

## **Monitoring of changes in the water surface and wetland area of the Aral Sea and the Aral Region**

SIC ICWC made monitoring of changes in the Aral Sea and the Aral Region by using the Landsat 8 OLI images. The images got on 16 October 2020 allowed having wetland and open water surface areas within the boundaries of the Aral Region and the Aral Sea.



**Figure 1. Western and Eastern parts of the Aral Sea.  
Landsat 8, 16 October 2020**

**Table 1**

**The area of wetlands and open water surfaces in the Western and Eastern parts of the Aral Sea**

|   | <b>25.05.2020</b>                       | <b>10.06.2020</b> | <b>28.07.2020</b> | <b>20.08.2020</b> | <b>14.09.2020</b> | <b>16.10.2020</b> |
|---|---|-------------------|-------------------|-------------------|-------------------|-------------------|
|   | <i>Western part of the Aral Sea, ha</i> |                   |                   |                   |                   |                   |
| Wetland   | <b>312 359</b>                          | <b>314 138</b>    | <b>317 639</b>    | <b>320543.7</b>   | <b>318 593</b>    | <b>327 267</b>    |
| Water surface                                     | <b>248 993</b>                          | <b>247 212</b>    | <b>243 710</b>    | <b>240806.5</b>   | <b>242 757</b>    | <b>234 087</b>    |
|   | <i>Eastern part of the Aral Sea, ha</i> |                   |                   |                   |                   |                   |
| Wetland   | <b>1431 090</b>                         | <b>1445300</b>    | <b>1462442</b>    | <b>1474628</b>    | <b>1478 120</b>   | <b>1483 932</b>   |
| Water surface                                     | <b>65 733</b>                           | <b>51 523</b>     | <b>34 381</b>     | <b>22 195</b>     | <b>18 703</b>     | <b>12 892</b>     |
|   | April                                   | May               | June              | July              | August            | September         |
| Water quota                                       | <b>594</b>                              | <b>181</b>        | <b>337</b>        | <b>480</b>        | <b>391</b>        | <b>370</b>        |
| Inflow to the Aral Region, Mm <sup>3</sup> /month | <b>217</b>                              | <b>210</b>        | <b>193</b>        | <b>187</b>        | <b>126</b>        | <b>107</b>        |



**Figure 2 The Aral Region, Landsat 8, 16 October 2020**

**Table 2****Areas of wetlands in the Aral Region, ha**

| <b>Water body</b>  | <b>25.05.2020</b> | <b>10.06.2020</b> | <b>28.07.2020</b> | <b>20.08.2020</b> | <b>14.09.2020</b> | <b>16.10.2020</b> |
|--|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Sudoche  | 47471.64          | 51796.53          | 60811.51          | 62688.82          | 63465.16          | 62736.88          |
| Mejdureche   | 32105.02          | 34195.34          | 35012.09          | 36047.27          | 36777.53          | 37020.8           |
| Rybatche   | 8874.27           | 9087.16           | 9547.38           | 9727.92           | 9662.22           | 9503.55           |
| Muynak   | 15151.95          | 15559.56          | 15935.52          | 15944.85          | 15981.84          | 15939.36          |
| Djiltyrbas<br>dam-terminated                                   | 42580.52          | 42792.12          | 42816.06          | 42630.3           | 42742.08          | 41931.81          |
| Djiltyrbas (together<br>with former right<br>and left streams) | 97239.29          | 98263.85          | 98843.05          | 98876.3           | 98873.33          | 98650.94          |
| Dumalak  | 15978.9           | 16031.46          | 16048.38          | 16049.19          | 16050             | 16050             |
| Makpalkul  | 8282.22           | 8550.71           | 8408.69           | 8456.21           | 8633.42           | 8646.2            |
| Mashan Karadjar  | 26539.18          | 26861.97          | 29976.45          | 27046.65          | 27021.63          | 26881.5           |
| Water surface<br>southward<br>of Muynak                        | 9605              | 9605              | 9605              | 9605              | 9605              | 9605              |
| Water surface<br>along<br>Kazakhdarya river<br>channel         | 4751              | 4751.5            | 4751.5            | 4751.5            | 4751.5            | 4751              |
| Zakirkol   | 2783.17           | 2788.24           | 2788.3            | 2791.3            | 2791.3            | 2791.3            |
| <b><i>Total:</i></b>   | <b>311 862.7</b>  | <b>320 283.4</b>  | <b>331 540.9</b>  | <b>334 615.3</b>  | <b>336 355.01</b> | <b>334 508.8</b>  |

**Table 3**

**The area of open water surface  
in the Aral region, ha**

| <b>Water body</b>   | <b>25.05.2020</b> | <b>10.06.2020</b> | <b>28.07.2020</b> | <b>20.08.2020</b> | <b>14.09.2020</b> | <b>16.10.2020</b> |
|---|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Sudoche   | 24725.4           | 20900.5           | 11885.5           | 10008.2           | 9231.84           | 9960.12           |
| Mejdureche  | 5678.98           | 3588.66           | 2771.91           | 1736.73           | 1006.47           | 763.2             |
| Rybatche  | 2618.73           | 2405.84           | 1945.62           | 1765.08           | 1830.78           | 1989.45           |
| Muynak  | 1012.05           | 604.44            | 231.48            | 219.15            | 182.16            | 224.64            |
| Djiltyrbas<br>dam-terminated                                      | 4891.87           | 4680.27           | 4656.33           | 4842.09           | 4730.31           | 5540.58           |
| Djiltyrbas<br>(together<br>with former right<br>and left streams) | 1711.71           | 687.15            | 107.95            | 74.7              | 77.67             | 300.06            |
| Dumalak   | 71.1              | 18.54             | 1.62              | 0.81              | 0                 | 0                 |
| Makpalkul   | 401.78            | 133.29            | 275.31            | 227.79            | 50.58             | 37.8              |
| Mashan Karadjar   | 661.82            | 339.03            | 224.55            | 154.35            | 179.37            | 319.5             |
| Water surface<br>southward<br>of Muynak                           | 0                 | 0                 | 0                 | 0                 | 0                 | 0                 |
| Water surface<br>along<br>Kazakhdarya<br>river channel            | 0                 | 0                 | 0                 | 0                 | 0                 | 0                 |
| Zakirkol  | 8.13              | 3.06              | 3                 | 0                 | 0                 | 0                 |
| <b>Total</b>  | <b>41 781.53</b>  | <b>33 360.75</b>  | <b>22 103.5</b>   | <b>19028.88</b>   | <b>17 289.18</b>  | <b>19 135.35</b>  |

Since 2019, SIC ICWC has been using a new methodology for detection of water surfaces and wetlands through the controlled classification (Automated Water Extraction Index, AWEI).

The boundaries of water bodies and wetlands (i.e. Sudoche lake system, Mejdureche reservoir, Makpalkul, Djiltyrbas reservoirs, etc.) digitized manually in 2016 were used as a 'conditional design' boundaries for statistics on the total open water surface and wetland area of these water bodies (i.e. total water body area = open water area + wetland area).

Such a method minimizes erroneous interpretation/digitization of an area under consideration as the water or land surface (e.g. if plants cover the water's surface). However, the problem of detecting wetlands, i.e. the possibility to distinguish them from land (dry, degraded land) remained open. Moreover, the wetland areas within the 2016 boundaries have changed considerably over the last years, mainly, towards shrinkage/drying (dry, degraded land replaced wetlands).

Therefore, in early 2022, we undertook a research to improve the 2019 methodology. To this end, we determined the threshold values of open water surface (water depth of 5-25 cm, depending on the rise or fall of water), wetlands (water depth of up to 5 cm, wet and moist soil), and non-water sites (all other land surfaces, except for open water and wetlands) for 10 spectral indices (including NDVI and AWEI).

Based on the research results, we selected the threshold values for NDVI ( $< -0.001$  for open water,  $-0.001 \div 0.05$  for wetland, and  $> 0.05$  for other land surfaces) for further classification of water sites.

By present, the information for 2020 and 2021 have been updated on the base of the improved methodology. In this context, differences can be found when making comparison with the data for the past years.

**Prepared by:**

Sh. Zaitov

I. Ruziev