Regional Meeting of Experts to review the Draft Desalination and Dumping Protocol Guidelines

Greece, 4-6 April 2017

Agenda item 5: Updated Assessments of Dumping and Desalination Activities in the Mediterranean

Countries Questionnaires on Desalination Activities

D R A F T

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1. Introduction
Seawater desalination has for a long time been a major source of water in parts of the Mediterranean to meet water demands, supplying ca. 12 Mm$^3$/day desalinated water in 2013. The desalination effort is expected to continue to increase. The MED POL Programme of UNEP/MAP is assessing now the implementation of its desalination guidelines published in 2004 and evaluating the state of play of the desalination section in the Mediterranean. The purpose is to produce an updated guideline and provide the Contracting Parties with adequate technical guidance to reduce to a minimum all environmental impacts. For this we would appreciate your collaboration in completing this short questionnaire.

2. General Questions
2.1. Country: **ALGERIA**
2.2. How many desalination plants are in operation in your country? **32 (2011)**
   2.2.1. How many plants desalinate seawater? ______
   2.2.2. How many plants desalinate brackish water? ______
   2.2.3. How many plants have a production capacity >50,000 m$^3$/day? **10 (ref 8)**
2.3. What is the total annual desalination installed capacity? **876 Mm$^3$/year (2013)**
   2.3.1. What is the total annual production of desalinated water? **693.5 Mm$^3$/year (2014)**
   2.3.2. What is the total annual production originating from seawater desalination? **85% (ref 7); 1,461,920 m$^3$/day, 533.6 Mm$^3$/year**
2.4. Are there more desalination plants at the planning/construction stage? **Yes**
   2.4.1. How many? **2, Jilel, Bejaia**
   2.4.2. Total planned desalination production **200,000 m$^3$/day**
   2.4.3. Expected year for start of production ________________
3. Detailed information for large size desalination plants (>10,000 m$^3$/day, 3.65 Mm$^3$/year production). (Please copy table for additional columns).

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Kahrama</td>
<td>El Hamma</td>
<td>Beni Saf</td>
<td>Fouka</td>
<td>Skikda</td>
</tr>
<tr>
<td>Year starting to operate</td>
<td>2006</td>
<td>2008</td>
<td>2009</td>
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<tr>
<td>Location</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Desalination Technology$^2$</td>
<td>MSF</td>
<td>RO</td>
<td>RO</td>
<td>RO</td>
<td>RO</td>
</tr>
<tr>
<td>Production, m$^3$/day</td>
<td>86,000</td>
<td>200,000</td>
<td>150,000</td>
<td>120,000</td>
<td>100,000</td>
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<tr>
<td>Method of brine discharge$^3$</td>
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<tr>
<td>Co- discharge with brine$^4$</td>
<td></td>
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</tr>
</tbody>
</table>

**Chemicals used in the desalination process$^5$**

- Coagulants
- Anti-Scalant
- Biocides
- Water Hardener
- Other

**Chemicals co-discharged with brine$^6$**

Is there a marine monitoring program in place?

$^1$Location: city, area

$^2$Desalination technology: RO-Reverse Osmosis, MSF-Multi Stage Flash, MED-Multi Effect Distillation, Other–please add technology

$^3$Method of Brine discharge: OD-Open discharge, MO-Marine outfall, Other–please add details

$^4$Co-discharge with brine: Other discharges, for example, cooling waters from Electric power stations

$^5$Please name the chemicals: i.e Coagulants – iron salts (FE); anti-scalant- polyphosphonates (Ppho), If the identity of the chemical is unknown, please add yes or no
Please name the chemicals discharged with the brine

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
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</thead>
<tbody>
<tr>
<td>Name</td>
<td>Magtaa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year starting to operate</td>
<td>2014</td>
<td></td>
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<tr>
<td>Location1</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Desalination Technology2</td>
<td>RO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production, m³/day</td>
<td>500,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method of brine discharge4</td>
<td>MO</td>
<td></td>
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</tr>
<tr>
<td>Co- discharge with brine4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chemicals used in the desalination process5

- Coagulants
- Anti-Scalant
- Biocides
- Water Hardener
- Other

Chemicals co-discharged with brine6

Is there a marine monitoring program in place?

4. References and historical data


FAO: “Le dessalement de l’eau de mer a considérablement augmenté ces dernières années en passant d’une capacité de production de 47 000 m³/jour en 2002 à 1.9 millions m³/jour en 2014, soit près de 695 millions m³/an, par 10 grandes stations. La station d’El-Mactaa, près d’Oran, inaugurée fin 2014 dispose à elle seule d’une capacité de 500 000 m³/jour, soit l’une des plus grandes unités de dessalement par osmose inverse au monde, permettant la couverture à long terme des besoins de cinq millions de personnes en eau potable. Le dessalement a en effet fortement contribué à la sécurisation de l’approvisionnement en eau potable des villes côtières.”.

2. FAO, Aquastat
613 Mm³/year (2012)

Installed capacity in Algeria in 2013 – 20% of total desalination in the Mediterranean – 876 Mm$^3$/year (2,400,000 m$^3$/day).

http://www.imida.es/documents/13436/877249/06_REPORT_ON_WATER+DESALINATION.pdf/ae6203f4-68f9-4a37-b728-22b5d247909e

In 2011, 166 desalination plants were reported, 57 with total capacity of 1559,000 m$^3$/day on line, 75 plants with total capacity of 141,000 m$^3$/day presumed to be on line and 19 plants (with total capacity of 1331,500 m$^3$/day) under construction.


Installed capacity in 2008: MSF (113,000 m$^3$/day), MED (41,100 m$^3$/day), RO (603,000 m$^3$/day).


In 2000, there were 32 operating plants with production capacity > 500 m$^3$/day with a total of 36.8 Mm$^3$/year (100,739 m$^3$/day) installed capacity.


Les grandes stations

<table>
<thead>
<tr>
<th>N°</th>
<th>Localisation</th>
<th>Capacité m3/j</th>
<th>Population à servir</th>
<th>Echéancier prévisionnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Kahrama (Arzew)</td>
<td>90 000</td>
<td>540 000</td>
<td>En Exploitation</td>
</tr>
<tr>
<td>02</td>
<td>Hamma (Alger)</td>
<td>200 000</td>
<td>L'Algérois</td>
<td>En Exploitation</td>
</tr>
<tr>
<td>03</td>
<td>Skikda</td>
<td>100 000</td>
<td>666 660</td>
<td>En Exploitation</td>
</tr>
<tr>
<td>04</td>
<td>BeniSaf (A Temouchent)</td>
<td>200 000</td>
<td>1 333 320</td>
<td>En Exploitation</td>
</tr>
<tr>
<td>05</td>
<td>Mostaganem</td>
<td>200 000</td>
<td>1 333 320</td>
<td>En Exploitation</td>
</tr>
<tr>
<td>06</td>
<td>Douaouda (Alger Ouest)</td>
<td>120 000</td>
<td>666 660</td>
<td>En Exploitation</td>
</tr>
<tr>
<td>07</td>
<td>Cap Djene (Alger Est)</td>
<td>100 000</td>
<td>666 660</td>
<td>En Exploitation</td>
</tr>
<tr>
<td>08</td>
<td>Souk Tita (Tlemcen)</td>
<td>200 000</td>
<td>1 333 320</td>
<td>En Exploitation</td>
</tr>
<tr>
<td>09</td>
<td>Hocine (Tlemcen)</td>
<td>200 000</td>
<td>1 333 320</td>
<td>En Exploitation</td>
</tr>
<tr>
<td>10</td>
<td>Mactaa (Gan)</td>
<td>500 000</td>
<td>1 333 320</td>
<td>1er T 2014</td>
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<tr>
<td>11</td>
<td>El Tarf</td>
<td>50 000</td>
<td>-</td>
<td>-</td>
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<tr>
<td>12</td>
<td>Ténès</td>
<td>200 000</td>
<td>999 990</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>Oued Sebt (Tipaza)</td>
<td>100 000</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Total Stations : 13
Capacité m3/j : 2 260 000
Population : 11 873 220
1. Introduction
Seawater desalination has for a long time been a major source of water in parts of the Mediterranean to meet water demands, supplying ca. 12 Mm$^3$/day desalinated water in 2013. The desalination effort is expected to continue to increase. The MED POL Programme of UNEP/MAP is assessing now the implementation of its desalination guidelines published in 2004 and evaluating the state of play of the desalination section in the Mediterranean. The purpose is to produce an updated guideline and provide the Contracting Parties with adequate technical guidance to reduce to a minimum all environmental impacts. For this we would appreciate your collaboration in completing this short questionnaire.

2. General Questions
2.1. Country: CYPRUS
2.2. How many desalination plants are in operation in your country? 4 (Operating under Contracts with Cyprus Government)
   2.2.1. How many plants desalinate seawater? 4
   2.2.2. How many plants desalinate brackish water? 0
   2.2.3. How many plants have a production capacity >50,000 m$^3$/day? 3
2.3. What is the total annual desalination installed capacity? **80.5 Mm$^3$/year (2016)**
   2.3.1. What is the total annual production of desalinated water?
       - 48.7 Mm$^3$/year (2011)
       - 17.6 Mm$^3$/year (2012)
       - 10.7 Mm$^3$/year (2013)
       - 32.8 Mm$^3$/year (2014)
       - 38.1 Mm$^3$/year (2015)
       - 68.7 Mm$^3$/year (2016)
   2.3.2. What is the total annual production originating from seawater desalination? **100% (2016)**
2.4. Are there more desalination plants at the planning/construction stage? YES
   2.4.1. How many? 1
   2.4.2. Total planned desalination production **15,000 m$^3$/day**
   2.4.3. Expected year for start of production **2019**
3. Detailed information for large size desalination plants (>10,000 m$^3$/day, 3.65 Mm$^3$/year production).
(Please copy table for additional columns).

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Plant Name</th>
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</thead>
<tbody>
<tr>
<td>Name</td>
<td>Dhekelia</td>
<td>Larnaca</td>
<td>Vasilikos</td>
<td>Limassol</td>
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<tr>
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<td>2015</td>
<td>2014</td>
<td>2014</td>
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<td>Location$^1$</td>
<td></td>
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<tr>
<td>Desalination Technology$^2$</td>
<td>RO</td>
<td>RO</td>
<td>RO</td>
<td>RO</td>
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</tr>
<tr>
<td>Production, m$^3$/day</td>
<td>60,500</td>
<td>60,000</td>
<td>60,000</td>
<td>40,000</td>
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<tr>
<td>Method of brine discharge$^3$</td>
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<tr>
<td>Co- discharge with brine$^4$</td>
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<tr>
<td><strong>Chemicals used in the desalination process$^5$</strong></td>
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<tr>
<td>Coagulants</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>ferric chloride</td>
<td>ferric sulfate</td>
<td>ferric sulfate</td>
<td>no</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-Scalant</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>polyphosphonates</td>
<td>polyphosphonates</td>
<td>polyphosphonates</td>
<td>polyphosphonates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biocides</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>sodium hypochloride</td>
<td>sodium hypochloride</td>
<td>sodium hypochloride</td>
<td>sodium hypochloride</td>
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<tr>
<td>Water Hardener</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO$_2$ + Ca(OH)$_2$</td>
<td>calcium carbonate</td>
<td>calcium carbonate</td>
<td>calcium carbonate</td>
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<tr>
<td>Other</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chemicals co-discharged with brine$^6$</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>polyphosphonates</td>
<td>polyphosphonates</td>
<td>polyphosphonates</td>
<td>polyphosphonates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there a marine monitoring program in place?</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
</tbody>
</table>

$^1$Location: city, area
$^2$Desalination technology: RO-Reverse Osmosis, MSF- Multi Stage Flash, MED- Multi Effect Distillation, Other – please add technology
$^3$Method of Brine discharge: OD-Open discharge, MO- Marine outfall, Other – please add details
$^4$Co-discharge with brine: Other discharges, for example, cooling waters from Electric power stations
$^5$Please name the chemicals: i.e Coagulants – iron salts (FE); anti-scalant- polyphosphonates (Ppho), If the identity of the chemical is unknown, please add yes or no
$^6$Please name the chemicals discharged with the brine
Questinnaire Egypt
1. Introduction
Seawater desalination has for a long time been a major source of water in parts of the Mediterranean to meet water demands, supplying ca. 12 Mm$^3$/day desalinated water in 2013. The desalination effort is expected to continue to increase. The MED POL Programme of UNEP/MAP is assessing now the implementation of its desalination guidelines published in 2004 and evaluating the state of play of the desalination section in the Mediterranean. The purpose is to produce an updated guideline and provide the Contracting Parties with adequate technical guidance to reduce to a minimum all environmental impacts. For this we would appreciate your collaboration in completing this short questionnaire.

2. General Questions – Only for plants along or near the Mediterranean Coast
2.1. Country: EGYPT
2.2. How many desalination plants are in operation in your country along or near the Mediterranean coast? __________
   2.2.1. How many plants desalinate seawater? ________
   2.2.2. How many plants desalinate brackish water? ________
   2.2.3. How many plants have a production capacity >50,000 m$^3$/day?_____
   2.3.1. What is the total annual production of desalinated water? 200 Mm$^3$/year (2013). Includes desalination in the Red Sea.
   2.3.2. What is the total annual production originating from seawater desalination? ____
2.4. Are there more desalination plants at the planning/construction stage along the Mediterranean coast? YES.
   2.4.1. How many? 1 Al Almein
   2.4.2. Total planned desalination production 150,000 m$^3$/day __
   2.4.3. Expected year for start of production ________________
3. Detailed information for large size desalination plants (>10,000 m$^3$/day, 3.65 Mm$^3$/year production) only along the Mediterranean Coast. (Please copy table for additional columns).

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Plant Name</th>
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<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
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<tbody>
<tr>
<td>Name</td>
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<tr>
<td>Year starting to operate</td>
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<tr>
<td>Location$^1$</td>
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<tr>
<td>Desalination Technology$^2$</td>
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<tr>
<td>Production, m$^3$/day</td>
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<tr>
<td>Method of brine discharge$^3$</td>
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<tr>
<td>Co- discharge with brine$^4$</td>
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</tr>
</tbody>
</table>

Chemicals used in the desalination process$^5$

| Coagulants |            |            |            |            |            |
| Anti-Scalant |            |            |            |            |            |
| Biocides |            |            |            |            |            |
| Water Hardener |            |            |            |            |            |
| Other |            |            |            |            |            |

Chemicals co-discharged with brine$^6$

| Is there a marine monitoring program in place? |            |            |            |            |            |

---

$^1$Location: city, area  
$^2$Desalination technology: RO-Reverse Osmosis, MSF- Multi Stage Flash, MED - Multi Effect Distillation, Other – please add technology  
$^3$Method of Brine discharge: OD-Open discharge, MO- Marine outfall, Other – please add details  
$^4$Co-discharge with brine: Other discharges, for example, cooling waters from Electric power stations  
$^5$Please name the chemicals: i.e Coagulants – iron salts (Fe), anti-scalant- polyphosphonates (Ppho), If the identity of the chemical is unknown, please add yes or no  
$^6$Please name the chemicals discharged with the brine
4. References and historical data


FAO: “Sea water desalination is concentrated in the coastal areas along the Mediterranean and Red Sea, where there is no other source of water, and for tourism resorts. In 2010, desalination plants produced around 200 million m³/year (ICARDA and AusAID, 2011)”.

2. FAO, Aquastat
200 Mm³/year (2010)

Installed capacity in Egypt in 2013 – 7% of total desalination in the Mediterranean – 307 Mm³/year (840,000 m³/day). MAY INCLUDE DESALINATION ON THE RED SEA

http://www.imida.es/documents/13436/877249/06_REPORT_ON_WATER+DESALINATION.pdf/ae6203f4-68f9-4a37-b728-22b5d247909e
In 2011, 385 desalination plants with total capacity of 542,000 m³/day were on line, 153 plants with total capacity of 141,400 m³/day were presumed to be on line and 39 plants (with total capacity of 196,500 m³/day) were under construction. Most of the plants are small. Seawater desalination compriseds of 80% of the total desalination effort. INCLUDES DESALINATION IN THE RED SEA.

Installed capacity in 2008: MSF (10,500 m³/day), MED (4,132 m³/day), RO (8,756 m³/day). The location (Mediterranean or Red Sea) of the following desalination effort was unknown: MSF (6,530 m³/day), MED (11,990 m³/day), RO (89,352 m³/day).

In 2000, there were 7 operating plants with production capacity > 500 m³/day with a total of 7.6 Mm³/year (20,860 m³/day) installed capacity.
Questionnaire France
1. Introduction
Seawater desalination has for a long time been a major source of water in parts of the Mediterranean to meet water demands, supplying ca. 12 Mm$^3$/day desalinated water in 2013. The desalination effort is expected to continue to increase. The MED POL Programme of UNEP/MAP is assessing now the implementation of its desalination guidelines published in 2004 and evaluating the state of play of the desalination section in the Mediterranean. The purpose is to produce an updated guideline and provide the Contracting Parties with adequate technical guidance to reduce to a minimum all environmental impacts. For this we would appreciate your collaboration in completing this short questionnaire.

2. General Questions—Only for plants along or near the Mediterranean Coast
2.1. Country: FRANCE
2.2. How many desalination plants are in operation in your country along or near the Mediterranean coast? __________
   2.2.1. How many plants desalinate seawater? ________
   2.2.2. How many plants desalinate brackish water? ________
   2.2.3. How many plants have a production capacity >50,000 m$^3$/day?_______
2.3. What is the total annual desalination installed capacity? _77 Mm$^3$/year (2011), mostly riverine water desalination._
   2.3.1. What is the total annual production of desalinated water? _13 Mm$^3$/year (2013)._ 
   2.3.2. What is the total annual production originating from seawater desalination? 10 %
2.4. Are there more desalination plants at the planning/construction stage along the Mediterranean coast? __________
   2.4.1. How many? ______________
   2.4.2. Total planned desalination production ______________
   2.4.3. Expected year for start of production _______________
3. Detailed information for large size desalination plants (>10,000 m$^3$/day, 3.65 Mm$^3$/year production) only along the Mediterranean Coast. (Please copy table for additional columns).

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Year starting to operate</td>
<td>Location$^1$</td>
<td>Desalination Technology$^2$</td>
<td>Production, m$^3$/day</td>
</tr>
</tbody>
</table>

Chemicals used in the desalination process$^5$

| Coagulants | Anti-Scalant | Biocides | Water Hardener | Other | Chemicals co-discharged with brine$^6$ |

Is there a marine monitoring program in place?

$^1$Location: city, area

$^2$Desalination technology: RO-Reverse Osmosis, MSF- Multi Stage Flash MED - Multi Effect Distillation, Other – please add technology

$^3$Method of Brine discharge: OD-Open discharge, MO-Marine outfall, Other – please add details

$^4$Co-discharge with brine: Other discharges, for example, cooling waters from Electric power stations

$^5$Please name the chemicals: i.e Coagulants – iron salts (Fe), anti-scalant- polyphosphonates (Ppho), If the identity of the chemical is unknown, please add yes or no

$^6$Please name the chemicals discharged with the brine
4. References and historical data

   FAO: No data.

2. FAO, Aquastat
   No data

   Installed capacity in France in 2013 – 0.3% of total desalination in the Mediterranean – 13 Mm³/year (36,000 m³/day).

   http://www.imida.es/documents/13436/877249/06_REPORT_ON_WATER+DESALINATION.pdf/ae6203f4-68f9-4a37-b728-22b5d247909e
   In 2011, 39 desalination plants with total capacity of 212,152 m³/day were on line and 23 plants with total capacity of 20,952 m³/day were presumed to be on line. Seawater desalination constituted 10% of the total desalination effort, and riverine water 71%. Most of the plants are small and medium size.

   NO DATA

   NO DATA
Questionnaire
Seawater desalination status in the Mediterranean Region

1. Introduction
Seawater desalination has for a long time been a major source of water in parts of the Mediterranean to meet water demands, supplying ca. 12 Mm³/day desalinated water in 2013. The desalination effort is expected to continue to increase. The MED POL Programme of UNEP/MAP is assessing now the implementation of its desalination guidelines published in 2004 and evaluating the state of play of the desalination section in the Mediterranean. The purpose is to produce an updated guideline and provide the Contracting Parties with adequate technical guidance to reduce to a minimum all environmental impacts. For this we would appreciate your collaboration in completing this short questionnaire.

2. General Questions
2.1. Country: GREECE
2.2. How many desalination plants are in operation in your country? 157 (2011)
   2.2.1. How many plants desalinate seawater? ________
   2.2.2. How many plants desalinate brackish water? ________
   2.2.3. How many plants have a production capacity >50,000 m³/day?______
2.3. What is the total annual desalination installed capacity? 44 Mm³/year (2013)
   2.3.1. What is the total annual production of desalinated water? 40 Mm³/year (2011)
   2.3.2. What is the total annual production originating from seawater desalination? 56 % (2011)
2.4. Are there more desalination plants at the planning/construction stage? Yes
   2.4.1. How many? Upgrade Almyros, Iraklion, Crete________
   2.4.2. Total planned desalination production - 20,000 m³/day
   2.4.3. Expected year for start of production ________________
3. Detailed information for large size desalination plants (>10,000 m³/day, 3.65 Mm³/year production). (Please copy table for additional columns).

<table>
<thead>
<tr>
<th>Plant Name</th>
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<th>Plant Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Year starting to operate</td>
<td>Location¹</td>
<td>Desalination Technology²</td>
<td>Production, m³/day</td>
<td>Method of brine discharge³</td>
</tr>
<tr>
<td>Co-discharge with brine⁴</td>
<td>Chemicals used in the desalination process⁵</td>
<td>Coagulants</td>
<td>Anti-Scalant</td>
<td>Biocides</td>
<td>Water Hardener</td>
</tr>
<tr>
<td>Other</td>
<td>Chemicals discharged with the brine⁶</td>
<td>Is there a marine monitoring program in place?</td>
<td></td>
<td></td>
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</tbody>
</table>

¹Location: city, area

²Desalination technology: RO-Reverse Osmosis, MSF- Multi Stage Flash, MED - Multi Effect Distillation, Other – please add technology

³Method of Brine discharge: OD-Open discharge, MO- Marine outfall, Other – please add details

⁴Co-discharge with brine: Other discharges, for example, cooling waters from Electric power stations

⁵Please name the chemicals: i.e Coagulants – iron salts (FE), anti-scalant- polyphosphonates (Ppho), If the identity of the chemical is unknown, please add yes or no

⁶Please name the chemicals discharged with the brine
4. References and historical data

   FAO: No data

2. FAO, Aquastat
   No data

   Installed capacity in Greece in 2013 – 1% of total desalination in the Mediterranean – 44 Mm$^3$/year (130,000 m$^3$/day).

   In 2011, 157 desalination plants were reported on line for Greece with total capacity of 109,115 m$^3$/day on line, and 35 plants with total capacity of 40,135 m$^3$/day were presumed to be on line. Most of the plants are small. Seawater desalination consisted of 56% of the total desalination effort.

   Installed capacity in 2008: MSF (10,080 m$^3$/day), MED (11,620 m$^3$/day), RO (22,519 m$^3$/day).

   In 2000, there were 9 operating plants with production capacity > 500 m$^3$/day and a total of 8 Mm$^3$/year (21,840 m$^3$/day) installed capacity.

Questionnaire Israel
1. Introduction
Seawater desalination has for a long time been a major source of water in parts of the Mediterranean to meet water demands, supplying ca. 12 Mm$^3$/day desalinated water in 2013. The desalination effort is expected to continue to increase. The MED POL Programme of UNEP/MAP is assessing now the implementation of its desalination guidelines published in 2004 and evaluating the state of play of the desalination section in the Mediterranean. The purpose is to produce an updated guideline and provide the Contracting Parties with adequate technical guidance to reduce to a minimum all environmental impacts. For this we would appreciate your collaboration in completing this short questionnaire.

2. General Questions– Only for plants along or near the Mediterranean Coast
2.1. Country: ISRAEL
2.2. How many desalination plants are in operation in your country along or near the Mediterranean Coast? 13
2.2.1. How many plants desalinate seawater? 5
2.2.2. How many plants desalinate brackish water? 8
2.2.3. How many plants have a production capacity >50,000 m$^3$/day? 5
2.3. What is the total annual production of desalinated water? 637 Mm$^3$/year
2.4. What is the actual total annual production originating from seawater desalination? 587 Mm$^3$/year (1,608,000 m$^3$/day, 92% of total desalination effort). Less in rainy years.
2.5. Are there more desalination plants at the planning/construction stage along the Mediterranean coast? Yes
2.5.1. How many? 1
2.5.2. Total planned desalination production - 100 Mm$^3$/year
2.5.3. Expected year for start of production - Unknown
### Detailed information for large size plants (>10,000 m$^3$/day, 3.65 Mm$^3$/year production) only along the Mediterranean Coast.

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<thead>
<tr>
<th>Name</th>
<th>Plant Name</th>
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<td>Year starting to operate</td>
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<td>2010</td>
<td>2013</td>
<td>2015</td>
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<tr>
<td>Location$^1$</td>
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<td>Palmachim</td>
<td>Hadera</td>
<td>Palmachim</td>
<td>Ashdod</td>
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<tr>
<td>Desalination Technology$^2$</td>
<td>RO</td>
<td>RO</td>
<td>RO</td>
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<tr>
<td>Production, m$^3$/day</td>
<td>329,000</td>
<td>247,000</td>
<td>348,000</td>
<td>411,000</td>
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#### Chemicals used in the desalination process$^5$

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<th>Polymer</th>
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<th>Polymer</th>
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<tr>
<td>Biocides</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
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<tr>
<td>Water Hardener</td>
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</tr>
</tbody>
</table>

#### Chemicals co-discharged with brine$^6$

<table>
<thead>
<tr>
<th>Is there a marine monitoring program in place?</th>
<th>Fe, Ppho</th>
<th>Ppho</th>
<th>Ppho</th>
<th>Ppho</th>
<th>Ppho</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

$^1$Location: city, area

$^2$Desalination technology: **RO**-Reverse Osmosis, **MSF**- Multi Stage Flash , **MED** - Multi Effect Distillation, **Other** – please add technology

$^3$Method of Brine discharge: **OD**-Open discharge, **MO**- Marine outfall, **Other** – please add details

$^4$Co-discharge with brine: Other discharges, for example, cooling waters from Electric power stations

$^5$Please name the chemicals: i.e **Coagulants** – iron salts (FE), **anti-scalant**- polyphosphonates (Ppho), **If the identity of the chemical is unknown, please add yes or no**

$^6$Please name the chemicals discharged with the brine
4. References and historical data


FAO: “Mekorot, Israel’s national water supply company, has built and operated small- and medium-size desalination facilities in the southern part of the country since the 1960s. Eilat at the southern tip of the country by the Red Sea was the first city to use desalination. Some 29 small plants generate 25 million cubic meters of water per year, mainly from brackish water. A decision to desalinate on a larger scale was taken in 2000 as a result of Israel’s growing water scarcity. The national goal is to produce 750 million m$^3$/year of desalinated water in 2020 (MAE, 2005). In the near future a string of desalination plants along the Mediterranean coast will produce 400 million cubic meters per year. One large plant for the desalination of seawater was recently completed on the Mediterranean coast, and is now producing 115 million cubic meters a year of potable water (MITL, 2008). Using the reverse osmosis process, this plant is generating water for about 60 cents per cubic meter. All tenders issued for desalination facilities stipulate stringent threshold levels for water quality and provide incentives for even higher water qualities, especially in terms of chloride levels, in order to allow for irrigation without the attendant problem of soil salinity. In 2002, the total installed gross desalination capacity (design capacity) in Israel was 439 878 m$^3$/day or 160.6 million m$^3$/year (Wangnick Consulting, 2002).” DATA NOT UPDATED SINCE 2008

2. FAO, Aquastat

140 Mm$^3$/year (2007).


Installed capacity in Israel in 2013 – 18% of total desalination in the Mediterranean – 788 Mm$^3$/year (2,1600,000 m$^3$/day).


In 2011, 39 desalination plants with total capacity of 1124,712 m$^3$/day on line, 11 plants with total capacity of 44,762 m$^3$/day presumed to be on line and 4 plants (with total capacity of 911,000 m$^3$/day) under construction. INCLUDES THE RED SEA.


Installed capacity in 2008: MED (17,000 m$^3$/day), RO (441,000 m$^3$/day).
In 2000, there was 1 operating plant with production capacity > 500 m³/day with a total of 6.2 Mm³/year (17,000 m³/day) installed capacity.

Questionnaire Italy
Questionnaire
Seawater desalination status in the Mediterranean Region

1. Introduction
Seawater desalination has for a long time been a major source of water in parts of the Mediterranean to meet water demands, supplying ca. 12 Mm³/day desalinated water in 2013. The desalination effort is expected to continue to increase. The MED POL Programme of UNEP/MAP is assessing now the implementation of its desalination guidelines published in 2004 and evaluating the state of play of the desalination section in the Mediterranean. The purpose is to produce an updated guideline and provide the Contracting Parties with adequate technical guidance to reduce to a minimum all environmental impacts. For this we would appreciate your collaboration in completing this short questionnaire.

2. General Questions
2.1. Country: ITALY
2.2. How many desalination plants are in operation in your country?
   2.2.1. How many plants desalinate seawater? _______
   2.2.2. How many plants desalinate brackish water? ______
   2.2.3. How many plants have a production capacity >50,000 m³/day?_____
2.3. What is the total annual desalination installed capacity? 131 Mm³/year (2013)
   2.3.1. What is the total annual production of desalinated water?
   2.3.2. What is the total annual production originating from seawater desalination? 52% of total production.
2.4. Are there more desalination plants at the planning/construction stage? _ __
   2.4.1. How many? _ _ _________
   2.4.2. Total planned desalination production -
   2.4.3. Expected year for start of production ____________________
3. Detailed information for large size desalination plants (>10,000 m$^3$/day, 3.65 Mm$^3$/year production).
(Please copy table for additional columns).

<table>
<thead>
<tr>
<th>Plant Name</th>
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<td><strong>Location</strong>$^1$</td>
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<td><strong>Desalination Technology</strong>$^2$</td>
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<td><strong>Production, m$^3$/day</strong></td>
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<td><strong>Method of brine discharge</strong>$^3$</td>
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<td><strong>Co-discharge with brine</strong>$^4$</td>
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<tr>
<td><strong>Chemicals used in the desalination process</strong>$^5$</td>
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<td><strong>Coagulants</strong></td>
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<td><strong>Anti-Scalant</strong></td>
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<td><strong>Biocides</strong></td>
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<td><strong>Water Hardener</strong></td>
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<td><strong>Other</strong></td>
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</table>

| **Chemicals co-discharged with brine**$^6$ |            |            |            |            |            |
| **Is there a marine monitoring program in place?** |            |            |            |            |            |

$^1$Location: city, area

$^2$Desalination technology: RO-Reverse Osmosis, MSF- Multi Stage Flash, MED - Multi Effect Distillation, Other – please add technology

$^3$Method of Brine discharge: OD-Open discharge, MO- Marine outfall, Other – please add details

$^4$Co-discharge with brine: Other discharges, for example, cooling waters from Electric power stations

$^5$Please name the chemicals: i.e Coagulants – iron salts (Fe); anti-scalant- polyphosphonates (Ppho), If the identity of the chemical is unknown, please add yes or no

$^6$Please name the chemicals discharged with the brine
4. References and historical data

   
   FAO: No data.

2. FAO, Aquastat
   
   No data

   
   Installed capacity in Italy in 2013 –3% of total desalination in the Mediterranean – 131 Mm\(^3\)/year (360,000 m\(^3\)/day).

   
   [http://www.imida.es/documents/13436/877249/06_REPORT_ON_WATER+DESALINATION.pdf/ae6203f4-68f9-4a37-b728-22b5d247909e](http://www.imida.es/documents/13436/877249/06_REPORT_ON_WATER+DESALINATION.pdf/ae6203f4-68f9-4a37-b728-22b5d247909e)
   
   In 2011, 195 desalination plants with total capacity of 361,588 m\(^3\)/day were on line and 124 plants with total capacity of 373,333 m\(^3\)/day were presumed to be on line. Seawater desalination constituted 52% of the total desalination effort.

   
   Installed capacity in 2008: MSF (84,930 m\(^3\)/day), MED (87,100 m\(^3\)/day), RO (97,723 m\(^3\)/day).

   
   In 2000, there were 64 operating plants with production capacity > 500 m\(^3\)/day with a total of 129 Mm\(^3\)/year (353,990 m\(^3\)/day) installed capacity
Questionnaire Lebanon
1. Introduction
Seawater desalination has for a long time been a major source of water in parts of the Mediterranean to meet water demands, supplying ca. 12 Mm$^3$/day desalinated water in 2013. The desalination effort is expected to continue to increase. The MED POL Programme of UNEP/MAP is assessing now the implementation of its desalination guidelines published in 2004 and evaluating the state of play of the desalination section in the Mediterranean. The purpose is to produce an updated guideline and provide the Contracting Parties with adequate technical guidance to reduce to a minimum all environmental impacts. For this we would appreciate your collaboration in completing this short questionnaire.

2. General Questions
2.1. Country: **LEBANON**
2.2. How many desalination plants are in operation in your country? 13
   2.2.1. How many plants desalinate seawater? __________
   2.2.2. How many plants desalinate brackish water? ________
   2.2.3. How many plants have a production capacity >50,000 m$^3$/day?_______
2.3. What is the total annual desalination installed capacity? _10.6 Mm$^3$/year (2011)_
   2.3.1. What is the total annual production of desalinated water? _8.8 Mm$^3$/year (2013), 7.3 Mm$^3$/year (2011)_
   2.3.2. What is the total annual production originating from seawater desalination? 91% (2011); 18,263 m$^3$/day, 6.7 Mm$^3$/year
2.4. Are there more desalination plants at the planning/construction stage?
   2.4.1. How many? __________
   2.4.2. Total planned desalination production __________
   2.4.3. Expected year for start of production _________________
3. Detailed information for large size desalination plants (>10,000 m³/day, 3.65 Mm³/year production).
(Please copy table for additional columns).

<table>
<thead>
<tr>
<th>Plant Name</th>
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<tbody>
<tr>
<td><strong>Name</strong></td>
<td><strong>Year starting to operate</strong></td>
<td><strong>Location</strong>¹</td>
<td><strong>Desalination Technology</strong>²</td>
<td><strong>Production, m³/day</strong></td>
<td><strong>Method of brine discharge</strong>³</td>
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<tr>
<td><strong>Chemicals used in the desalination process</strong>⁵</td>
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<td><strong>Coagulants</strong></td>
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<td><strong>Biocides</strong></td>
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<td><strong>Water Hardener</strong></td>
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<tr>
<td><strong>Chemicals co-discharged with brine</strong>⁶</td>
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</table>

¹Location: city, area

²Desalination technology: **RO**-Reverse Osmosis, **MSF**- Multi Stage Flash **MED**- Multi Effect Distillation, **Other** – please add technology

³Method of Brine discharge: **OD**-Open discharge, **MO**- Marine outfall, **Other** – please add details

⁴Co-discharge with brine: Other discharges, for example, cooling waters from Electric power stations

⁵Please name the chemicals: i.e **Coagulants** – iron salts *(FE)*; **anti-scalant**- polyphosphonates (Ppho), **If the identity of the chemical is unknown, please add yes or no**

⁶Please name the chemicals discharged with the brine
4. References and historical data


FAO: No text

2. FAO, Aquastat

47.3 Mm$^3$/year (2006)


Installed capacity in Lebanon in 2013 – 0.2% of total desalination in the Mediterranean – 8.8 Mm$^3$/year (24,000 m$^3$/day).

http://www.imida.es/documents/13436/877249/06_REPORT_ON_WATER+DESALINATION.pdf/ae6203f4-68f9-4a37-b728-22b5d247909e

In 2011, 13 desalination plants with total capacity of 20,069 m$^3$/day on line, and 7 plants with total capacity of 9,056 m$^3$/day were presumed to be on line. Seawater desalination constituted 91% of the total effort.


NO DATA.


In 2000, there were 61 operating plants with production capacity > 500 m$^3$/day with a total of 5.5 Mm$^3$/year (15,190 m$^3$/day) installed capacity.
Questionnaire Libya
Questionnaire
Seawater desalination status in the Mediterranean Region

1. Introduction
Seawater desalination has for a long time been a major source of water in parts of the Mediterranean to meet water demands, supplying ca. 12 Mm$^3$/day desalinated water in 2013. The desalination effort is expected to continue to increase. The MED POL Programme of UNEP/MAP is assessing now the implementation of its desalination guidelines published in 2004 and evaluating the state of play of the desalination section in the Mediterranean. The purpose is to produce an updated guideline and provide the Contracting Parties with adequate technical guidance to reduce to a minimum all environmental impacts. For this we would appreciate your collaboration in completing this short questionnaire.

2. General Questions
2.1. Country: LIBYA
2.2. How many desalination plants are in operation in your country? 400 (2011)
   2.2.1. How many plants desalinate seawater? 20
   2.2.2. How many plants desalinate brackish water? _________
   2.2.3. How many plants have a production capacity >50,000 m$^3$/day? 11
2.3. What is the total annual desalination installed capacity? 482 Mm$^3$/year (2013)
   2.3.1. What is the total annual production of desalinated water? 70 Mm$^3$/year (2012)
   2.3.2. What is the total annual production originating from seawater desalination? 92% (2011)
2.4. Are there more desalination plants at the planning/construction stage? YES
   2.4.2. Total planned desalination production 1,265,000 m$^3$/day
   2.4.3. Expected year for start of production ___________________
3. **Detailed information for large size desalination plants (>10,000 m\(^3\)/day, 3.65 Mm\(^3\)/year production).** (Please copy table for additional columns).

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Tobruk</td>
<td>Bomba</td>
<td>Derna</td>
<td>Soussa</td>
<td>Abutaraba</td>
</tr>
<tr>
<td>Location(^1)</td>
<td>MED/TVC</td>
<td>MSF</td>
<td>MED/TVC</td>
<td>MED/TVC</td>
<td>MED/TVC</td>
</tr>
<tr>
<td>Production, m(^3)/day</td>
<td>40,000</td>
<td>30,000</td>
<td>40,000</td>
<td>50,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Method of brine discharge(^3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co-discharge with brine(^4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Chemicals used in the desalination process\(^5\)

- **Coagulants**
  - Btegard or Socolan

- **Anti-Scalant**
  - Polyphosphonates (Ppho)

- **Biocides**
  - Water Hardener

- **Other**
  - Chemicals co-discharged with brine\(^6\)

---

\(^1\)Location: city, area

\(^2\)Desalination technology: **RO**-Reverse Osmosis, **MSF**- Multi Stage Flash , **MED** - Multi Effect Distillation, **Other** – please add technology

\(^3\)Method of Brine discharge: **OD**-Open discharge, **MO**- Marine outfall, **Other** – please add details

\(^4\)Co-discharge with brine: Other discharges, for example, cooling waters from Electric power stations

\(^5\)Please name the chemicals: i.e **Coagulants** – iron salts (Fe), **anti-scalant**- polyphosphonates (Ppho), **If the identity of the chemical is unknown, please add yes or no**

\(^6\)Please name the chemicals discharged with the brine
<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Zawiya</td>
<td>Zuwara</td>
<td>Zuwara</td>
<td>Khoms</td>
<td>Elzutina</td>
</tr>
<tr>
<td>Location¹</td>
<td>Zawiya</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desalination Technology²</td>
<td>MED/TVC</td>
<td>MED</td>
<td>MED/TVC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Production, m³/day</td>
<td>80,000</td>
<td>40,000</td>
<td>40,000</td>
<td>40,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Method of brine discharge³</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co- discharge with brine⁴</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Chemicals used in the desalination process⁵**

- Coagulants
- Anti-Scalant
- Biocides
- Water Hardener
- Other

**Chemicals co-discharged with brine⁶**

Is there a marine monitoring program in place?
<table>
<thead>
<tr>
<th>Name</th>
<th>Year starting to operate</th>
<th>Location</th>
<th>Desalination Technology</th>
<th>Production, m³/day</th>
<th>Method of brine discharge</th>
<th>Co-discharge with brine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobruk 2</td>
<td>2001</td>
<td></td>
<td>MED</td>
<td>40,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zuara</td>
<td>1983</td>
<td></td>
<td></td>
<td>40,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Derna 2</td>
<td>2009</td>
<td></td>
<td></td>
<td>40,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zuara 2</td>
<td>2009</td>
<td></td>
<td></td>
<td>40,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Misrata Iron 2</td>
<td>2009</td>
<td></td>
<td></td>
<td>100,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soussa 2</td>
<td>2009</td>
<td></td>
<td></td>
<td>40,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Chemicals used in the desalination process

- Coagulants
- Anti-Scalant
- Biocides
- Water Hardener
- Other

### Chemicals co-discharged with brine

<table>
<thead>
<tr>
<th>Is there a marine monitoring program in place?</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
</tr>
</tbody>
</table>

### References and historical data


   FAO: “Desalination started in Libya in the early 1960s and installed capacity reached 226.3 million m³/year in 2006 for a total of more than 400 desalination plants, including 17 large ones (GEC, 2006). In 2012, the total desalinated water produced in Libya is estimated at 70 million m³/year aimed at municipal and industrial water demands and using both thermal and membrane technologies. Thermal desalination plants are located directly at electricity generation facilities.”

2. FAO, Aquastat

   70 Mm³/year (2012)

Installed capacity in Libya in 2013 – 11% of total desalination in the Mediterranean – 482 Mm$^3$/year (1320,000 m$^3$/day).


http://www.imida.es/documents/13436/877249/06_REPORT_ON_WATER+DESALINATION.pdf/ae6203f4-68f9-4a37-b728-22b5d247909e

In 2011, 285 desalination plants were reported for Libya, 68 with total capacity of 488,000 m$^3$/day on line, 75 plants with total capacity of 321,000 m$^3$/day presumed to be on line and 2 plants (with total capacity of 80,000 m$^3$/day) under construction.


Installed capacity in 2008: MSF (374,000 m$^3$/day), MED (380,000 m$^3$/day), RO (37,970 m$^3$/day).


In 2000, there were 61 operating plants with production capacity > 500 m$^3$/day with a total of 215 Mm$^3$/year (589,604 m$^3$/day) installed capacity.


Interview with the Chairman of the General desalination company of Libya (GDCOL), Mr. A. A. Elhassadi (2013).


Questionnaire Malta
1. **Introduction**

Seawater desalination has for a long time been a major source of water in parts of the Mediterranean to meet water demands, supplying ca. 12 Mm$^3$/day desalinated water in 2013. The desalination effort is expected to continue to increase. The MED POL Programme of UNEP/MAP is assessing now the implementation of its desalination guidelines published in 2004 and evaluating the state of play of the desalination section in the Mediterranean. The purpose is to produce an updated guideline and provide the Contracting Parties with adequate technical guidance to reduce to a minimum all environmental impacts. For this we would appreciate your collaboration in filling out this short questionnaire.

2. **General Questions**

   2.1. **Country:** MALTA

   2.2. How many seawater desalination plants are in operation in your country? ____________

   2.3. What is the total annual installed capacity of desalinated water?

   87.6 Mm$^3$/year (2013)

   2.4. What is the actual total annual production of desalinated water?

   Mm$^3$/year

   2.5. Are there more desalination plants at the planning/construction stage? __________

      2.5.1. How many? ____________

      2.5.2. Total planned desalination production ____________

      2.5.3. Expected year for start of production ____________

   2.6. Are there brackish water desalination plants? ________ Annual capacity________
3. Detailed information for large size desalination plants (>10,000 m$^3$/day, 3.65 Mm$^3$/year production).

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Malta</td>
<td>Penbrooke</td>
<td>Ghar Lapsi</td>
<td>Valetta</td>
</tr>
<tr>
<td>Year starting to operate</td>
<td>2006</td>
<td>2007</td>
<td>2008</td>
<td>1967</td>
</tr>
<tr>
<td>Location$^1$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desalination Technology$^2$</td>
<td>RO</td>
<td>RO</td>
<td>RO</td>
<td>MSF</td>
</tr>
<tr>
<td>Production, m$^3$/day</td>
<td>40,500</td>
<td>36,000</td>
<td>50,000</td>
<td>35,000</td>
</tr>
<tr>
<td>Method of brine discharge$^3$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co- discharge with brine$^4$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Chemicals used in the desalination process$^5$**

- Coagulants
- Anti-Scalant
- Biocides
- Water Hardener
- Other

**Chemicals co-discharged with brine$^6$**

| Is there a marine monitoring program in place? |

$^1$Location: city, area

$^2$Desalination technology: **RO**-Reverse Osmosis, **MSF**- Multi Stage Flash, **MED** - Multi Effect Distillation, **Other** – please add technology

$^3$Method of Brine discharge: **OD**-Open discharge, **MO**- Marine outfall, **Other** – please add details

$^4$Co-discharge with brine: Other discharges, for example, cooling waters from Electric power stations

$^5$Please name the chemicals: i.e **Coagulants** – iron salts (FE); **anti-scalant**- polyphosphonates (Ppho), **If the identity of the chemical is unknown, please add yes or no**

$^6$Please name the chemicals discharged with the brine

PLEASE COPY TABLE FOR ADDITIONAL COLUMNS.
4. References and historical data


FAO: “The desalinated water (31.40 million m³) was all used for the provision of potable water in the public supply, which is equal to 65% of the total potable water supply. “

2. FAO, Aquastat

18.9 Mm³/year (2013)


Installed capacity in Malta in 2013 – 2% of total desalination in the Mediterranean – 87.6 Mm³/year (240,000 m³/day).


http://www.imida.es/documents/13436/877249/06_REPORT_ON_WATER+DESALINATION.pdf/ae6203f4-68f9-4a37-b728-22b5d247909e

In 2011, 15 desalination plants with total capacity of 131,273 m³/day were on line and 16 plants with total capacity of 119,878 m³/day were presumed to be on line. Seawater desalination constituted 99% of the desalination effort.


Installed capacity in 2008: MED (4,200 m³/day), RO (186,920 m³/day).


In 2000, there were 15 operating plants with production capacity > 500 m³/day with a total of 45.2 Mm³/year (123,868 m³/day) installed capacity.
Questionnaire Morroco
Questionnaire
Seawater desalination status in the Mediterranean Region

1. Introduction
Seawater desalination has for a long time been a major source of water in parts of the Mediterranean to meet water demands, supplying ca. 12 Mm$^3$/day desalinated water in 2013. The desalination effort is expected to continue to increase. The MED POL Programme of UNEP/MAP is assessing now the implementation of its desalination guidelines published in 2004 and evaluating the state of play of the desalination section in the Mediterranean. The purpose is to produce an updated guideline and provide the Contracting Parties with adequate technical guidance to reduce to a minimum all environmental impacts. For this we would appreciate your collaboration in completing this short questionnaire.

2. General Questions – Only for plants along or near the Mediterranean Coast
2.1. Country: MOROCCO

2.2. How many desalination plants are in operation in your country along or near the Mediterranean coast? None
2.2.1. How many plants desalinate seawater? None along the Mediterranean coast and 06 along the Atlantic coast.
2.2.2. How many plants desalinate brackish water? None along the Mediterranean coast and 06 on the country.
2.2.3. How many plants have a production capacity >50,000 m$^3$/day? None

2.3. What is the total annual desalination installed capacity? 33.4 Mm$^3$/year
2.3.1. What is the total annual production of desalinated water? 33.4 Mm$^3$/year
2.3.2. What is the total annual production originating from seawater desalination? 11.3 Mm$^3$/year

2.4. Are there more desalination plants at the planning/construction stage along the Mediterranean coast? Yes
2.4.1. How many? One (EL Hoceima)
2.4.2. Total planned desalination production 200 l/s
2.4.3. Expected year for start of production: End of 2018
3. Detailed information for large size desalination plants (>10,000 m³/day, 3.65 Mm³/year production) only along the Mediterranean Coast. (Please copy table for additional columns).

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Name</th>
<th>Year starting to operate</th>
<th>Location</th>
<th>Desalination Technology</th>
<th>Production, m³/day</th>
<th>Method of brine discharge</th>
<th>Co-discharge with brine</th>
<th>Chemicals used in the desalination process</th>
<th>Is there a marine monitoring program in place?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>El Hoceima</td>
<td></td>
<td>El Hoceima</td>
<td>RO (Reverse osmosis)</td>
<td>17280 m³/day</td>
<td>Driving with diffuser</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>

1 Location: city, area
2 Desalination technology: RO-Reverse Osmosis, MSF- Multi Stage Flash, MED - Multi Effect Distillation, Other – please add technology
3 Method of Brine discharge: OD-Open discharge, MO-Marine outfall, Other – please add details
4 Co-discharge with brine: Other discharges, for example, cooling waters from Electric power stations
5 Please name the chemicals: i.e Coagulants – iron salts (Fe); Anti-scaIant - polyphosphonates (Ppho), If the identity of the chemical is unknown, please add yes or no

<table>
<thead>
<tr>
<th>Coagulants</th>
<th>Anti-Scalant</th>
<th>Biocides</th>
<th>Water Hardener</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>~ 136 meq/l</td>
<td></td>
</tr>
</tbody>
</table>

Chemicals co-discharged with brine

<table>
<thead>
<tr>
<th>Is there a marine monitoring program in place?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>At Different stages of the treatment process</td>
</tr>
</tbody>
</table>
Please name the chemicals discharged with the brine
4. References and historical data


**FAO**: “Actuellement, le recours au dessalement de l’eau de mer et à la déminéralisation des eaux souterraines saumâtres pour l’approvisionnement en eau potable des villes et des centres déficitaires est limité aux zones sahariennes du sud du Maroc. La capacité était d’environ 13.11 millions de m³ en 2011 (35 910 m³/jour dont 5 030 m³/jour de déminéralisation d’eau saumâtre; CSEC, 2014), mais devrait augmenter pour atteindre plus 100 millions de m³ en 2020, avec en particulier l’installation d’une usine à Agadir (Jariri, 2009), de Sidi Ifni et de Tantan (10 000 m³/jour) (CES, 2014) et 400 millions de m³ en 2030 selon la stratégie nationale de l’eau (Plan Bleu, 2011).” MOSTLY IN THE ATLANTIC COAST

2. **FAO, Aquastat**

7 Mm³/Year (2008)


Installed capacity in Morocco in 2013 – 1% of total desalination in the Mediterranean – 43.8 Mm³/year (120,000 m³/day). MAY INCLUDE DESALINATION OF ATLANTIC SEAWATER.


In 2011, 40 desalination plants were reported in Morocco, 15 with total capacity of 46,750 m³/day on line, 25 plants with total capacity of 38,721 m³/day presumed to be on line. Seawater desalination constituted 77% of the total desalination effort. MAY INCLUDE DESALINATION OF ATLANTIC SEAWATER.


NO DATA FOR THE MEDITERRANEAN


In 2000, there were 3 operating plants with production capacity > 500 m³/day with a total of 5.4 Mm³/year (14,802 m³/day) installed capacity.

Questionnaire Syria
Questionnaire
Seawater desalination status in the Mediterranean Region

1. Introduction
Seawater desalination has for a long time been a major source of water in parts of the Mediterranean to meet water demands, supplying ca. 12 Mm$^3$/day desalinated water in 2013. The desalination effort is expected to continue to increase. The MED POL Programme of UNEP/MAP is assessing now the implementation of its desalination guidelines published in 2004 and evaluating the state of play of the desalination section in the Mediterranean. The purpose is to produce an updated guideline and provide the Contracting Parties with adequate technical guidance to reduce to a minimum all environmental impacts. For this we would appreciate your collaboration in completing this short questionnaire.

2. General Questions
2.1. Country: SYRIA
2.2. How many desalination plants are in operation in your country? 8
   2.2.1. How many plants desalinate seawater? _______
   2.2.2. How many plants desalinate brackish water? _______
   2.2.3. How many plants have a production capacity >50,000 m$^3$/day? ______
2.3. What is the total annual desalination installed capacity? 5.1 Mm$^3$/year (2011)
   2.3.1. What is the total annual production of desalinated water? 2.9 Mm$^3$/year (2011)
   2.3.2. What is the total annual production originating from seawater desalination? 2 % (2011)
2.4. Are there more desalination plants at the planning/construction stage?
   2.4.1. How many? ____________
   2.4.2. Total planned desalination production ____________
   2.4.3. Expected year for start of production ________________
3. Detailed information for large size desalination plants (>10,000 m³/day, 3.65 Mm³/year production). (Please copy table for additional columns).

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
</tr>
</thead>
</table>

Name

Year starting to operate

Location

Desalination Technology

Production, m³/day

Method of brine discharge

Co-discharge with brine

<table>
<thead>
<tr>
<th>Chemicals used in the desalination process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coagulants</td>
</tr>
<tr>
<td>Anti-Scalant</td>
</tr>
<tr>
<td>Biocides</td>
</tr>
<tr>
<td>Water Hardener</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemicals co-discharged with brine</th>
</tr>
</thead>
</table>

Is there a marine monitoring program in place?

---

1 Location: city, area
2 Desalination technology: RO-Reverse Osmosis, MSF-Multi Stage Flash, MED-Multi Effect Distillation, Other - please add technology
3 Method of Brine discharge: OD-Open discharge, MO-Marine outfall, Other - please add details
4 Co-discharge with brine: Other discharges, for example, cooling waters from Electric power stations
5 Please name the chemicals: i.e Coagulants – iron salts (Fe); anti-scalant- polyphosphonates (Ppho), If the identity of the chemical is unknown, please add yes or no
6 Please name the chemicals discharged with the brine
4. References and historical data

   FAO: No relevant text

2. FAO, Aquastat
   No data

   Installed capacity in Syria in 2013 – 0% of total desalination in the Mediterranean

   http://www.imida.es/documents/13436/877249/06_REPORT_ON_WATER+DESALINATION.pdf/ae6203f4-68f9-4a37-b728-22b5d247909e
   In 2011, 8 desalination plants with total capacity of 7,893 m$^3$/day were on line and 6 plants with total capacity of 6,088 m$^3$/day were presumed to be on line. Seawater desalination constituted 3% of the desalination effort.

   NO DATA.

   NO DATA.
Questionnaire Tunisia
1. **Introduction**

Seawater desalination has for a long time been a major source of water in parts of the Mediterranean to meet water demands, supplying ca. 12 Mm$^3$/day desalinated water in 2013. The desalination effort is expected to continue to increase. The MED POL Programme of UNEP/MAP is assessing now the implementation of its desalination guidelines published in 2004 and evaluating the state of play of the desalination section in the Mediterranean. The purpose is to produce an updated guideline and provide the Contracting Parties with adequate technical guidance to reduce to a minimum all environmental impacts. For this we would appreciate your collaboration in completing this short questionnaire.

2. **General Questions**

2.1. **Country: TUNISIA**

2.2. How many desalination plants are in operation in your country? 32 (2011)

2.2.1. How many plants desalinate seawater? ________

2.2.2. How many plants desalinate brackish water? ________

2.2.3. How many plants have a production capacity >50,000 m$^3$/day? ______

2.3. What is the total annual desalination installed capacity? 19.7 Mm$^3$/year Brackish water desalination (2012), 8.8 Mm$^3$/year seawater desalination (2013)

2.3.1. What is the total annual production of desalinated water? 17.6 Mm$^3$/year (2011)

2.3.2. What is the total annual production originating from seawater desalination? 11% (2011); 9,900 m$^3$/day, 3.6 Mm$^3$/year

2.4. Are there more desalination plants at the planning/construction stage? Yes

2.4.1. How many? 1 at Sfax __________

2.4.2. Total planned desalination production 150,000 m$^3$/day

2.4.3. Expected year for start of production ________________
### 3. Detailed information for large size desalination plants (>10,000 m$^3$/day, 3.65 Mm$^3$/year production).

(Please copy table for additional columns).

<table>
<thead>
<tr>
<th>Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
<th>Plant Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kerkennah Brackish water</td>
<td>Gabès Brackish water</td>
<td>Zarzis Brackish water</td>
<td>Djerba Brackish water</td>
<td>Djerba Seawater</td>
<td></td>
</tr>
<tr>
<td>Year starting to operate</td>
<td>2016</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location$^1$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desalination Technology$^2$</td>
<td>RO</td>
<td></td>
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<tr>
<td>Production, m$^3$/day</td>
<td>50,000</td>
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<td>Method of brine discharge$^3$</td>
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<td>Co- discharge with brine$^4$</td>
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**Chemicals used in the desalination process$^5$**

- Coagulants
- Anti-Scalant
- Biocides
- Water Hardener
- Other

**Chemicals co-discharged with brine$^6$**

**Is there a marine monitoring program in place?**

$^1$Location: city, area

$^2$Desalination technology: RO-Reverse Osmosis, MSF- Multi Stage Flash, MED - Multi Effect Distillation, Other – please add technology

$^3$Method of Brine discharge: OD-Open discharge, MO- Marine outfall, Other – please add details

$^4$Co-discharge with brine: Other discharges, for example, cooling waters from Electric power stations

$^5$Please name the chemicals: i.e Coagulants – iron salts (Fe); anti-sclant- polyphosphonates (Ppho), If the identity of the chemical is unknown, please add yes or no

$^6$Please name the chemicals discharged with the brine
4. **References and historical data**


   FAO: “Les ressources en eau non conventionnelles ont été prises en considération depuis les années 1970. Quatre stations de dessalement (Kerkennah, Gabès, Zarzis et Djerba) ont permis au volume d’eau saumâtre dessalée de passer de 13 millions de m³ en 2000 à 19.7 millions de m³ en 2012 (Eurostat, 2014). L’eau dessalée est destinée essentiellement à l’approvisionnement en eau potable des centres urbains dans la région du sud-est. Une vingtaine de nouvelles stations devraient être construites prochainement pour l’amélioration de la qualité des eaux dans le Sud tunisien pour une capacité totale de 68 700 m³/jour. De plus une station sur l’île de Djerba d’une capacité nominale de 50 000 m³/jour devrait être mise en service en 2016 pour le dessalement d’eau de mer cette fois (MEDD, 2009).”

2. FAO, Aquastat
   19.7 Mm³/year (2012)


   Installed capacity in Tunisia in 2013 – 0.1% of total desalination in the Mediterranean – 8.8 Mm³/year (24,000 m³/day).


   In 2011, 56 desalination plants were reported, 32 with total capacity of 48,244 m³/day on line, 28 plants with total capacity of 45,032 m³/day presumed to be on line. Seawater desalination constituted 11% of the total effort, and the remaining was brackish water desalination.


   Installed capacity in 2008: MED (3,760 m³/day), RO (2,220 m³/day) – Total of 2.2 Mm³/year


   In 2000, there were 3 operating plants with production capacity > 500 m³/day with a total of 0.8 Mm³/year (2,220 m³/day) installed capacity.
Questinnaire Turkey
1. Introduction
Seawater desalination has for a long time been a major source of water in parts of the Mediterranean to meet water demands, supplying ca. 12 Mm$^3$/day desalinated water in 2013. The desalination effort is expected to continue to increase. The MED POL Programme of UNEP/MAP is assessing now the implementation of its desalination guidelines published in 2004 and evaluating the state of play of the desalination section in the Mediterranean. The purpose is to produce an updated guideline and provide the Contracting Parties with adequate technical guidance to reduce to a minimum all environmental impacts. For this we would appreciate your collaboration in completing this short questionnaire.

2. General Questions – Only for plants along or near the Mediterranean Coast
2.1. Country: TURKEY
2.2. How many desalination plants are in operation in your country? 57
   2.2.1. How many plants desalinate seawater? _______
   2.2.2. How many plants desalinate brackish water? _______
   2.2.3. How many plants have a production capacity >50,000 m$^3$/day? _______
2.3. What is the total annual desalination installed capacity? 131 Mm$^3$/year (2013). Mostly in the Marmara and Black Seas.
   2.3.1. What is the total annual production of desalinated water? 166 Mm$^3$/year (2011)
   2.3.2. What is the total annual production originating from seawater desalination? 93% (2011).
2.4. Are there more desalination plants at the planning/construction stage?
   2.4.1. How many? ___________
   2.4.2. Total planned desalination production ___________
   2.4.3. Expected year for start of production ________________
3. Detailed information for large size desalination plants (>10,000 m$^3$/day, 3.65 Mm$^3$/year production) only along the Mediterranean Coast. (Please copy table for additional columns).

<table>
<thead>
<tr>
<th>Plant Name</th>
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<td>Name</td>
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<td>Year starting to operate</td>
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<td>Desalination Technology$^2$</td>
<td>RO</td>
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<td>Production, m$^3$/day</td>
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<td>Method of brine discharge$^3$</td>
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<td>Co- discharge with brine$^4$</td>
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<td>Chemicals used in the desalination process$^5$</td>
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<td>Coagulants</td>
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<td>Water Hardener</td>
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<td>Other</td>
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<td>Chemicals co-discharged with brine$^6$</td>
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<tr>
<td>Is there a marine monitoring program in place?</td>
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</tbody>
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$^1$Location: city, area

$^2$Desalination technology: RO-Reverse Osmosis, MSF- Multi Stage Flash, MED - Multi Effect Distillation, Other – please add technology

$^3$Method of Brine discharge: OD-Open discharge, MO- Marine outfall, Other – please add details

$^4$Co-discharge with brine: Other discharges, for example, cooling waters from Electric power stations

$^5$Please name the chemicals: i.e Coagulants – iron salts (FE); anti-scalant- polyphosphonates (Ppho), If the identity of the chemical is unknown, please add yes or no

$^6$Please name the chemicals discharged with the brine
4. References and historical data

   FAO: No relevant text

2. FAO, Aquastat
   0.5 Mm³/year (2008)

   Installed capacity in Turkey in 2013 – 3% of total desalination in the Mediterranean – 131 Mm³/year (360,000 m³/day).

   In 2011, 59 desalination plants were reported on line for Turkey, with total capacity of 457,000 m³/day on line, and 2 plants with total capacity of 11,628 m³/day presumed to be on line. MOST OF THE DESALINATION SEEMS TO BE IN THE MARMARA AND BLACK SEA. Seawater desalination accounted for 93% of the total desalination effort.

   Installed capacity in 2008: MSF (1,000 m³/day), MED (8,640 m³/day), RO (30,850 m³/day), mostly in the Marmara Sea.

   NO DATA
Questionnaire State of Palestine
1. Introduction
Seawater desalination has for a long time been a major source of water in parts of the Mediterranean to meet water demands, supplying ca. 12 Mm$^3$/day desalinated water in 2013. The desalination effort is expected to continue to increase. The MED POL Programme of UNEP/MAP is assessing now the implementation of its desalination guidelines published in 2004 and evaluating the state of play of the desalination section in the Mediterranean. The purpose is to produce an updated guideline and provide the Contracting Parties with adequate technical guidance to reduce to a minimum all environmental impacts. For this we would appreciate your collaboration in completing this short questionnaire.

2. General Questions
2.1. How many desalination plants are in operation in your country? 7
   2.1.1. How many plants desalinate seawater? 1
   2.1.2. How many plants desalinate brackish water? 6
   2.1.3. How many plants have a production capacity >50,000 m$^3$/day?

2.2. What is the total annual desalination installed capacity? No data
   2.2.1. What is the total annual production of desalinated water? 4% of the total water demand (ref 7 and 8).
   2.2.2. What is the total annual production originating from seawater desalination?

2.3. Are there more desalination plants at the planning/construction stage? Yes
   2.3.1. How many? Expansion of Central coast plant
   2.3.2. Total planned desalination production - additional 12,000 m$^3$/day
   2.3.3. Expected year for start of production
3. Detailed information for large size desalination plants (>10,000 m$^3$/day, 3.65 Mm$^3$/year production). (Please copy table for additional columns).

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\(^6\)Please name the chemicals discharged with the brine
4. References and historical data

   FAO: No data

2. FAO, Aquastat
   No data

   No data

   http://www.imida.es/documents/13436/877249/06_REPORT_ON_WATER+DESALINATION.pdf/ae6203f4-68f9-4a37-b728-22b5d247909e
   No data

   No data

   No data
