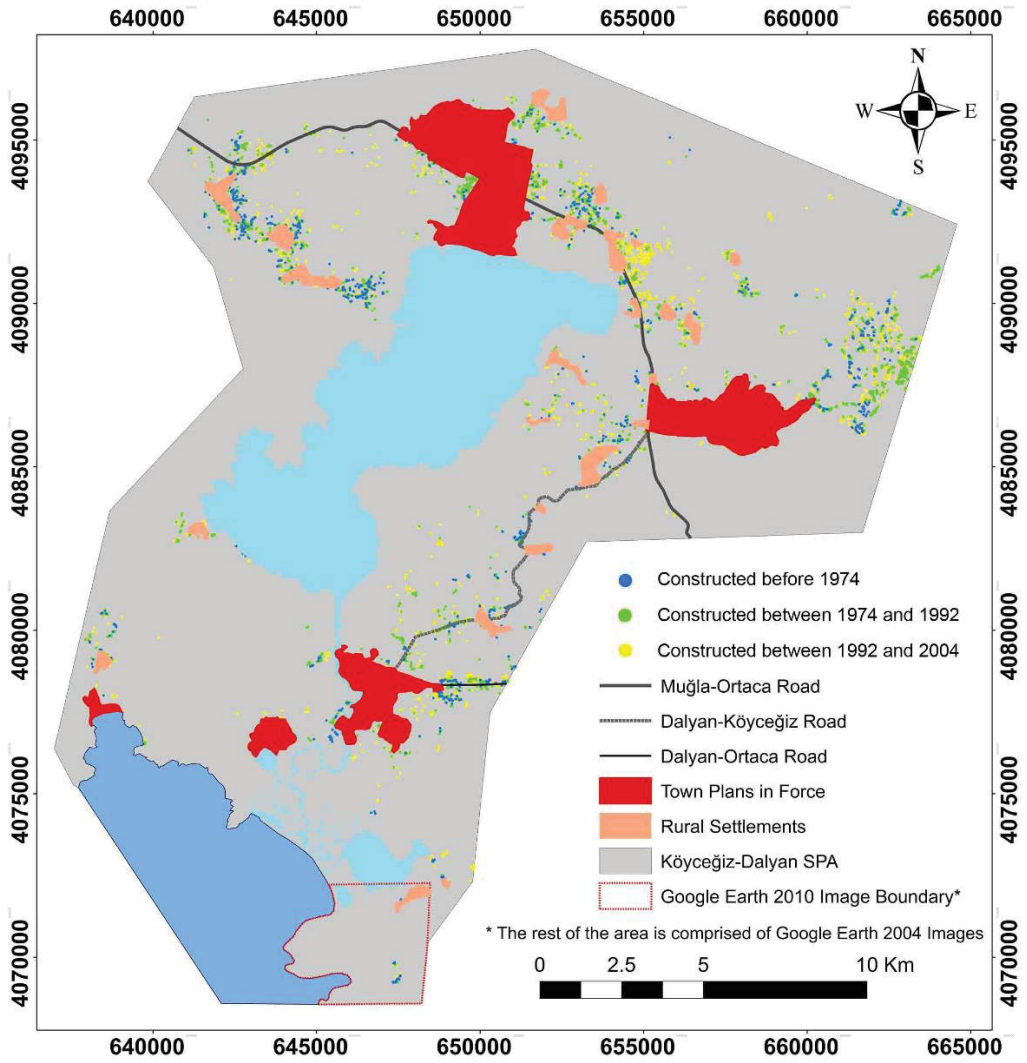


Figure 12: Spatial distribution of buildings as of 2004 based on their construction periods.

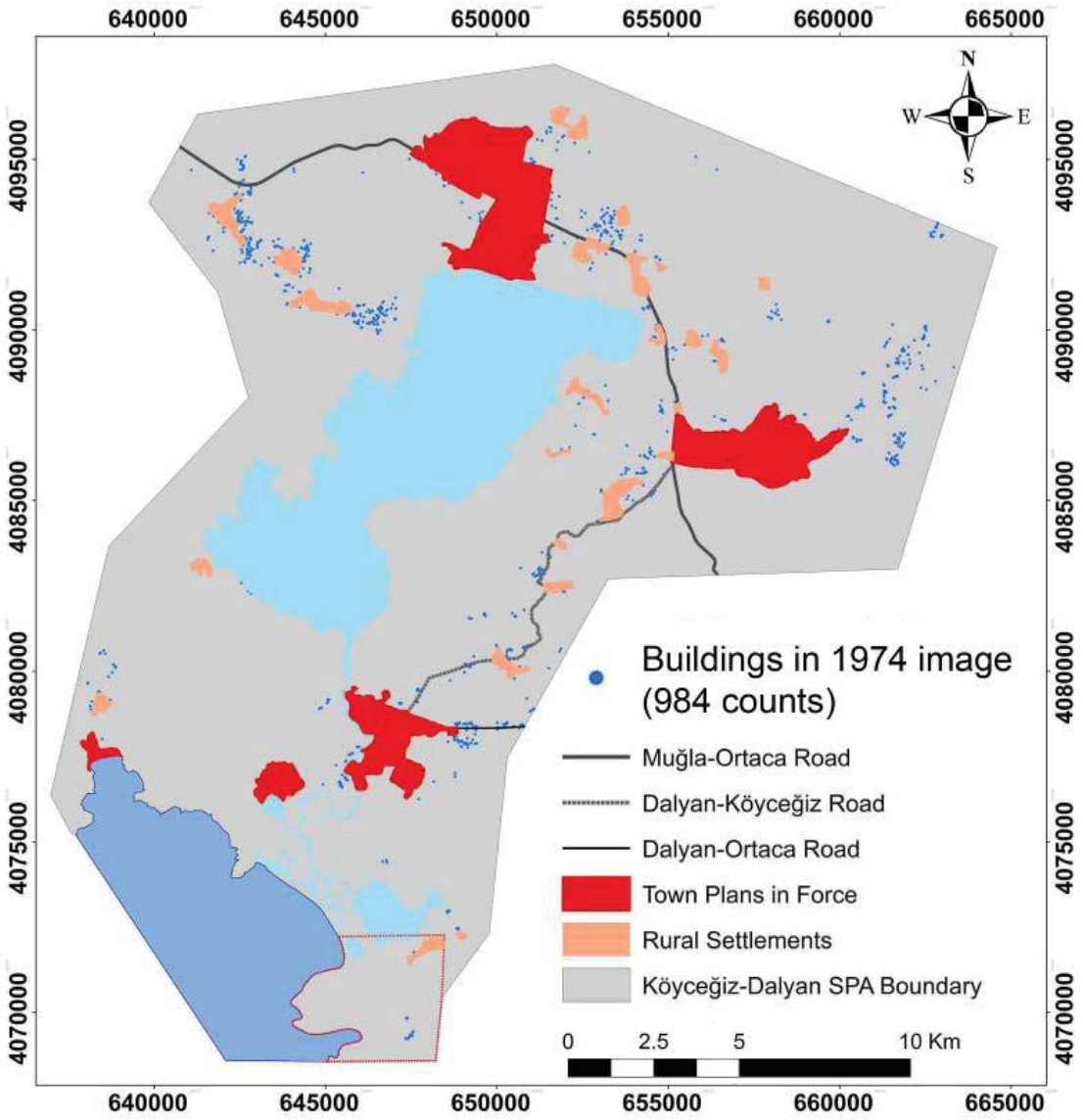


Figure 13: Spatial distribution of buildings out of the town plans and rural settlements, based on aerial photographs taken in 1974.

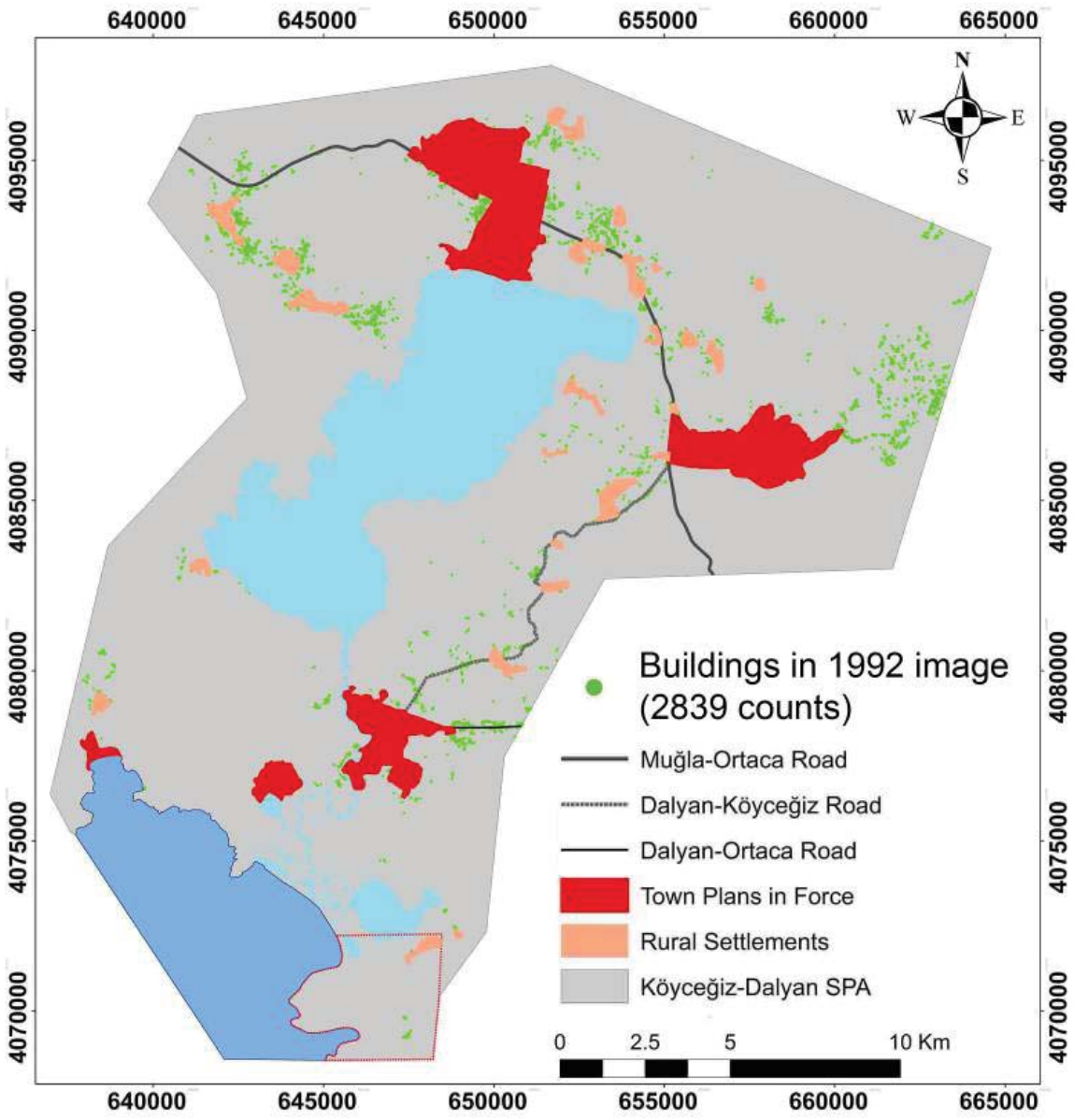


Figure 14: Spatial distribution of buildings out of the town plans and rural settlements, based on aerial photographs taken in 1992.

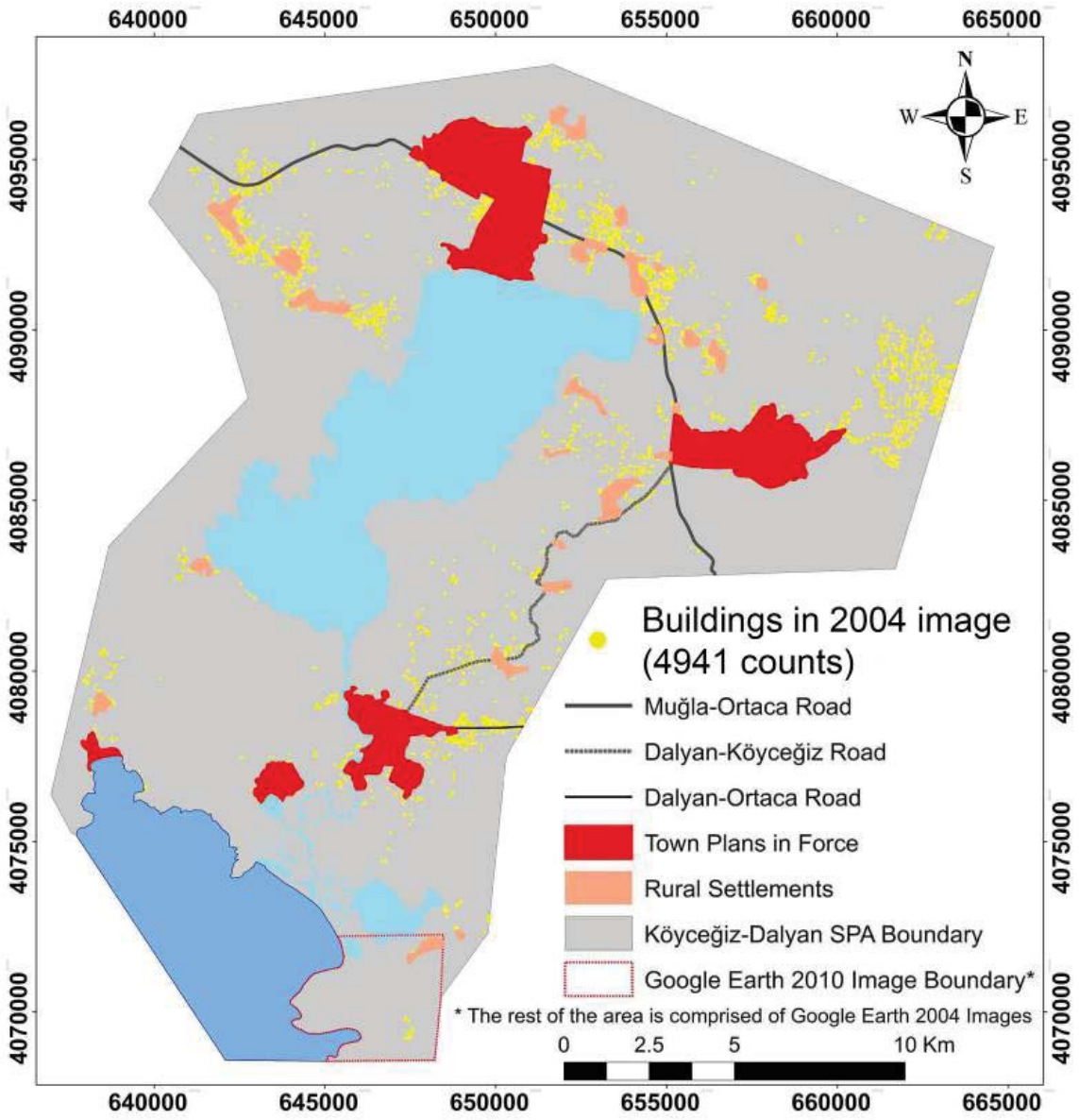


Figure 15: Spatial distribution of buildings out of the town plans and rural settlements, based on Google Earth images taken in 2004.

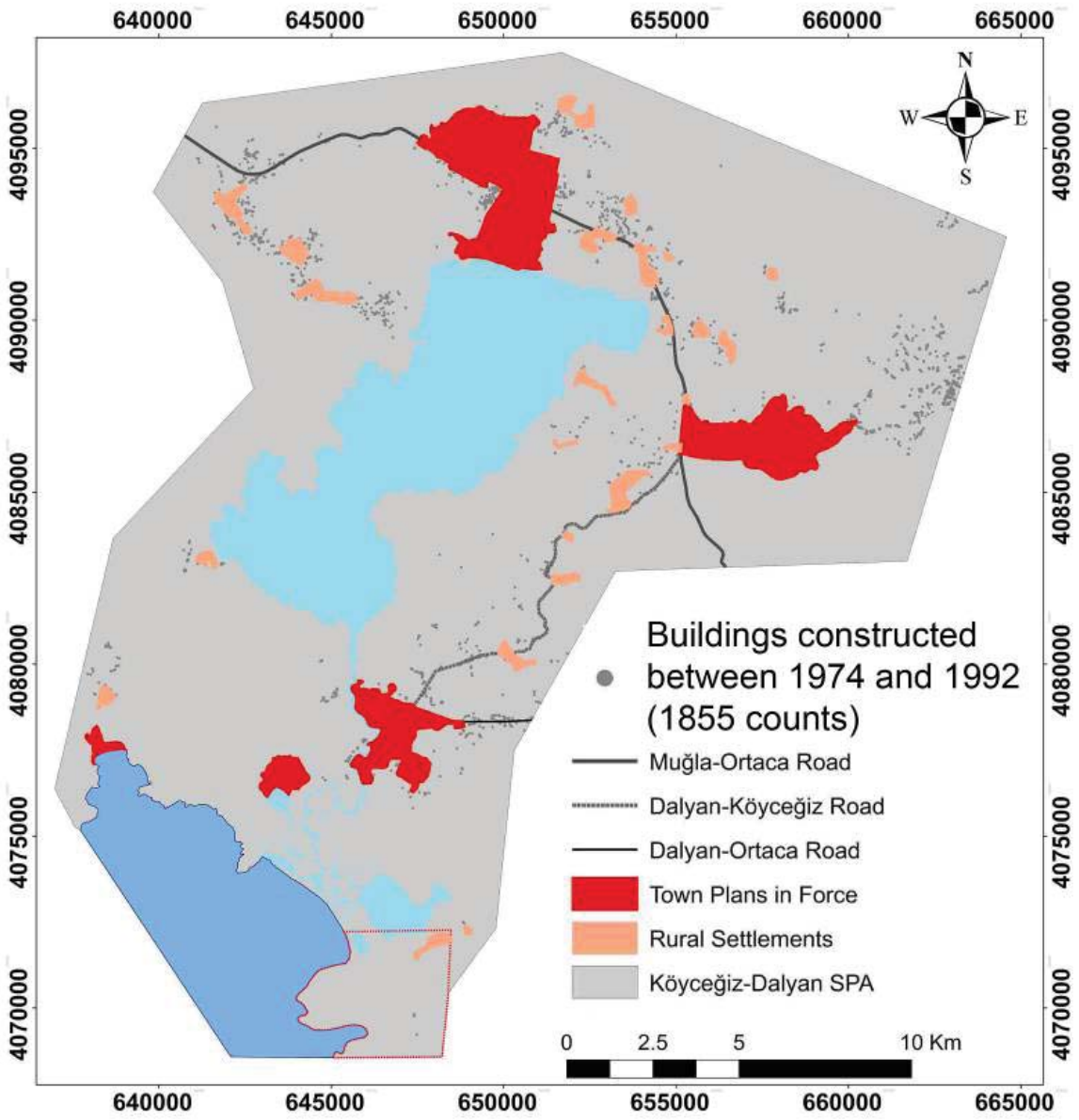


Figure 16: Spatial distribution of 1855 buildings constructed between 1974 and 1992.

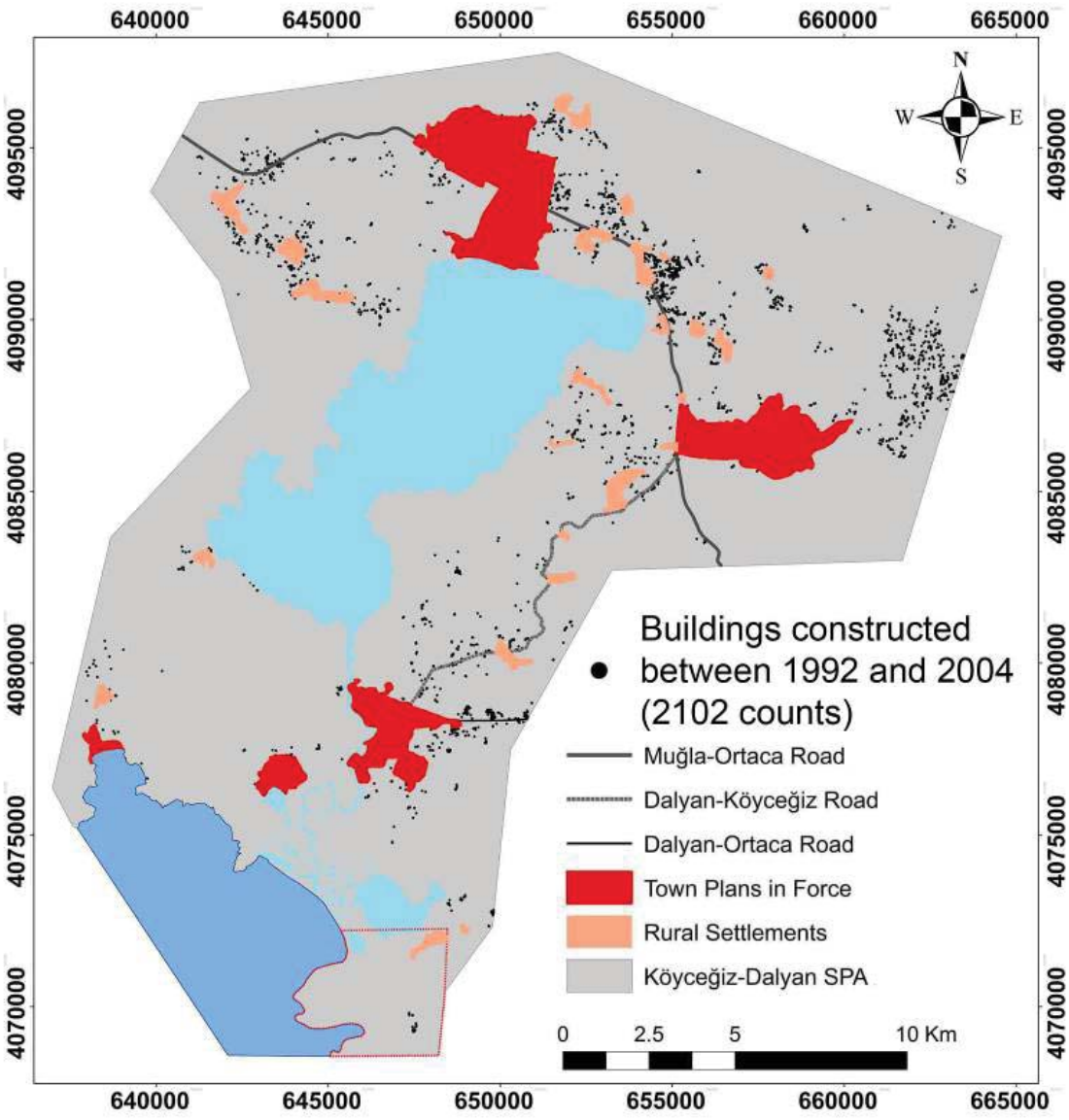


Figure 17: Spatial distribution of 2102 buildings constructed between 1992 and 2004.

8.2.3 Climate Change Impacts and Assessment of Flooding due to Sea Level Rise

GIS techniques were also employed to evaluate the possible consequences of sea level rise resulting from the climate change. Shuttle Radar Topography Mission (SRTM) images were used to obtain spatial distribution of flooding risk resulting from the sea level rises of 0.25, 0.50, 0.75 and 1.00 meters (Figure 18). Accordingly, the area around the outlet of Köycegiz Lake, the Dalyan Lagoon and İztuzu Beach are found to be highly sensitive to sea level rise. Close-up views of these areas are presented in Figure 19. It clearly shows that even the sea level rise of 25 cm will flood a good part

of the wetlands in the delta and most of the area will be flooded if the sea level rises about 50 cm.

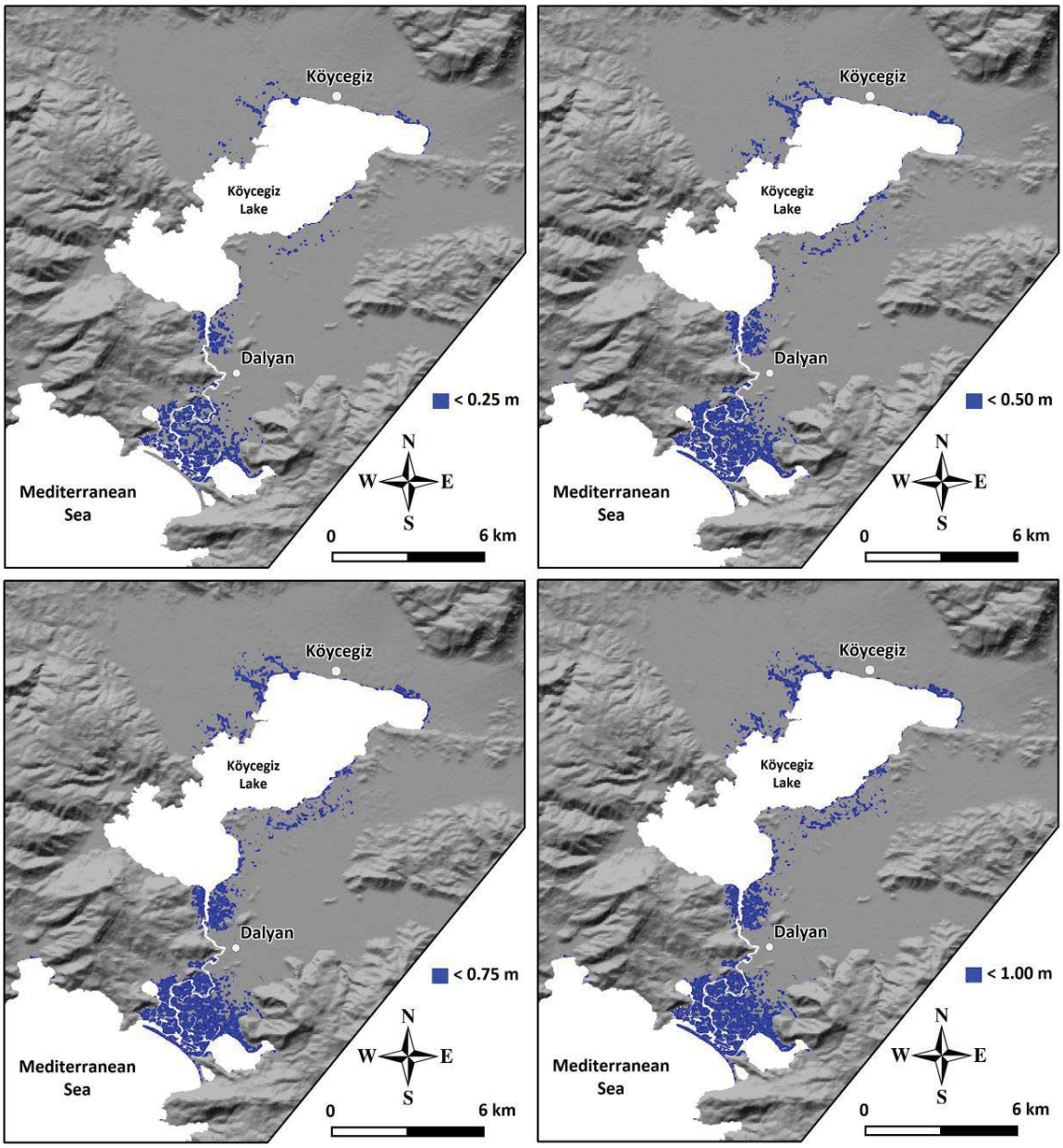


Figure 18: Areas expected to be flooded when 0.25, 0.50, 0.75 and 1.00 meter sea level rise occur. Digital Elevation Model (DEM) is based on Shuttle Radar Topograph Mission (SRTM) images. Please note that the lagoon and the areas around the outlet of Köycegiz Lake seem to be most susceptible to flooding.

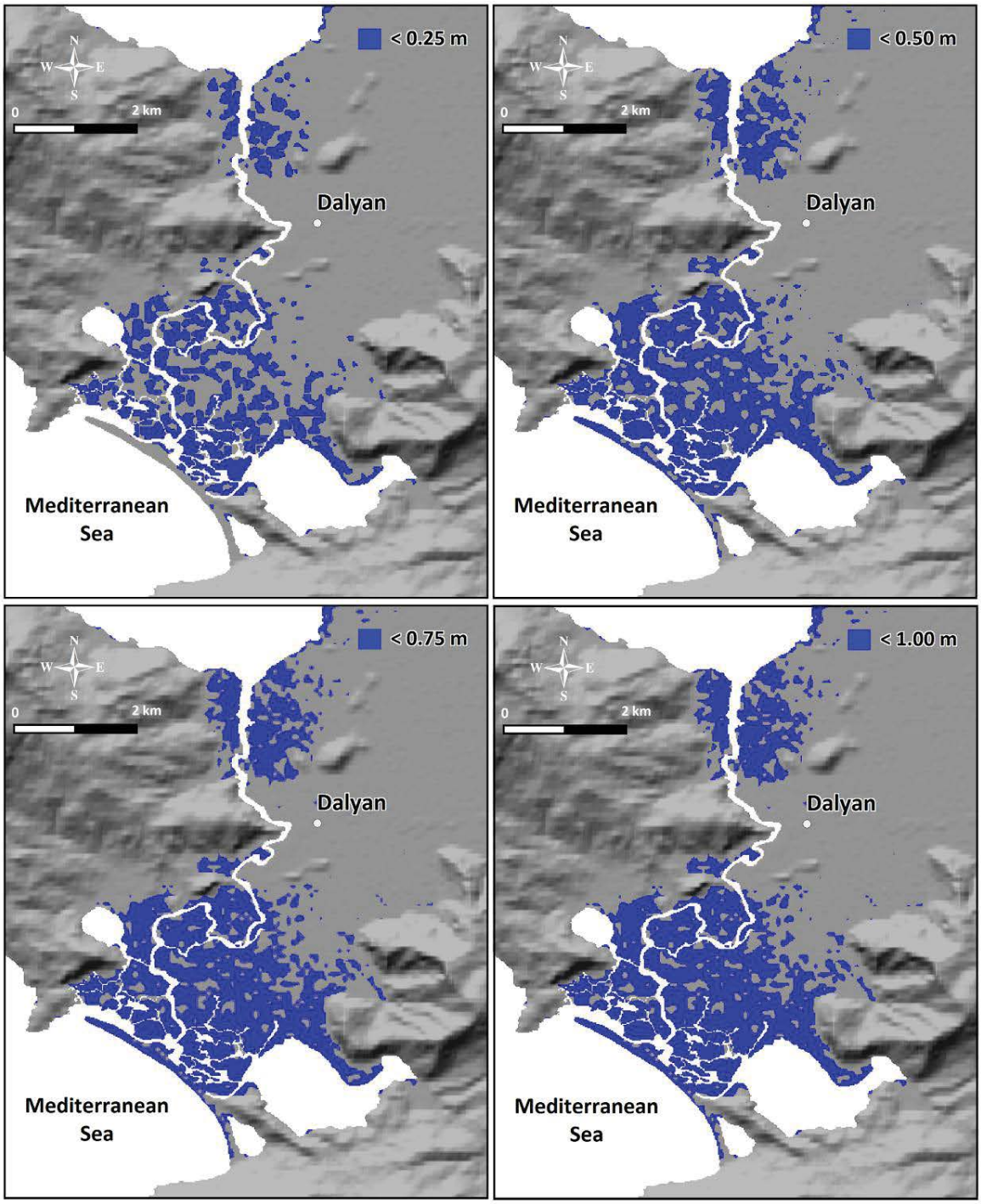


Figure 19: Close-up views of flooding risk at the outlet of Köycegiz Lake, Dalyan Lagoon and İztuzu Beach.

The flooding risk presented in Figure 18 and 19 is only a physical impact of sea level rise due to climate change. Other probable impacts of climate change at Köycegiz-Dalyan SPA can be listed as follows:

1) Flooding of urban areas during south-westerly storms due to both sea level rise and increased storm intensity,
2) Impact of temperature rise to nesting of marine turtles (sex distribution of hatchlings),
3) Impacts of temperature rise on species and ecosystem,
4) Impact of temperature rise on fisheries (impacts on commercial species, introduction of new alien species),
5) Impacts on coastal agriculture (crops, yield),
6) Impacts on tourism (too hot summers and tourist losses), and
7) Salinization of groundwater aquifers due to sea level rise and increased water consumption due to increased air temperature.

8.3 Motor boat traffic

Monitoring of the motor boat traffic at Dalyan channel is a crucial issue for evaluating the pressure exerted by this activity on the deltaic-lagoonal ecosystem. A total of 491 motor boats are officially licensed through Köycegiz and Dalyan Municipalities for navigating in the water body from Köycegiz Lake to the Aegean Sea. Majority of these (373 of 491) are the so-called commercial boats that transport visitors and tourists between the Towns of Koycegiz or Dalyan and the sand-spit beach at the end of the delta. There are only 4 licensed fishing boats that are used for catching fish in the sea as fishing in the lagoon by the third parties is not allowed. The remaining 114 boats are private (non-commercial) boats.

The ongoing and return routes followed by the motor boats in the lagoon are indicated in Figure 20. Along an important part of the designated route, two-direction navigation is allowed. The motor boats use different ongoing and return channels in the heart of the delta since 2011. This decision was taken to decrease the pressure on the ecosystem on one hand and to prevent motor boats from accidents due to heavy traffic on the other. In order to monitor the boat traffic, MEDCOAST has installed a security cam (blue dot in Figure 20) and developed a script for counting in an

automated manner the number of boats passing through the channel in front of the former office of MEDCOAST.

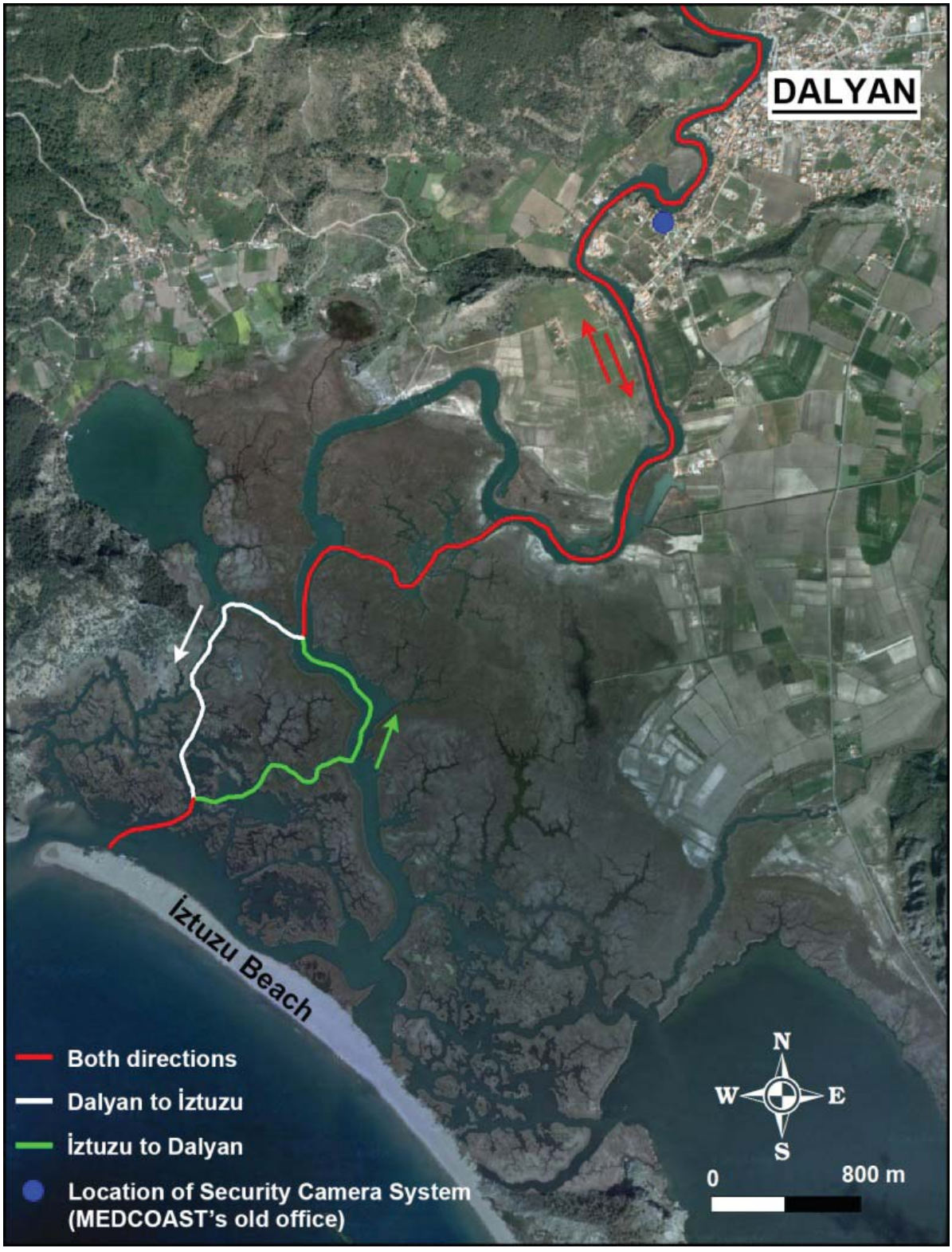


Figure 20: The route taken by motor boats in Dalyan Lagoon.

The boat traffic monitoring is arranged on hourly basis and it captures 5 frames per second. The logic behind the boat counting script is similar to moving object algorithms. Accordingly, each frame, which is in RGB format (Figure 21A) is converted to greyscale and the area out of interest is masked (Figure 21B). Then the difference between two consecutive masked greyscale images is obtained and the resulting image is converted to two-valued image (binary image), where no-motion and motion pixels have value of “0” and “1” respectively. Afterwards, morphological closing is performed on the binary image to connect disconnected neighbourhood pixels and form the approximate shape of the moving object (Figure 21C). Next, the mean of the pixel values falling within a reference rectangle is calculated for each frame and the results are plotted against time (Figure 21D). Each peak with a certain mean value threshold corresponds to a boat. Hence, the number of peaks above this threshold gives the number of boats.

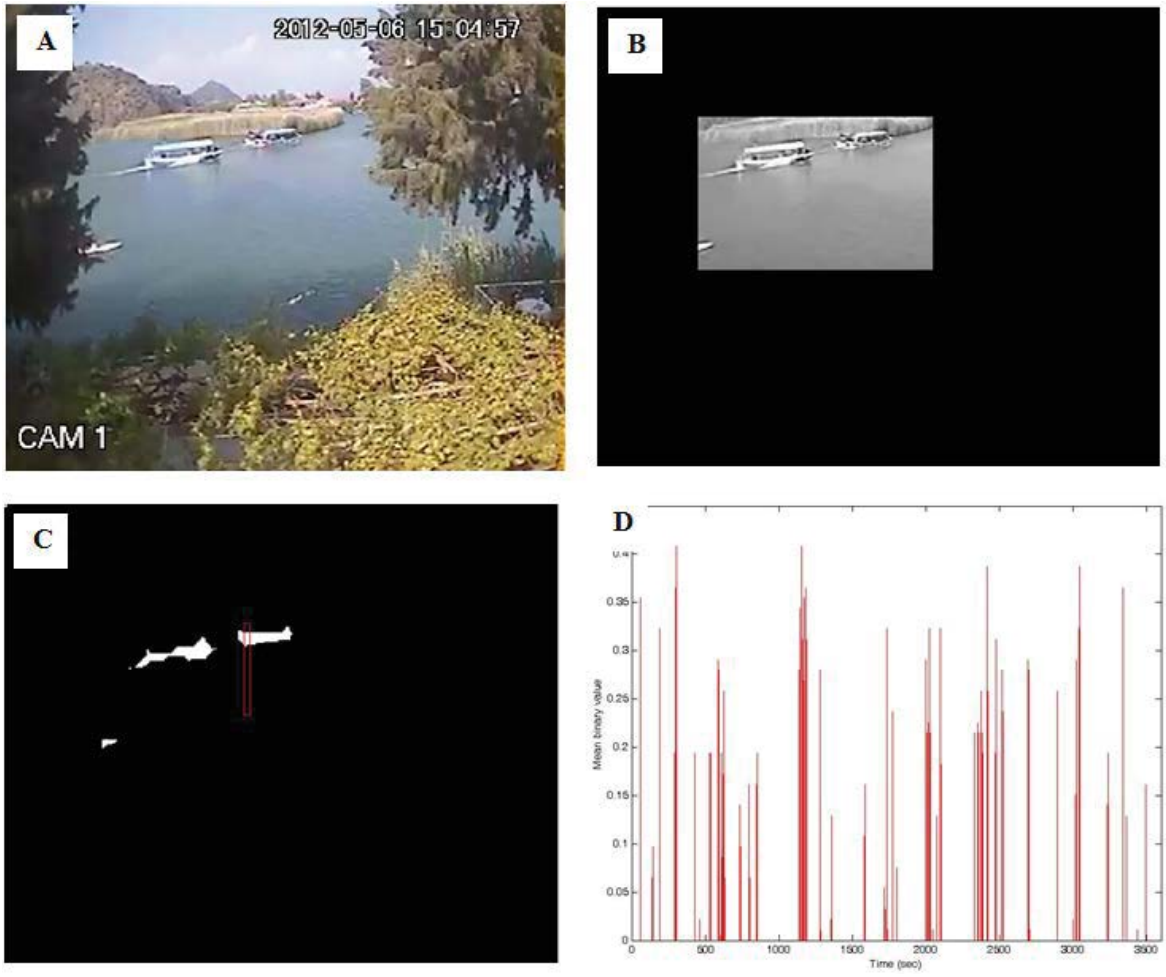
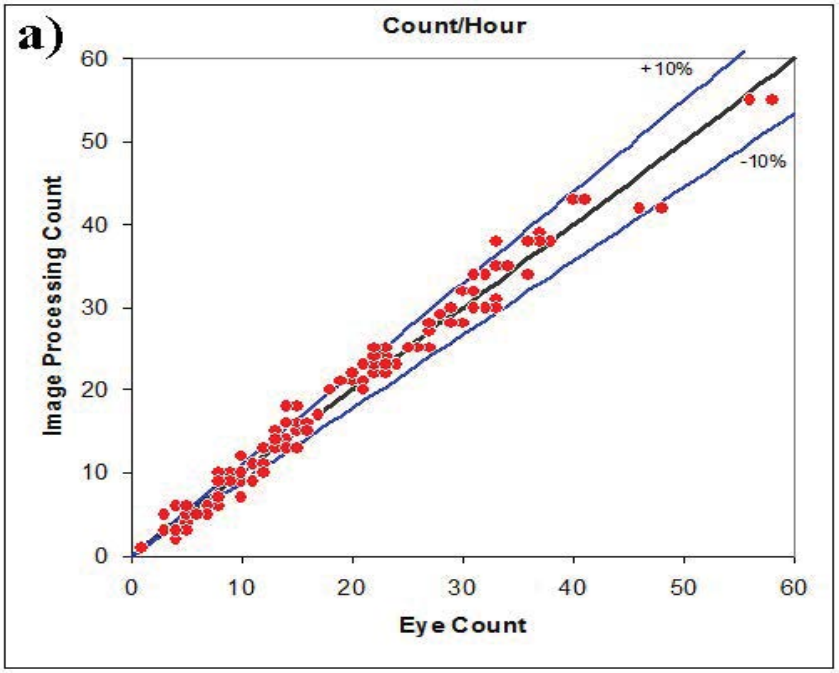


Figure 21: The main procedure of the boat counting algorithm. A) The RGB image of a

single frame. B) Masked greyscale image. C) Binarized image with a morphological closing. The red rectangle is the area of interest, within which mean values are calculated. D) The plot of mean values with respect to time.

The results of boat counting presented in this report covers the period of 03 March 2012 to 30 September 2013. First of all, eye count was performed on videos covering total of 112 hours and 8 days. Eye count values are then compared with the image processing counts in order to evaluate the accuracy of the automated counting system (Figure 22). Based on count/hour values, the scattering is mostly within 10% error range (Figure 22a) where count/day based scattering is even less than 5% (Figure 22b).



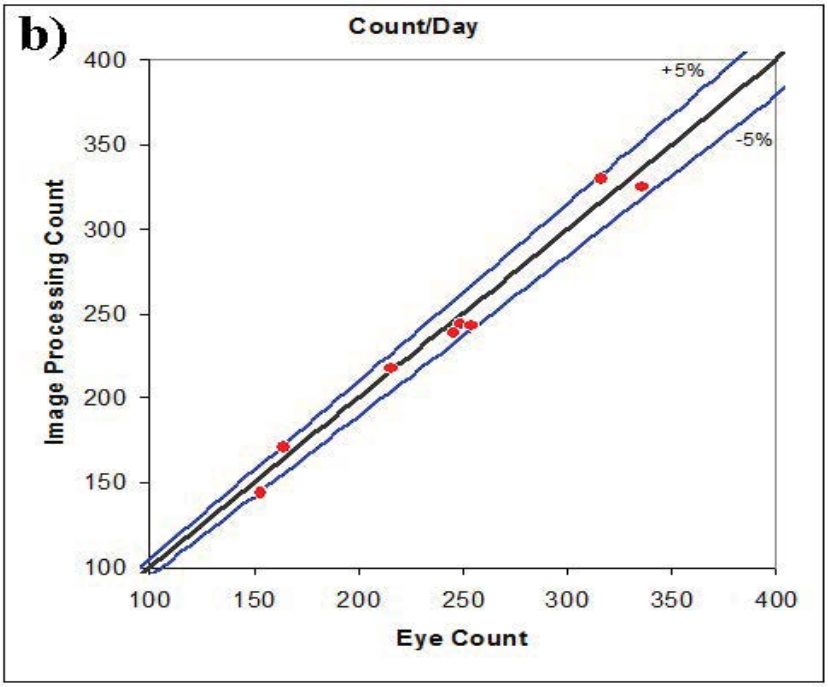


Figure 22: The accuracy of image processing counts.

Between 03 March 2012 and 30 September 2013 corresponding to duration of 577 days, 202033 boats were detected passing through the Dalyan channel. This number provides the average of 350,1 counts per day. Figure 23 provides the time series of the daily counts during the observation period. Accordingly, the traffic in the channel during the low tourism season (November-March) is about 50-150 boats per day. July and August are the busiest months, when there are approximately 700 counts per day. At the end of April 2013, the number of the boats start increasing rapidly again during the high tourism season and the boat numbers in 2013 are very similar to those in 2012 with more or less the same cycle. The religious and national holidays correspond to distinct peaks, with the one in the high tourism season reaching the maximum of 1006 counts per day on 9 August 2013. Assuming that a boat is counted twice while going in either direction during a day, 1026 counts correspond to 513 boats navigating through the channel and the delta during a single day. Recalling that the total number of licensed boats using the system is 491, the boats detected navigating on 9 August 2013 correspond to 104 % of all licensed boats. Figure 24 is prepared to find out if certain days of a week are busier than the others. During the low tourism season, the boat counts for Saturday and Sunday are slightly higher than the rest of the week. This is mainly due to the recreational use of the delta by the local residents. During the high season however, boat traffic is almost evenly distributed throughout the whole week days. Figure 25 provides the preference for navigation as to the time of the day. It appears that the busiest hours of the day are 10:00-11:00, 13:00-15:00 and

16:00-17:00. One should point out that the boat counts in Figure 23 contain boats boat going to or coming from the beach. The peak between 10:00 and 11:00 is due to transfer of tourists and visitors from Köycegiz-Dalyan Towns to the beach. The traffic between 13:00 and 15:00 could be due to boats moving in either direction (e.g. to and from the beach). The boats returning from the beach back to the towns provide the peak observed between 16:00-18:00.

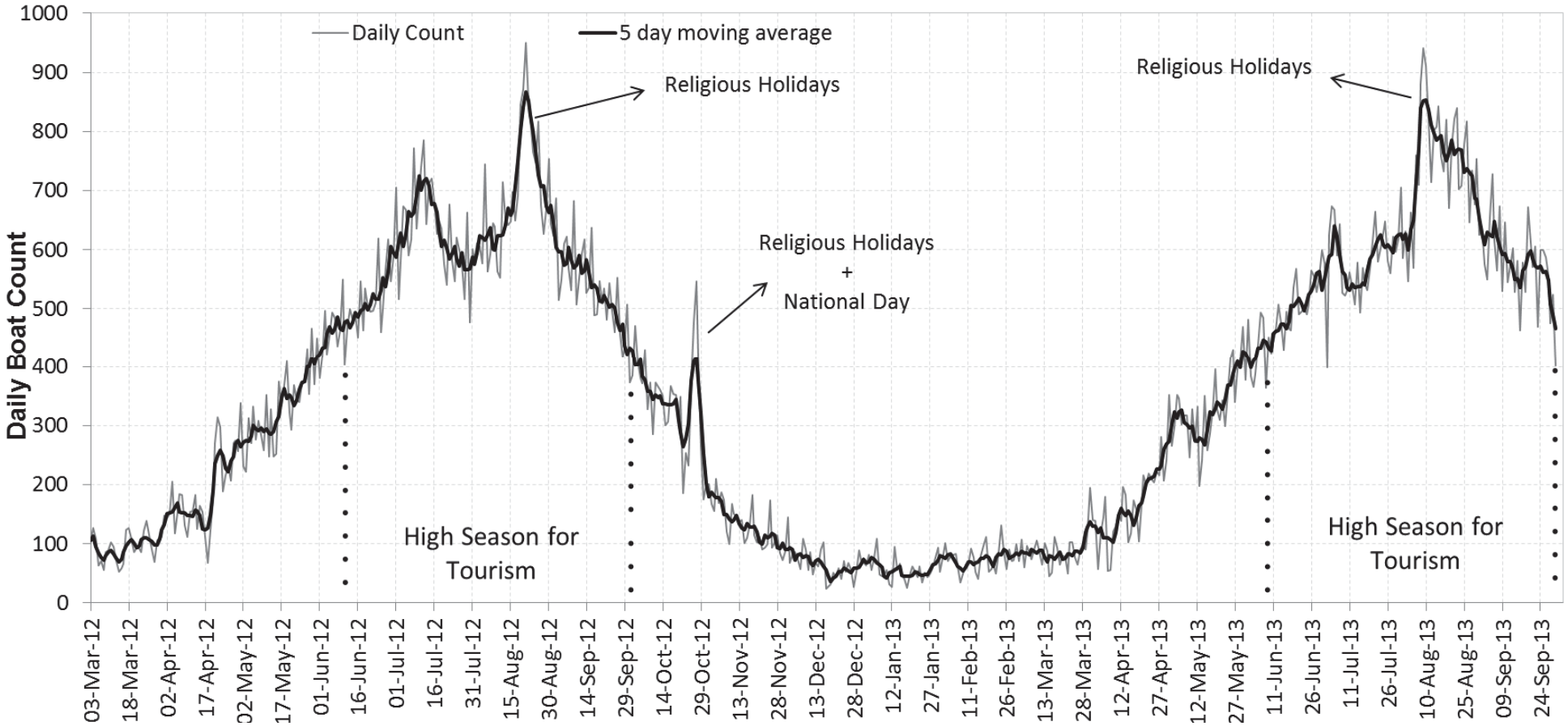


Figure 23: Plot of number of boats per day from 1 April 2012 to 30 September 2013.

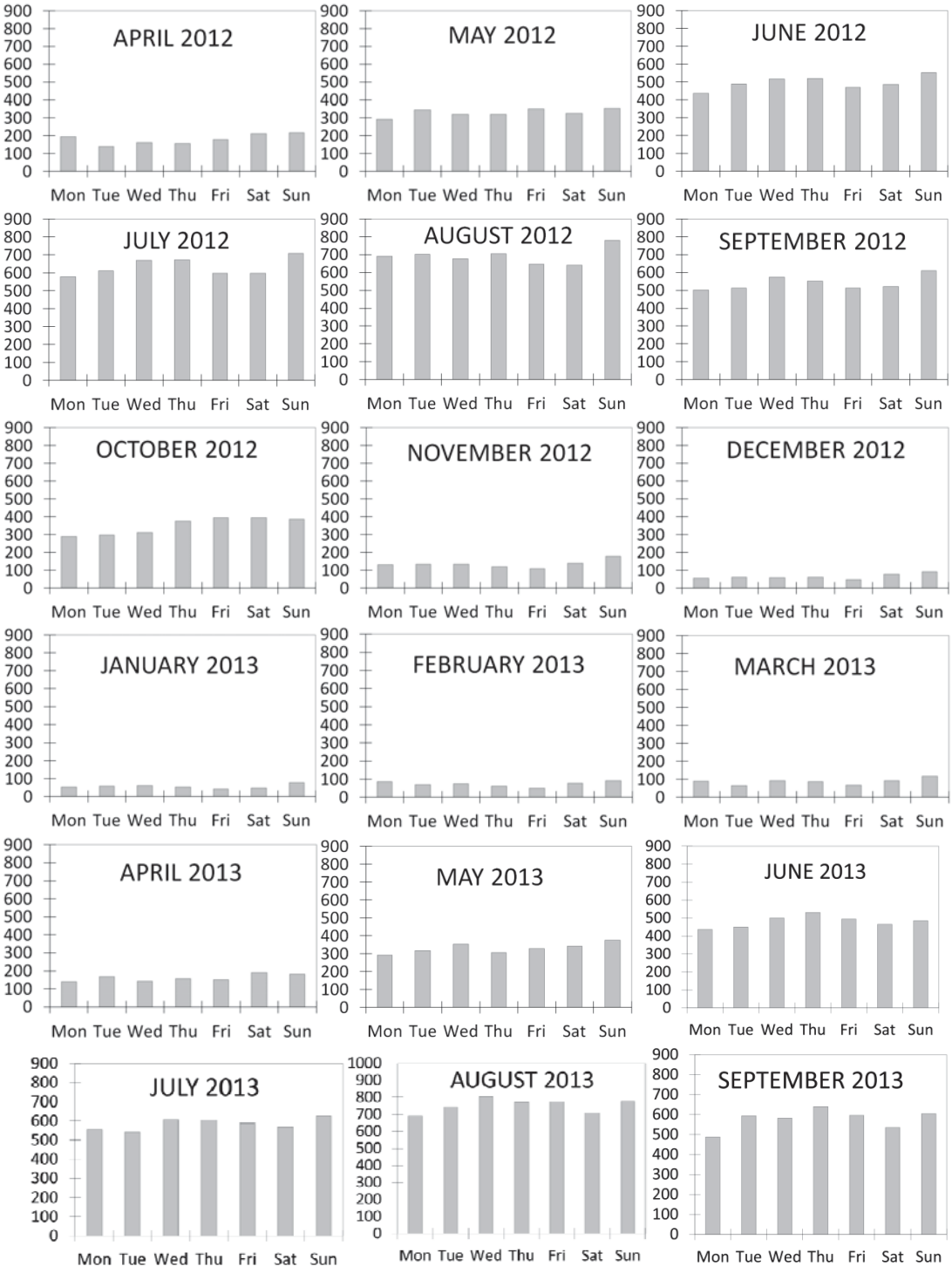


Figure 24: The number of average daily boat count per the days of week.

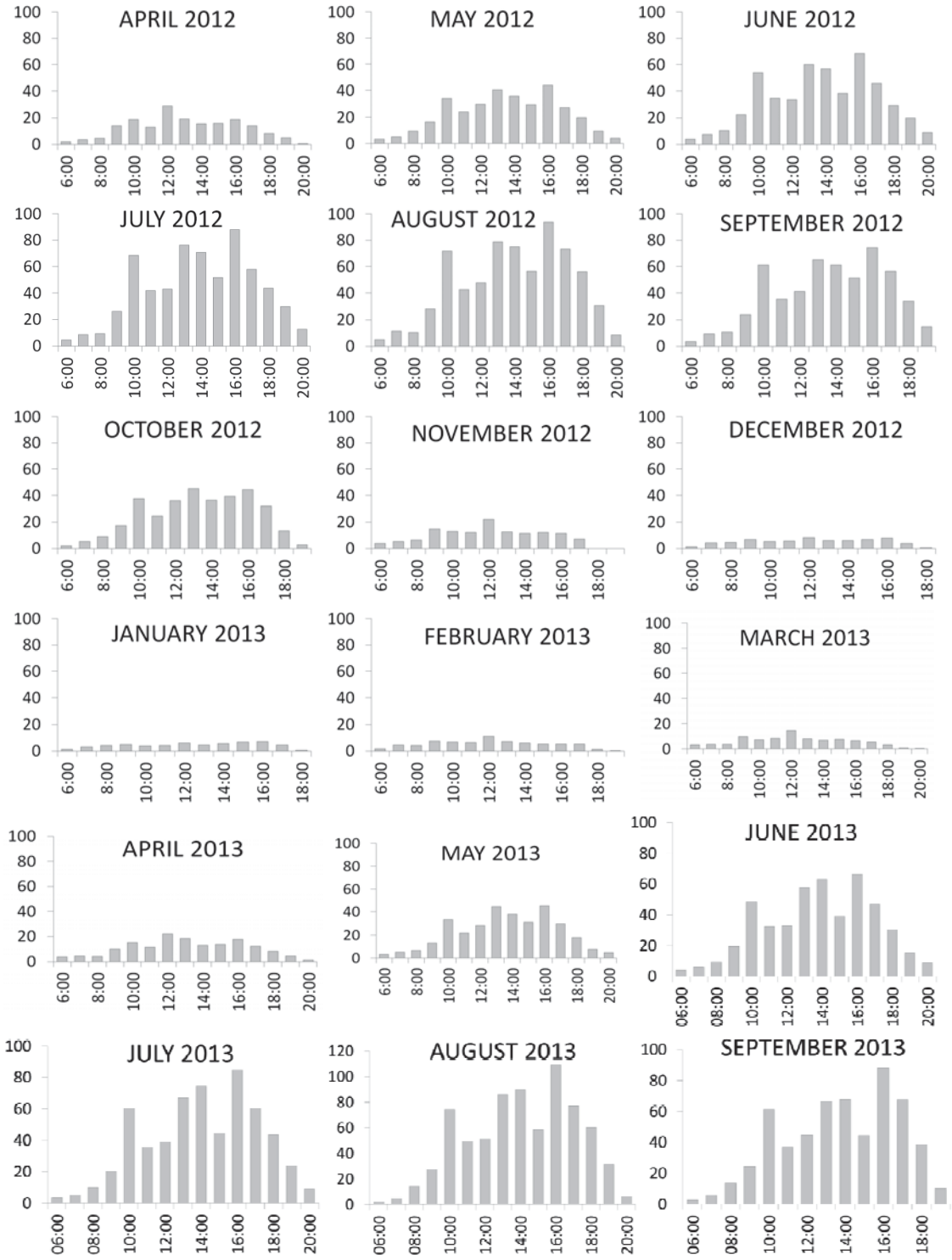


Figure 25: The number of average hourly boat count per hours of a day.

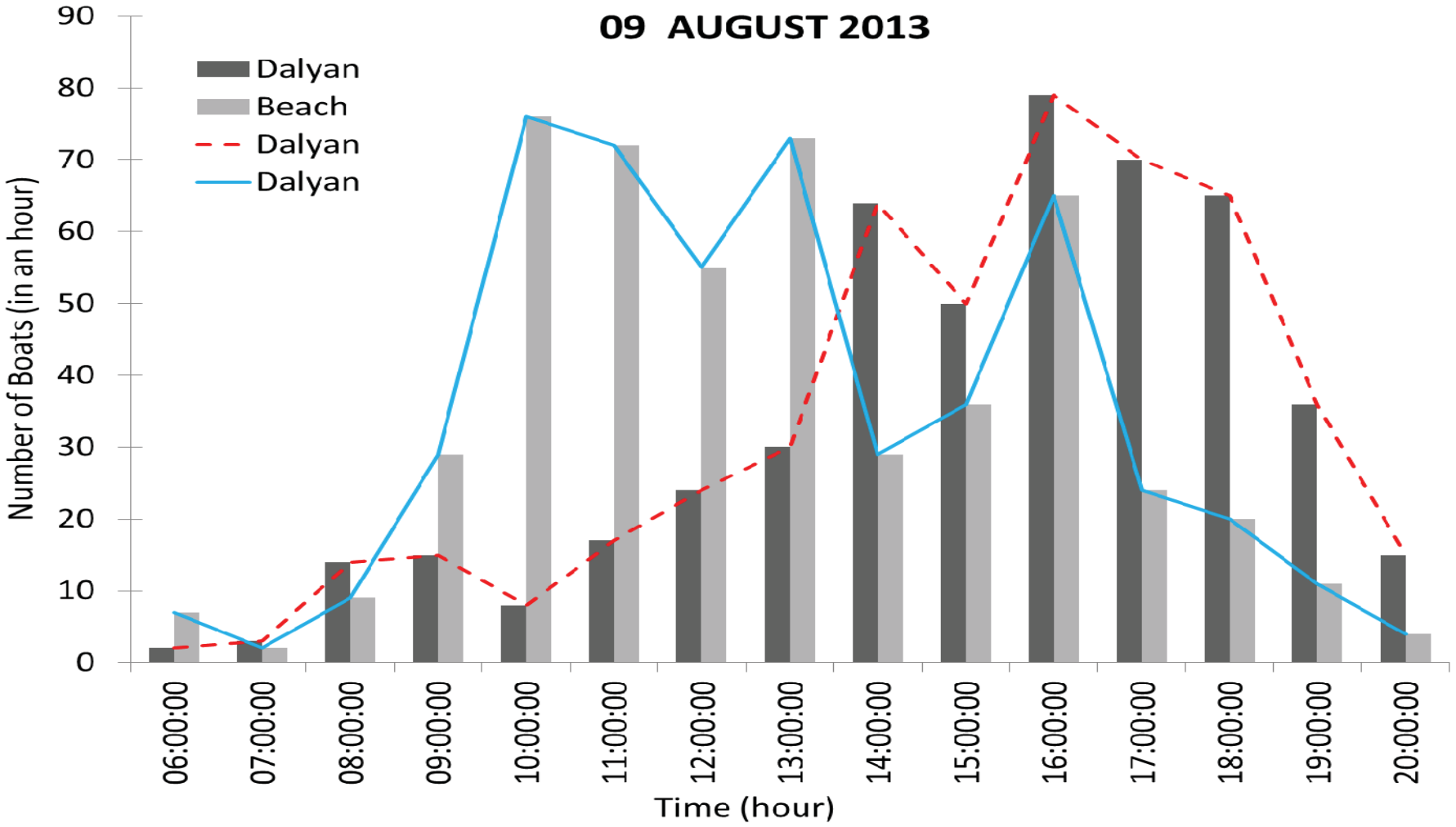


Figure 26: The hourly boat count per direction to Iztuzu Beach and to Dalyan.

The video images of 9 August 2013, when we had the highest number of boat counts (1026 boat counts), were visually studied to separate the boats going to the beach or going to the towns (Dalyan). The results are presented in Figure 26 as two plots, one corresponding to boats navigating in the direction of the beach and the other in the direction of the Town of Dalyan. Two graphs clearly tell us that tourists are carried to the beach in the morning from 9:00 to 13:00, and also in smaller numbers after the lunch break. A part of the tourists return back to the town early in the afternoon (at 14:00 hours) and the remaining larger part returns later in the afternoon during 16:00 and 18:00.

Water quality impacts, species disturbance and bank erosion are three major adverse impacts of heavy boat traffic in the channel and the lagoons. Figure 27 illustrates the scale of bank erosion caused by the turbulence generated by boat engines. Obviously, this is a significant threat in the long run for the lagoon ecosystem.

Figure 27: Bank erosion caused by the water motion generated by propellers (October 2013)

8.4 Fisheries

According to data records of the fisheries cooperative over the period 2003 to 2013, the annual fish catch and mariculture showed variations (Figure 28). The total fish landings and production (wild catch and mariculture) was around 200 tons during 2005 - 2008. The annual total landings and production increased from 232 tons in 2008 to 589 tons in 2009, and peaked at 633 tons in 2010. The reason for this sharp, remarkable increase is not known. In the following three years, the annual tonnage dropped, but remained higher than the figures for 2004-2008. Gray mullet is the main commercial fish caught. Eel has also been an important fish species caught until recent years. The cooperative also produces and sells caviar of gray mullet. The cooperative utilizes ponds placed in the Sulungur lagoon for mariculturing sea bream and sea bass at medium scales.

During the period between 2003 and 2013, the great majority of the fish caught was gray mullet. Sea bream, sea bass and eel are the other species, but in much less quantities (Figure 29). In 2013, 392.9 tons of gray mullet, 0.4 tons of sea bream, 1.7 tons of sea bass, 5.4 tons of juvenile sea bream, 0.6 tons of striped sea bream and 0.8 tons of other species were caught (Table 7). Eel catch was realized only 11 kg in 2013 due problems of marketing. A total of 38.4 tons of maricultured fish were produced in net cages (12.8 tons sea bass and 25.7 tons of sea bream) (Figure 30). Caviar production was 424 kg in 2013.

Table 7. The annual tonnages of wild catch and cultured fish species in 2013.

Species	Annual catch/production (tons)
Gray mullet	392.9
Sea bass (Maricultured)	12.8
Sea bream (Maricultures)	25.7
Juvenile Sea bream (wild	5.4
Striped sea bream (wild catch)	0.6
Sea bass (Wild catch)	1.7
Sea bream (Wild catch)	0.4
Caviar	0.4
Other species	0.8

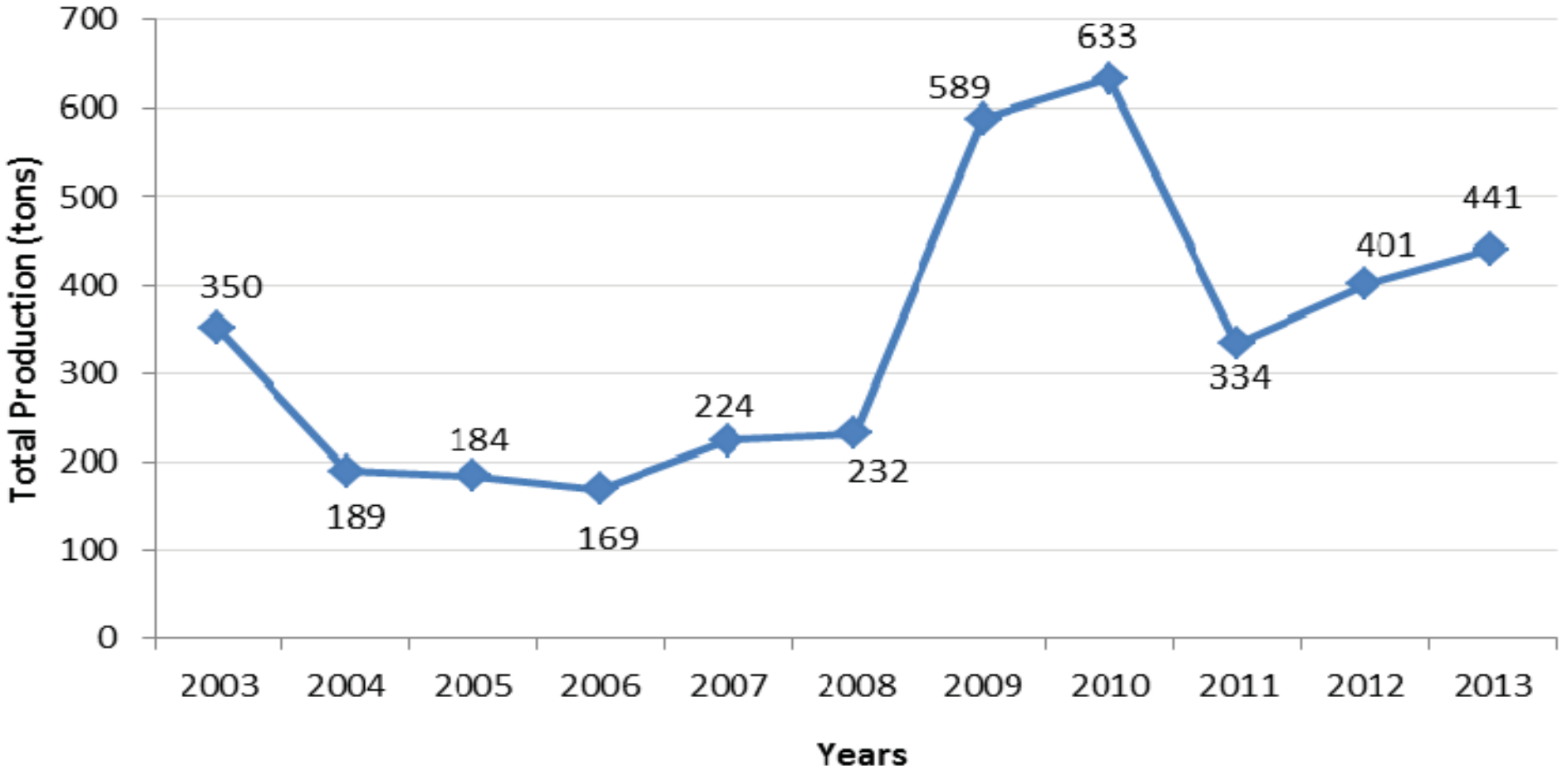


Figure 28. The annual wild catch + mariculture production of fish during (2003 - 2013).

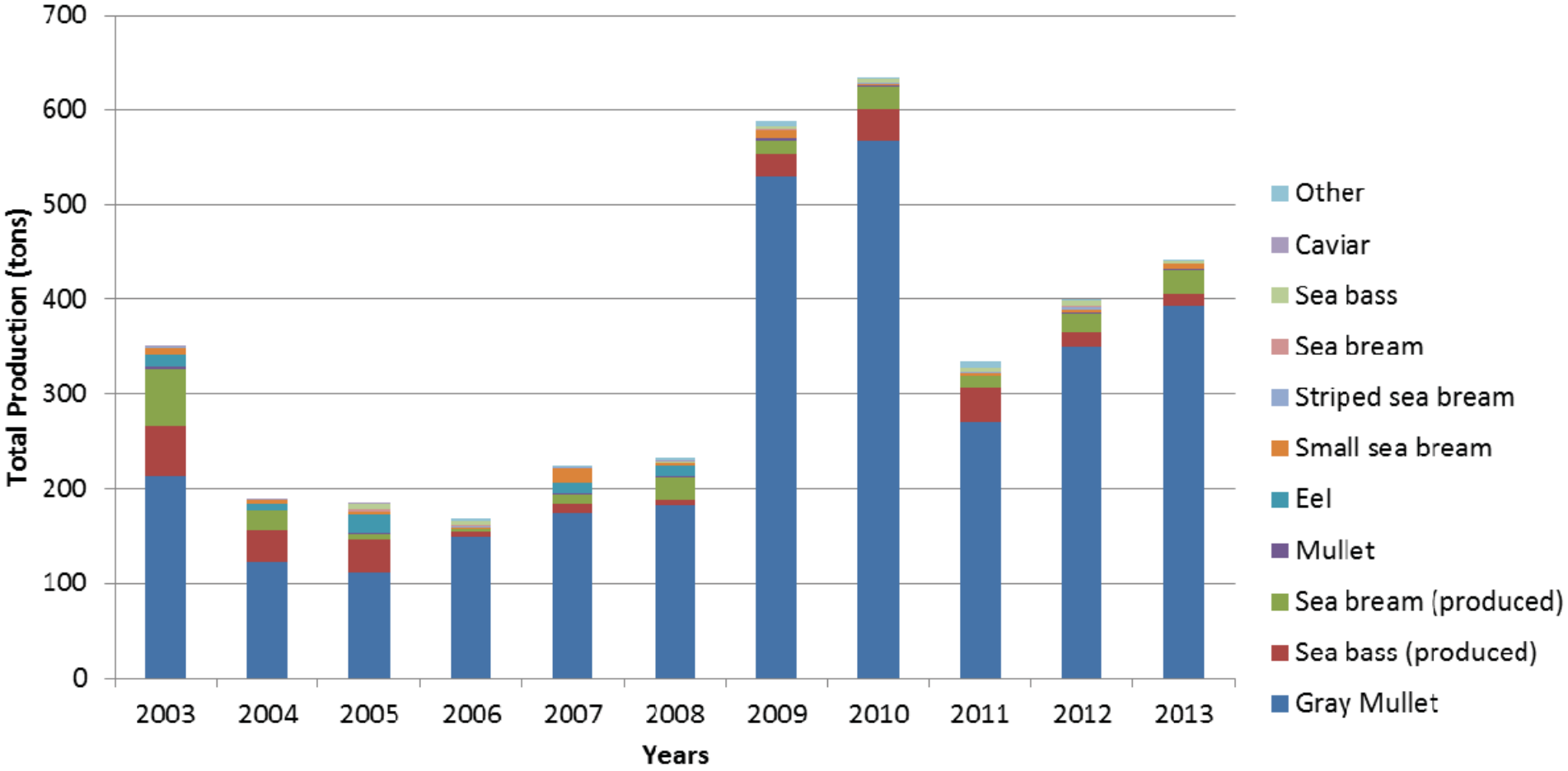


Figure 29. Annual wild catch and mariculture production according to fish species (2003 2013).

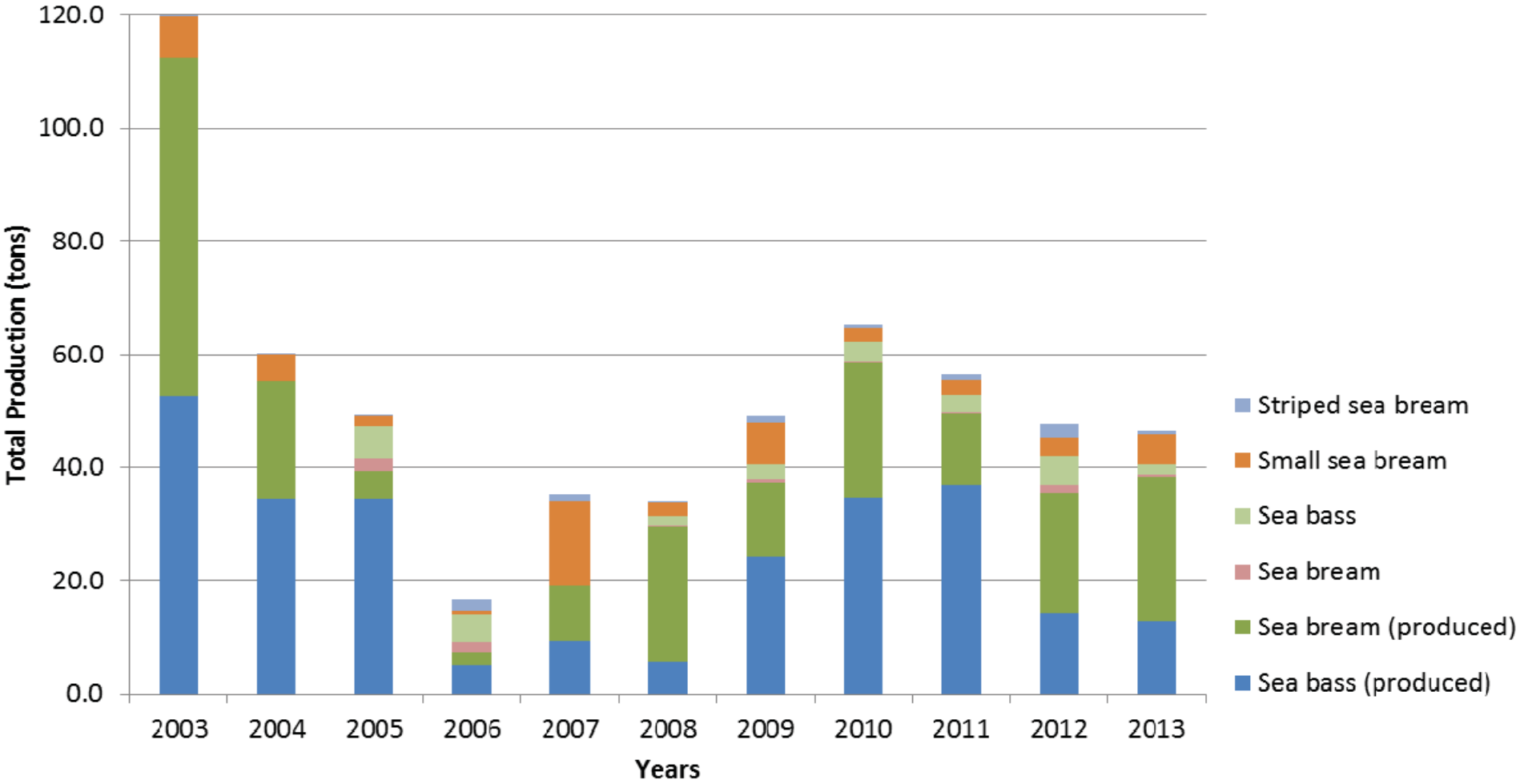


Figure 30: Wild catch and mariculture production of sea bass and sea bream (2003 - 2013).

The 11-year long annual fish statistics (2003-2013) of Dalko indicates that the fishery in the delta-lagoon system is rather stable, with positive surprises in the years of 2009 and 2010.

8.5 Water quality

Several water quality parameters have been systematically monitored by a private company commissioned by the SPA Agency starting with 2006. The monitoring stations are distributed to Köyceğiz Lake, Dalyan Channel, the delta lagoon system and the sea . The parameters monitored comprise dissolved oxygen, salinity, total N, total P, total coliform, temperature, pH, fecal coliform, fecal streptococci and Secchi depth. Measurements of each parameter at all stations were plotted as time series in separate graphs to find out both the temporal and spatial changes.

The water quality measurement results are presented through the Figures 31-42. The measurements comprise Dissolved Oxygen, Salinity, total N, total P, total Coliform, temperature, pH, fecal Coliform, fecal Streptococci and Secchi depth. After the increased controls on boats and the industrial facilities in the catchment starting from the end of 2009, water quality seems to be improved in terms of increased dissolved oxygen and decreased total and fecal Coliform. However, a sharp increase of coliform count in 2013 is observed. The reason for this increase is not known.

As an indicator of water quality, variation of dissolved oxygen (DO) measurements at monitoring locations within the lake, channel and the lagoons are shown in Figure 31. Water of the Köycegiz Lake is basically fresh whereas the water in the lagoons and the channel is brackish with salinity decreasing from the sea water value of 38 %o at the mouth of the delta to 1 to 2 %o at junction with the Köycegiz Lake. The monitoring locations are marked on the insert map.

The dissolved oxygen is seen to show fluctuations basically due to seasonal and climatologic changes as well as the intensity of human activities (most importantly agriculture). One cannot detect a pronounced spatial difference, indicating homogeneity of water quality in the system. For most of the time, the DO level is from 7 to 8 mg/lt and occasionally drops below 6 mg/lt. In winter months, when the fresh water runoff from the creeks discharging into Köycegiz Lake is high and the scale of agricultural activity is low, the DO levels increase.

As a measure of pressure from human activities, the temporal and spatial

changes of total coliform bacteria concentration are displaced in Figure 35. For this parameter, spatial changes are more pronounced and we see significantly larger coliform concentrations at the monitoring station in front of the Town of Köyceğiz (station KYYS035). In the period from 2006 to 2010, the coliform level is seen to exceed many times the limit for bathing water standards. Towards the end of 2009, sharp decreases of coliform concentrations are observed for all stations. One may guess that this could be the result of the sewage collection system and the treatment facility. However, the waste water management facilities had already been in use for several years before 2009 and thus the reason for the sharp decrease is not available.

In conclusion, the water quality of the Köycegiz-Dalyan water system could be classified as vulnerable due to the high level of enclosureness (Özhan, 1988), but not very critical. The summer season is periodically seen to be of higher concern.

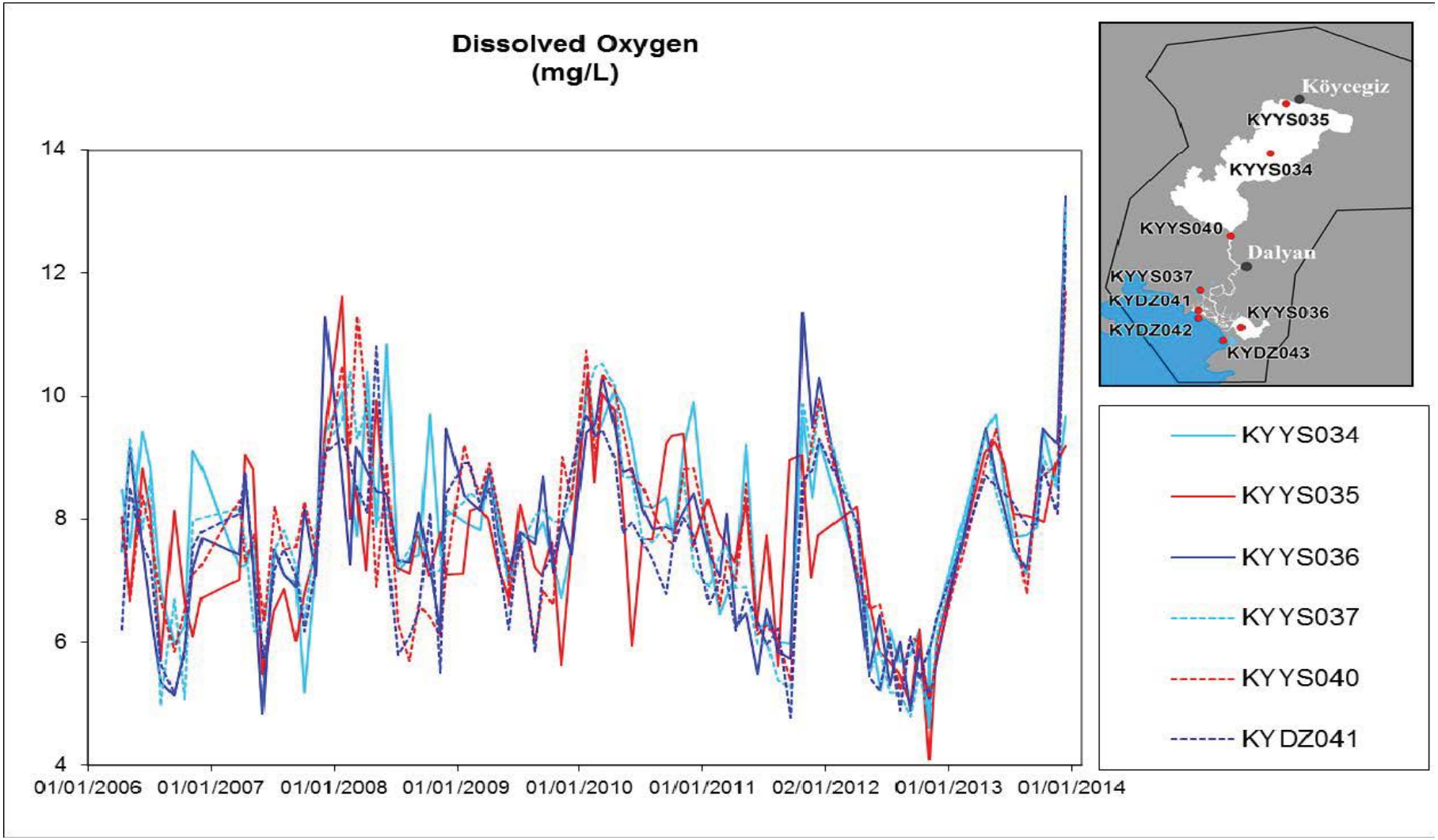


Figure 31: Dissolved oxygen variation of inland waters.

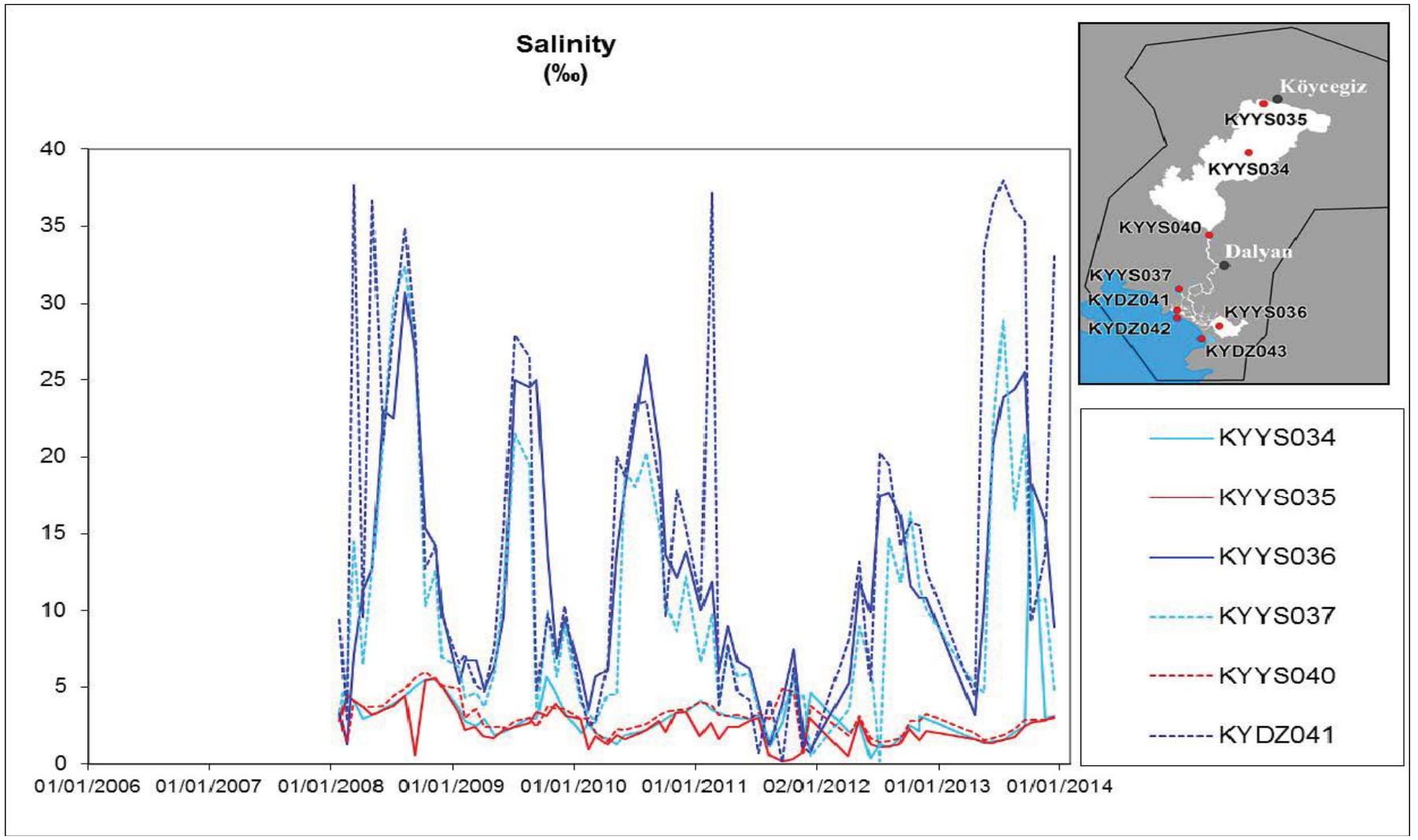


Figure 32: Salinity variation of inland waters.

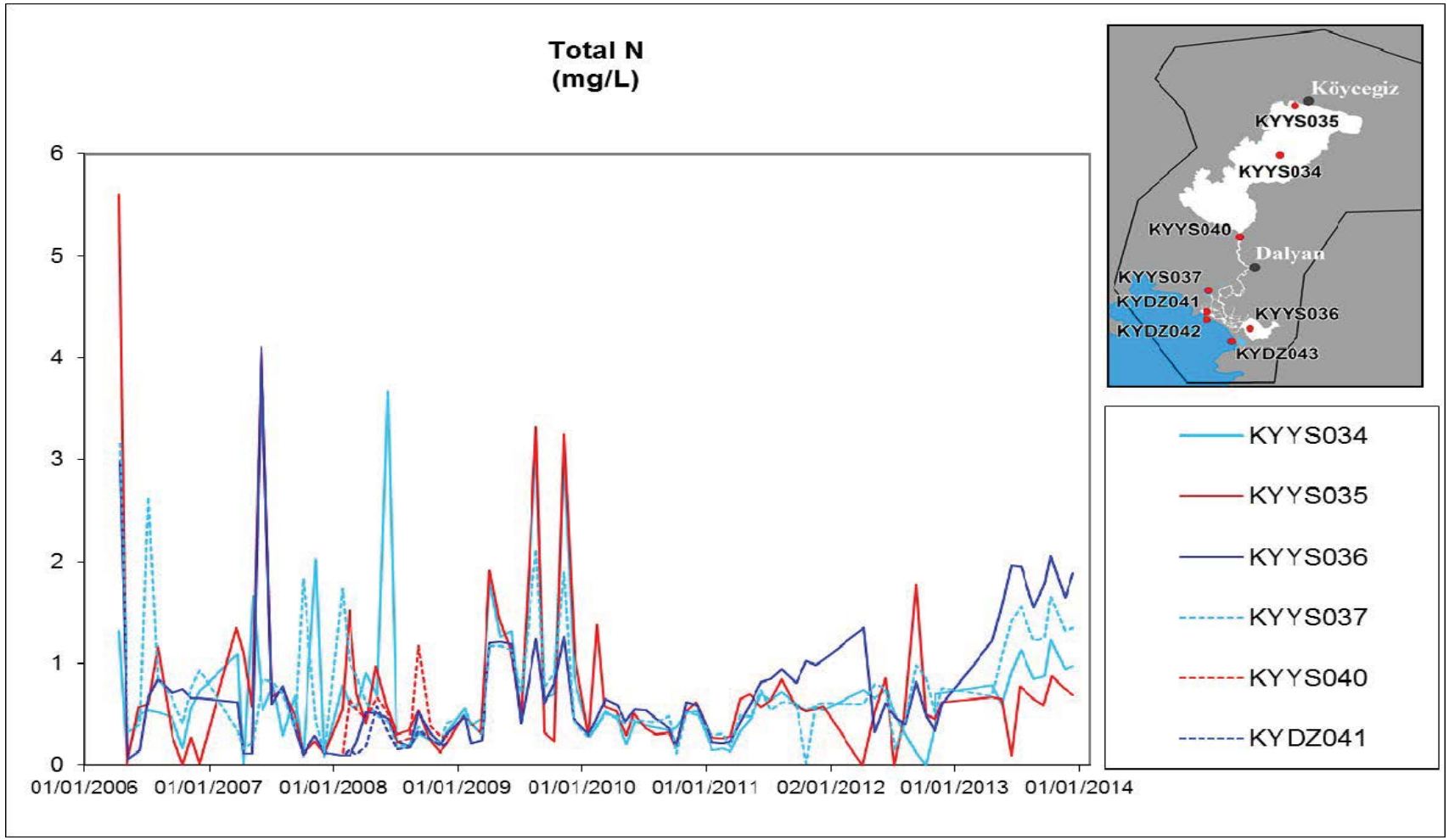


Figure 33: Total nitrogen variation of inland waters.

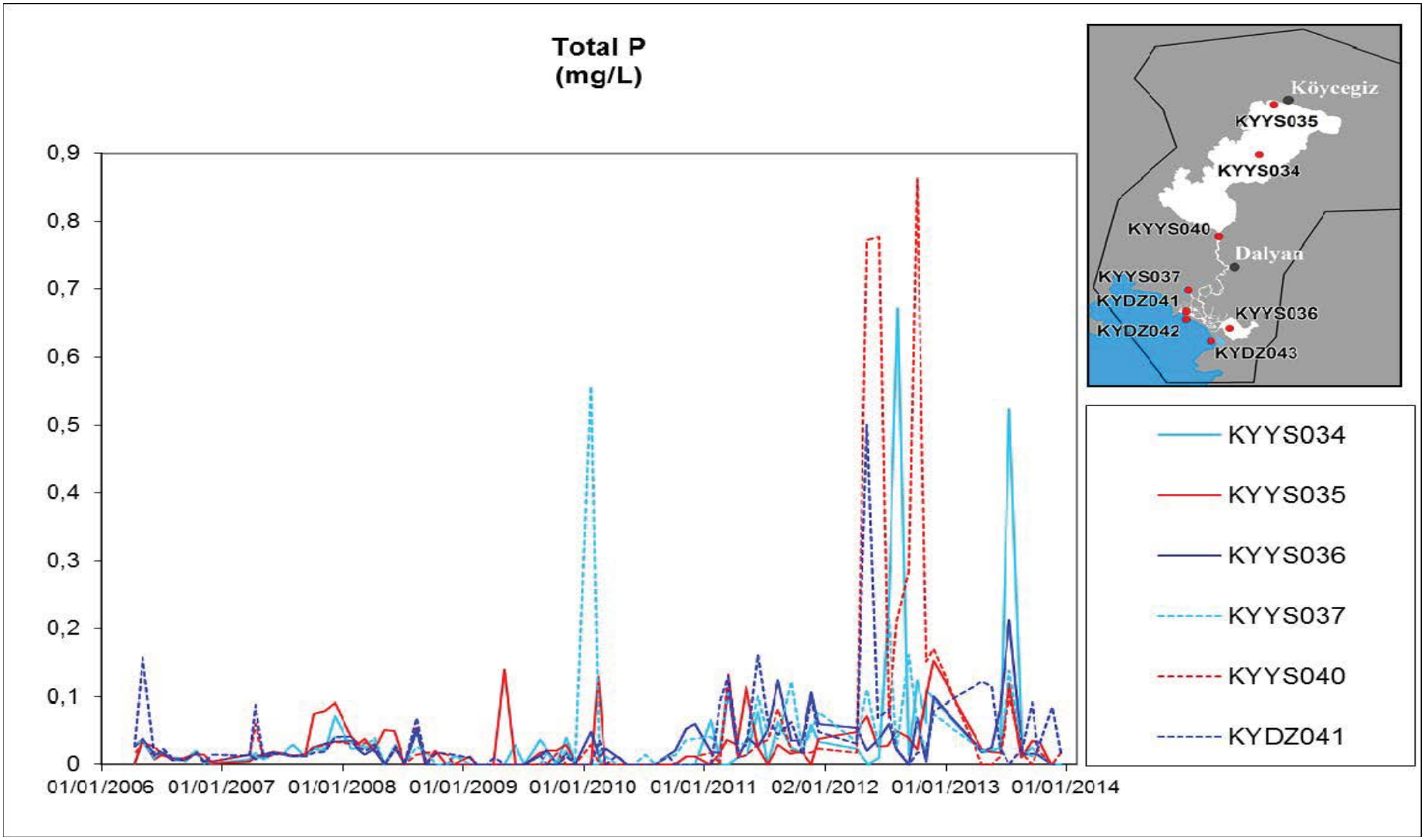


Figure 34: Total phosphorus variation of inland waters.

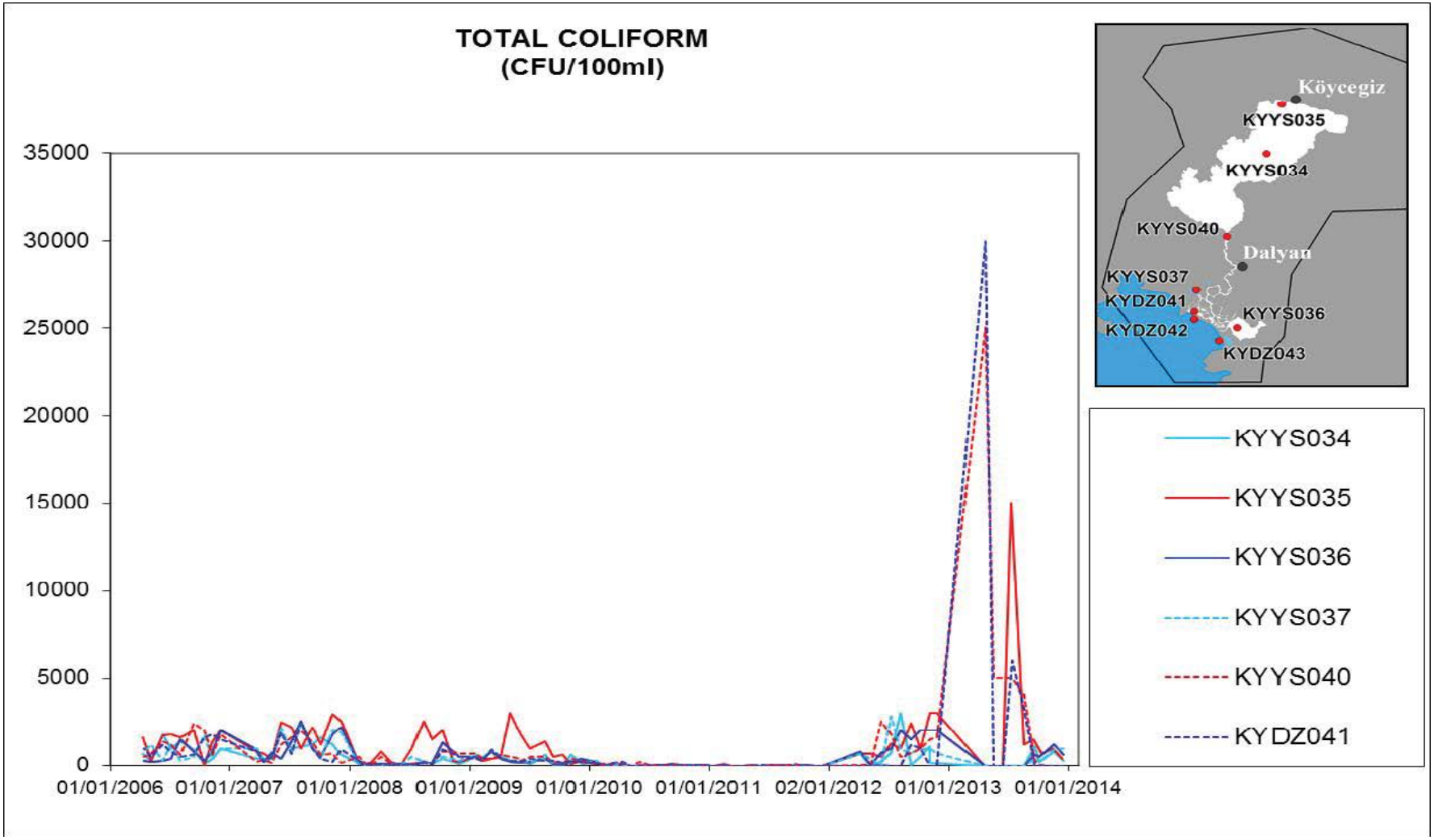


Figure 35: Total coliform variation of inland waters.

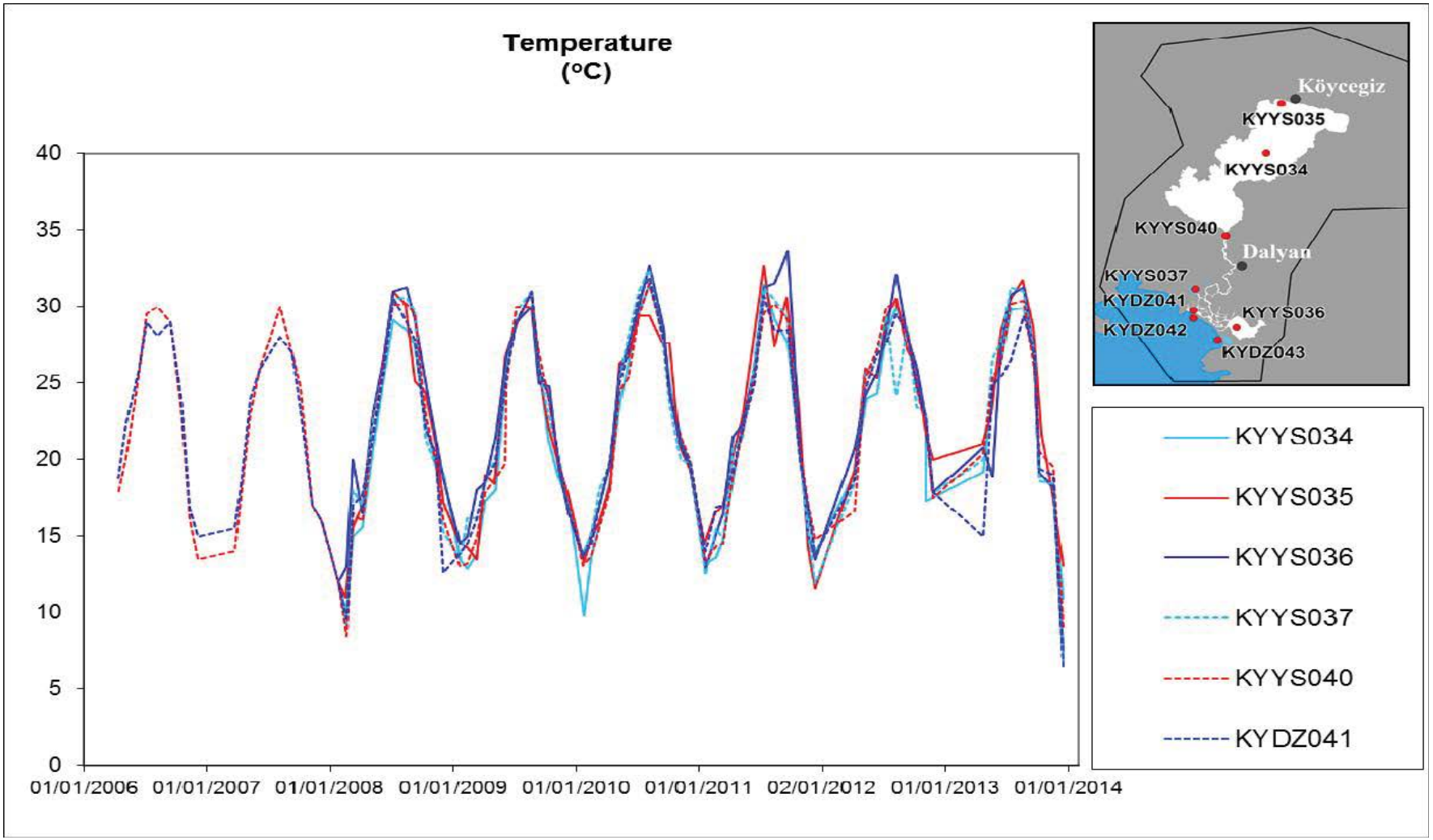


Figure 36: Temperature variation of inland waters.

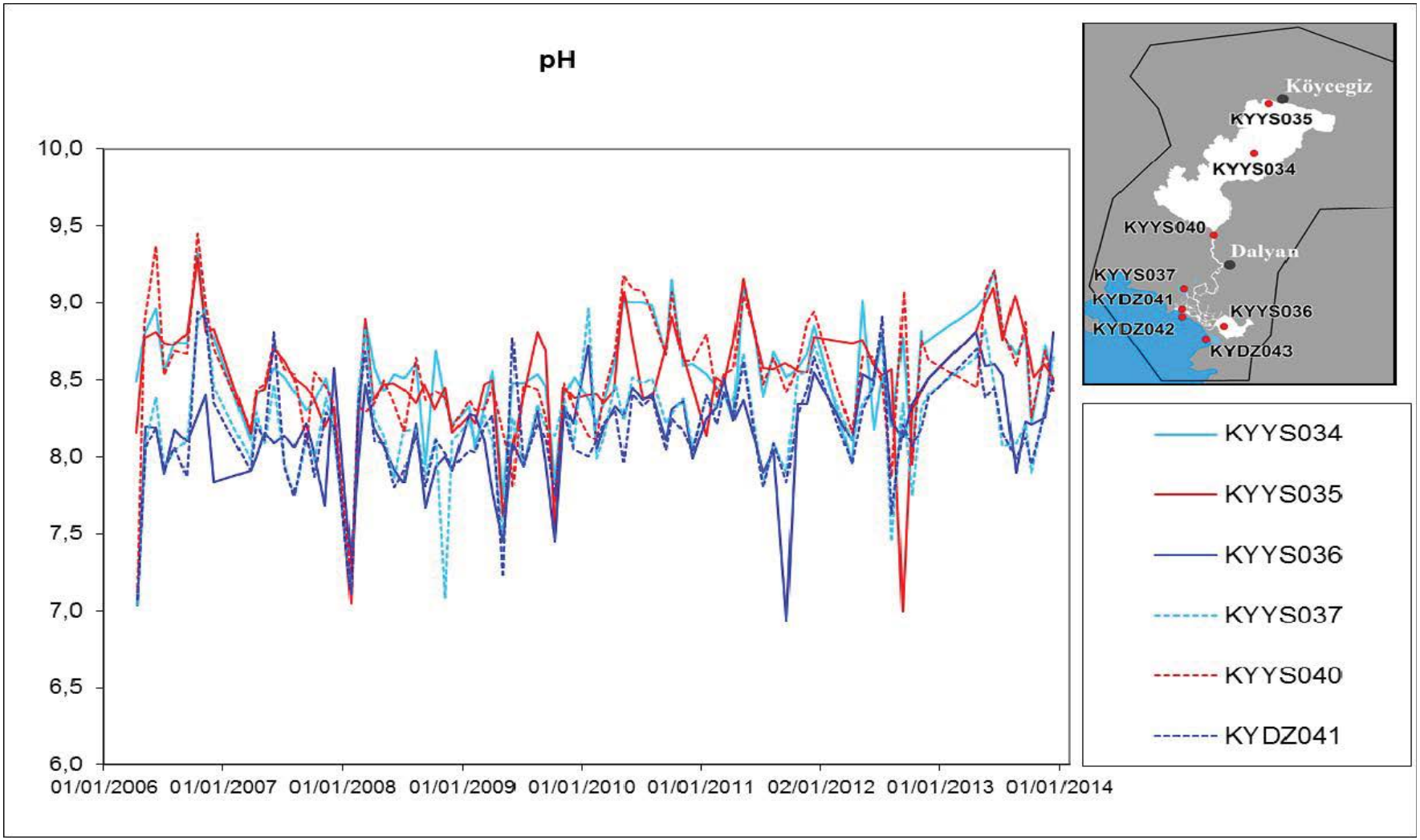


Figure 37: pH variation of inland waters.

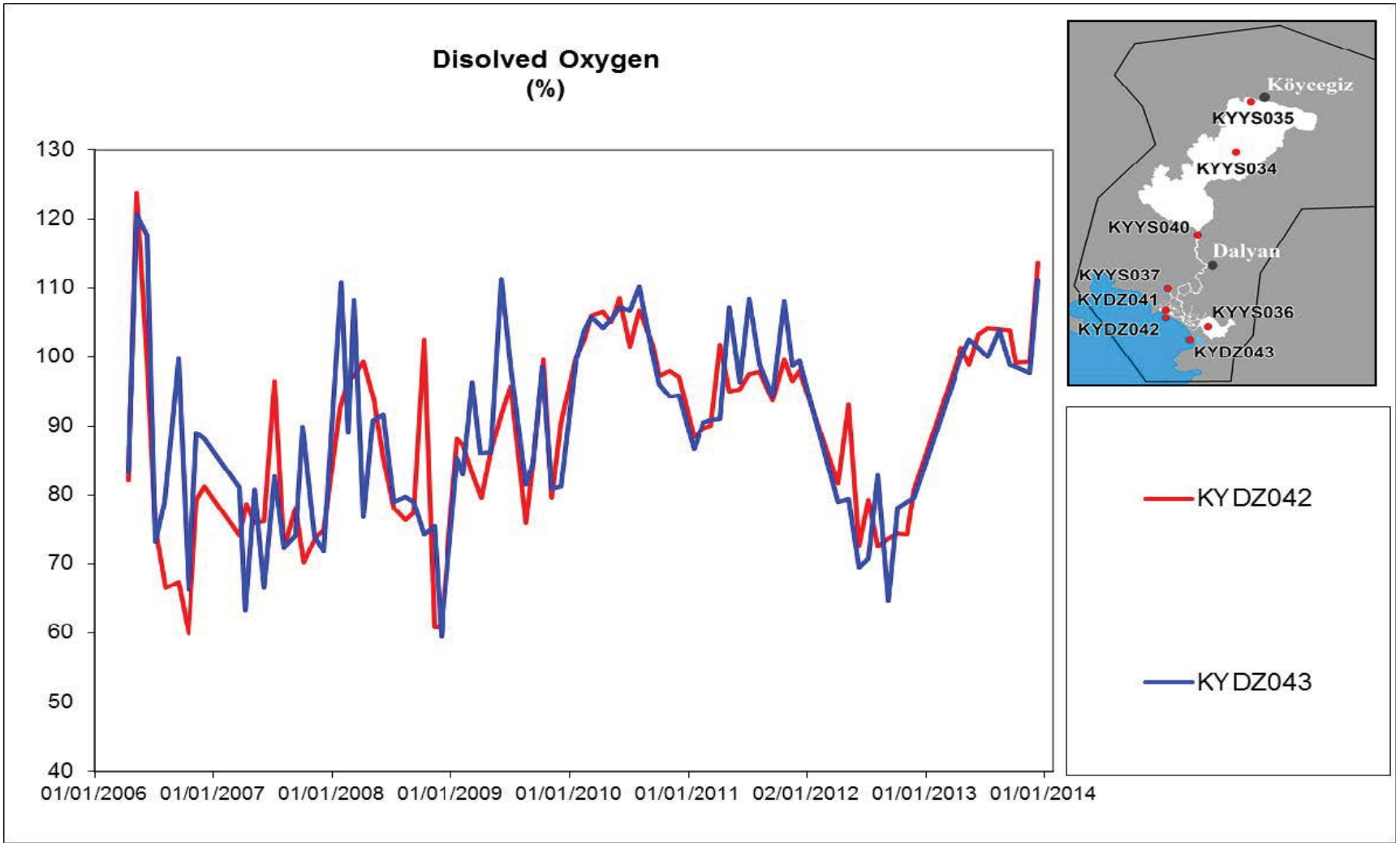


Figure 38: Dissolved oxygen variation of shore waters.

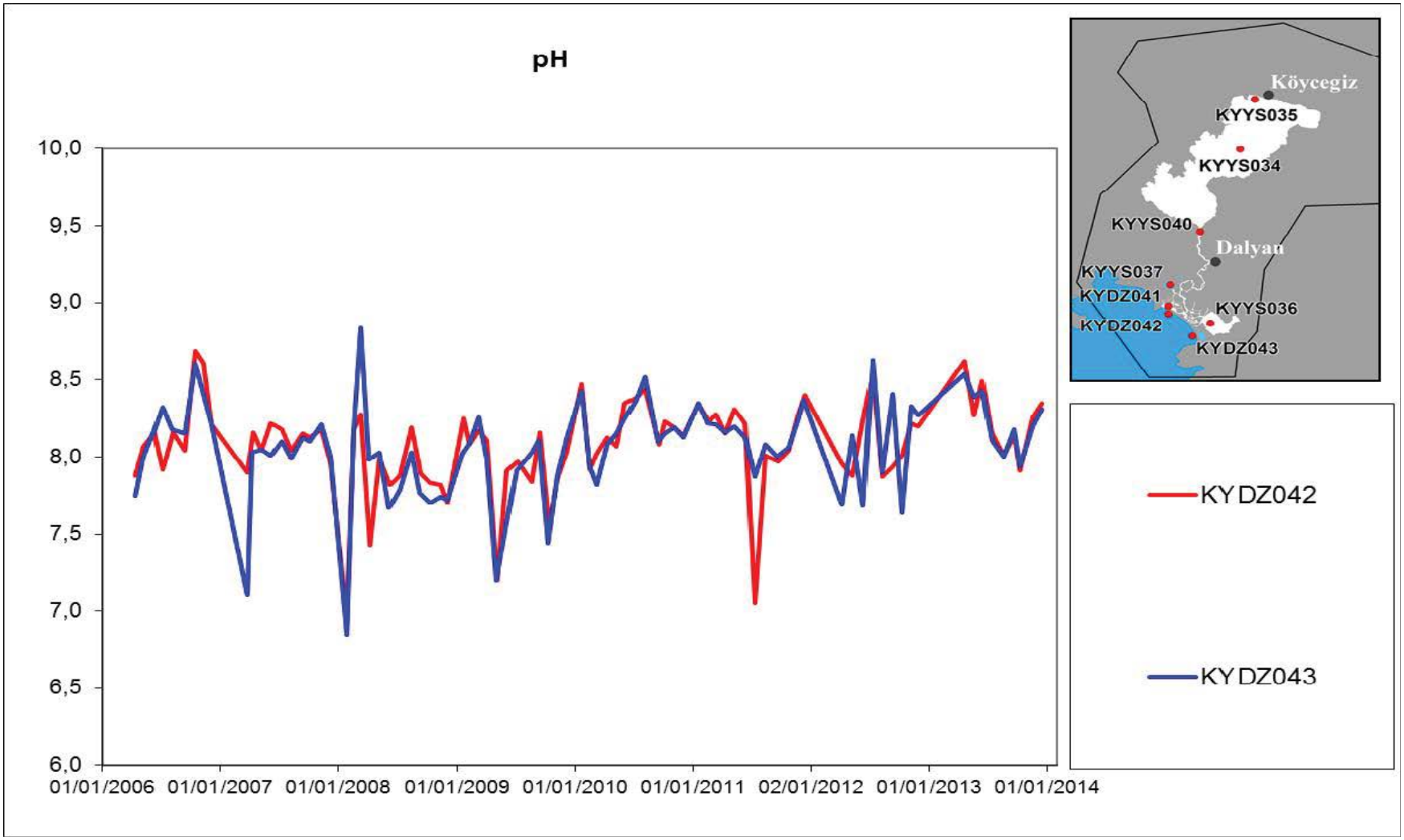


Figure 39: pH variation of shore waters.

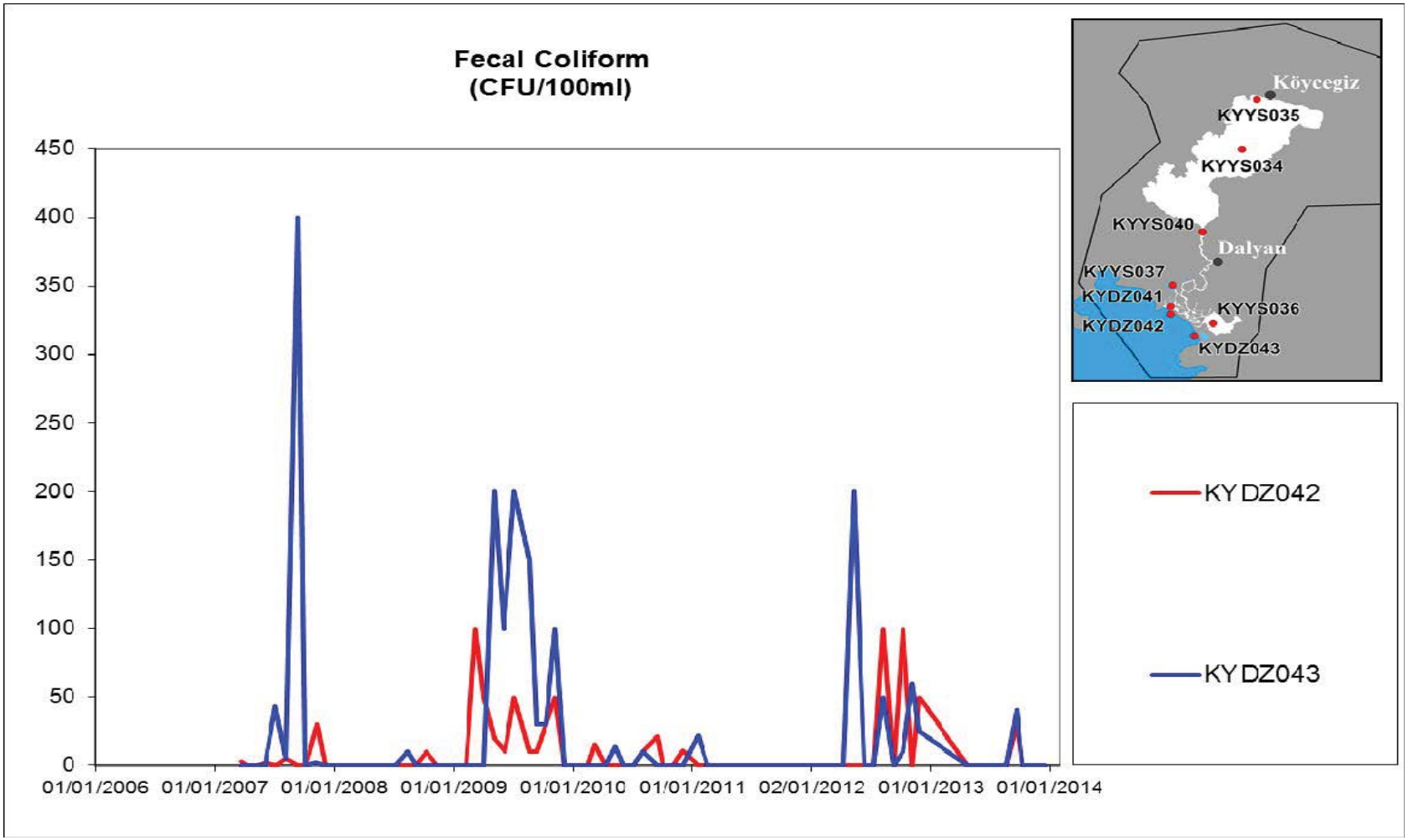


Figure 40: Fecal coliform variation of shore waters.

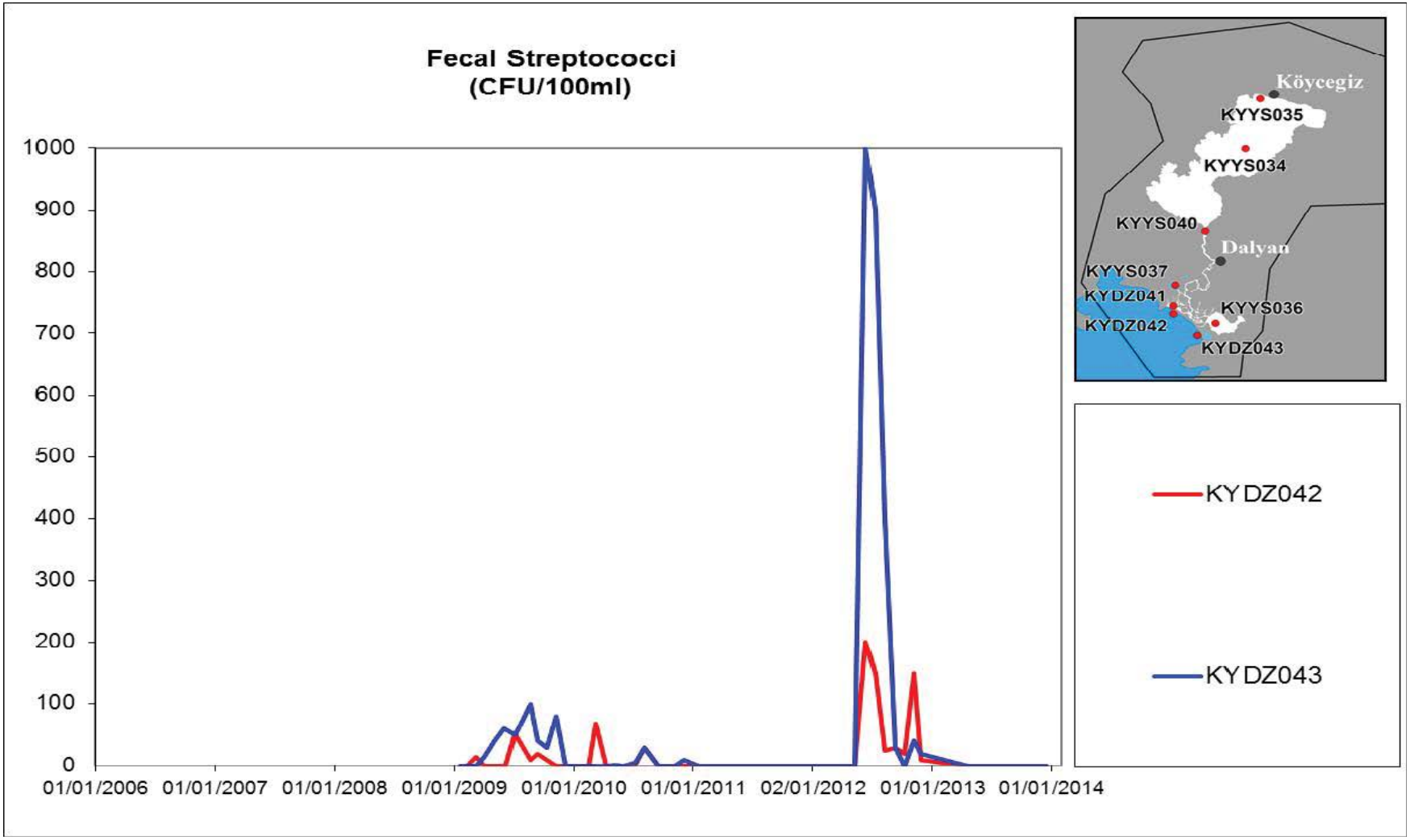


Figure 41: Fecal streptococci variation of shore waters.

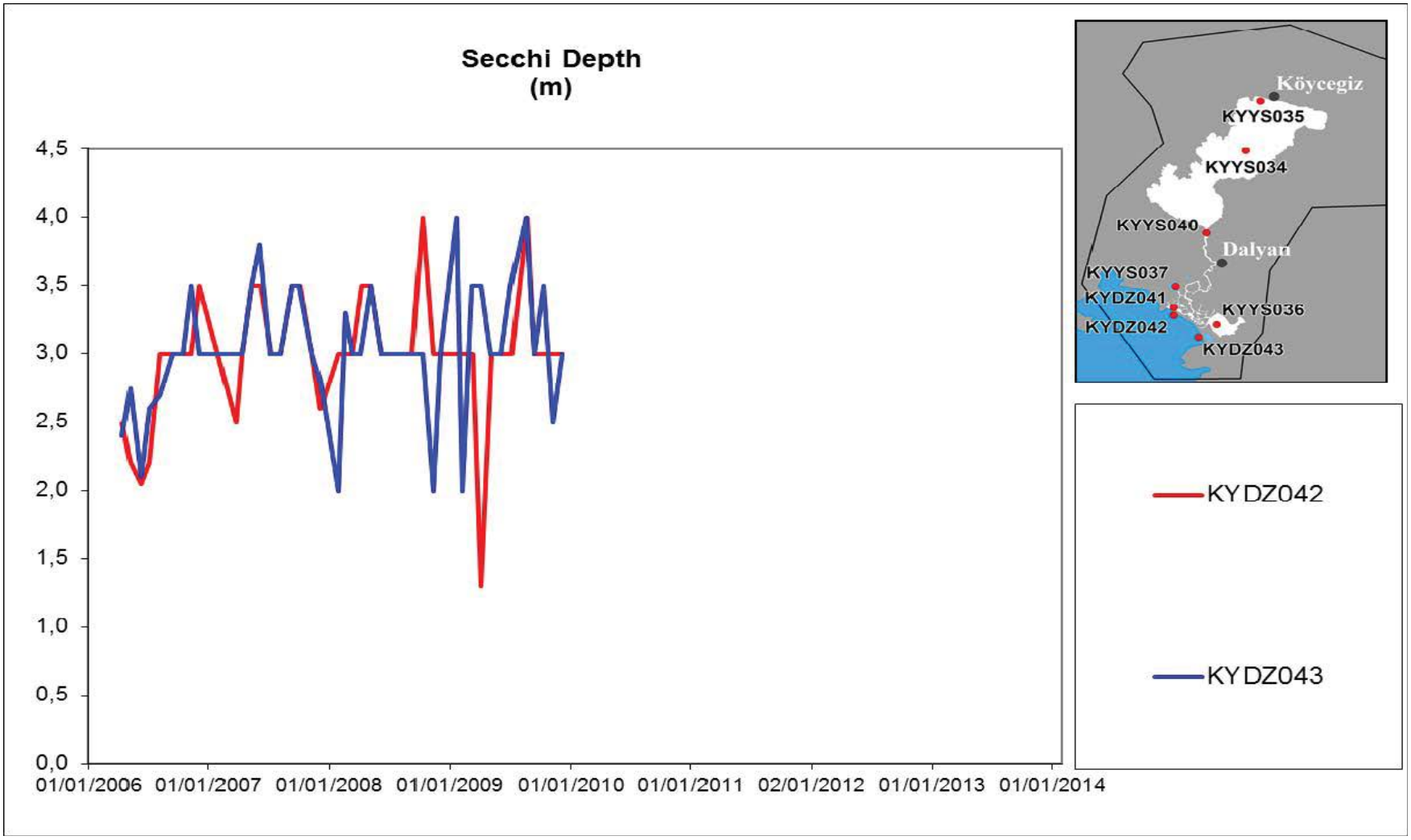


Figure 42: Secchi depth measurements in shore waters.

8.6 Sea Turtle Monitoring

The seasonal monitoring of the nesting turtles and hatchlings has been sponsored by the Ministry of Environment and Urbanism on yearly project basis since 1988 and the monitoring is carried out by teams belonging to Universities or specialized companies. Figure 43 presents the annual number of sea turtle nests since 1988. It is observed that, during the recent years, the number of nests has been slightly increased and getting more regular within sequential years. In 2013 there is a rapid increase observed in the Dalyan/Iztuzu Beach. These are probably due to the increased sea turtle population as a consequence of long-term conservation efforts. Moreover, it is seen that the number of hatchlings who can reach the sea has also been increasing during the recent years and the success on reaching the sea has been increased to 85%. (Figure 44).

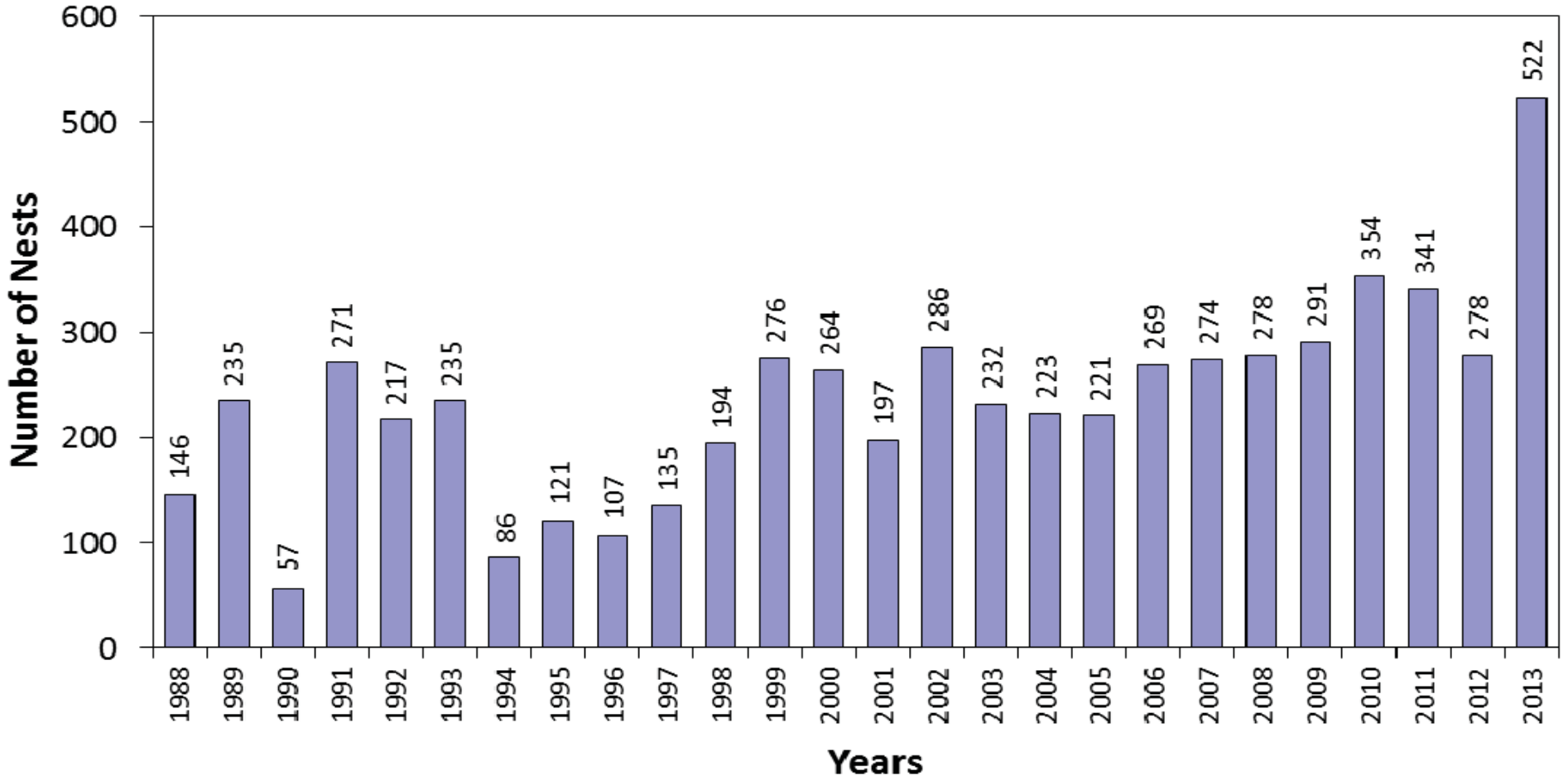


Figure 43: Total number of sea turtle nests at Dalyanagzi/İztuzu Beach since 1988. Protection efforts seem to result in increased number of nests.

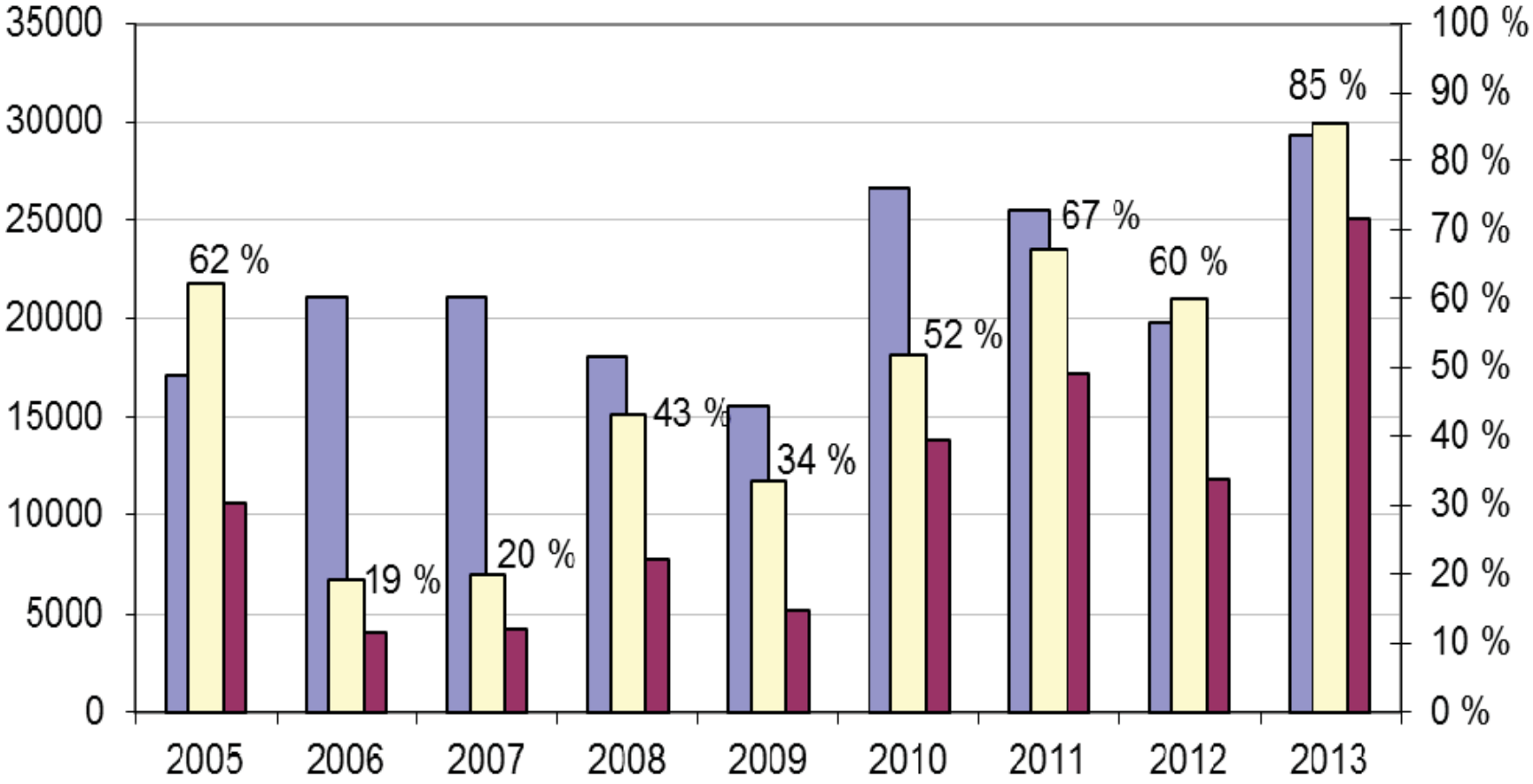


Figure 44: Total number of sea turtle eggs laid in nests and the hatchlings reaching the sea.

8.7 Nature Conservation

Köyceğiz – Dalyan SPA was designated in July 1988 and the area has the protection status under the Decree for Establishment of the Agency for Specially Protected Areas (no: 383, dated: 19/10/1989). Several parts of the SPA has had other protection status prior to the SPA designation. These are; forest areas, sweetgum –liquidamber oriantalis- woods, natural site, wildlife protection and enhancement areas. The water areas such as the Köyceğiz Lake, Dalyan Channel, delta and wetlands, covering over 8 000 hectares, have the status of Important Bird Habitat (no: 24) due to the large number of wintering water birds (Cinar Muhendislik, 2007). Several types of Endangered Habitats defined by the Bern Convention also exist within the boundaries of the SPA.

A comprehensive study was conducted in the SPA during 2006-07 on the biological wealth of the SPA with the purpose of preparing a management plan. The project report (Cinar Muhendislik, 2007) contains a wealth of information about the status of the SPA. The land-use patter of the SPA at the end of 2007 is described in Figure 45. It is readily observed that three dominant land uses in the SPA are forestry, agriculture and urbanization. Four municipalities –Köycegiz, Toparlar, Dalyan and Beyobasi – and several villages are located within the SPA.

The sites with different protection status are described in Figure 46. One can see that there are a number of archaeological sites (Kaunos) within the SPA in addition to nature conservation areas and various habitats. The map also indicates a sizable proposed zone as “natural site”. This zone covers the delta, lagoons and wetlands, the sand spit –beach- and the surrounding areas. Finally, the protection zones proposed by the study of Cinar Muhendislik (2007) are described by Figure 47. It is seen that the protection zone labelled as A1 requires strict protection and covers the shores of the Köycegiz Lake and a part of the Delta. The protections zone designated as A2 covers a much larger area. “Limited” human intervention is allowed in A2 zone. B1 and B2 are designated as the active management zones. B1 labelled small areas are the “active habitat management” zones and far more extensive B2 areas are “active species management areas”. There are buffer zones next to the nature protection zones A1 and A2.

Due to several reasons, the nature protection map and the so-called management plan for the SPA have not been enforced up to date. Extensive information provided by the study within the report and the annexes has been used as a source of reference by the SPA Agency in their decision making. One important reason for the failure of implementing the management plan stems from the process of the preparation of the plan. The development of the management plan was not carried out as a collective work involving all agencies,

public administration units and other stakeholders. Consequently, the plan did not reflect the consensus of all actors involved in or affected by the management plan. Secondly, the planning process did not follow the routine which is required by law. Therefore, the final nature protection plan (status, zones, etc.) for the SPA could not have the legitimacy. Finally, there was no lead agency for implementation of the management plan since the SPA Agency was not designed as an implementing institution and did not have the required capacity.

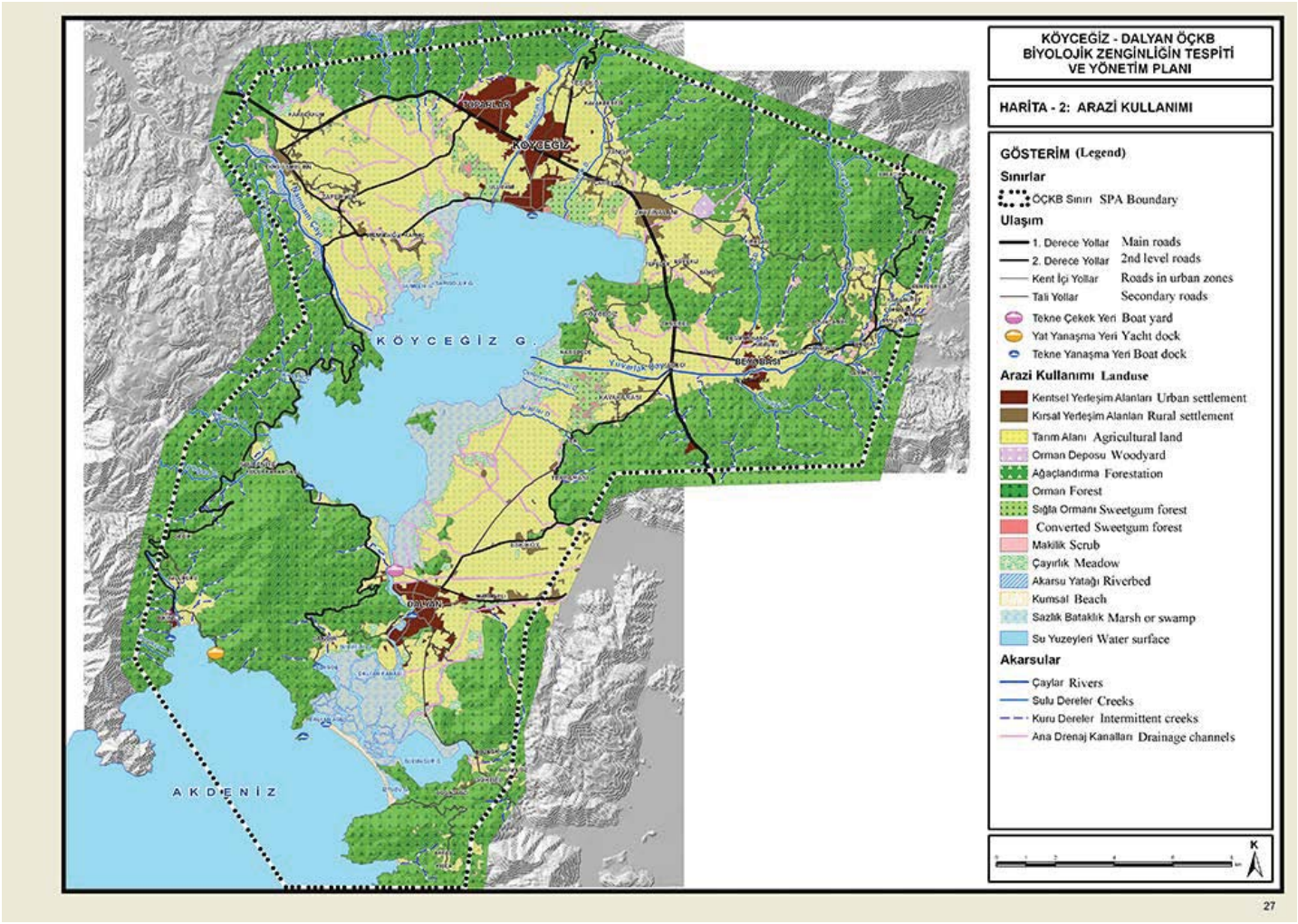


Figure 45: Land use map (Cinar Muhendislik, 2007)

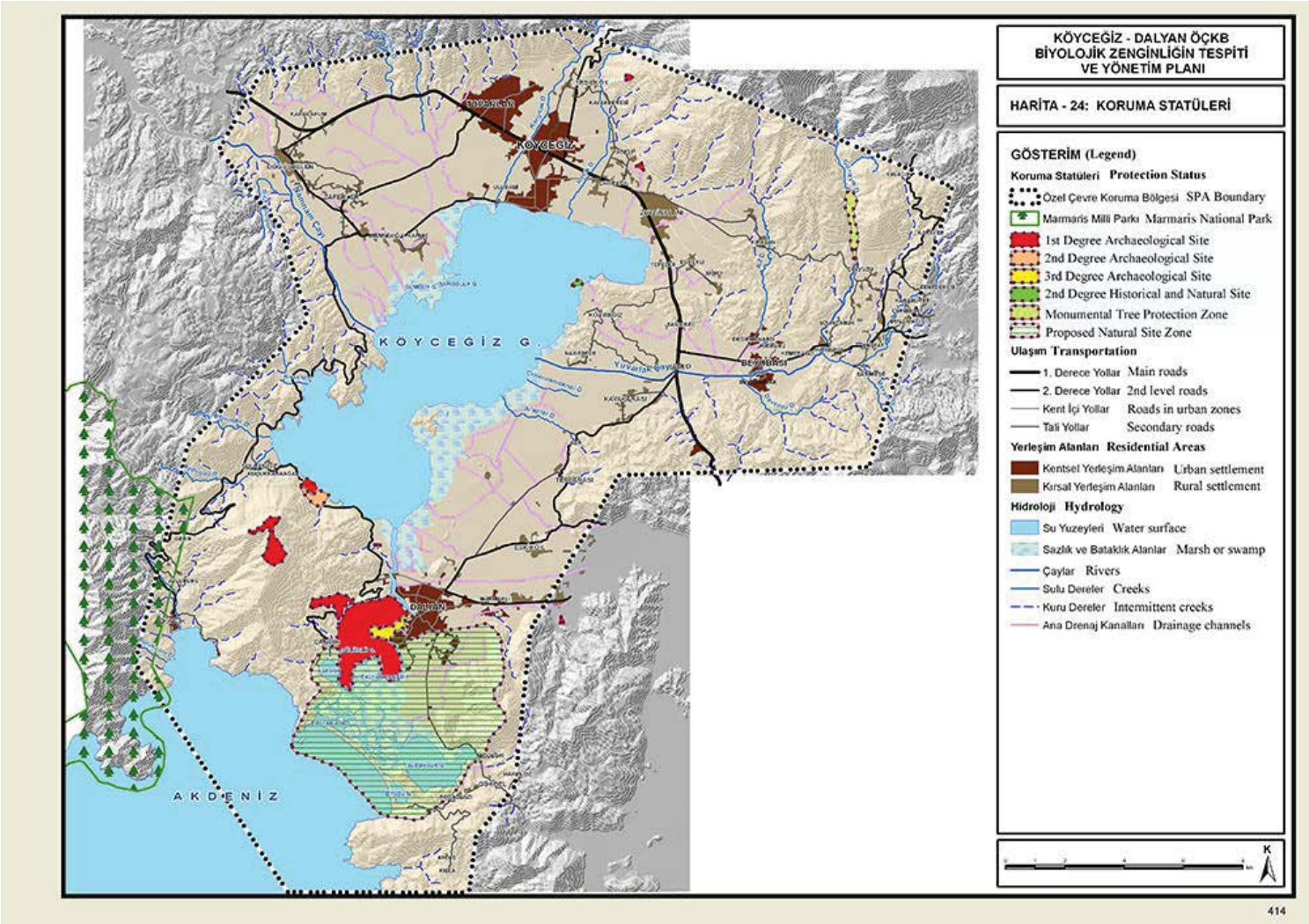


Figure 46: The existing and proposed protection status (Cinar Muhendislik, 2007)

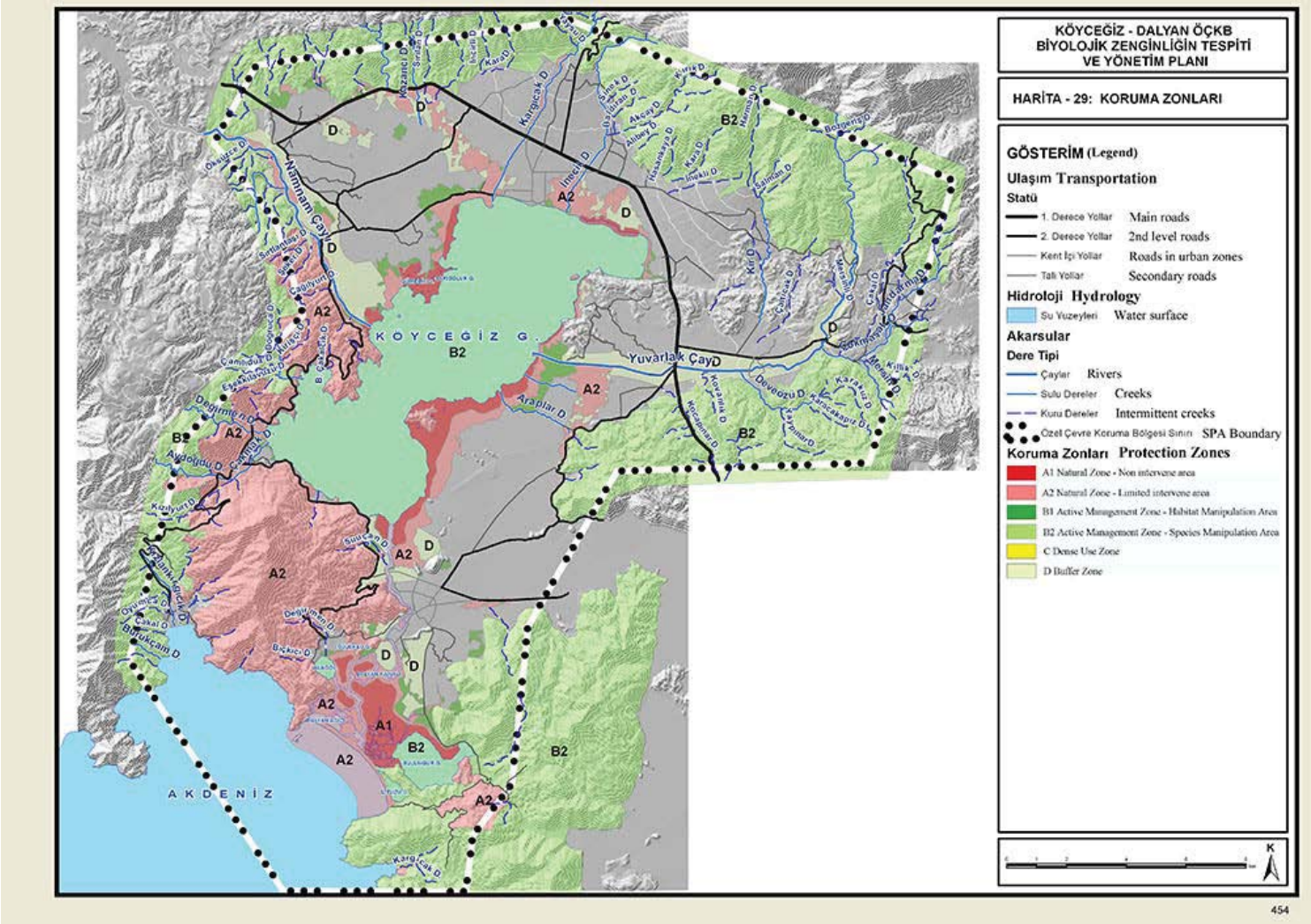


Figure 47: Protection zones proposed (Cinar Muhendislik, 2007)

Section 9. Lessons Learnt

The following issues were engaged during the work done in Köycegiz-Dalyan SPA CASE.

a. Effective and comprehensive participation is not an easily achievable target in a society where authority sharing and collective decision making are not inherent in culture.

b. Consensus at all three stakeholders meetings was that increasing public awareness and participation is crucial in achieving successful management of Köycegiz-Dalyan SPA. However, stakeholder meetings revealed the typical constraint in terms of authority vs. interest relation where the ones having authority for decision making do not show enough interest for participation.

c. The interest of local and regional media on management of the Köycegiz-Dalyan SPA is at high levels.

d. The BBN tool could be used as an interactive participatory method. In-depth analysis in BBN approach and inputs integrated with the quantitative data would be more helpful to create a BBN to use in decision making tool for the stakeholders.

e. The existing capacity among local NGOs and concerned people is rather high for guiding future coastal management practices. This capacity will be elaborated by the Mediterranean Coastal Foundation in the post-PEGASO period.

f. The PEGASO CASE efforts in Köycegiz-Dalyan SPA has been a fruitful start for "integrated" management. However, the diffusion of integrated coastal management practices at nationwide scale will require a much longer timeframe.

EPILOGUE

An ironic event is taking place nowadays in association with turtle conservation. The scientist in charge of the first ever turtle rehabilitation centre in Turkey, who has been operating at temporal facilities next to the İztuzu Lake, has been pursuing a project for developing a major turtle research and rehabilitation centre on the premises of the existing temporal facilities. The project involves building a huge steel structure (400 sq.m. base area and two stories reaching the height of 7.5 m.), in the shape of a loggerhead turtle. The environmental NGOs (including Mediterranean Coastal Foundation) and the people of Dalyan are presently fighting against this project for saving the nesting turtles from the turtle rehabilitation facility, a struggle similar to the one in 1987 and 88 against the hotel complex in the same area. This collaborative effort of NGOs and concerned people for proper SPA management has no doubt been enriched by the teachings of the PEGASO project.

References

Cinar Muhendislik (2007). “Koycegiz - Dalyan Specially Protected Area – Investigations on the Biological Wealth and Preparation of the Management Plan”, Final Report, Prepared for the Agency for Specially Protected Areas, 498 pages + annexes, December 2007 (In Turkish)

Özhan, E. (1988), “Flow regimes and dynamic equilibrium of coastal changes at Köycegiz Lake Inlet, Turkey”, *Journal of Coastal Engineering*, Elsevier, 12 (2), 109-1032.

Özhan, E. (1990), “Dalyan çelişkisi: geçmiş, şimdi ve gelecek”, *Turizm ve Çevre Konferansı*, Türkiye Çevre Vakfı, Kasım 1990, Çesme, 117-204. (in Turkish).

Özhan, E. (2005), *Coastal Area Management in Turkey*, Mediterranean Action Plan Priority Actions Programme Regional Activity Centre (PAP/RAC), Split, Croatia, 69 p.

Özhan, E., Avsar, U., Tufekci, N., Özuslu, S., Önder, S., Konaklı, D. and Kan, N. (2013), “Management Issues of Köycegiz – Dalyan SPA, Turkey”, In: Özhan, E (Ed.), *Proceedings of the Global Congress on ICM: Lessons Learned to Address New Challenges, EMECS 10 - MEDCOAST 2013 Joint Conference,* 30 Oct – 03 Nov, Marmaris, Turkey, 71-80.

Tüfekçi, N., Avşar, U. and Özhan, E. (2013), “Monitoring of Boat Navigation in the Dalyan Channel”, In: Özhan, E (Ed.), *Proceedings of the Global Congress on ICM: Lessons Learned to Address New Challenges, EMECS 10 - MEDCOAST 2013 Joint Conference,* 30 Oct – 03 Nov, Marmaris, Turkey, 81-92.