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# Information Sheet on Ramsar Wetlands (RIS)

*Categories approved by Recommendation 4.7 of the Conference of the Contracting Parties.*

**1. Date this sheet was completed/updated:**
24th July 2001

FOR OFFICE USE ONLY.
DD MM YY
27 08 01 — Designation date
1 K E Ø Ø 3 — Site Reference Number

**2. Country:**
**Republic of Kenya**

**3. Name of wetland:**
**Lake Bogoria**

**4. Geographical coordinates:** Longitude $36^0\ 4' - 36^0\ 7'$ E
Latitude $0^0\ 10' - 0^0\ 20'$ N

**5.Elevation:** (average and/or max. & min.) **900-963masl** **6. Area:** (in hectares) Total area of the Reserve **107 km²** (10,700 ha) Total area of the Lake (Water body) **33 km²** (3,300 ha). The Ramsar site area includes the entire Reserve, (i.e.10,700 ha). The terrestrial component around the lake is an important buffer zone and integral part of the lake.

**7. Overview:** (general summary, in two or three sentences, of the wetland's principal characteristics)

Lake Bogoria is within the East African Great Rift Valley, consisting of a gaben which is dominated by volcanic faults and cliffs. The wetland is an alkaline soda lake, which is hydrologically dominated by hot springs The lake is a critical refuge for the lesser *flamingo (Phoenicopterus minor*) with a population that ranges from 1 to 1.5 million. The birds are maintained by the plentiful blue green algae (*Spirulina platensis).* The riparian ecosystem comprises a narrow shoreline fringe dominated by *Sporobolus spicatus* and *Sporobolus laevigatus* and an *Acacia- Salvadora* woodland. The latter is a critical habitat for the endangered Greater Kudu (*Tragelaphus strepsciseros*) and other mammalian species. It has high biodiversity values with more than 300 recorded waterbird species, The lake is, thus, an important stop-over point for a wide range of the northern migratory waterfowl species, further it is a critical revenue base in terms of tourism and socio-economic and cultural significance for the northern tourist circuit.

**8. Wetland Type** (please circle the applicable codes for wetland types; in the present document, the "Ramsar Classification System for Wetland Type" is found on page 9)

**Inland:** M N Q Sp Tp Y Zg

**Please now rank these wetland types by listing them from the most to the least dominant:**
**Ranking**

1. **Q**
2. **Zg**
3. **Y**
4. **Tp**
5. **Sp**
6. **M**
7. **N**

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**9. Ramsar Criteria:** (please circle the applicable Criteria; the *Criteria for Identifying Wetlands of International Importance* are reprinted beginning on page 11 of this document.)

1. 2. 4. 5. 

**Please specify the most significant criterion applicable to the site:** _____

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**10. Map of site included? Please tick *yes* ☑ -or- *no* ☐**
(Please refer to the *Explanatory Note and Guidelines* document for information regarding desirable map traits).

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**11. Name and address of the compiler of this form:**

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***Please provide additional information on each of the following categories by attaching extra pages* (please limit extra pages to no more than 10):**

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**12. Justification of the criteria selected under point 9, on previous page.** (Please refer to the *Criteria for Identifying Wetlands of International Importance* appended to this document)

*Criteria 1: It is a particularly good representative example of a natural or near natural wetland type found within the appropriate biogeographic region;*

Within this biogeographical region (Gregorian Rift valley) it is the only alkaline lake that has minimal lake water fluctuations. The marshes to the north of the Lake contribute to the hydrological functions of both Lake Bogoria and an adjacent Lake Baringo, both of which are fed by the Wasenges river. However, the wetland does not contribute to the functions of any river outlet.

*Criteria 2. It supports threatened ecological communities.*

Due to changing environmental conditions in the East African saline lakes, *Spirulina platensis*, the main food for lesser Flamingo is under ecological threat as evidenced by the frequent occurrence of microcystine (algal toxin) and algal blooms.

Lake Bogoria national Reserve is one of the few remaining pockets of the former Greater Kudu (*Tragelaphus strepsciseros)* range in northern Africa. The antelope species is now listed as endangered in the IUCN red data book. The population of the species has been reduced due to poaching for meat and trophies and habitat loss through overgrazing and habitat degradation. The Lake also supports over 1.5 million Flamingos and is a critical dispersal range during extreme environmental conditions in other Rift Valley Lakes.

*Criterion 4. It supports animal species at a critical stage in their life cycles and provides refuge during adverse conditions.*

During prolonged droughts and adverse environmental conditions, especially when lake levels are very low in the other Rift Valley saline lakes of East Africa, Lake Bogoria provides refuge to hundreds of thousands and occasionally millions of lesser flamingos. On such occasions, it is the only lake with substantial water level and high biomass of *Spirulina platensis* capable of supporting regional populations of the lesser flamingoes.

Unlike other soda lakes in the region (Gregorian Rift), depth fluctuations are minimal and thus acts as a steady water reservoir and refuge site for the Lesser Flamingoes during extreme weather conditions, when other soda lakes are less preferred especially during flooding and dry outs.

*Criteria 5 It regularly supports 20,000 0r more Waterbirds*

Lake Bogoria supports high numbers of waterfowls (which include migrants) through out the year. More than 300 species of birds have been recorded in the lake which is also one of Kenya's Important Bird Areas (IBA). The assemblage of 1.5 million flamingoes and other palaearctic waders is an indication that it supports over 20,000 water birds. For species and populations, see attached annex 1.

13. **General location:** (include the nearest large town and its administrative region)

Lake Bogoria is located in Baringo and Koibatek districts of Rift Valley Province of Kenya. It is about 120 km (along Nakuru- Marigat Junction-Loboi Road) north of Nakuru town and 240km. North of Nairobi, the capital of Kenya. Access to the Lake can be through three routes namely: Loboi, Maji Moto and Emsoss gates. The Loboi access route (in the North) is all weather-tarmac road; usage of the other two routes is variable with weather.

14 **Physical features:** (e.g., geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; catchment area; downstream area; climate)

Lake Bogoria is located in the Gregory Eastern Rift Valley at an altitude of 963 meters asl. and is part of the Bogoria/ Baringo basin. The area is made up of volcanic rocks and sediments overlying metamorphic substrata. These are believed to belong to the Pleistocene and Mimocene geological era. The area is highly faulted and fissured with the major rivers flowing north along the fault-line. Close to the lake and the surroundings, there are stratified deltaic silts and saline beach deposits. The western section of the lake comprises of analcitic, phonolites and porphyritic trachytes. The eastern section beyond the deltaic silts comprises of sedimentary deposits, volcanic soils, screes and alluvium deposits. It is also important to note that porphyritic olivine basalts are found along the eastern lake Bogoria faults.

Lake Bogoria and its catchment has been affected by tectonic events such as faulting, warping, volcanicity and the subsequent development of the Rift Valley. There is evidence that rifting is still in progress as shown by the presence of steam vents, hot springs and geysers within the lake and along the lake shores. The lake is located along one of the three defining major fault blocks in the Rift Valley, the Solai-Subukia Block. This fault block includes the Solai, Iguamiti and South Arabel fault scarps. Lake Bogoria is further separated from this main fault block by the Kisanana- Chemasa-Emsoss fault that merges into Lake Bogoria fault along the Emsoss "spoon" fault structure at Sirken Hill. These fault lines are aligned in the north - south direction with Sandai deposition pans being north of the lake and stretching to Lake Baringo.

Lake Bogoria is characterized by steep shoreline and trough basin morphometry. The Lake has three basins; the north, central and the south. The southern basin is a volcanic crater joined to the rest of the lake and forms its deepest part (10 m). The geomorphology of the area in and around the lake is complex and comprises of soils with varied textures and drainage conditions which have developed on the lake's alluvial deposits. Soils in the area can be selectively classified as Lithosols and Regosols.

**Origin**

The origin of the Bogoria-Baringo half gaben (0°-1°N, 36°E) can be distinctively associated with the formation of the Rift Valley system. The Bogoria- Baringo basin occupies the eastern flank of the axial trough of the Gregory Rift, Kenya. Three main tectonic trends (N 0°, N 150° and N 50°) determine several compartments made up of Miocene to Pleistocene

volcanic rocks and sedimentary intercalations overlying a metamorphic substratum. These are part of the formation of the Gregory Rift Valley. The Bogoria is believed to have evolved from the last 30,000 years B.P. with the genesis in the paleohydrological and sedimentary evolution eras. Climatic conditions, and it's variations have played a key role in defining transitions from fresh to salt water thereby affecting the succession patterns of high –low lake levels and their associated phenomena.

**Hydrology**

Lake Bogoria has a unique hydrology in that it is both a saline and alkaline lake, with a meromictic regime and a high hydrothermal activity. It also exhibits a trellis drainage pattern, with river flow along fault lines to the higher elevation Lake Baringo. Lake Bogoria is replenished and sustained by a number of springs most of which emerge along the fissures at the shore of the Lake. Principally the lake is fed by Rivers Sandai- Wasenges draining the Subukia and Iguamiti highland to the South- East. The river follows a determined northward course towards Lake Baringo, before diverting and flowing southwards towards lake Bogoria. The river dries up at the Sandai swamps during the dry season, and brings in huge volumes of suspended solids during the wet season. River Loboi draining into lake Baringo, recently diverted its course to flow into Bogoria after it's bed was blocked by excessive siltation. A number of dry *wadis (river beds)* are found further south to the West. These bring in water during the wet season. Emsoss warm spring water flows in from the south. The Wasenges River forms a large part of the drainage system that is approximately 1,075.5 $Km^2$. This river collects numerous short tributary springs. The lake water balance is maintained by evaporation, rainfall, surface flow, underground hot springs and geysers, with minimal lake level fluctuations. However despite the minimal fluctuations in lake levels, it should be noted that the lake is located in the semi- arid area with temperatures reaching as high as $39^0C$, rainfall of 500mm per annum and annual pan evaporation of 2,300mm. Arrays of hot alkaline springs and fumaroles along the shoreline and within the lake floor discharge enormous volumes of waters that effectively counter-balance evaporative losses. The lake however does not have a record of drying out and it is the most permanent of the alkaline lakes found in the Rift Valley. Permanent springs found within the vicinity of the Lake are located at the southern two thirds of the lake with substantial surface flow from Wasenges – Sandai River to the north.

The water that emanate from the hot springs is believed to originate from the higher elevation areas of Nakuru, Elementaita and Eburu, flowing through underground hydrological systems in constant contact with underlying hot lava. Some of the springs have been recorded to have temperatures as high as $90^0C$, pH 8.33 and electrical conductivity of 4.55m*S* /cm.

**Soil types and Chemistry**

The soils have a high pH ranging from 6.8 to 9.0. Sodium levels are correspondingly high ranging from 0.5 m.e.% to 9.92 m.e.%. The salinity and sodicity is attributed to the parent material. Highly alkaline soils are found within and the surrounding shore fringes, while soils located close to the permanent water sources exhibit intermediate values. The soils in the ridges and scarps have the lowest pH values. Soil depth is directly related to the landscape

gradient levels. The depth ranges between 7.5 – 85 cm in the steep slopes and plains respectively. However, soil texture is not variable, with most soils being categorized as loamy with exceptions of clay loams mainly restricted to the riverine area.

Nutrient availability indexes are high indicating high fertility contents with phosphorous being recorded as high as 80 ppm in the riverine soils. Potassium, Magnesium and Manganese are generally low. The Calcium levels are high and exhibit wide variations from 10.37 to 37.26 m.e.% in riverine soils.

It should be noted that no significant relationships are apparent between vegetation composition and distribution of soil factors. Most prominent of soil factors influencing species incidence are soil pH and Sodium concentrations.

The soils are complex and with varied textures and drainage conditions. These soils are mainly composed of volcanic sediments and alluvial deposits. The alluvials have originated from river and lake depositions. The soil and their associated sediments consist of the types of diverse granulomites, conglomerates, silts and gravels. 70 – 80% of the silts are dominated by Kaolinites while 10 – 20% are the illionites that are inter-stratified.

**Water Quality (physio-chemical characteristics)**
Lake Bogoria has relatively high salinity with pH ranging between 9.8-10.6, alkalinity between 480-800meq/L and an electrical conductivity of 35-80$\mu Scm^{-1}$. Phosphorus levels are extremely high and occur in the form of orthophosphates. Nitrogen limitations are experienced but some nitrogen is obtained by dissolution from its large reservoir in the atmosphere. Total phosphate and nitrogen concentrations are 3.5 $mgl^{-1}$ and 32 $mgl^{-1}$ respectively.

**Tidal variations**
None

**Catchment**
The catchment size is approximately 1,200 $km^2$ and covers the Subukia and Iguamiti shrines in Subukia catchment forest areas among others. See attached figure 2.

**Climate**
The climate of lake Bogoria is unique and is intermediate between the arid and semi arid regimes found along the Rift Valley system. The climate is influenced by the ITCZ (Inter Tropical Convergence Zone) with two distinct wet and dry seasons. The climatic conditions are harsh with temperatures at the Lake ranging from 18$^0$C to 39$^0$C with a daily mean of 25$^0$C. Mean annual precipitation ranges from 500-1000mm occurring in two seasons April-May and October- November. These weather variables combine to give the lake a hot, semi arid climate and a radiation/ evaporation matrix that greatly affects the ecology of the Lake.

Rainfall reliability is very low, with daily sunshine hours averaging 8.6 (E. Mwangi 1993), making the area hot for most part of the year. There is a marked hot spell from January to

March that doubles with the dry season during which average maximum monthly temperatures (34°C) are higher than other months. Cold spells are observed in the months of July and August. The lake and it's surroundings can be categorized under agro-ecological climatic class E.

**15. Hydrological values:** (groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.)

Discharge of the lake water into the aquifer of the immediate hot springs and geysers has not been documented. On the surface, the lake is a closed basin.

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**16. Ecological features:** (main habitats and vegetation types) The open water consists of microphytes like; *Spirulina platensis, Microcystis aeruginosa, Anabaenopsis arnoldii* among others. The shoreline harbors such plant species as; *Cyperus laevigatus* and *Sporoblus spicatus*.

Vegetation composition (immediate to the site), structure and distribution are influenced by edaphic factors such as: Soil pH, available sodium, soil depth, organic carbon, Potassium and Magnesium. This relationship is further modified by biological factors such as grazing.
Lake Bogoria has 53 plant families and approximately 210 plant species. Among these are 38 species of Graminae and 15 species of *Acanthaceae*. Six broad vegetation types can be classified according to physiognomic representation. They include: Riverine, Forest, Wooded bush land, Bushed thicket, Bush land, Bushed grassland and Swamps. These can further be differentiated into ten vegetation communities on the basis of dominance. Dominant grasses include: *Sporobolus ioclados, Dactyolectenium aegyptium, Chlonis virgata and Digitaria velutina.* Shrubs include: *Grewia tenax, G. bicolor, Acalypha fruticosa and Acacia mellifora*. The most dominant tree species is *Acacia tortilis*. Depressions (*wadis*) harbor varied vegetation types such as those found in the Loboi swamps and grasslands. Evergreen and semi deciduous bush land cover large areas along stream valley and other inhospitable areas.

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**17. Noteworthy flora:** (indicating, e.g., which species/communities are unique, rare, endangered or biogeographically important, etc.) *Spirulina plantensis* and other species of phytoplankton, which occur depending on season and water chemistry, dominate the Lake open water. A small forest of *Ficus sp.* occurs at the Southern end of the lake associated with fresh water springs. Some of these fig trees are about 1.5 to 2m in diameter.

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**18. Noteworthy fauna:** (indicating, e.g., which species are unique, rare, endangered, abundant or biogeographically important; include count data, etc.)

The Lesser Flamingo *(Phoeniconaias minor)* and Greater Flamingo (*Phoeniconaias lubar*) are the most conspicuous and abundant primary and secondary consumers in lake Bogoria eco-system Waterfowl counts have been done in the area (see Appendix 1).

The area is rich in wildlife common species being; Zebras (*Equus burcheli)*, Greater Kudu (*Tragelaphus strepsciceros*) (The Greater Kudu and the Oryx are thought to be locally endangered in its former rangeland, which includes Bogoria primarily because of poaching, by communities), Grants Gazelle (*Gazelle grantii*), Cheetahs (*Acinonyx jubatus*) initially

occupied this range but are now considered locally extinct, with other carnivores including Hyenas (*Crocuta crocuta*), Civets (*Civettictis civetta*), and White tailed Mongoose (*Ichneumia albicauda*).

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**19. Social and cultural values:** (e.g., fisheries production, forestry, religious importance, archaeological site, etc.) Lake Bogoria has no fish or fishery activities. The Tugen and Jemps communities who are pastoralists inhabit the area. Human population is increasing with consequent pressure on the natural resource. These communities traditionally keep large herds of livestock (Cattle, Donkey, Goats and Sheep) which have a direct bearing on the vegetation cover. It is important to note that the larger the size of the herds the wealthier the owner is considered in the community. These communities have a free dry season grazing access rights into the reserve. It is for this reason that grazing is the largest land use activity in this area.

Due to the intrinsic value of the wildlife the lake and its environs have been designated as wildlife reserve. These serve as important tourist attractions in the area with tourist coming to view both the wildlife, hot spring at the lakeshore and the spectacular physiography of cliffs, escarpments and the spectacular natural landscape in the region.

**Religion**

The local communities have high cultural value for the lake and occasionally conduct religious prayers and sacrifices at the site.

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**20. Land tenure/ownership of:** (a) site (b) surrounding area The Lake and the reserve are trust land under the jurisdiction of County Councils of Baringo and Koibatek. The area surrounding the reserve is communally owned and utilized collectively for grazing, bee keeping and small-scale irrigation agriculture.

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**21. Current land use:** (a) site (b) surroundings/catchment

The various Land uses in Lake Bogoria are

- Biological Conservation within the gazetted lake Bogoria national reserve.,
- Tourism/recreation within the lake and surrounding areas.
- Community access into the reserve for
    - Medicine,
    - Salt licks,
    - Sacred prayer grounds and
    - Controlled dry season grazing.

The catchment or the surrounding area land use types are

- Cultivation/Agriculture, both small and large scales
- Ranching/livestock grazing, mainly traditional breeds, though a few high-breeds have been introduced in areas with favorable climate and conditions.

- Transport net work – generally good as described earlier
- Irrigation- some small-scale schemes exists, though there is one large irrigation scheme ( Perkerra) to the north of the lake.
- Bee keeping/Apiculture- a major economic activity by the majority of the communities. Honey is exported to other markets in the country.
- Settlements- Occur in traditional form across the range. The main settlements are Maji Ya Moto, Loboi, Emsoss, Marigat etc.

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**22. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land use and development projects:** (a) at the site (b) around the site

There are several environmental factors that have been identified in Lake Bogoria that affect it's ecological character and require urgent attention. These are anthropogenic in nature and around the site include:

- Occasionally uncontrolled seasonal burning to improve range conditions,
- Shift cultivation within the arable zones especially around the Loboi swamps
- Wildlife habitat degradation due to wildlife/livestock competition,
- Dry season irrigation, destruction/cutting of indigenous trees for building and fuel wood, Increasing settlements and cultivation,
- Siltation of the feeder rivers and the lake,
- Overgrazing – leading the degraded landscape, soil erosion and soil loss.
- Deforestation- a common feature over most of the range especially to obtain timber, fuel wood and wood for charcoal burning. Perennial soil erosion due to land denuded by the above activities.
- Abstraction of water- mainly for agricultural irrigation schemes and watering of hundreds of livestock.

Environmental threats within the Ramsar site and close to the lake:

- Waterfowl disturbance by visitors and tourists along the shoreline,
- Littering along the roads and at picnic and campsites.
- Cyclic occurrence of algal toxins in the lake, leading to lesser flamingo mortalities.
- Occurrence of alien species in the lake and surrounding drainage area.
- Siltation of the feeder rivers and the lake. There is evidence of serious sedimentation leading to rivers changing their courses in the region.
- Deforestation and water diversion/abstraction in the upper zones leading to less water flow for the lake's recharge.

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**23. Conservation measures taken:** (national category and legal status of protected areas - including any boundary changes which have been made: management practices; whether an officially approved management plan exists and whether it has been implemented)

The site is gazetted as a National Reserve and has distinctly marked boundaries. As a National Reserve, management regime is in line with Wildlife Conservation and Management Act ,(section

18), that deals with the establishment and management of National reserves in the country. There is emphasis on conservation and sustainable management of biodiversity resources and controlled community access to and use of the resources in the Reserve. The Reserve is co-managed by Koibatek and Baringo County Councils with technical advice from Kenya Wildlife Service, the Government's lead wildlife management agency.

Other management practices include implementation of management oriented research projects like ecological monitoring (Wildlife census and waterfowl counts), water quality monitoring; Community and School education and awareness programs, and visitor management and eco-tourism and integrated planning.

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**24. Conservation measures proposed but not yet implemented:** (e.g., management plan in preparation; officially proposed as a protected area, etc.)

The Reserve has an outdated management plan, however an Integrated Management Plan is in preparation process. Stakeholders to be involved in the process have already been identified, and the first workshop held.

Other conservation measures or programs in place include

- The lake is proposed to be designated also as a world heritage site
- Community based Wetlands Conservation Project (WWF) already initiated.
- Proposed GEF Rift Valley Lakes project- to improve conservation of Biodiversity in the lakes' ecosystems. .

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**25. Current scientific research and facilities:** (e.g., details of current projects; existence of field station, etc.)

Research projects in this Reserve include

- Interlake Flamingo movements within the Rift Valley lake system.
- Algal Ecotoxicology studies to determine the course of lesser flamingo deaths.
- Earth watch research on Flamingo pathology – to determine course of deaths.
- Distribution and concentration of heavy metals in the Rift Valley lakes, and the effects of heavy metals on Flamingo.

The Reserve has no Research field station, however other field facilities include an education center.

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**26. Current conservation education:** (e.g., visitors centre, hides, info booklet, facilities for school visits, etc.)

In the reserve a visitor center is in place, and visitor information is provided for at the Park Gate. The Reserve has areas designated as observation points, picnic and campsites. A spacious center is in place for use by school groups on visit to the park, however this center needs modern audiovisual equipments. The Reserve has an elaborate school environmental education curricular and program being conducted by the reserve management and WWF.

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27. **Current recreation and tourism:** (state if wetland is used for recreation/tourism; indicate type and frequency/intensity)

Major tourist attractions in Lake Bogoria include the biological, ecological, geophysical, and socio-cultural attractions. The wetland and its surrounding landforms form a beautiful and magnificent landscape and scenery. The most significant features are the hot springs and the flamingoes which are also essential for both research, education and tourism purposes. The water geysers sprouting to almost four meters are believed to have medicinal value and are important for geophysical research. The main tourist activities are game drives, scenic beauty, game, bird viewing and photography.. Tourists have a preference of this lake because it is within a transition zone between the northern and the southern afro-tropical fauna. Further more the indigenous people around lake Bogoria have a rich culture.

Tourist facilities in this area include

- Campsites: Fig tree, Acacia, Loboi camp sites
- Picnic sites: Loburu hotspring and Maji Moto picnic sites.
- Lake Bogoria hotel, a three star international hotel
- Papyrus inn for low paying guests and local communities

Lake Bogoria is highly visited with over 200,000 Annual visitors.

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28. **Jurisdiction:** (territorial, e.g. state/region, and functional, e.g. Dept of Agriculture/Dept. of Environment, etc.)
Territorial Jurisdiction: County Councils of Baringo and Koibatek. The lake is intersected by the administrative boundary of the two districts.
Functional Jurisdiction: Kenya Wildlife Service and the two County Councils.

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29. **Management authority:** (name and address of local body directly responsible for managing the wetland)

County Council of Baringo and Koibatek.
Lake Bogoria National Reserve
P.O. Box 64
**Marigat**
Tel: 254-037-40746

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