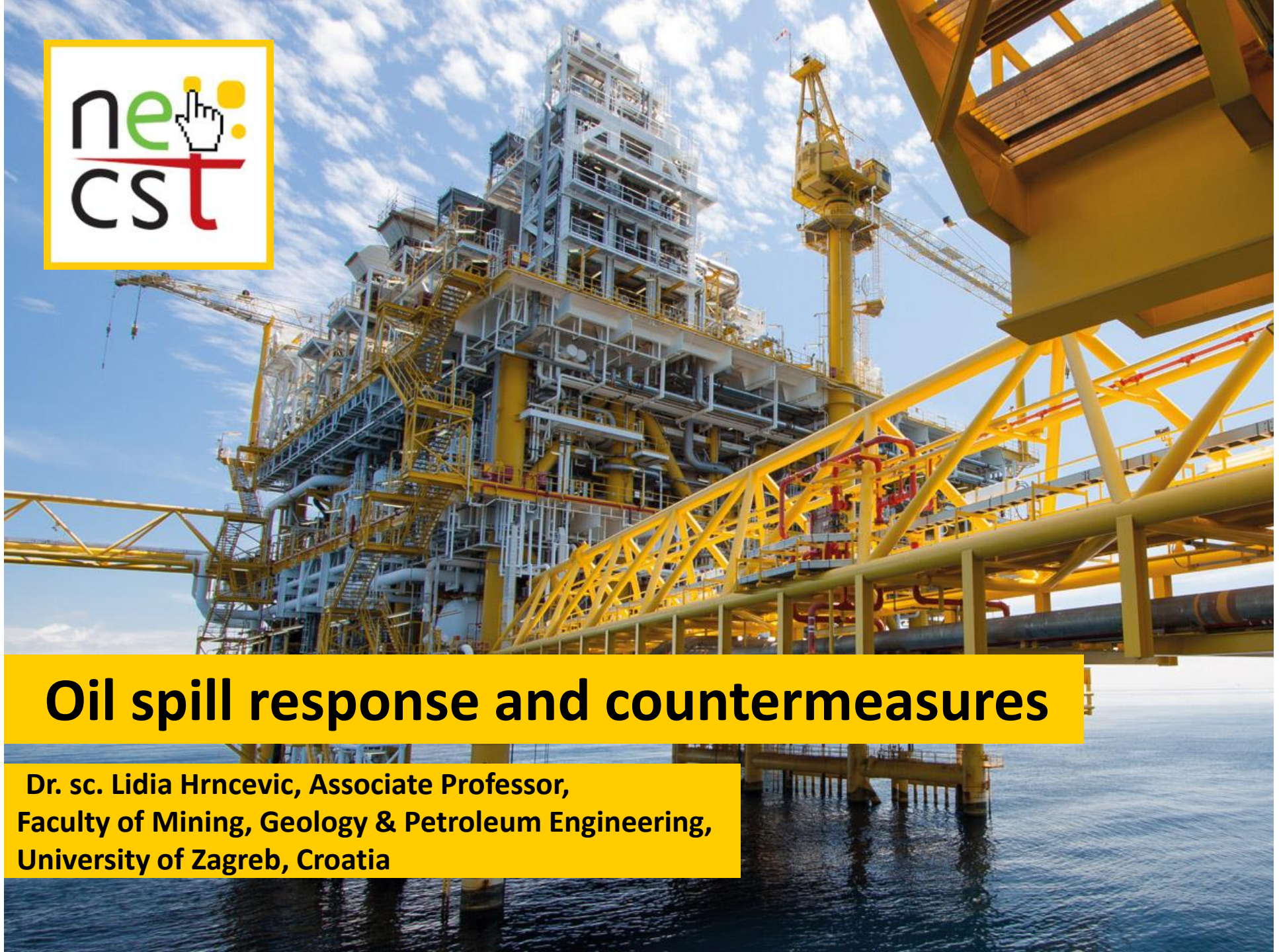
A new energy culture

sustainability and territories

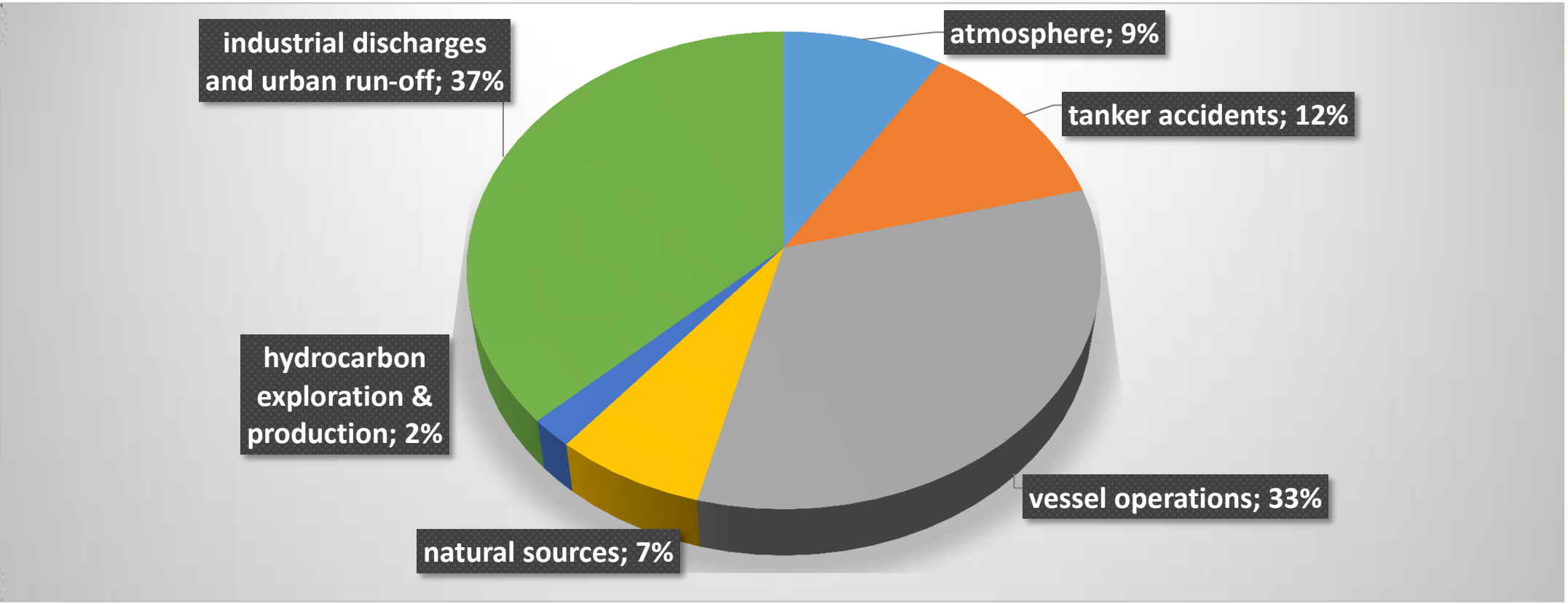


Oil spill response and countermeasures

Dr. sc. Lidia Hrncevic, Associate Professor,
Faculty of Mining, Geology & Petroleum Engineering,
University of Zagreb, Croatia

Erasmus+

Major sources of marine oil pollution



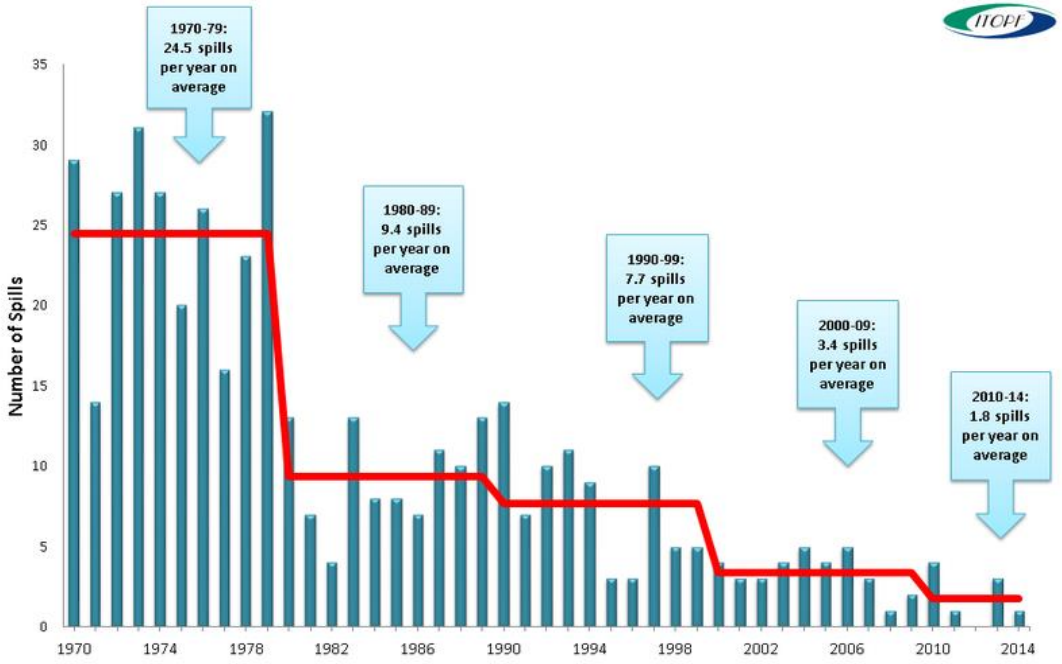
Source: World Petroleum Council

Erasmus+

Tanker oil spills

- < 7 tonnes
- 7-700 tonnes
- >700 tonnes

Source: ITOPF

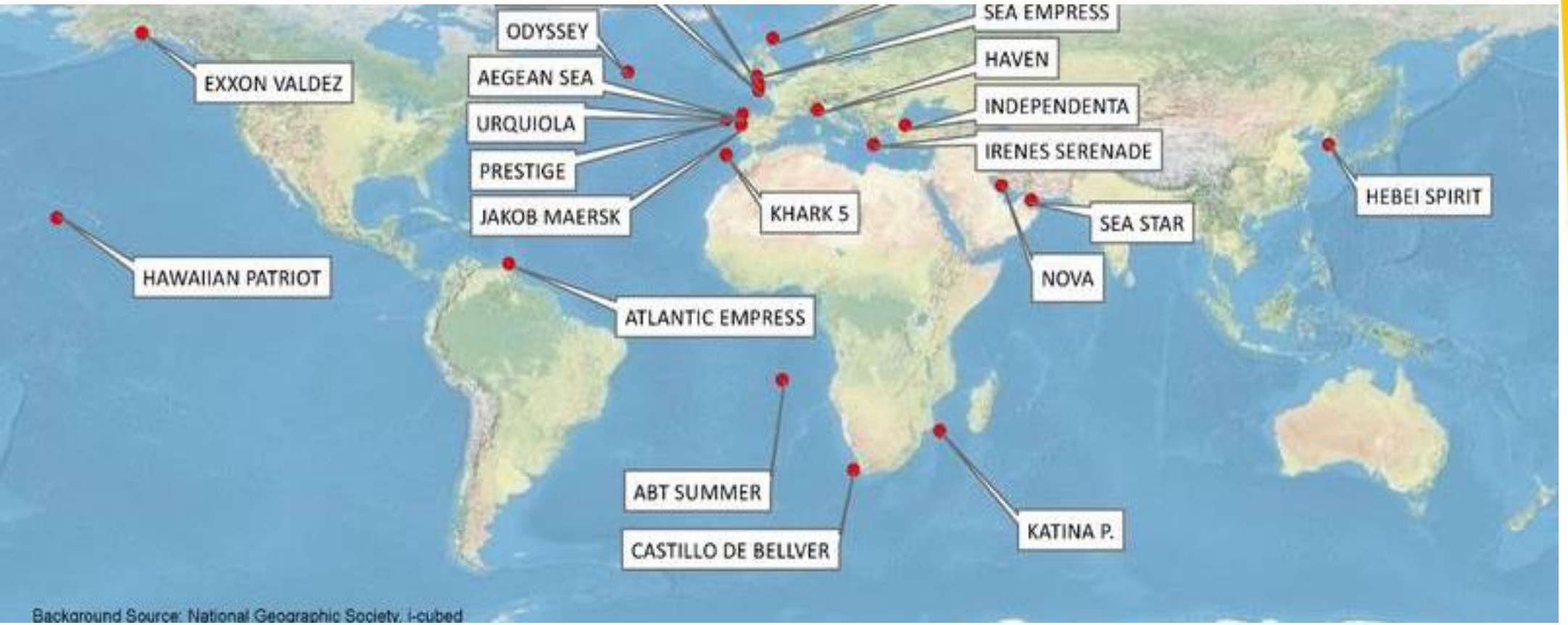


Source: ITOPF

Erasmus+

INTERNATIONA TANKER OWNERS POLLUTION FEDERATION

Major tanker oil spills



Source: ITOPF

Marine environment- global conventions

London Convention- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (), London, 1972.

MARPOL 73/78-International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (), London 1973 and 1978.

OILPOL- International Convention for the Prevention of Pollution of the Sea by Oil, London 1954, 1962 and 1969.

Barcelona Convention, Convention for the Protection and Development of the Marine Environment and Coastal Region of the Mediterranean Sea, Barcelona, 1976.

OPRC-International Convention on Oil Pollution Preparedness, Response and Co-operation (), London, 1990.

OPRC-HNS PROTOCOL- Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances, London, 2000.

OSPAR Convention-Convention for the Protection of the Marine Environment of the North-east Atlantic, Paris, 1992.

Contingency planning

- Coordination of all aspects of the response to an oil spill
- Scope- from single facility to state level
- „Prepare for the worst, expect the best” principle
- Testing

Contingency planning

- **Phases:**
  - Alerting and reporting
  - Evaluation and mobilization
  - Containment and recovery
  - Disposal
  - Remediation and restoration

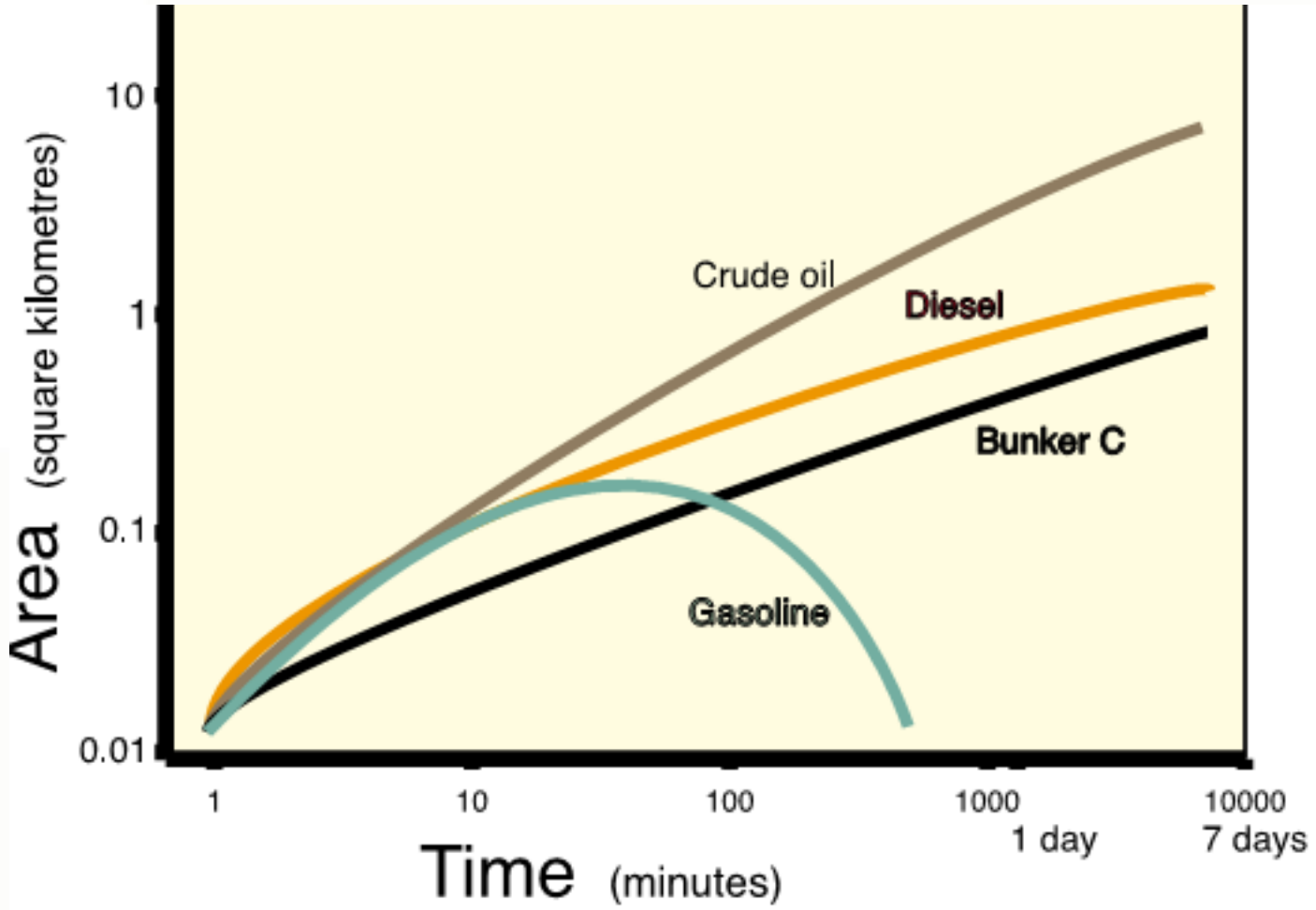
Contingency planning-Croatia

- Contingency Plan for Accidental Marine Pollution (Official Gazette 8/08)
- Procedures and measures for predicting, preventing, resticting, preparedness and response
- Oil spill > 2000 m^3
- Entities:

  - Headquarters for the implementation of the Contingency Plan –Headquarters
  - Maritime Rescue Coordination Centre – Rijeka- MRCC
  - County Operational Centre- COC

Fate of oil in marine environment

- Spreading
- Drifting
- Weathering

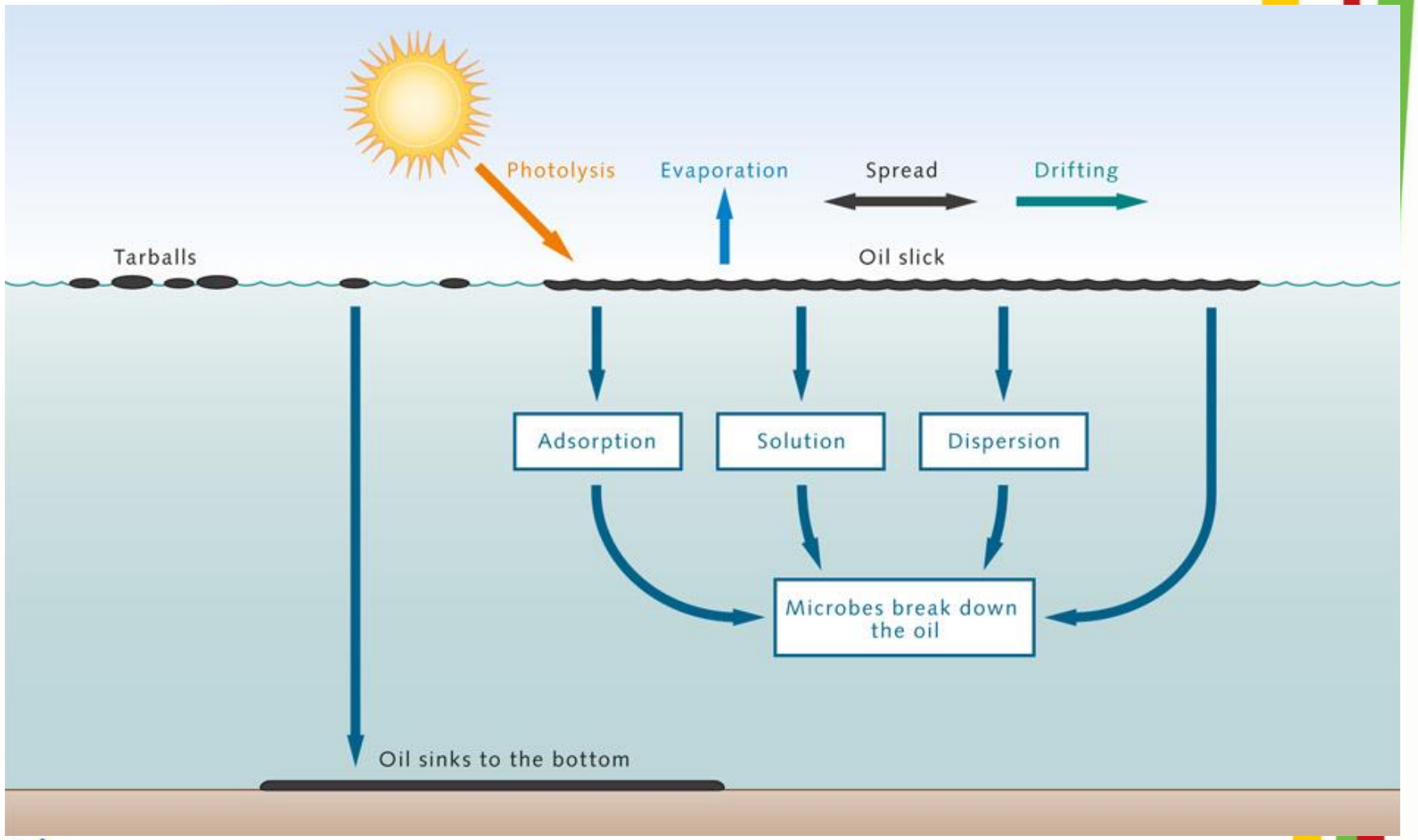


Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Erasmus+

Weathering

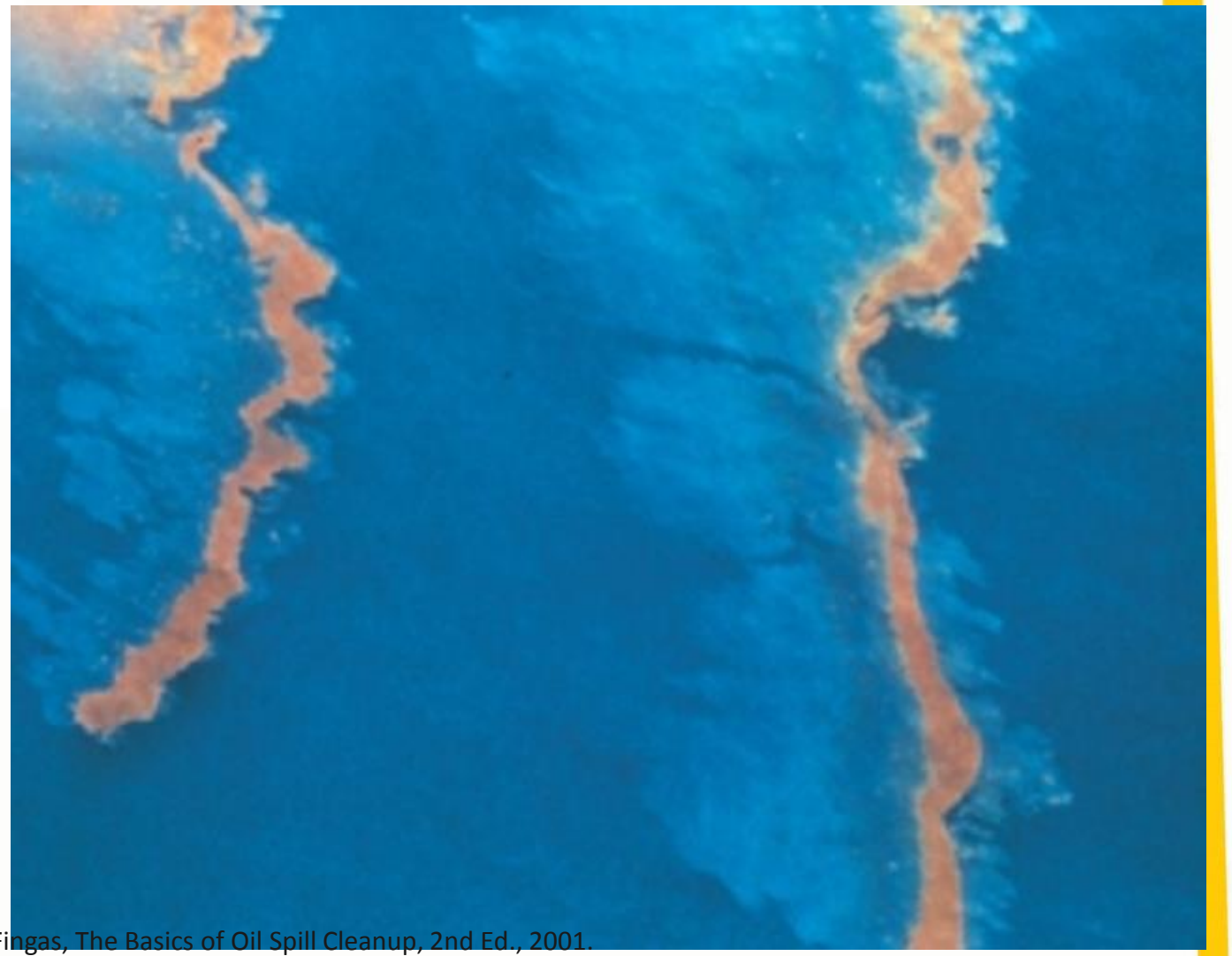
- Evaporation
- Emulsification-2 i 3
- Natural Dispersion-4
- Dissolution
- Photo-oxidation
- Sedimentation-5
- Adhesion
- Biodegradation
- Sinking
- Formation of tar balls



Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Weathering

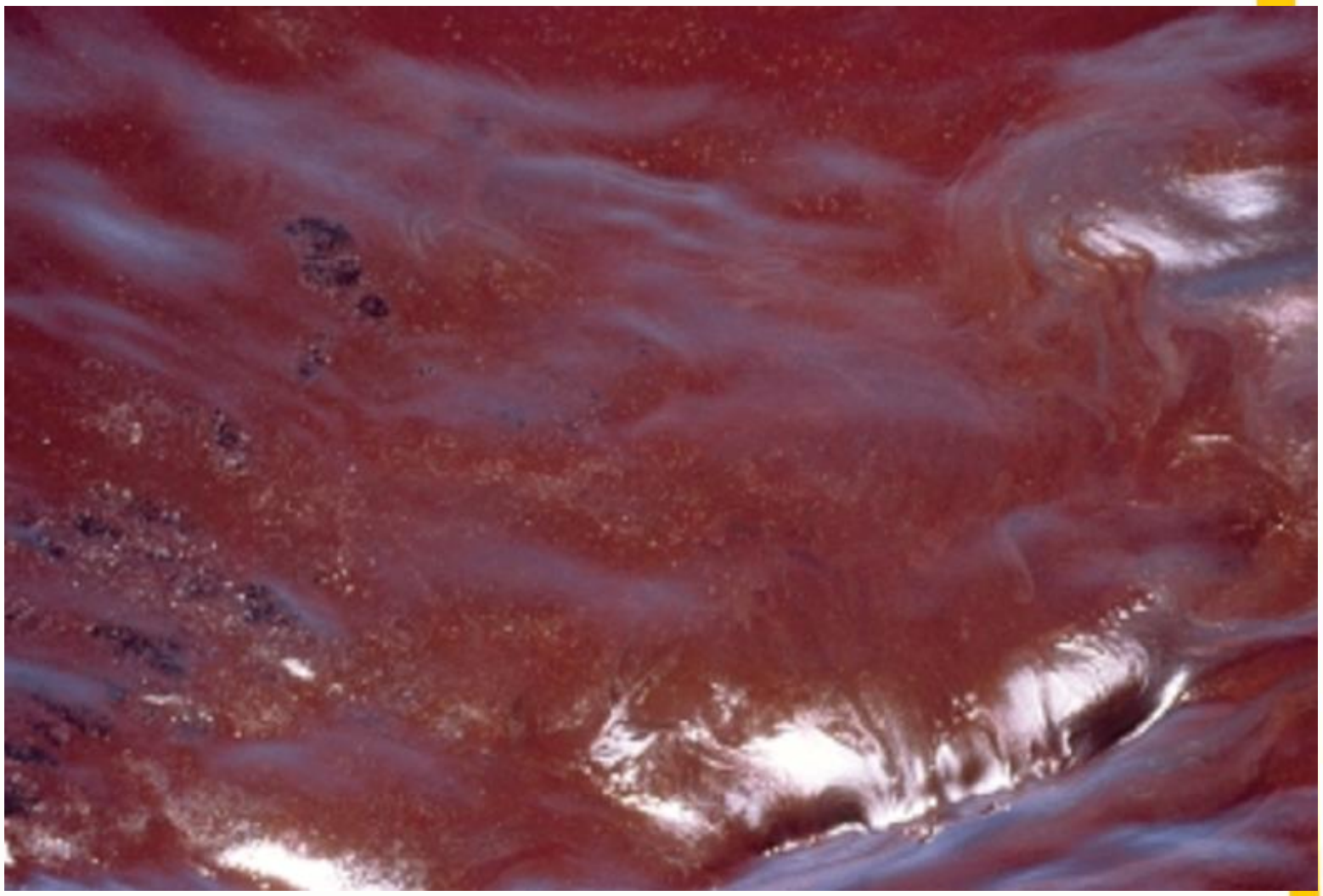
- Evaporation
- Emulsification-2 i 3
- Natural Dispersion-4
- Dissolution
- Photo-oxidation
- Sedimentation-5
- Adhesion
- Biodegradation
- Sinking
- Formation of tar balls



Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Weathering

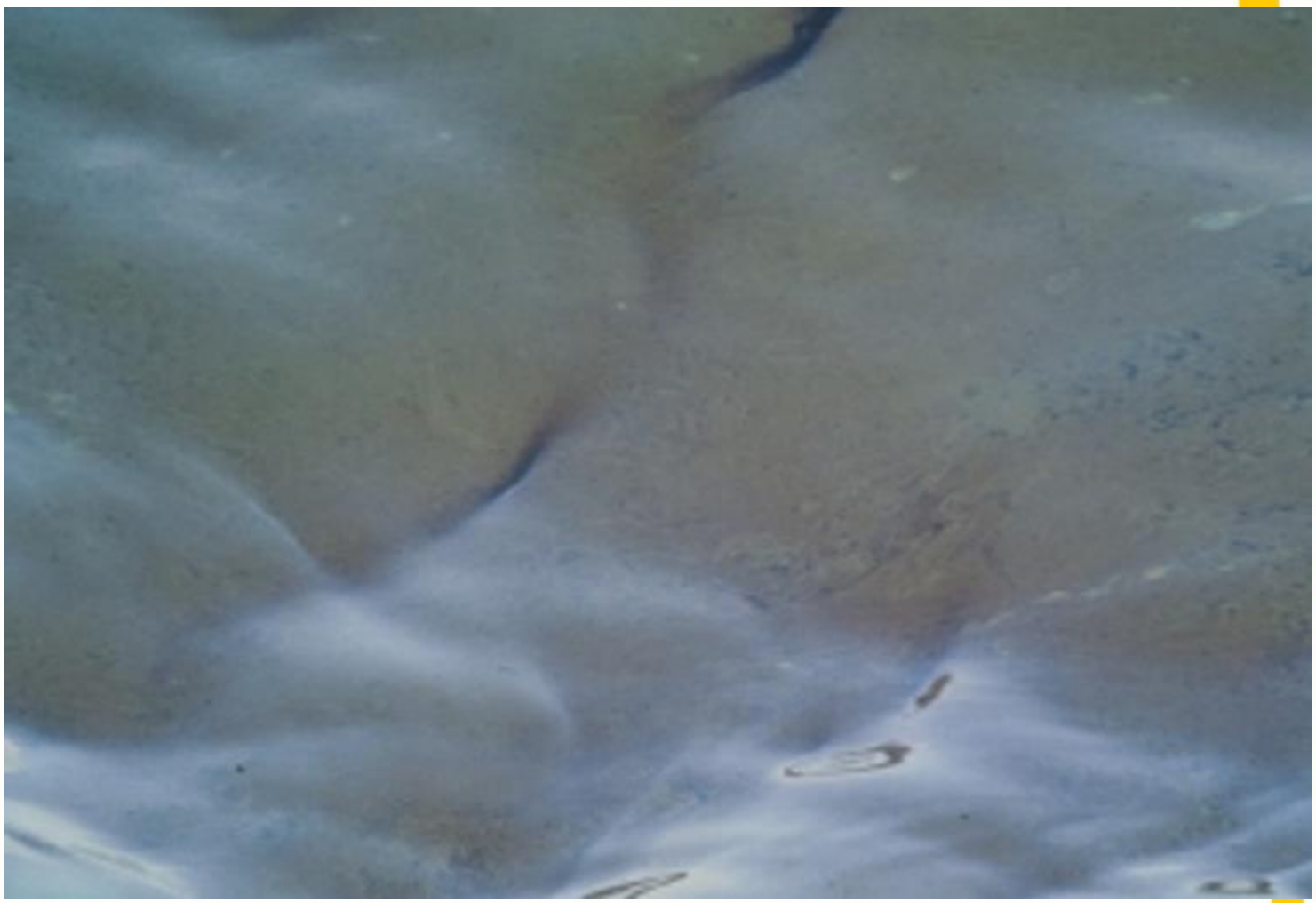
- Evaporation
- Emulsification-2 i 3
- Natural Dispersion-4
- Dissolution
- Photo-oxidation
- Sedimentation-5
- Adhesion
- Biodegradation
- Sinking
- Formation of tar balls



Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Weathering

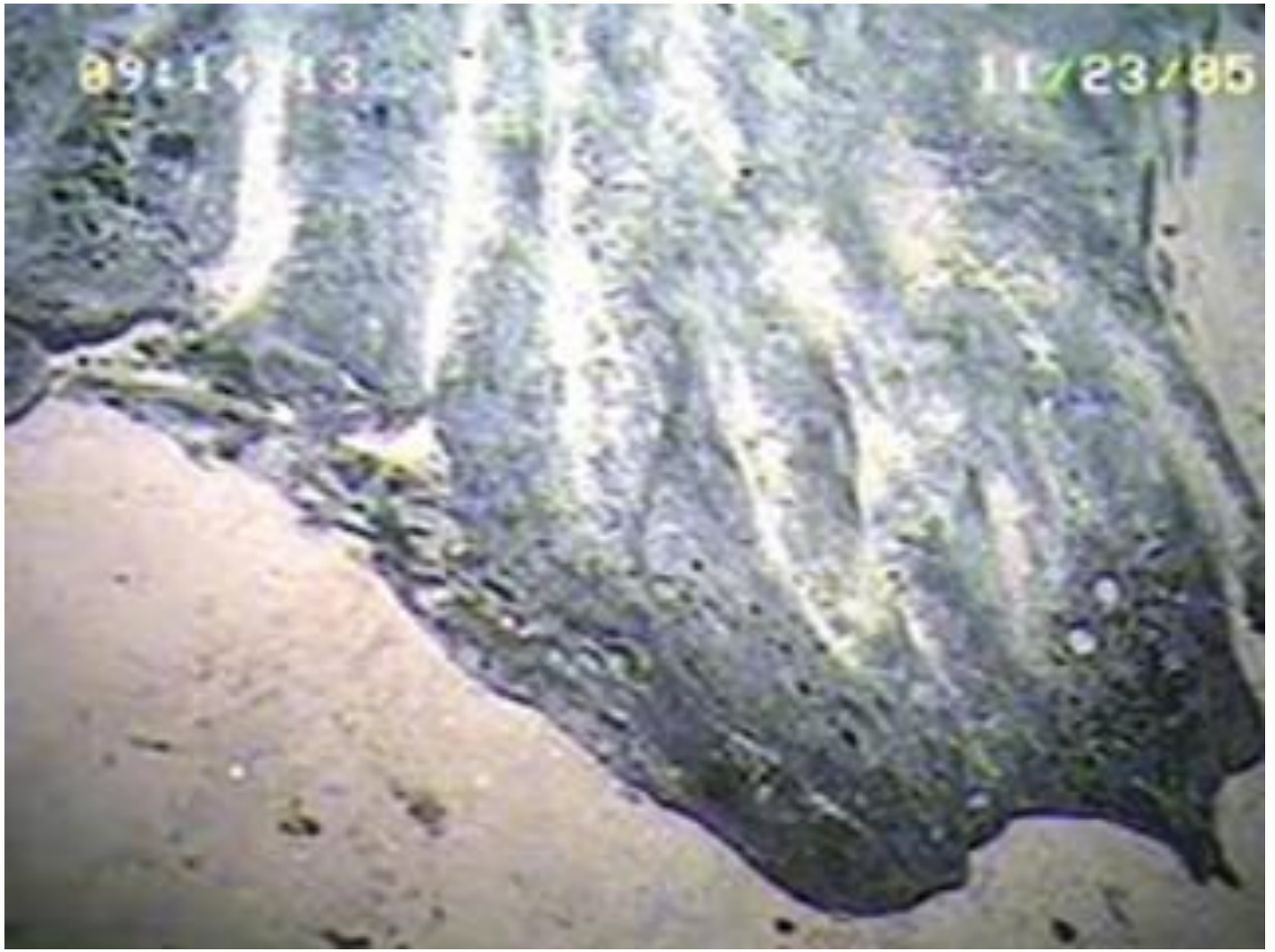
- Evaporation
- Emulsification-2 i 3
- Natural Dispersion-4
- Dissolution
- Photo-oxidation
- Sedimentation-5
- Adhesion
- Biodegradation
- Sinking
- Formation of tar balls



Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Weathering

- Evaporation
- Emulsification-2 i 3
- Natural Dispersion-4
- Dissolution
- Photo-oxidation
- Sedimentation-5
- Adhesion
- Biodegradation
- Sinking
- Formation of tar balls



Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

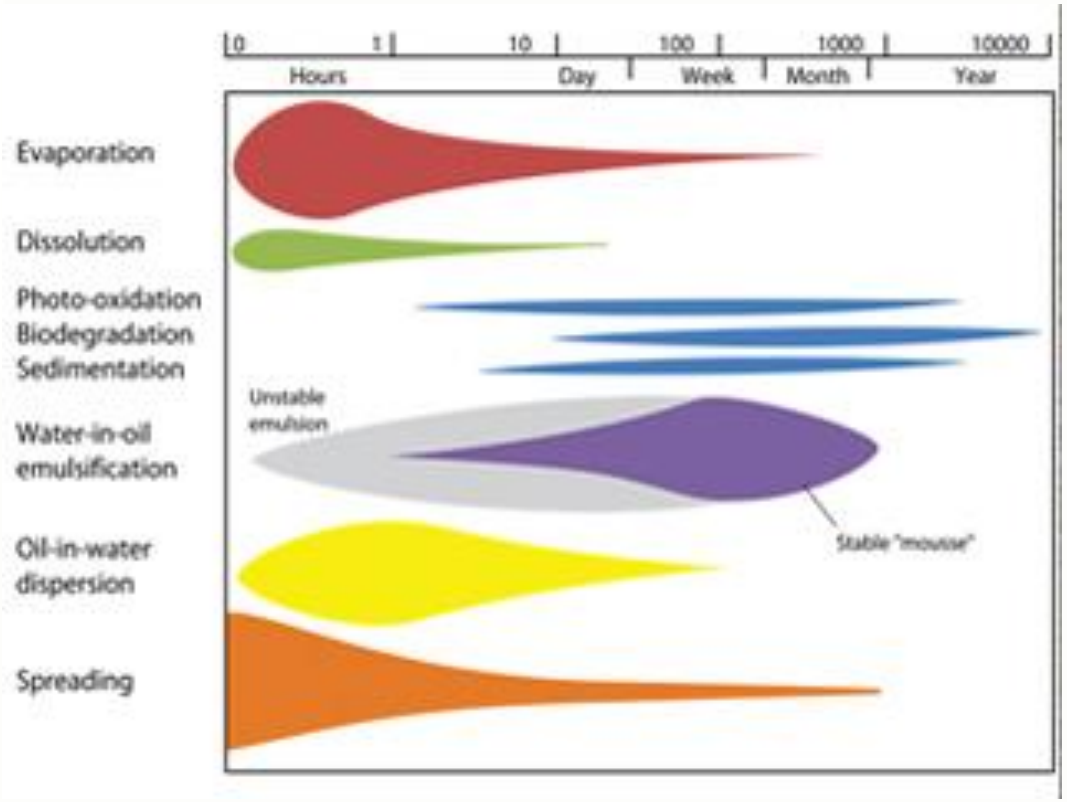
Weathering

- Evaporation
- Emulsification-2 i 3
- Natural Dispersion-4
- Dissolution
- Photo-oxidation
- Sedimentation-5
- Adhesion
- Biodegradation
- Sinking
- Formation of tar balls

Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Weathering

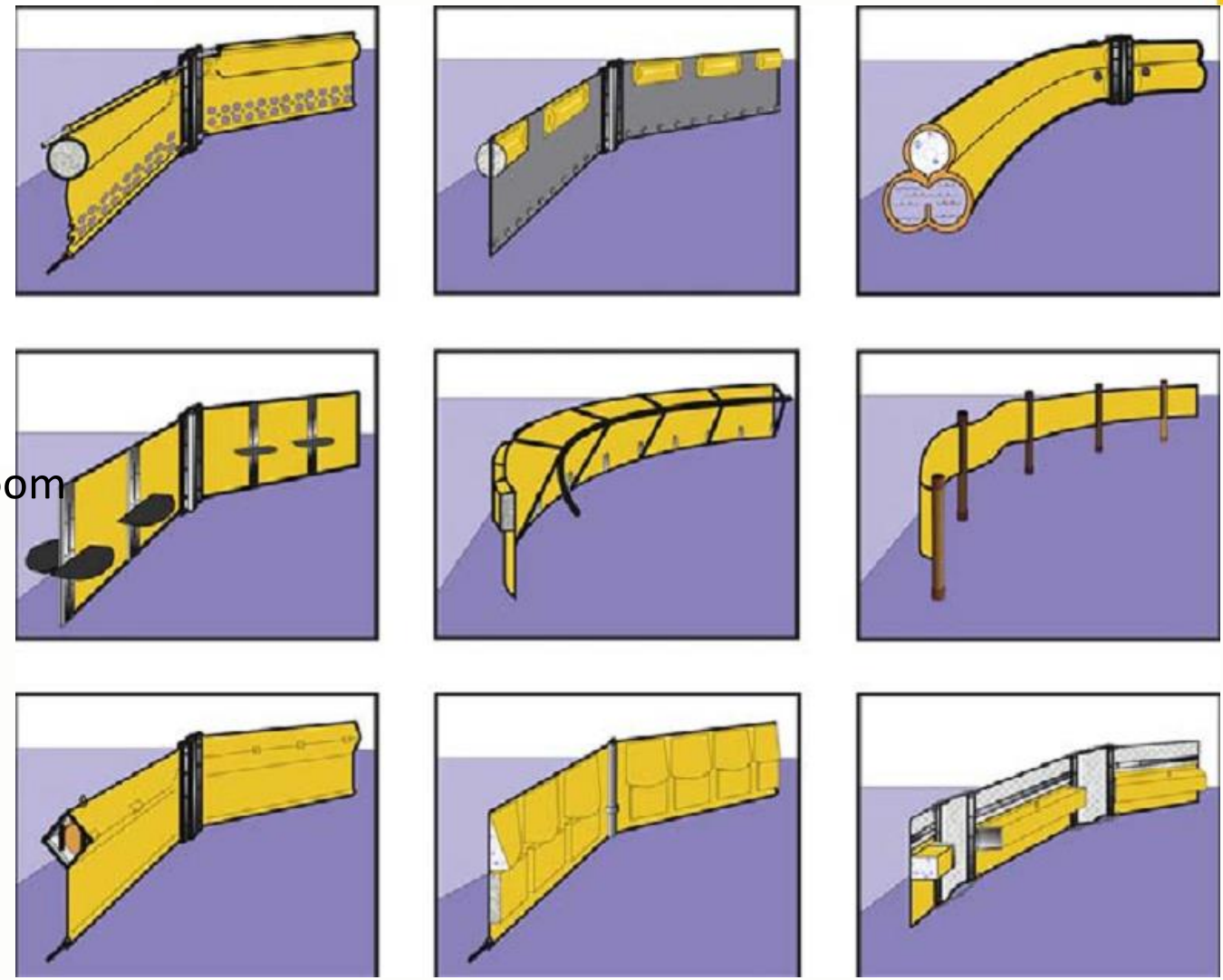
- Evaporation
- Emulsification-2 i 3
- Natural Dispersion-4
- Dissolution
- Photo-oxidation
- Sedimentation-5
- Adhesion
- Biodegradation
- Sinking
- Formation of tar balls



Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Booms

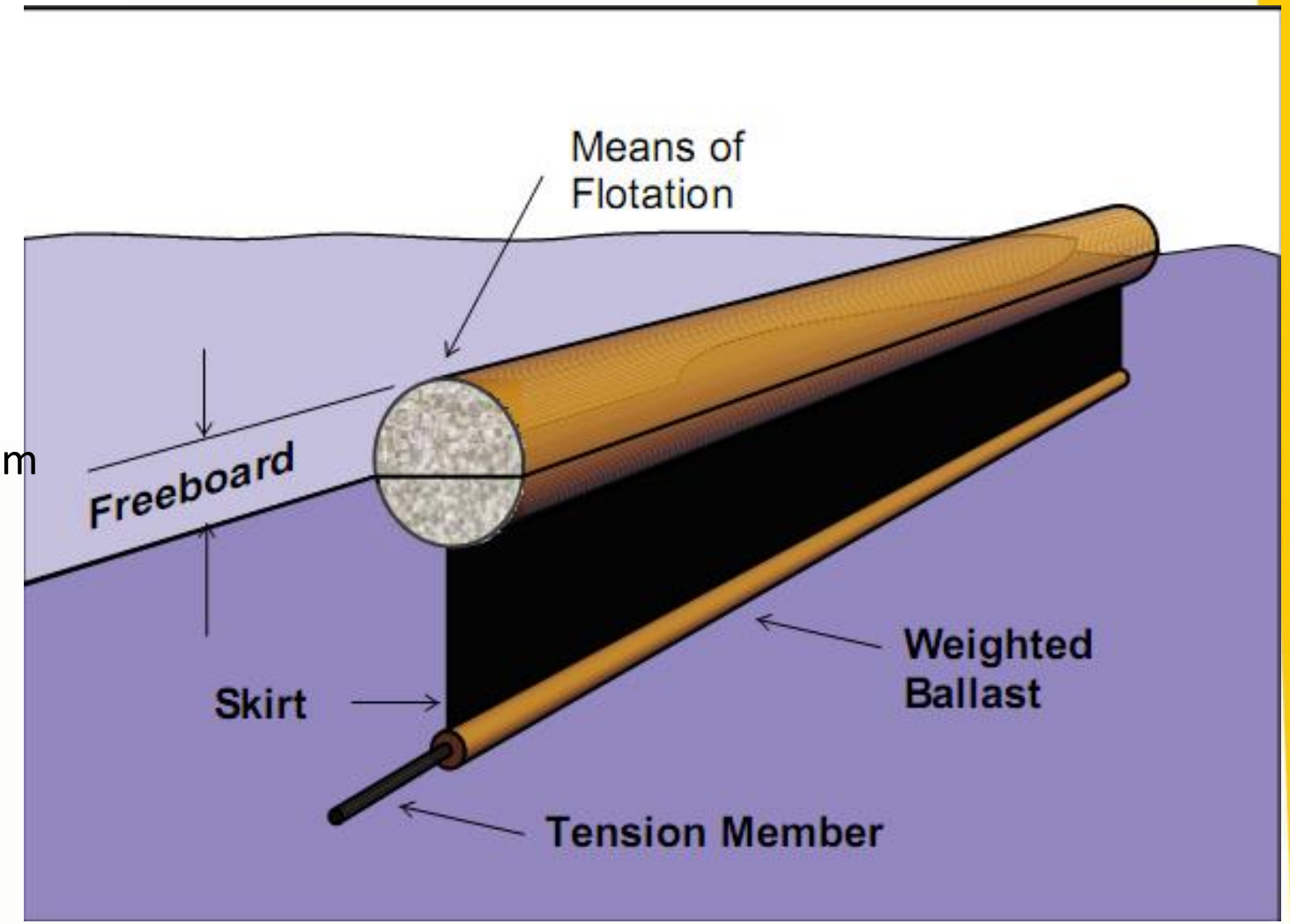
- Containment or deflection of oil slick
- **Types:**
  - Fence booms
  - Curtain booms2,3
  - External tension member boom
  - **Special types:**
    - Bubble barrier-4
    - Sorbent booms-5
    - Fire-resistant booms 6 i7



Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Booms

- Containment or deflection of oil slick
- **Types:**
  - Fence booms
  - Curtain booms2,3
  - External tension member boom
  - **Special types:**
    - Bubble barrier-4
    - Sorbent booms-5
    - Fire-resistant booms 6 i7



Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

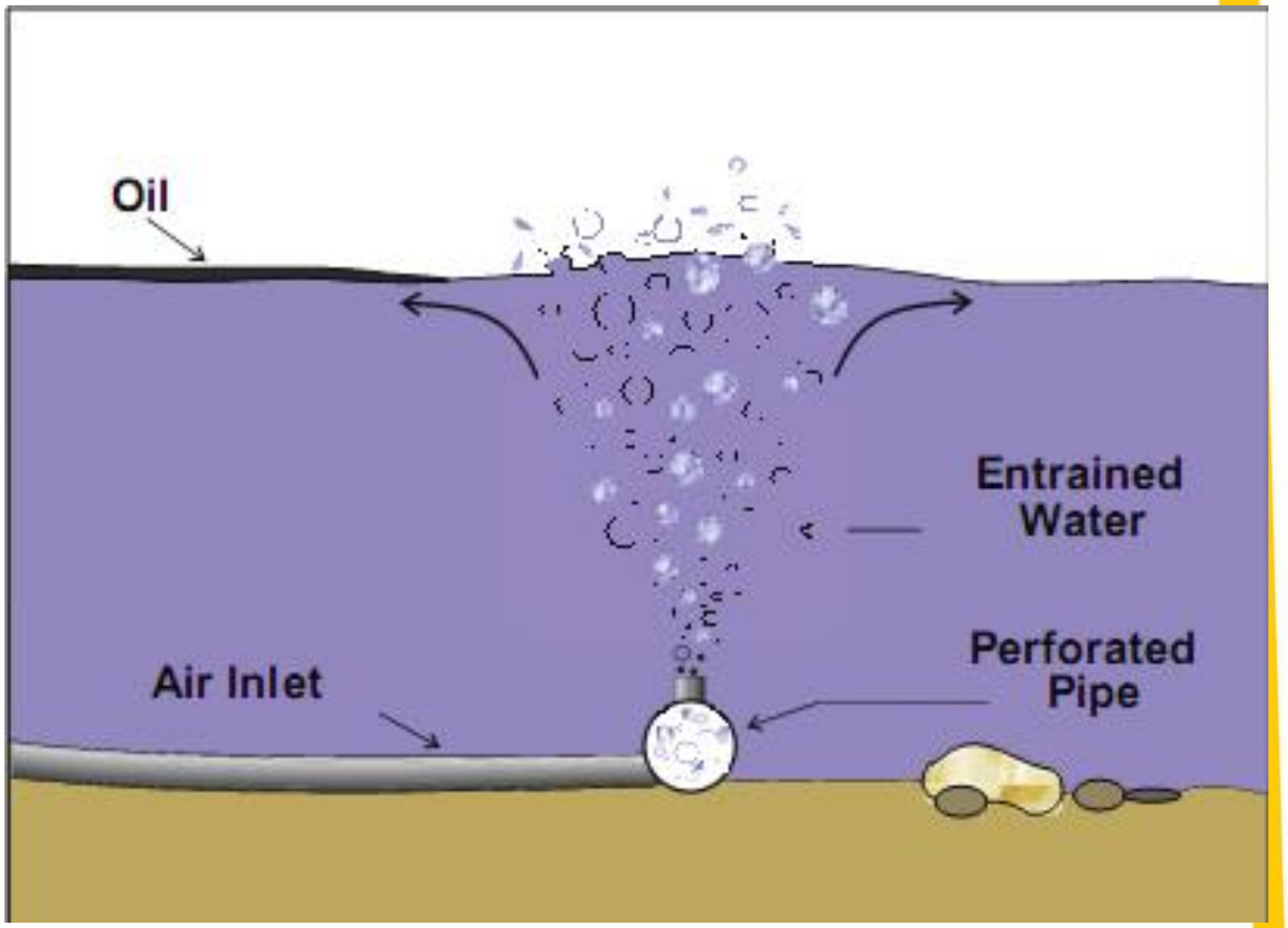
Booms

- Containment or deflection of oil slick
- **Types:**
  - Fence booms
  - Curtain booms2,3
  - External tension member boom
  - **Special types:**
    - Bubble barrier-4
    - Sorbent booms-5
    - Fire-resistant booms 6 i7

Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Booms

- Containment or deflection of oil slick
- **Types:**
  - Fence booms
  - Curtain booms2,3
  - External tension member boom
  - **Special types:**
    - Bubble barrier-4
    - Sorbent booms-5
    - Fire-resistant booms 6 i7



Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

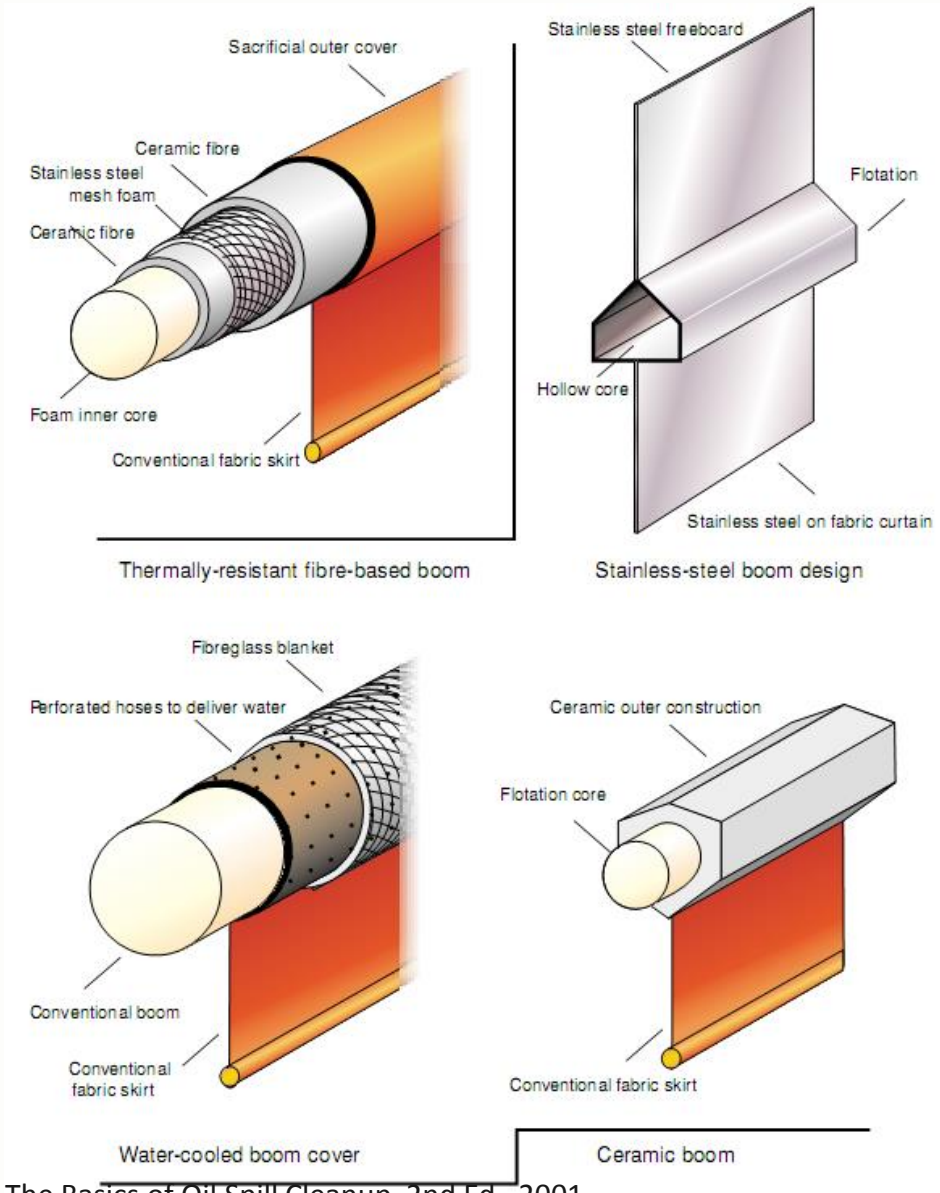
Booms

- Containment or deflection of oil slick
- **Types:**
  - Fence booms
  - Curtain booms2,3
  - External tension member boom
  - **Special types:**
    - Bubble barrier-4
    - Sorbent booms-5
    - Fire-resistant booms 6 i7

Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Booms

- Containment or deflection of oil slick
- **Types:**
  - Fence booms
  - Curtain booms2,3
  - External tension member boom
  - **Special types:**
    - Bubble barrier-4
    - Sorbent booms-5
    - Fire-resistant booms 6 i7



Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Booms

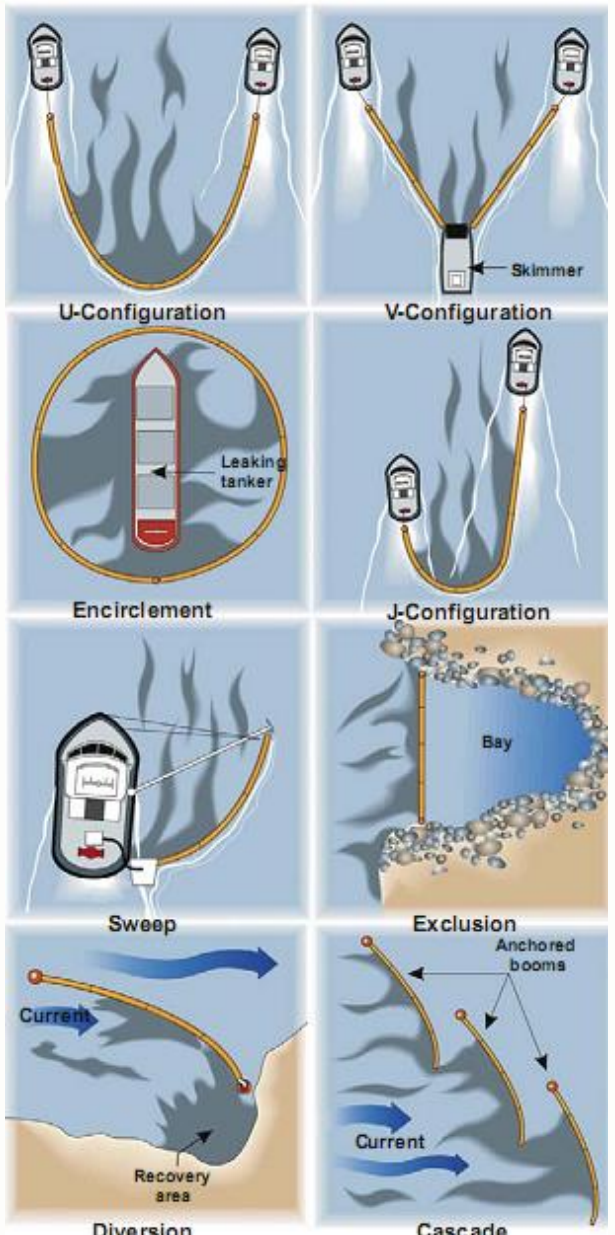
- Containment or deflection of oil slick
- **Types:**
  - Fence booms
  - Curtain booms2,3
  - External tension member boom
  - **Special types:**
    - Bubble barrier-4
    - Sorbent booms-5
    - Fire-resistant booms 6 i7

Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Booms

- Containment or deflection of oil slick

- **Characteristics:**
  - Buoyancy-to-weight ratio
  - Heave response
  - Roll-over response



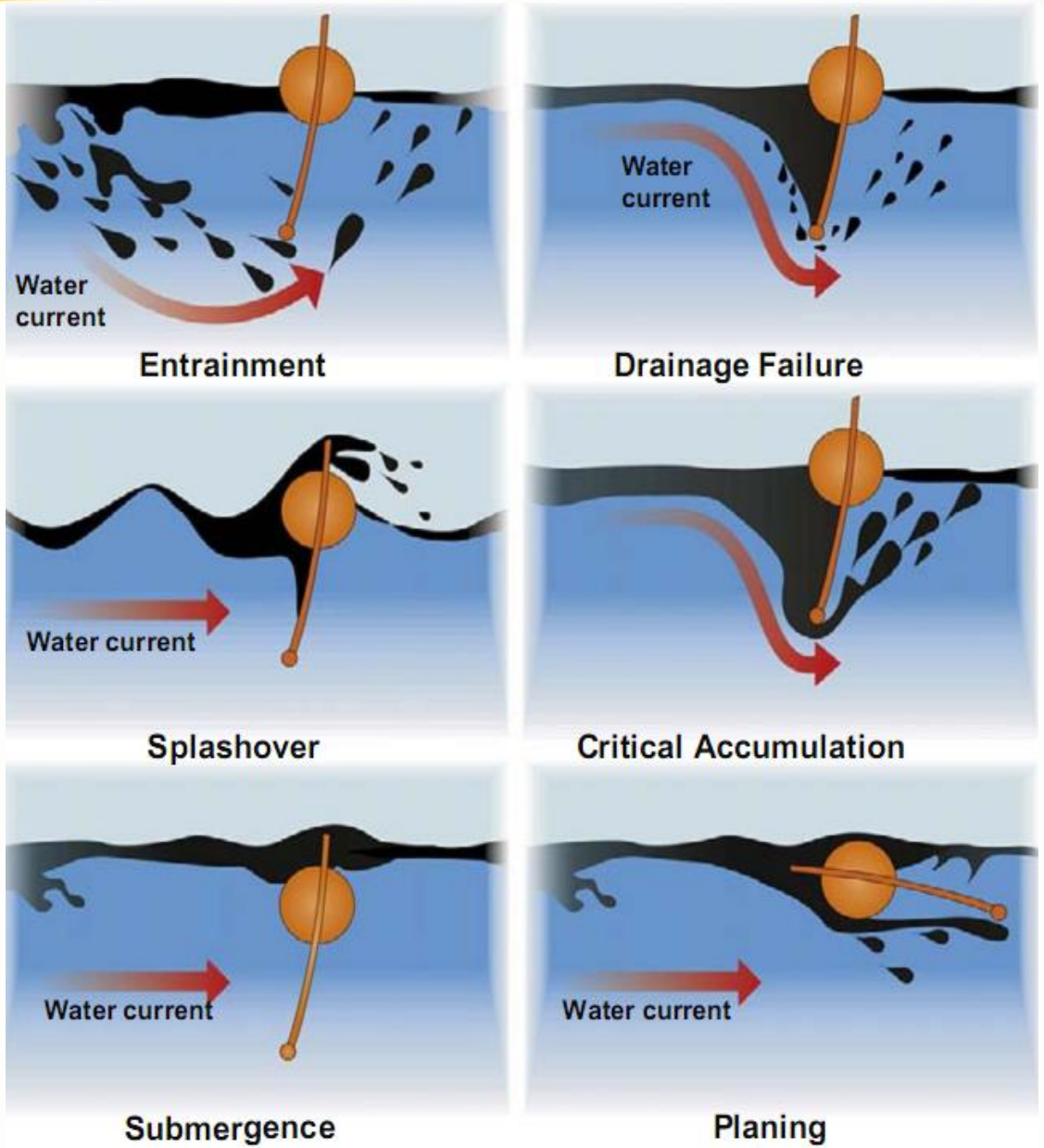
Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Erasmus+

Booms

- Containment or deflection of oil slick

- **Characteristics:**
  - Buoyancy-to-weight ratio
  - Heave response
  - Roll-over response



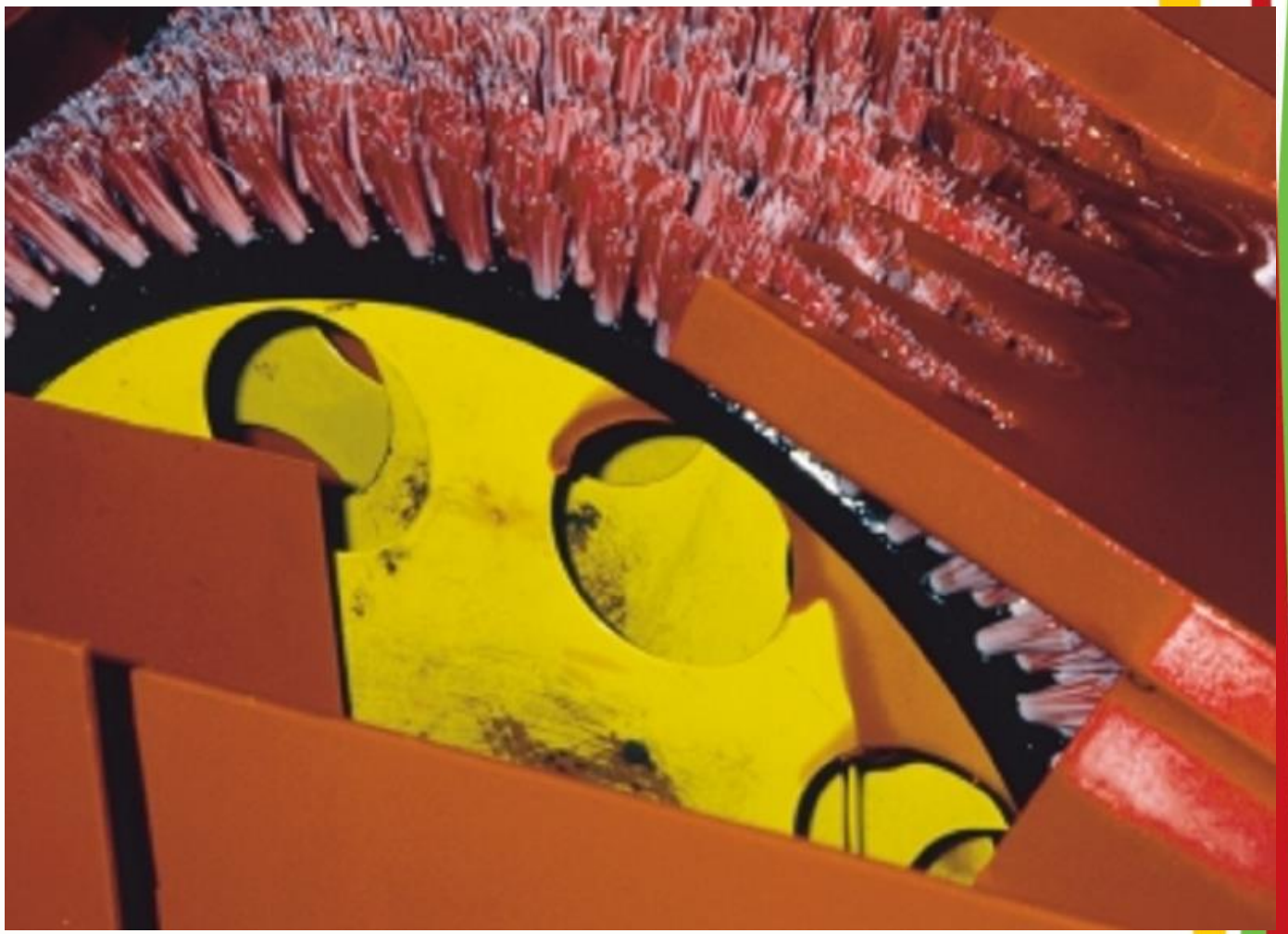
Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Erasmus+

Skimmers

- Remove oil from water surface

- **Types:**
  - Oleophylic surface skimmer
  - Weir skimmers
  - Suction skimmers
  - Elevating skimmers
  - Submersion skimmers
  - Vortex skimmers

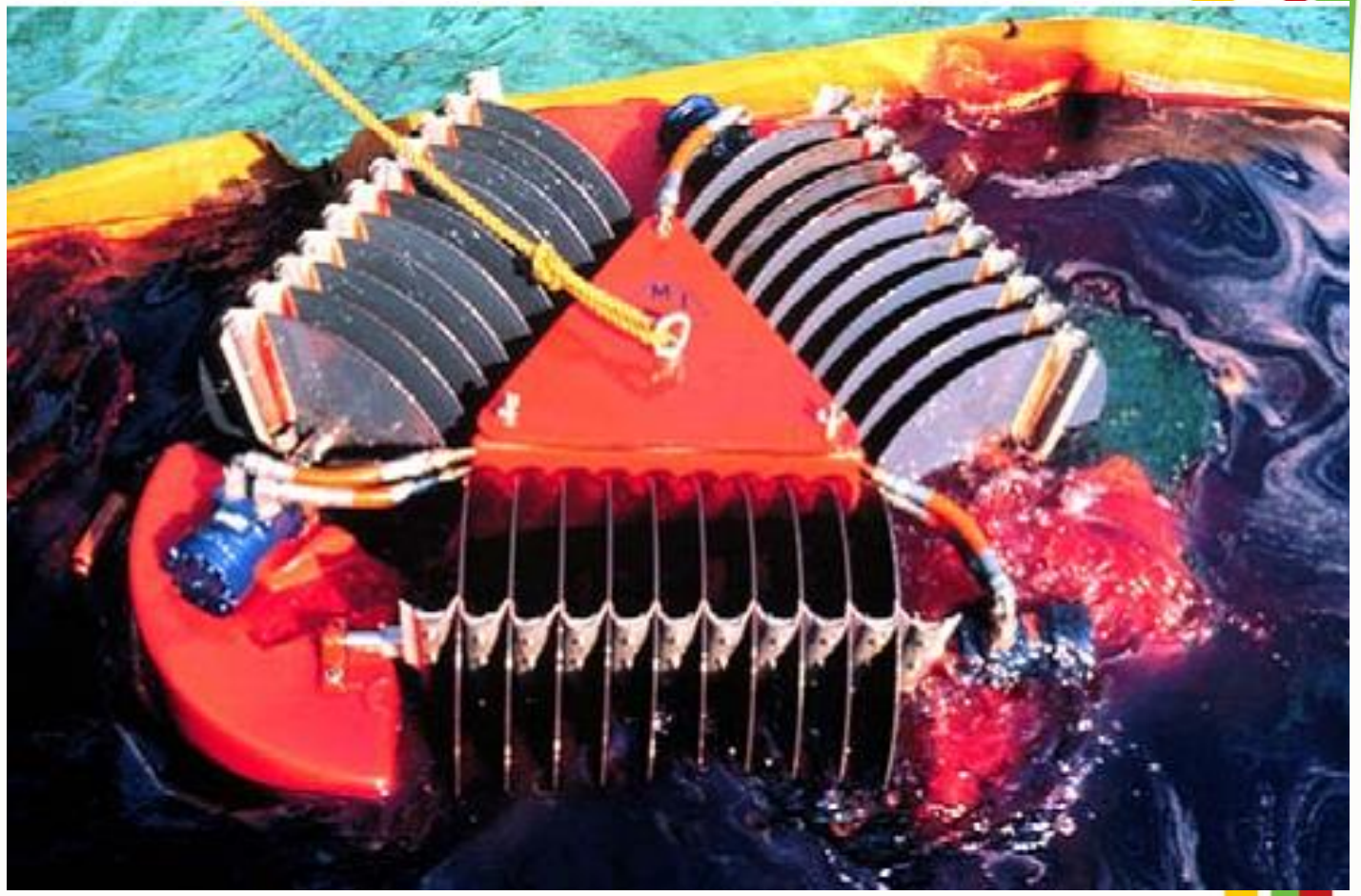


Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Skimmers

- Remove oil from water surface

- **Types:**
  - Oleophylic surface skimmer
  - Weir skimmers
  - Suction skimmers
  - Elevating skimmers
  - Submersion skimmers
  - Vortex skimmers



Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Skimmers

- Remove oil from water surface

- **Types:**
  - Oleophylic surface skimmer
  - Weir skimmers
  - Suction skimmers
  - Elevating skimmers
  - Submersion skimmers
  - Vortex skimmers

Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Skimmers

- Remove oil from water surface

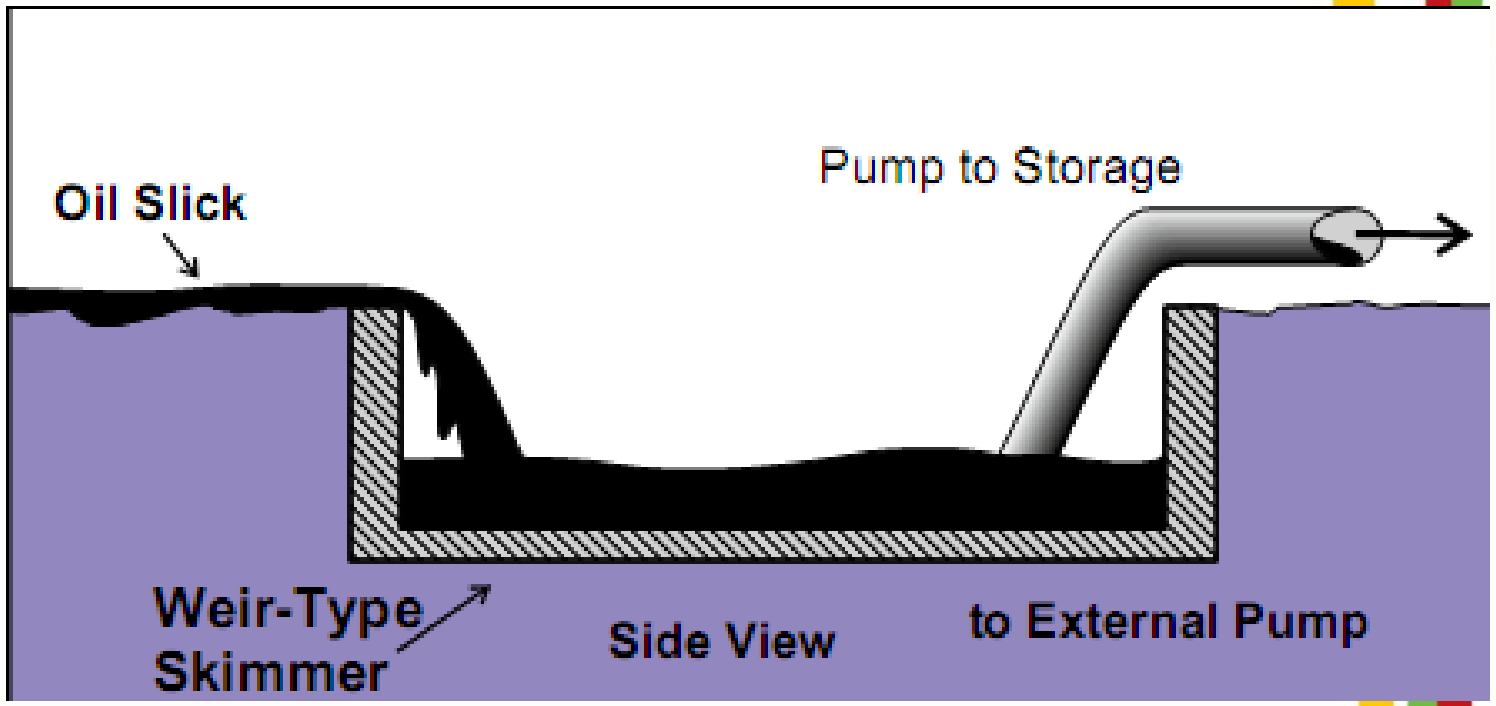
- **Types:**
  - Oleophylic surface skimmer
  - Weir skimmers
  - Suction skimmers
  - Elevating skimmers
  - Submersion skimmers
  - Vortex skimmers

Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Skimmers

- Remove oil from water surface

- **Types:**
  - Oleophylic surface skimmer
  - Weir skimmers
  - Suction skimmers
  - Elevating skimmers
  - Submersion skimmers
  - Vortex skimmers



Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Skimmers

- Remove oil from water surface

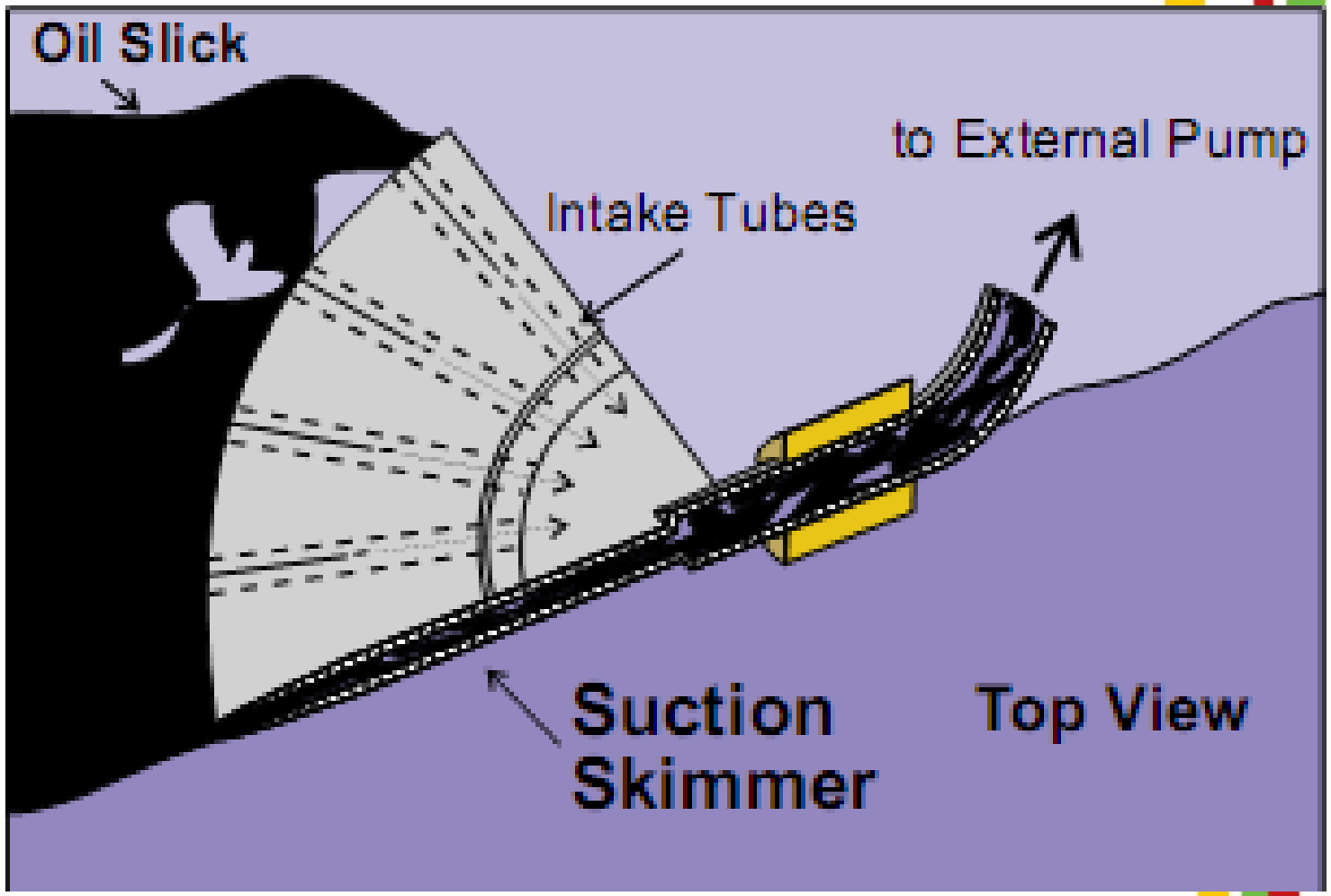
- **Types:**
  - Oleophylic surface skimmer
  - Weir skimmers
  - Suction skimmers
  - Elevating skimmers
  - Submersion skimmers
  - Vortex skimmers

Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Skimmers

- Remove oil from water surface

- **Types:**
  - Oleophylic surface skimmer
  - Weir skimmers
  - Suction skimmers
  - Elevating skimmers
  - Submersion skimmers
  - Vortex skimmers



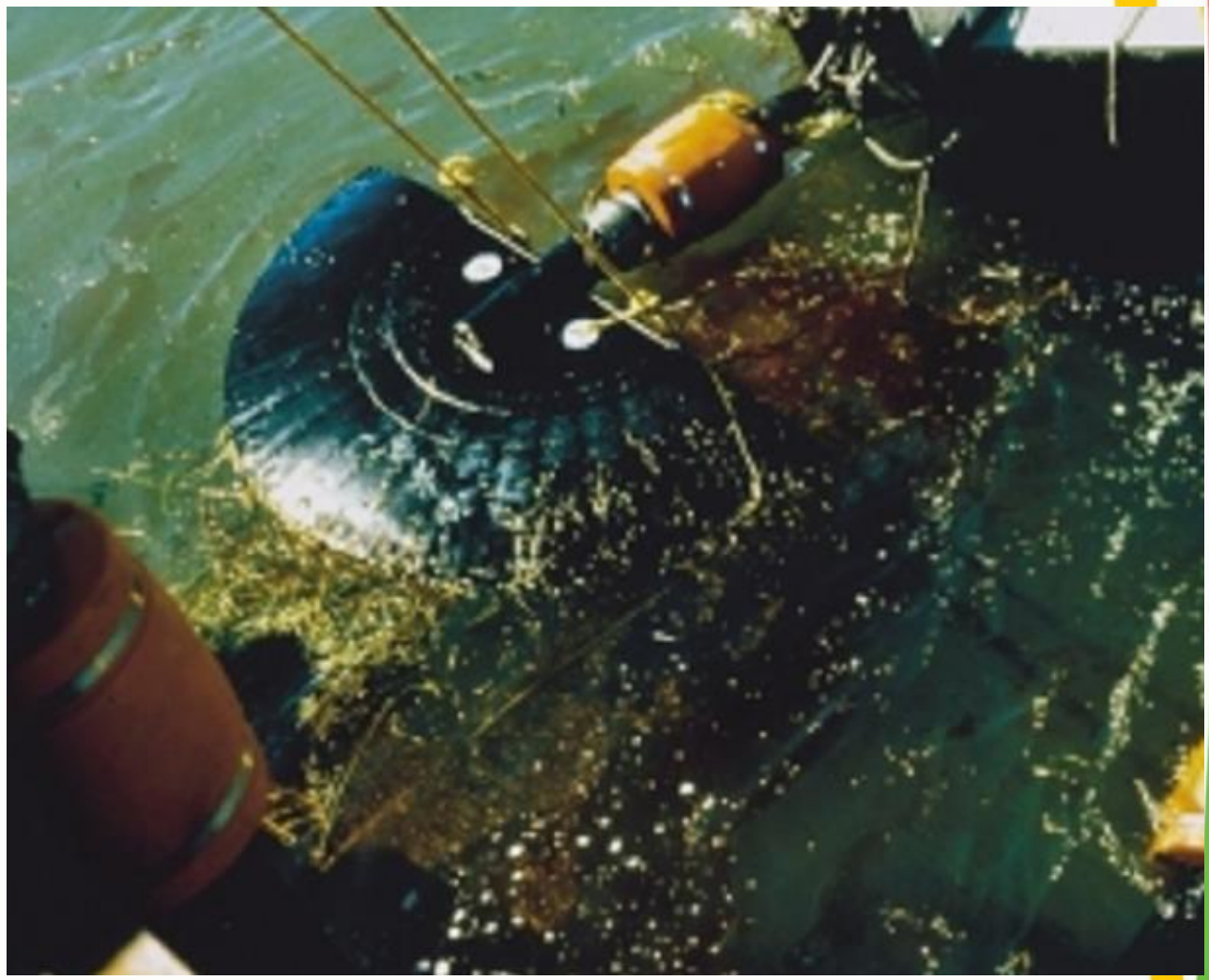
Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Erasmus+

Skimmers

- Remove oil from water surface

- **Types:**
  - Oleophylic surface skimmer
  - Weir skimmers
  - Suction skimmers
  - Elevating skimmers
  - Submersion skimmers
  - Vortex skimmers

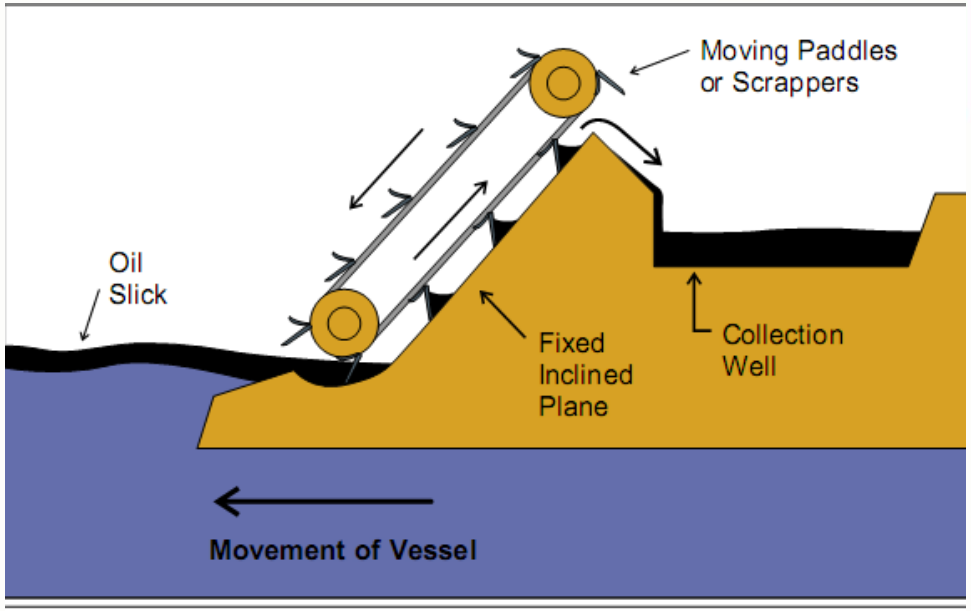


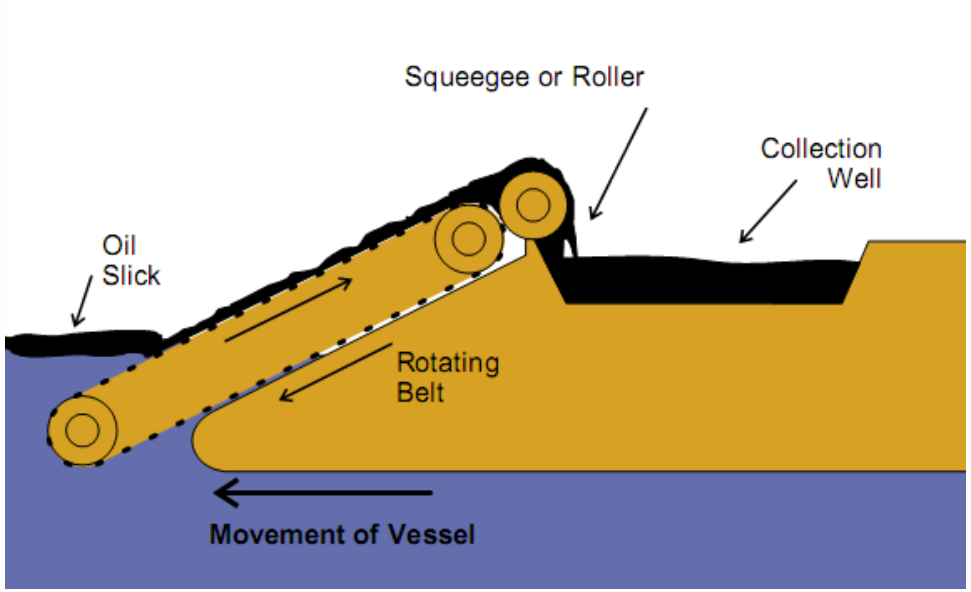
Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Skimmers

- Remove oil from water surface

- **Types:**
  - Oleophylic surface skimmer
  - Weir skimmers
  - Suction skimmers
  - Elevating skimmers
  - Submersion skimmers
  - Vortex skimmers





Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Skimmers

- Remove oil from water surface

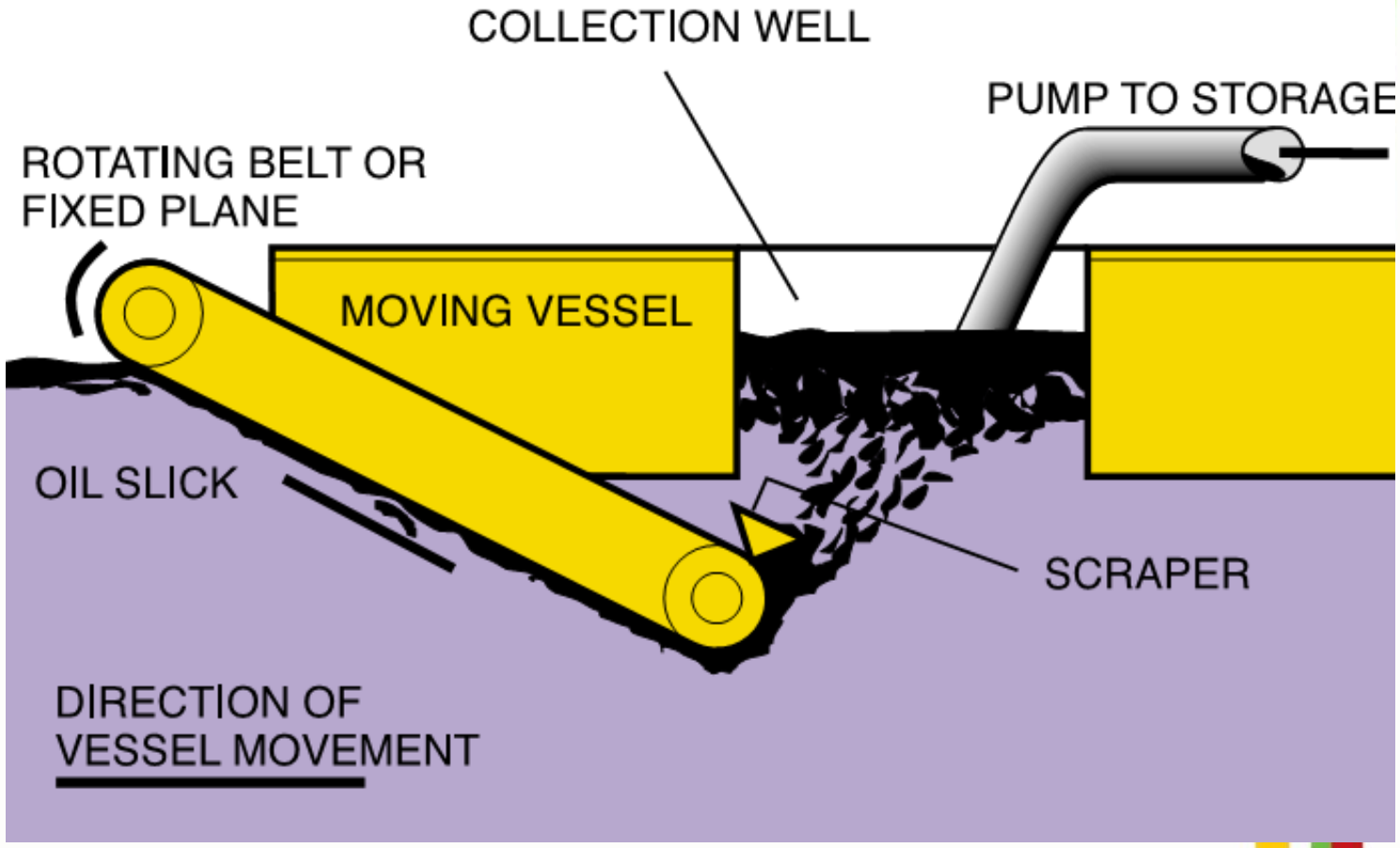
- **Types:**
  - Oleophylic surface skimmer
  - Weir skimmers
  - Suction skimmers
  - Elevating skimmers
  - Submersion skimmers
  - Vortex skimmers

Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Skimmers

- Remove oil from water surface

- **Types:**
  - Oleophylic surface skimmer
  - Weir skimmers
  - Suction skimmers
  - Elevating skimmers
  - Submersion skimmers
  - Vortex skimmers



Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Spill treating agents

- Sinking agents
- Sorbent agents
- Solidifiers or gelling agents
- Collecting agents
- Recovery enhancers
- Emulsion breakers and inhibitors
- Dispersants
- Biodegradation agents

Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Spill treating agents

- Sinking agents
- Sorbent agents
- Solidifiers or gelling agents
- Collecting agents
- Recovery enhancers
- Emulsion breakers and inhibitors
- Dispersants
- Biodegradation agents

Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Spill treating agents

- Sinking agents
- Sorbent agents
- Solidifiers or gelling agents
- Collecting agents
- Recovery enhancers
- Emulsion breakers and inhibitors
- Dispersants
- Biodegradation agents

Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Spill treating agents

- Sinking agents
- Sorbent agents
- Solidifiers or gelling agents
- Collecting agents
- Recovery enhancers
- Emulsion breakers and inhibitors
- Dispersants
- Biodegradation agents

Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Shoreline treatment

- A survey and assessment of the shoreline oiling conditions
- Development of treatment recommendations and priorities
- Establishment of treatment endpoints
- A signoff process to determine when endpoints are reached

- Surface-washing agents

Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Erasmus+

Waste

Source: M. Fingas, The Basics of Oil Spill Cleanup, 2nd Ed., 2001.

Final remarks

- Hydrocarbon exploration and production- 2% of marine oil pollution
- Contingency plans
- Oil spill response:
  - containment- booms
  - removal- skimmers & spill treating agents
- Site restoration

Want to learn more?

www.itopf.com

http://oils.gpa.unep.org

http://response.restoration.noaa.gov