The Impact of Oil & Gas Drilling Accidents on EU Fisheries

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European Fisheries in EU waters

Stocks overexploited

• Northeast Atlantic (39%)
• Mediterranean Sea (75%)
• Black Sea (88%)
Oil & Gas & Fisheries in EU waters

Regions

(I) Arctic waters
(II) Greater North Sea
(III) Celtic Seas
(IV) Bay of Biscay - Iberian Coast
(V) Wider Atlantic
(VI) Baltic Sea
(VII) Mediterranean Sea
(VIII) Black Sea
## Oil & Gas Industry in EU Waters

<table>
<thead>
<tr>
<th>REGION</th>
<th>O&amp;G INDUSTRY</th>
<th>ENVIRONMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>(I) Arctic Waters</td>
<td><strong>Production</strong> of O&amp;G Shallow waters (&lt; 230m)</td>
<td>Extreme climatic conditions -- risk of accident</td>
</tr>
<tr>
<td></td>
<td>Exploration in Faroe and Iceland</td>
<td></td>
</tr>
<tr>
<td>(II) Greater North Sea</td>
<td><strong>Exploration</strong> and <strong>production</strong> of O&amp;G Old exploitations (since 1960s) Very shallow waters (&lt; 100m)</td>
<td>South: sandy sediments and strong currents. Adapted fauna North: less sandy and weaker current. Corals and sponges</td>
</tr>
<tr>
<td>(III) Celtic Seas</td>
<td><strong>Production</strong> since 1985 Shallow bays</td>
<td>Shore areas are seabird heavens in winter. Oil spill may have strong impact</td>
</tr>
<tr>
<td>(IV) Bay of Biscay and Iberian Coast</td>
<td>Production of gas in Gulf of Cadiz</td>
<td>Variable topography Rich ecosystems and fauna</td>
</tr>
<tr>
<td>(V) Wider Atlantic</td>
<td><strong>Early exploration</strong> Deep waters (&gt; 2000m)</td>
<td>Mud and clay Cold water coral</td>
</tr>
<tr>
<td>(VI) Baltic Sea</td>
<td><strong>Exploration</strong> and <strong>production</strong> Shallow waters (~ 100m)</td>
<td>Shallow brackish water Semi-closed configuration Sensitive marine ecosystem</td>
</tr>
<tr>
<td>(VII) Mediterranean Sea</td>
<td><strong>Exploration</strong> and <strong>early production</strong></td>
<td>Semi-closed configuration Significant seismic activity Tourism industry</td>
</tr>
<tr>
<td>(VIII) Black Sea</td>
<td><strong>Exploration</strong> and <strong>early production</strong> Variable water depth (50-2000m)</td>
<td>Closed configuration Limited knowledge of biological life in deep waters. Vulnerable to disturbance</td>
</tr>
</tbody>
</table>
Types of Accidents

- Blowout
- Explosion
- Transportation
- Structural failure or collapse
- Spillage of oil or chemicals

Factors Determining the Effect of Oil Spillage

- Size of spill
- Nature of spill (light oil vs. dense crude)
- Season of year
- Weather conditions (storminess vs. calm atmosphere)
- Physical environment (open ocean vs. enclosed water)
- Response (fast vs. inadequate)
### Databases of Accidents

<table>
<thead>
<tr>
<th>Database</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BLOWOUT</strong></td>
<td>Compilation of blowouts and well releases since 1955</td>
</tr>
<tr>
<td><strong>WOAD</strong></td>
<td>Worldwide Offshore Accident Databank</td>
</tr>
<tr>
<td><strong>ITOPF</strong></td>
<td>Database of oil spills from tankers, carriers and barges since 1970</td>
</tr>
<tr>
<td><strong>REMPEC</strong></td>
<td>(Regional Marine Pollution Emergency Response Centre for Mediterranean Sea)</td>
</tr>
<tr>
<td><strong>ACOPS</strong></td>
<td>(Advisory Committee on Protection of the Sea) Annual report spills</td>
</tr>
<tr>
<td><strong>HSE</strong></td>
<td>Health and Safety Executive bodies in Norway and UK Compile incidents data</td>
</tr>
<tr>
<td><strong>MAIB</strong></td>
<td>Marine Accident Investigation Branch (UK Department of Transport)</td>
</tr>
</tbody>
</table>

**HSE** and **MAIB** are bodies in Norway and the UK that compile and investigate marine accidents and incidents data, respectively.

**ACOPS** is an annual report on spills from vessels and offshore installations in UK waters.

**REMPEC** is an online database and GIS alerts system for Mediterranean Sea spillages of oil and other substances.

**ITOPF** is a database operated by Det Norske Veritas, containing information on oil spills from tankers, carriers, and barges since 1970, with 10,000 spillages recorded.

**WOAD** (Worldwide Offshore Accident Databank) is operated by Det Norske Veritas, compiling blowouts and well releases since 1955.

**BLOWOUT** is a database by SINTEF, focusing on blowouts and well releases since 1955.
Recent History of Accidents (1/4)

All databases show a reduction in the number of accidents and their impact.
Recent History of Accidents (2/4)
Study from OGUK during the period 2000-2007

Floating units: 51 % accidents
Fixed units: 49 % accidents

![Pie chart showing percentages of accidents for floating and fixed units]

<table>
<thead>
<tr>
<th>Installation</th>
<th>Accidents (2000-2007)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td>2538</td>
</tr>
<tr>
<td>Drilling</td>
<td>19</td>
</tr>
<tr>
<td>Wellhead</td>
<td>169</td>
</tr>
<tr>
<td>Compression</td>
<td>18</td>
</tr>
<tr>
<td>Pumping</td>
<td>0</td>
</tr>
<tr>
<td>Injection</td>
<td>3</td>
</tr>
<tr>
<td>Accommodation</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>2750</strong></td>
</tr>
</tbody>
</table>

24/01/2014
Recent History of Accidents (3/4)
Study from OGUK during period 2000 - 2007 (floating units)

Mobile Offshore Drilling Unit

- Jackup
- Semisub.
- Drillship

Total: 254

Mobile Offshore Production Unit

- Jackup
- Semisub.
- TLP

Total: 195

24/01/2014

The impact of oil and gas drilling accidents on EU fisheries
## Recent History of Accidents (4/4)

Some examples of tanker transportation accidents

Tanker accidents occurring in European waters since 1967
Nine of the twenty major worldwide historical tanker accidents occurred in Europe are included for comparison.

<table>
<thead>
<tr>
<th>Date</th>
<th>Name</th>
<th>Country</th>
<th>Spillage</th>
<th>Spill (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1967</td>
<td>Torrey Canyon</td>
<td>Scilly Islands, UK</td>
<td>Crude oil</td>
<td>119,000</td>
</tr>
<tr>
<td>1975</td>
<td>Jakob Maersk</td>
<td>Portugal</td>
<td>Crude oil</td>
<td>88,000</td>
</tr>
<tr>
<td>1976</td>
<td>Urquiola</td>
<td>Spain</td>
<td>Crude oil</td>
<td>100,000</td>
</tr>
<tr>
<td>1978</td>
<td>Amoco Cadiz</td>
<td>France</td>
<td>Crude oil</td>
<td>223,000</td>
</tr>
<tr>
<td>1980</td>
<td>Irene Serenade</td>
<td>Portugal</td>
<td>Crude oil</td>
<td>100,000</td>
</tr>
<tr>
<td>1991</td>
<td>Haven</td>
<td>Italy</td>
<td>Crude oil</td>
<td>144,000</td>
</tr>
<tr>
<td>1992</td>
<td>Aegean</td>
<td>Spain</td>
<td>Light crude oil</td>
<td>74,000</td>
</tr>
<tr>
<td>1993</td>
<td>Braer</td>
<td>United Kingdom</td>
<td>Light crude oil</td>
<td>85,000</td>
</tr>
<tr>
<td>1996</td>
<td>Sea Empress</td>
<td>United Kingdom</td>
<td>Light crude oil</td>
<td>72,000</td>
</tr>
<tr>
<td>1999</td>
<td>Erika</td>
<td>France</td>
<td>Heavy fuel oil</td>
<td>20,000</td>
</tr>
<tr>
<td>2000</td>
<td>Eurobulker</td>
<td>Greece</td>
<td>Bunker fuel oil</td>
<td>700</td>
</tr>
<tr>
<td>2000</td>
<td>Alhambra</td>
<td>Estonia</td>
<td>Heavy fuel oil</td>
<td>250</td>
</tr>
<tr>
<td>2001</td>
<td>Baltic Carrier</td>
<td>Denmark</td>
<td>Heavy fuel oil</td>
<td>2,700</td>
</tr>
<tr>
<td>2002</td>
<td>Prestige</td>
<td>Spain</td>
<td>Heavy fuel oil</td>
<td>77,000</td>
</tr>
<tr>
<td>2003</td>
<td>Fu Shan Hai</td>
<td>Baltic-3 countries</td>
<td>Heavy fuel oil and others</td>
<td>1,200</td>
</tr>
<tr>
<td>2012</td>
<td>Alfa I</td>
<td>Greece</td>
<td>Oil</td>
<td>330</td>
</tr>
</tbody>
</table>
Other Sources of Impact

There are harmful effects occurring in association with offshore O&G accidents but not limited to those events that impact the fauna and marine environment.

• **Noise**: Underwater sources of noise related with offshore O&G are various, including seismic surveys, drilling operations, and supporting vessels. May lead to redistribution of fish and affect spawning.

• **Cuttings piles**: When drilling the substrate to access the oil or gas reservoir, small pieces of rocks known as cuttings are originated. The cuttings are discharged to the seabed, re-injected into a well or taken ashore for treatment and disposal. Oil based drilling fluids, although effective, are considered harmful for the environment, as they do not disperse easily. Oil-based mud is transported ashore for treatment and recycling and only water-based mud can remain to disperse in the sea. Sediments deposited on the seabed can smother fauna that require particular sediments to feed and spawn on, as well as even resilient corals (Larsson and Purser, 2011) and phytoplankton (Pabortsova et al., 2011). In shallow waters sediments deposit faster and may harm living species.

• **Atmospheric emissions**: Activities producing gaseous emissions due to flaring at the well site are assumed to have no impact on fish populations (OGUK, 2009).

• **Radioactive materials**: “Produced water” (the compound of water and waste materials that result from drilling) contains soluble components, including Barium and radioactive intermediates of Uranium and Thorium that can precipitate forming an insoluble NORM (naturally occurring radioactive material) scale. However, the radioactivity discharged from offshore oil and gas operations is not considered to have a significant environmental impact (OGUK, 2009).
Impacts of O&G Accidents on Fisheries and Aquaculture

Direct impact on fisheries

- Closure of fisheries
- Change in demand (public perception)

Indirect impact on fisheries

- Reduction in harvesting rates
- Mortality of organisms
- Altered behaviour and reproductive capacity

Indirect impact on ecosystems

- Long-term effects - Not well known
- Dependent on environment resilience
Economic Cost of Impacts (1/5)

Direct impact
- Damage to equipment
- Loss of working time
- Loss of revenue

Indirect impact
- Loss of public confidence
- Adaptation of market: loss of quota
Economic Cost of Impacts (2/5)

Example:

**IMPACT ON FISHERIES PRODUCTION IN SHETLAND**

As a result of the Braer grounding in the southern coast of Shetland in 1993 and the spillage of 85,000 tonnes of oil affecting the environment:

- **10% of the demersal fisheries were adversely affected during four months**
- **40% of all shellfish grounds were excluded for two years**
- **25% of total production of farmed salmon was severely tainted**

These impacts on fisheries represented an important and direct loss of income for the industry.
## Economic Cost of Impacts (3/5)

Methods for estimation of cost of impacts

<table>
<thead>
<tr>
<th>Name</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social cost</td>
<td>Assessment of the loss of benefit or revenue from fishing activities; it is frequently evaluated as economic value of the difference in landings before and after the accident.</td>
</tr>
<tr>
<td>Compensation</td>
<td>The monetary value accepted to be rewarded by compensation mechanisms is assumed to be the cost on fisheries.</td>
</tr>
<tr>
<td>Evaluation of affected productive sectors</td>
<td>Economic losses of all sectors associated with fishing activities are assessed with existing base data.</td>
</tr>
<tr>
<td>Habitat Equivalency Analysis</td>
<td>Compares resources lost as a result of an incident with benefits that can be gained from a habitat or wildlife restoration project. Requires modelling.</td>
</tr>
<tr>
<td>Resource Equivalence Analysis</td>
<td>Monetary cost of funding the reestablishment of a comparable amount of resources lost or injured. Requires modelling.</td>
</tr>
<tr>
<td>Restoration Based Analysis</td>
<td>Estimation of costs needed to restore resources equivalent to those existing prior to the accident.Requires modelling.</td>
</tr>
</tbody>
</table>
Elastic Cost of Impacts (4/5)

ECONOMIC COST OF MINOR IMPACT INCIDENTS

Fisheries affected in the North Sea by incidents in relation with the offshore O&G industry

Since the year 2000 there have been almost 500 claims to the Fishermen’s Compensation Fund (UK) for damages to fishing vessels in relation to incidents of O&G activities in the North Sea. These claims have been made for three categories: loss of gear, loss of fishing time, and damage to vessel. The amount claimed and settled in individual cases ranged between £100 and £50,000 with a mean value of £3900. On average, the most costly component of the total amount claimed and settled is the damage produced to fishing gear (63%), followed by the loss of fishing time (31%). Damages to the fishing vessel make up - on average - 6% of the amount claimed and settled in individual cases.

The total amount claimed and settled between 2000 and May 2013 was £1.8 million.
Economic Cost of Impacts (5/5)
Example:

ECONOMIC COST OF MAJOR ACCIDENT

Fisheries affected on the Galician coast after the Prestige accident in 2002

Short-term cost of the accident impact analysing fish landings and aquaculture (mussel and turbot) production:

- The economic loss suffered in 2003 was €56 million (fishing) and €9 million (aquaculture)
- The reduction of production was 10% while income decreased more than 17%.

Short-term economic losses on commercial fisheries and shellfish, mussel production, and canning and processing industries:

- Landings of 36 species in the periods prior to the accident and after the accident showed a loss of 50% in quantity and 60% in revenue value.
- The accumulated economic loss associated with loss of landings in the two years following the accident was €124 million.
- Mussel economic loss was €12.8 million, affected by market fluctuations and loss of perceived quality and reputation.
- Losses by the canning industry were €26.8 million in two years following the accident.

Exhaustive analysis of landing losses with data broken down for the individual markets and species during period 1998-2005. They found total landings decreased by 17% after the accident, but more importantly highlighted a complex pattern of landings by species, probably explained by exploitation of new species or increased fishing effort.
Current Efforts to Mitigate Impacts (1/3)

Prevention

Legislation and conventions

Liability

Research and Technology
Current Efforts to Mitigate Impacts (2/3)

Alleviation

• Action plans (contingency plans)

• Remediation
  • Physical removal (preferred)
  • Chemical dispersants
  • Biodegradation agents
  • Shoreline cleaning

• Compensation

• International mechanisms
### Current Efforts to Mitigate Impacts (3/3)

#### Compensation Mechanisms

<table>
<thead>
<tr>
<th>Name</th>
<th>Date of Creation</th>
<th>Total Payable</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOPC Supplementary Fund Protocol</td>
<td>2003</td>
<td>750 million SDR</td>
<td>29</td>
</tr>
<tr>
<td>IOPC 1992 Fund</td>
<td>1992</td>
<td>203 million SDR</td>
<td>111</td>
</tr>
<tr>
<td>Bunker Convention</td>
<td>2001</td>
<td>Depends on bunker size</td>
<td>54</td>
</tr>
<tr>
<td>Offshore Pollution Liability Agreement</td>
<td>1974</td>
<td>$250 million</td>
<td>9</td>
</tr>
</tbody>
</table>
Conclusions

• Accidents happen!

• Historically the **major accidents** have been **transport related**

• **Methods developed** for the **evaluation of economic impacts**: Social Cost and Compensation

• European O&G industry has the **experience and knowledge** to **minimize risks** and to **assure maximum safety** during operations

• **Legislation** is being updated to meet industry requirements

• The recently approved **Directive 2013/30** establishes rules for the entire lifecycle of exploration and production activities

Recommendations (1/2)

Regulatory measures and activity guidelines

• State members should ensure timely transfer of Directive 2013/30 into the national legislation
• Provide mechanisms for effective enforcement
• Encourage governments in other countries to produce regulatory frameworks

• Operators should follow current rules in daily activities
• Report potential conflict of rules with current technology
• Operate with maximum safety in all waters

Influence on the international environment

• Promote safety standards and regulations in neighbouring countries
• Support the emerging industry
• Encourage non-European countries also to develop compatible and safety rules
Recommendations (2/2)

Research and Technology

• Improve knowledge of environmental conditions
• Research in extreme condition environments like the Arctic
• Produce and maintain databases of minor accidents
• Maintain / increase research effort

Compensation

• Improve methods for assessment of economic costs
• Develop and implement specific mechanisms for offshore O&G incidents
• Guarantee compensation to all sectors affected, including ones at a distance
Thank you