frontiers

Supplementary Material

Is OSPAR 98/3 science-based politics or politics-based science?

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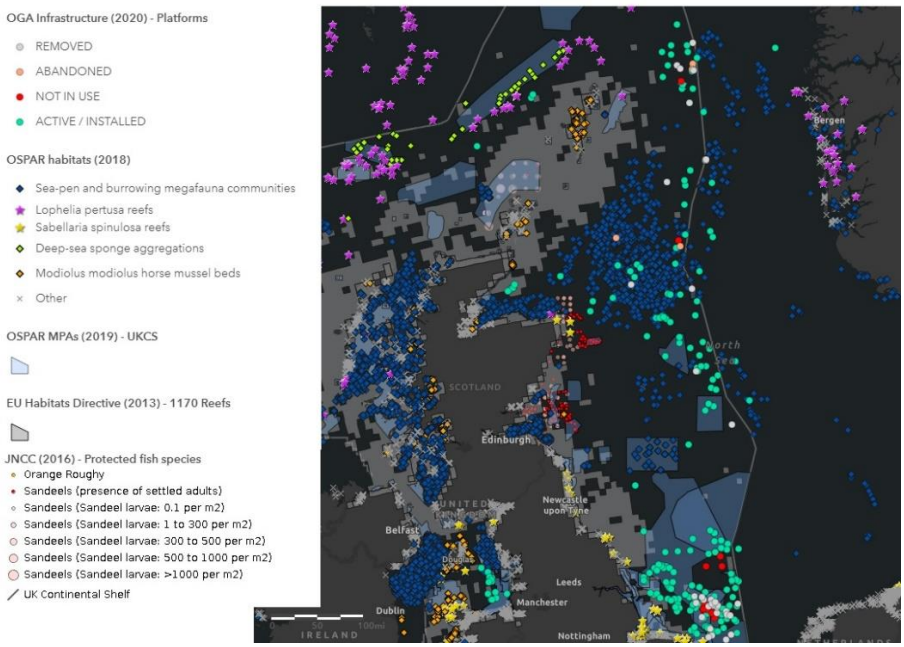
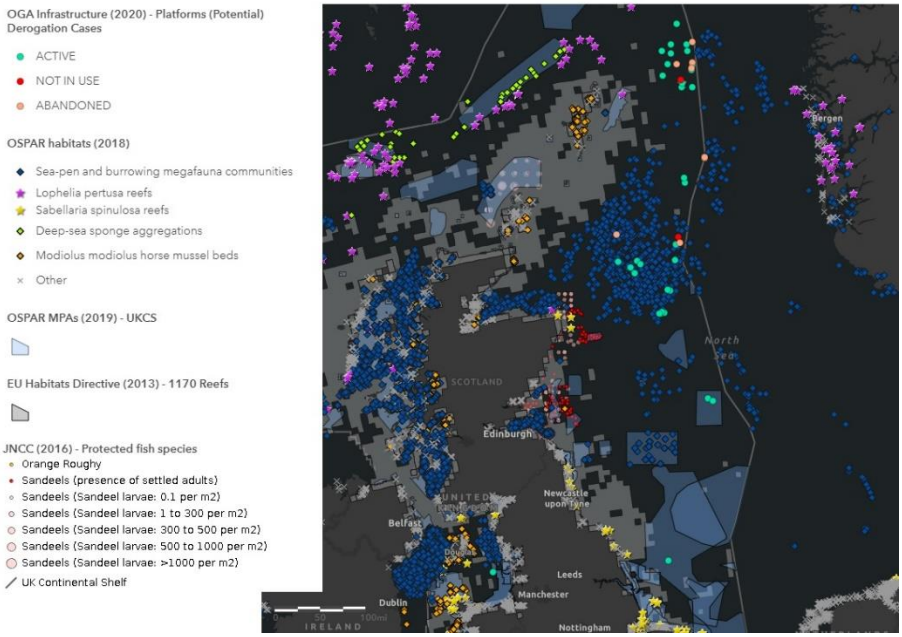
1 Supplementary Figures and Tables

1.1 Supplementary Figures



(a)



(b)

Supplementary Figure 1. Locations and status (Oil & Gas Authority 2020a) of (a) all UK platforms and (b) potential candidates for derogation under OSPAR Decision 98/3; Surrounded by threatened and/or declining habitats (OSPAR Commission 2018), designated MPAs (OSPAR Commission 2019a), protected reefs by EEA (2013), and protected fish species (JNCC 2016) in the North Sea. Geospatial layers are overlapped and based on the respective official metadata.

1.2 Supplementary Tables

Supplementary Table 1: Impact on water quality and seabed condition: List of contaminants deriving from O&G installations and surrounding drill cuttings.

Contaminants/ Disturbances	Findings due to substrate degradation and disturbances	Research References
Chemicals	• risk of potential release of legacy chemicals during or after decommissioning	(Sühring, et al. 2020)
Sacrificial anodes	• used to protect platform substructures against corrosion and consist mainly of aluminum and/or zinc • release of contaminants steadily decrease after abandonment • no significant increase of aluminum concentration found in water, but in surrounding sediments • low environmental impact expected, however, evidence limited due to lack of monitoring	(Picken, Curtis and Elliott 1997) (Pors, et al. 2011) (Gabelle, et al. 2012) (Kirchgeorg, et al. 2018)
Paintings & coatings	• organic compounds slowly released, but at very low concentrations	(Kirchgeorg, et al. 2018)
Steel corrosion & deterioration	• platform substructures consist mainly of steel and some traces of aluminum and copper or concrete for GBS • substructures will ultimately deteriorate and fall apart into iron oxide pieces that will accumulate on the seabed • estimations: +500 years for steel to fully corrode or concrete legs to fully fall apart	(Pors, et al. 2011) (Tornero and Hanke 2016) (Shell U.K. Limited 2017)
Drill cuttings	• natural degradation and intensive monitoring is the preferred option • disturbance (fishing, cable-laying) lead to leaching and spreading of contaminants	(Tornero and Hanke 2016) (Henry, Harries, et al. 2017)
Dredging operations	• enable oxygen entering the sediment, hence enhancing aerobic microbial processes leading to behaviour changes of species *L. conchilega*	(Mestdagh, et al. 2020)

Supplementary Table 2: List of recent research works dealing with the influence of man-made structures including O&G installations and OWFs on the benthic fauna in the Southern North Sea.

Key species	location max depth	Substrate type	sampling method/period/analysis	Research References
M. acherusicum *J. herdmani* *P. marina* *S. monoculoides*	SNS 25 m	O&G (GBS)	taxa collection by diving period n.a. statistical analysis, data used and compared to (Coolen, van der Weide, et al. 2018)	(Coolen, Bittner, et al. 2020)
M. edulis	SNS 25 m	various[a]	taxa collection by diving 2014–2016 statistical analysis and PTM incl. model validation with sample data	(Coolen, Boon, et al. 2020)
M. edulis *P. miliaris* *M. dianthus* Tubulariidae[b]	SNS 32 m	O&G OWF Natural reefs	taxa collection by diving 2014–2015 statistical analysis	(Coolen, van der Weide, et al. 2018)
C. linearis *C. mutica*	SNS 45 m	various[a]	taxa collection by diving 2013–2015 statistical analysis, complemented with other published research data	(Coolen, Lengkeek and Degraer, et al. 2016)
C. smithii	SNS 32 m	shipwrecks	taxa collection by diving 2014, species detection only	(Coolen, Lengkeek and Lewis, et al. 2015)
O. edulis	SNS n.a.	various[a]	meta-analysis 2001-ctd.	(Kerckhof, Coolen, et al. 2018)
C. pagurus	SNS 29 m	OWF	taxa collection by diving 2012–2014 statistical analysis	(Krone, et al. 2017)
M. edulis Anthozoa[c] *Jassa spp.*	SNS 28 m	research platform	taxa collection by diving 2005–2007 statistical analysis	(Krone, et al. 2013)
J. herdmani	SNS 28 m	various[a]	taxa collection by diving 2015–2016 statistical analysis, DNA extracted	(Luttikhuizen, et al. 2019)
M. edulis *M. senile* *A. rubens*	SNS/CNS 46 m 66 m	O&G	visual by ROV 2015–2016 statistical analysis	(Schutter, et al. 2019)
Asteroidea[c] *C. pagurus* *B. undatum* *L. holsatus* *P. bernhardus*	SNS depth n.a.	O&G pipeline	visual by ROV 2015 statistical analysis	(Todd, Williamson, et al. 2020)
Variation of sessile/motile invertebrates	SNS 49 m	fixed& mobile O&G	visual by ROV 2014 statistical analysis	(Todd, Lavallin and Macreadie 2018)
M. edulis *M. senile* *A. digitatum*	SNS 43 m	O&G	visual by ROV period n.a. statistical analysis	(van der Stap, Coolen and Lindeboom 2016)

[a]various substrate types include any kind of anthropogenic hard substrate and natural reefs; correct taxonomic rank of marine invertebrates: [b]family, [c]class

Supplementary Table 3: List of recent research works dealing with the influence of man-made structures including O&G installations and OWFs on the benthic fauna in the Central and Southern North Sea (NS).

Key species	location max depth	Substrate type	sampling method/period/analysis	Research References
F. foliacea	West-coast Scotland depth n.a.	artificial reef	taxa collection by diving period n.a. statistical analysis	(Rouse, Porter and Wilding 2020)
L. pertusa	NNS depth n.a.	O&G	meta-analysis period n.a	(Bergmark and Jørgensen 2014)
Cnidaria[b] Mollusca[b] Annelida[b] Arthropoda[b] Echinodermata[b]	NNS 185 m	O&G	taxa collection by diving and visual by ROV 2009–2018 statistical analysis, observation	(Gates, et al. 2019)
C. smithii Bryozoa[b] Hydrozoa[c] Actiniaria[d] *S. triqueter* *A. rubens* Paguridae[e]	CNS NNS 164 m	pipeline	visual by ROV 2012–2013 statistical analysis	(Lacey and Hayes 2020)
L. pertusa	NS from 80 m to 200 m	O&G	simulation based on research data 2010–2012 PTM modelling only	(Henry, Mayorga-Adame, et al. 2018)
A. digitatum *E. esculentus* *L. pertusa* *M. dianthus* *C. fornicata* *Porifera spp.*	NS depth n.a.	various[a]	simulation based on research data 2001–2010 PTM modelling only, based on (van der Molen, et al. 2018)	(Tidbury, et al. 2020)

[a]various substrate types include any kind of anthropogenic hard substrate and natural reefs; correct taxonomic rank of marine invertebrates: [b]phylum, [c]class, [d]order, [e]family

Supplementary Table 4: List of epifauna species with greatest abundance on man-made structures in the Southern North Sea including O&G installations and OWFs.

Species & community ecology		Findings of species' significant behaviour	Research References
M. acherusicum *J. herdmani* *P. marina* *S. monoculoides*	abundance	• significant on O&G (GBS = concrete)	(Coolen, Bittner, et al. 2020)
M. senile	abundance biomass	• dominated community biomass on O&G (GBS)	(Coolen, Bittner, et al. 2020)
Non-native spp.	detection	• low percentage on O&G (GBS), not registered in the Netherlands, but native in NS	(Coolen, Bittner, et al. 2020)
M. edulis *P. miliaris* *M. dianthus* Tubulariidae[a]	abundance	• *M. edulis*: pos. correlation with richness • *P. miliaris*: pos. correlation with richness • *M. dianthus*: neg. correlation with richness • all significant on O&G/OWF/natural reefs	(Coolen, van der Weide, et al. 2018)
C. mutica (non-native)	detection	• only on nearshore OWF	(Coolen, Lengkeek and Degraer, et al. 2016)
C. smithii	detection	• first record on shipwreck offshore	(Coolen, Lengkeek and Lewis, et al. 2015)
O. edulis	detection recovery	• relict populations on O&G/OWF • potential to recover	(Kerckhof, Coolen, et al. 2018)
C. pagurus *Liocarcinus spp.* *P. bernhardus*	abundance reproduction	• significant among crustaceans on OWF • *C. pagurus*: using OWF as nursery grounds	(Krone, et al. 2017)
M. edulis Anthozoa[b] *Jassa spp.*	abundance	• significant on research platform	(Krone, et al. 2013)
M. edulis	biomass	• dominated community biomass on structure • significant production/export: "*Mytilusation*"	(Krone, et al. 2013)
M. edulis *M. senile* *A. rubens*	abundance	• significant on O&G	(Schutter, et al. 2019)
M. leidyi (non-native)	detection	• in CNS on O&G • occur seasonally due to rising temperatures	(Schutter, et al. 2019)
P. bernhardus	abundance	• significant on newly installed O&G	(Todd, Williamson, et al. 2020)
A. rubens *E. esculentus* *C. pagurus* *P. bernhardus*	abundance	• significant on O&G	(Todd, Lavallin and Macreadie 2018)
M. senile	abundance biomass	• dominated community biomass on O&G	(Todd, Lavallin and Macreadie 2018)
B. undatum	reproduction	• egg masses found on O&G	(Todd, Lavallin and Macreadie 2018)
M. edulis *M. senile* *A. digitatum*	abundance	• significant on O&G	(van der Stap, Coolen and Lindeboom 2016)

correct taxonomic rank of marine invertebrates: [a]family, [b]class

Supplementary Table 5: List of epifauna species with greatest abundance on man-made structures in the Central and Northern North Sea including O&G and OWFs.

Species & community ecology		Findings of species' significant behaviour	Research References
C. smithii Bryozoa[a] Hydrozoa[b] Actiniaria[c] *S. triqueter* *A. rubens* Paguridae[d]	abundance	• significant on pipelines	(Lacey and Hayes 2020)
Cnidaria[a] Mollusca[a] Annelida[a] Arthropoda[a] Echinodermata[a]	biomass richness	• significant on O&G	(Gates, et al. 2019)
L. pertusa	recovery reproduction	• strong potential to form cold-water coral reefs on obsolete O&G in NNS	(Bergmark and Jørgensen 2014)
L. pertusa	recovery reproduction	• strong potential to form cold-water coral reefs on obsolete O&G in NS	(Henry, Mayorga-Adame, et al. 2018)

correct taxonomic rank of marine invertebrates: [a]phylum, [b]class, [c]order, [d]family

Supplementary Table 6: List of epifauna species and their community ecology influenced by water depth in relation to man-made structures including O&G installations and OWFs across the North Sea.

Species & community ecology		Findings due to water depth	Research References
M. edulis *P. miliaris* *M. dianthus*	richness	• buildup of vertical zonation: non-linear distribution, peak at intermediate depths	(Coolen, van der Weide, et al. 2018)
Non-native spp.	detection	• higher percentage in the intertidal zone	(Coolen, van der Weide, et al. 2018)
M. edulis	abundance	• highest in the upper 10 m	(Krone, et al. 2017)
M. edulis Anthozoa[a] *Jassa spp.*	abundance	• buildup of vertical zonation (from surface to bottom): Mytilus, Mytilus-Jassa, Anthozoa-Jassa, Anthozoa	(Krone, et al. 2013)
Variation of species	richness diversity	• higher in bottom zone compared to surface zone	(Schutter, et al. 2019)
Motile invertebrates	abundance richness diversity	• highest in bottom zone	(Todd, Lavallin and Macreadie 2018)
Sessile invertebrates	abundance richness diversity	• buildup of vertical zonation (from surface to bottom): infralittoral, circalittoral, epi-benthic assemblages	(Todd, Lavallin and Macreadie 2018)
M. edulis *M. senile* *A. digitatum*	richness	• buildup of vertical zonation: non-linear distribution, peak at intermediate depths	(van der Stap, Coolen and Lindeboom 2016)
Variation of species	abundance	• strong correlation with depth and latitude	(Lacey and Hayes 2020)

correct taxonomic rank of marine invertebrates: [a]class

Supplementary Table 7: List of epifauna species and their community ecology influenced by substrate type effects in relation to man-made structures including O&G installations and OWFs across the North Sea.

Species & community ecology		Findings due to substrate material/type	Research References
Variation of species	abundance	• large overlap in communities between GBS (=concrete) and steel O&G/OWF • low overlap in communities between GBS and sandy seabed • relative large overlap in communities between GBS and natural reefs in Borkum Reef Grounds	(Coolen, Bittner, et al. 2020)
Variation of species	uniqueness	• 23 % of species on GBS locally unique	(Coolen, Bittner, et al. 2020)
M. senile	biomass	• 12 times higher on GBS than in sandy seabed	(Coolen, Bittner, et al. 2020)
M. edulis *P. miliaris* *M. dianthus*	richness	• no great differentiation between rock and steel • gradient from deep rocks to shallow steel • no great differentiation between artificial and natural substrates	(Coolen, van der Weide, et al. 2018)
Variation of species	abundance	• large overlap in communities on steel and rock • large overlap in communities between young OWF and old O&G	(Coolen, van der Weide, et al. 2018)
C. linearis (native) *C. mutica* (non-native)	abundance	• minor overlap of habitat preference (offshore vs. nearshore) leading to co-existing potential	(Coolen, Lengkeek and Degraer, et al. 2016)
C. pagurus	abundance	• highest at monopiles with scour protection: two times higher than on tripod and six times higher than on jacket (all OWF)	(Krone, et al. 2017)
Sessile invertebrates	abundance	• low overlap in communities between fixed and mobile O&G	(Todd, Lavallin and Macreadie 2018)
F. foliacea	productivity	• higher in complex, voided reef block habitats compared to simple blocks (all artificial)	(Rouse, Porter and Wilding 2020)
Variation of invertebrates	abundance	• large overlap in communities between O&G and surrounding coarse/mixed seabed	(Gates, et al. 2019)
Porifera spp.	abundance	• high in surrounding seabed, not found on O&G	(Gates, et al. 2019)
Variation of invertebrates	richness abundance	• higher on Link-lok/concrete mattresses • low overlap in communities between pipelines and sandy seabed	(Lacey and Hayes 2020)
L. pertusa	abundance	• not only found on natural reefs, but also on O&G far offshore	(Henry, Mayorga-Adame, et al. 2018)

Supplementary Table 8: List of epifauna species and their community ecology influenced by location or substrate inter-connectivity effects in relation to man-made structures including O&G installations and OWFs across the North Sea.

Species & community ecology		Findings due to location and inter-connectivity	Research References
M. edulis	dispersal	• no clear connectivity pattern between hard substrates in SNS: PTM showing connectivity that is not validated by genetic data • PTM predicts locations greater than 85 km offshore to be isolated from coastal communities, but actual species found 181 km offshore • no correlation between isolation and distance	(Coolen, Boon, et al. 2020)
J. herdmani	dispersal	• no correlation between isolation and distance • no correlation between artificial substrates and genetic connectivity	(Luttikhuizen, et al. 2019)
Variation of species	abundance	• higher in CNS than in SNS • medium overlap in communities between CNS and SNS, significant clustering	(Schutter, et al. 2019)
L. pertusa	dispersal	• PTM showing strong potential of O&G infrastructure to form highly interconnected coral ecosystem networks	(Henry, Mayorga-Adame, et al. 2018)
Variation of species	dispersal	• PTM showing clear connectivity between all kind of hard substrates across NS: (1) Full removal of all O&G infrastructure leading to 60 % reduction in connectivity across NS (2) Decommissioning as per OSPAR Convention leading to complete loss of connectivity in CNS (3) SNS is well connected, removal of O&G infrastructure in SNS leading to loss of connectivity between CNS/SNS	(Tidbury, et al. 2020)

PTM: Particle Tracking Model; SNS/CNS/NNS: Southern/Central/Northern North Sea

Supplementary Table 9: List of epifauna species and their community ecology influenced by temporal and disturbance effects in relation to man-made structures including i.a. Oil & Gas (O&G) installations and offshore wind farms (OWF) across the North Sea.

Species & community ecology		Findings due to temporal and disturbance effects	Research References
M. edulis *P. miliaris* *M. dianthus*	richness	• no difference between old O&G and young OWF differences between sampling months	(Coolen, van der Weide, et al. 2018)
O. edulis	abundance	• sensitive to bottom trawling or sand/gravel extractions	(Kerckhof, Coolen, et al. 2018)
M. edulis Anthozoa[a] *Jassa spp.*	biomass	• differences between sampling months	(Krone, et al. 2013)
M. edulis *M. senile* *A. digitatum*	richness	• increases with community age	(van der Stap, Coolen and Lindeboom 2016)
Variation of species	abundance richness diversity	• no differences between pre/post installation of mobile O&G • differences between laid and trenched pipeline: significant decrease after trenching	(Todd, Williamson, et al. 2020)

correct taxonomic rank of marine invertebrates: [a]class

Supplementary Table 10: List of recent research works dealing with the influence of man-made structures including O&G installations and OWFs on various fish species across the North Sea.

Key species*	location max depth	Substrate type	sampling method/period/analysis	Research References
Variation of flatfishes	SNS/CNS depth n.a.	OWF	simulation based on research data 2010–2012 Particle tracking modelling only	(Barbut, et al. 2020)
Variation of fish species	SNS Depth n.a.	OWF wrecks	taxa collection by dive transects & line fishing 2001–2017, descriptive analysis	(Kerckhof, Rumes and Degraer 2018)
Atlantic cod Pouting	SNS 24 m	OWF steel & concrete	taxa collection by line gear & data collection by tagging, acoustic telemetry & visual observation 2011–2012, statistical analysis	(Reubens, Degraer and Vincx 2014) (Reubens, et al. 2013)
Whiting Common dab Sandeels	SNS 13.5 m	OWF	taxa collection by gillnets 2001 (pre-installation) & 2009 (post-installation), statistical analysis	(Stenberg, et al. 2015)
Variation of fish species	depth n.a.	O&G pipeline	visual by ROV 2015 statistical analysis	(Todd, Williamson, et al. 2020)
Atlantic cod Pollack Common ling	SNS 49 m	fixed & mobile O&G	visual by ROV 2014 statistical analysis	(Todd, Lavallin and Macreadie 2018)
Common dab Common sole Atlantic cod	SNS 21 m	OWF	taxa collection by gillnets & data collection by sonar 2011, statistical analysis	(van Hal, Griffioen and van Keeken 2017)
Saithe	CNS 103 m	ceased O&G	data collection by monitoring system: oceanographic instrumentation & time-lapse photography 2014, statistical analysis	(Fujii and Jamieson 2016)
Saithe Haddock Atlantic cod	CNS NNS 103 m	ceased O&G & open water	taxa collection by fish traps at O&G, data collection by using bottom trawl survey at open water 2010-2014 (2012 survey) statistical analysis	(Fujii 2016) (Fujii 2015)
Atlantic cod European plaice Thornback ray	CNS NNS depth n.a.	O&G OWF Cables wrecks	data collection by electronic tags & fisheries surveys 1993–2010, statistical analysis	(Wright, et al. 2020)

**scientific names*: Atlantic cod (*G. morhua*), Common dab (*L. limanda*), Common ling (*M. molva*), Common sole (*S. solea*), European plaice (*P. platessa*), Haddock (*M. aeglefinus*), Pollack (*P. pollachius*), Pouting (*T. luscus*), Saithe (*P. virens*), Sandeels (*Ammodytidae spp*), Thornback ray (*R. clavata*), Whiting (*M. merlangus*)

Supplementary Table 11: List of fish species with greatest abundance at man-made structures including O&G installations and OWFs across the North Sea.

Species & community ecology		Findings of species' significant behaviour	Research References
Variation of fish species	richness	• 25 different species observed at OWF and less at wrecks	(Kerckhof, Rumes and Degraer 2018)
Variation of fish species	detection	• first records of obligate hard substrate fish species uncommon to Belgian Sea though	(Kerckhof, Rumes and Degraer 2018)
Atlantic cod	abundance	• showing high residency, site fidelity at OWF, confirming early work (Jørgensen, Løkkeborg and Soldal 2002)	(Reubens, Degraer and Vincx 2014)
Atlantic cod Pouting	abundance	• strongly attracted towards OWF	(Reubens, Degraer and Vincx 2014)
Atlantic cod Pouting	food web	prey dominated in stomach for both species: • *J. herdmani* and *P. longicornis* (good quality)	(Reubens, Degraer and Vincx 2014)
Atlantic cod	abundance	• significant within 50 m of OWF (97 % of all records)	(Reubens, et al. 2013)
Whiting Common dab Sandeels	abundance	• significant at OWF	(Stenberg, et al. 2015)
Atlantic cod Common ling Pollack	abundance	• significant at O&G, dominated by Atlantic cod	(Todd, Lavallin and Macreadie 2018)
Atlantic cod Lumpsucker	reproduction	• Lumpsucker brooding eggs on O&G and juveniles of Atlantic cod spotted at O&G	(Todd, Lavallin and Macreadie 2018)
Common sole Atlantic cod	abundance	• significant at OWF	(van Hal, Griffioen and van Keeken 2017)
Goldsinny wrasse Grey triggerfish	detection	• first records in Belgian Sea	(van Hal, Griffioen and van Keeken 2017)
Saithe	biological rhythm	• showing diurnal rhythm of vertical movements at O&G, confirming early work (Soldal 2002)	(Fujii and Jamieson 2016)
Saithe Haddock Atlantic cod	abundance	• significant at O&G, dominated by saithe	(Fujii 2016)
Saithe Haddock Atlantic cod	food web	prey dominated in stomach in respective order: • Euphausiacea (O&G) & pouting (trawl) • Ophiuroidea (O&G) • unidentified fish (O&G)	(Fujii 2016)

Supplementary Table 12: List of fish species and their community ecology influenced by water depth and temporal effects in relation to man-made structures including O&G installations and OWFs across the North Sea.

Species & community ecology		Findings due to water depth and temporal effects	Research References
Variation of fish species	abundance	• buildup of vertical zonation: benthic fish (bottom zone), benthopelagic fish (live in bottom zone but do not rest there), pelagic fish (live in mid-depth or surface zone)	(Kerckhof, Rumes and Degraer 2018)
Atlantic cod Common ling Pollack	abundance	• highest in bottom zone, pollack also significant in surface zone	(Todd, Lavallin and Macreadie 2018)
Saithe	abundance	• peak at around 3–4 am at mid-depth and 34 pm at bottom of O&G, confirming early work (Soldal 2002)	(Fujii and Jamieson 2016)
Saithe Haddock Atlantic cod	abundance	• highest in bottom zone varying with season and year (correlated with temperature)	(Fujii 2015)
Atlantic cod	abundance	• spatial-temporal movement pattern: highest in surface zone in winter/spring and highest in bottom zone in autumn/winter	(Wright, et al. 2020)
European plaice	abundance	• highest in surface zone	(Wright, et al. 2020)

Supplementary Table 13: List of fish species and their community ecology influenced by temporal and disturbance effects in relation to man-made structures including O&G installations and OWFs across the North Sea.

Species & community ecology		Findings due to temporal and disturbance effects	Research References
Atlantic cod	abundance	• seasonal movement pattern: high in summer/ autumn (feeding season), very low in winter (spawning season)	(Reubens, et al. 2013)
Whiting Common dab Sandeels	abundance	• no significant changes due to installation of OWF (long term)	(Stenberg, et al. 2015)
Variation of fish species	abundance richness diversity	• significant increase from pre-installation to post-installation of mobile O&G (short term) • differences between laid and trenched pipeline: significant increase after trenching except for whiting	(Todd, Williamson, et al. 2020)
Variation of fish species	aggregation	• fish schools in April observed at OWF, none in summer	(van Hal, Griffioen and van Keeken 2017)
Saithe Haddock Atlantic cod	food web	• differences in stomach content between species varying seasonally	(Fujii 2016)
Saithe Haddock Atlantic cod	abundance	• seasonal movement pattern: high and constant from spring to autumn, very low in winter except for saithe	(Fujii 2015)

Supplementary Table 14: List of fish species and their community ecology influenced by substrate site/type and temporal effects in relation to man-made structures including O&G installations and OWFs across the North Sea.

Species & community ecology		Findings due to site/type and temporal effects	Research References
Variation of flatfishes	dispersal	• PTM showing potential overlap between potential spawning grounds and future OWF sites	(Barbut, et al. 2020)
Variation of fish species	diversity	• OWF: higher at turbines, decline with distance	(Stenberg, et al. 2015)
Common dab Sandeels	abundance	• OWF: higher at turbines, decline with distance	(Stenberg, et al. 2015)
Whiting	abundance	• OWF: lower at turbines, increase with distance	(Stenberg, et al. 2015)
Atlantic cod	body size	• larger at OWF than on sandy bottom varying seasonally	(van Hal, Griffioen and van Keeken 2017)
Atlantic cod Pouting	abundance	• higher at OWF than on sandy bottom	(van Hal, Griffioen and van Keeken 2017)
Flatfish species Whiting	abundance	• higher on sandy bottom than at OWF	(van Hal, Griffioen and van Keeken 2017)
Saithe	food web	• stomach content varies between O&G and open water across CNS/NNS, but showing seasonal overlap	(Fujii 2016)
Saithe	abundance	• higher and more constant over the seasons at O&G than in open water	(Fujii 2015)
Haddock Atlantic cod	abundance	• higher and more constant over the seasons in open water than at O&G	(Fujii 2015)
Atlantic cod	abundance	• positive correlation with density of cables varying seasonally • negative correlation with density of wrecks varying seasonally	(Wright, et al. 2020)
European plaice	abundance	• positive correlation with density of O&G and cables varying seasonally	(Wright, et al. 2020)
Thornback ray	abundance	• positive correlation with density of wrecks varying seasonally • negative correlation with density of O&G and cables varying seasonally	(Wright, et al. 2020)

Supplementary Table 15: List of recent research works dealing with the influence of man-made structures including O&G installations and OWFs on various fish species across the North Sea.

Mammals/sharks	location max depth	Substrate type	sampling method/period/analysis	Research References
Harbour porpoise	CNS 46 m 66 m	manned & unmanned O&G	visual observation & acoustic detection by PAM (2 y) & taxa identification by eDNA continued work (Delefosse, Rahbek, et al. 2018) descriptive statistics	(Delefosse, Jacobsen, et al. 2020)
Harbour porpoise Dolphins Whales Seals	CNS 46 m 66 m	manned & unmanned O&G	visual observation 2013–2015 statistical analysis	(Delefosse, Rahbek, et al. 2018)
Seals	SNS	new OWF pipeline	GPS tracking data 2008–2012: different tagging periods descriptive statistics	(Russell, et al. 2014)
Dolphins Seals Sharks	NS N-E Atlantic 353 m	O&G subsea pipeline	visual/acoustic detection by ROV 1998–2019 descriptive statistics	(Todd, Lazar, et al. 2020)
Harbour porpoise Whales Dolphins Seals, Sharks	SNS 30 m	fixed & mobile O&G	visual observation during daylight & acoustic detection by PAM 2004–2014 (PAM in 2014) descriptive statistics	(Todd, Warley and Todd 2016)
Harbour porpoise	SNS 48 m	fixed & mobile O&G	acoustic detection by PAM 2004–2006 statistical analysis	(Todd, Pearse, et al. 2009)

PAM: Passive Acoustic Monitoring

Supplementary Table 16: List of marine mammals and sharks sighted at man-made structures including O&G installations and OWFs across the North Sea.

Species*	**Findings of species' behaviour due to interactions with anthropocentric hard substrate**	**Research References**
Harbour porpoise	• highest abundance of mammals at/near O&G in NS • mainly observed during night by PAM from July to January, while eDNA confirmed presence of prey species (mackerel, whiting) at O&G • pronounced diel pattern in echolocation activity: foraging at O&G during night; not supported by observations (Osiecka, Jones and Wahlberg 2020) • sightings increased from North to South in CNS • sightings increased with areal footprint of O&G	(Delefosse, Jacobsen, et al. 2020) (Delefosse, Rahbek, et al. 2018) (Todd, Warley and Todd 2016) (Todd, Pearse, et al. 2009)
White-sided White beaked dolphins	• sightings increased with depth	(Delefosse, Rahbek, et al. 2018) (Todd, Warley and Todd 2016)
Minke/Killer Pilot whales	• significant abundance of minke whales at/near O&G	(Delefosse, Rahbek, et al. 2018) (Todd, Warley and Todd 2016)
Common seal Grey seal	• strongly associated with pipelines using for navigation and foraging confirmed by observation & GPS data • sightings increased with depth • foraging at OWF showing grid-like movement pattern	(Delefosse, Rahbek, et al. 2018) (Russell, et al. 2014) (Todd, Lazar, et al. 2020) (Todd, Warley and Todd 2016)
Basking shark Porbeagle shark	• travelling along pipeline	(Todd, Lazar, et al. 2020) (Todd, Warley and Todd 2016)

* *scientific names*: Harbour porpoise *(P. phocoena)*, Atlantic white-sided dolphin *(L. acutus)*, White beaked dolphin *(L. albirostris)*, Common dolphin *(D. delphis)*, Bottlenose dolphin *(T. truncatus)*, Minke whale *(B. acutorostrata)*, Killer whale *(O. orca)*, Pilot whales *(Globicephala spp.)*, Common seal *(P. vitulina)*, Grey seal *(H. grypus)*, Basking shark *(C. maximus)*, Porbeagle shark *(L. nasus)*

Supplementary Table 17: List of recent research works dealing with the interactions between fisheries and man-made structures including O&G installations and OWFs across the North Sea.

Interaction	Findings due to interactions with anthropocentric hard substrate	Research References
Safety zones	• also called exclusion zones of 500 m automatically established around O&G installations (active/non-active) • any fishing activities prohibited in such zones • no restrictions applied to pipelines; restrictions may be defined for OWF on a case-by-case basis	(Petroleum Act 1987)
Hazardous incidents	• majority of incidents occur in NNS and on muddy substrate • 80 % of incidents related to debris/wires/pipelines and occur near pipelines or wrecks • probability of fishing gear incident with pipeline: 7.86E-5	(Rouse, Hayes and Wilding 2020)
Deliberate, regular interactions	• 36 % of all fishing trips of Scottish demersal fleet occur within 200 m of a pipeline over a 5-year period • compromise pipeline integrity, increase risk of gear snagging	(Rouse, Kafas, et al. 2018)
Co-location potential	• high for crab/lobster fisheries within OWF • fisheries concerns: site-specific risk and safety issues • no existing collaboration of stakeholders	(Hooper, Ashley and Austen 2015)

Supplementary Table 18: List of threatened and/or declining species & habitats (OSPAR) filtered for protected species and habitats recently found on, at or in the close vicinity of O&G installations.

Species & habitats	Findings in literature	Research References
Invertebrates		
Ocean quahog	• found near O&G, especially in designated MPAs	**Invalid source specified.**
Ostrea edulis	• found on O&G	Supplementary Table 4
Fish		
Atlantic cod	• shown significant residency at O&G	Supplementary Table 11
Thornback ray	• sighted near O&G, but prefers wrecks	Supplementary Table 14
Mammals and sharks		
Harbour porpoise	• sighted regularly at O&G, especially in designated MPAs	Supplementary Table 16
Basking shark	• sighted near pipelines	Supplementary Table 16
Porbeagle shark	• sighted near pipelines	Supplementary Table 16
Habitats		
Deep-sea sponge aggregations	• found next to O&G, abundance potentially increased due to the proximity of designated MPAs and using O&G as "stepping stones"	Supplementary Table 7 Supplementary Figure 1
Intertidal *Mytilus edulis* beds on mixed and sandy sediments	• massive colonies found on O&G, due to biomass export to surrounding sediment potentially form Mytilus beds in shallower water	Supplementary Table 4
Lophelia pertusa reefs	• colonies found on O&G, reefs found near O&G, strong potential to form reefs around O&G	Supplementary Table 5 Supplementary Figure 1
Modiolus modiolus beds	• abundance potential near/at O&G	Supplementary Figure 1
Ostrea edulis beds	• potential to recover and form beds around O&G	Supplementary Table 4
Sabellaria spinulosa reefs	• abundance potential near/at O&G	Supplementary Figure 1
Sea-pen and burrowing megafauna communities	• abundance potential near/at O&G	Supplementary Figure 1

2 Supplementary References

Barbut, Léo, Berthe Vastenhoud, Laurence Vigin, Steven Degraer, Filip A. M. Volckaert, and Geneviève Lacroix. 2020. "The proportion of flatfish recruitment in the North Sea potentially affected by offshore windfarms." Edited by Silvana Birchenough. *ICES Journal of Marine Science* (Oxford University Press (OUP)) 77: 1227–1237. doi:10.1093/icesjms/fsz050.

Bergmark, P., and D. Jørgensen. 2014. "Lophelia pertusa conservation in the North Sea using obsolete offshore structures as artificial reefs." *Marine Ecology Progress Series* (Inter-Research Science Center) 516: 275–280. doi:10.3354/meps10997.

Coolen, Joop W. P., Arjen R. Boon, Richard Crooijmans, Hilde Pelt, Frank Kleissen, Daan Gerla, Jan Beermann, Silvana N. R. Birchenough, Leontine E. Becking, and Pieternella C. Luttikhuizen. 2020. "Marine stepping-stones: Connectivity of Mytilus edulis populations between offshore energy installations." *Molecular Ecology* (Wiley) 29: 686–703. doi:10.1111/mec.15364.

Coolen, Joop W. P., B. E. van der Weide, J. Cuperus, Maxime Blomberg, Godfried W. N. M. Van Moorsel, Marco A. Faasse, Oscar G. Bos, Steven Degraer, and Han J. Lindeboom. 2018. "Benthic biodiversity on old platforms, young wind farms, and rocky reefs." Edited by Joanna Norkko. *ICES Journal of Marine Science* (Oxford University Press (OUP)) 77: 1250–1265. doi:10.1093/icesjms/fsy092.

Coolen, Joop W. P., Oliver Bittner, Floor M. F. Driessen, Udo van Dongen, Midas S. Siahaya, Wim de Groot, Ninon Mavraki, Stefan G. Bolam, and Babeth van der Weide. 2020. "Ecological implications of removing a concrete gas platform in the North Sea." *bioRxiv*. doi:10.1101/2020.04.16.044263.

Coolen, Joop W. P., Wouter Lengkeek, Gareth Lewis, Oscar G. Bos, Lodewijk Van Walraven, and Udo Van Dongen. 2015. "First record of Caryophyllia smithii in the central southern North Sea: artificial reefs affect range extensions of sessile benthic species." *Marine Biodiversity Records* (Cambridge University Press (CUP)) 8. doi:10.1017/S1755267215001165.

Coolen, Joop W. P., Wouter Lengkeek, Steven Degraer, Francis Kerckhof, Roger Kirkwood, and Han Lindeboom. 2016. "Distribution of the invasive Caprella mutica Schurin, 1935 and native Caprella linearis (Linnaeus, 1767) on artificial hard substrates in the North Sea: separation by habitat." *Aquatic Invasions* (Regional Euro-Asian Biological Invasions Centre Oy (REABIC)) 11: 437–449. doi:10.3391/ai.2016.11.4.08.

Delefosse, Matthieu, Magnus W. Jacobsen, Jeppe D. Balle, Brian K. Hansen, Anne Lise Middelboe, Einar E. Nielsen, and Jonas Teilmann. 2020. "Marine Mammal Biodiversity Around Oil and Gas Platforms - Challenges and Successes of Long-Term Monitoring." *SPE International Conference and Exhibition on Health, Safety, Environment, and Sustainability.* Society of Petroleum Engineers. doi:10.2118/199479-ms.

Delefosse, Matthieu, Malene Louise Rahbek, Lars Roesen, and Karin Tubbert Clausen. 2018. "Marine mammal sightings around oil and gas installations in the central North Sea." *Journal of the Marine Biological Association of the United Kingdom* (Cambridge University Press (CUP)) 98: 993–1001. doi:10.1017/s0025315417000406.

European Environment Agency. 2013. "Conservation status of habitat types and species (Article 17, Habitats Directive 92/43/EEC) - Annex I habitat distribution filtered for Reefs (1170)." *Conservation status of habitat types and species (Article 17, Habitats Directive 92/43/EEC) - Annex I habitat distribution filtered for Reefs (1170).* https://www.eea.europa.eu/data-and-maps/data/article-17-database-habitats-directive-92-43-eec-1.

Fujii, Toyonobu. 2016. "Potential influence of offshore oil and gas platforms on the feeding ecology of fish assemblages in the North Sea." *Marine Ecology Progress Series* (Inter-Research Science Center) 542: 167–186. doi:10.3354/meps11534.

Fujii, Toyonobu. 2015. "Temporal variation in environmental conditions and the structure of fish assemblages around an offshore oil platform in the North Sea." *Marine Environmental Research* (Elsevier BV) 108: 69–82. doi:10.1016/j.marenvres.2015.03.013.

Fujii, Toyonobu, and Alan J. Jamieson. 2016. "Fine-scale monitoring of fish movements and multiple environmental parameters around a decommissioned offshore oil platform: A pilot study in the North Sea." *Ocean Engineering* (Elsevier BV) 126: 481–487. doi:10.1016/j.oceaneng.2016.09.003.

Gabelle, C., F. Baraud, L. Biree, S. Gouali, H. Hamdoun, C. Rousseau, E. van Veen, and L. Leleyter. 2012. "The impact of aluminium sacrificial anodes on the marine environment: A case study." *Applied Geochemistry* (Elsevier BV) 27: 2088–2095. doi:10.1016/j.apgeochem.2012.07.001.

Gates, Andrew R., Tammy Horton, Amanda Serpell-Stevens, Chester Chandler, Laura J. Grange, Katleen Robert, Alexander Bevan, and Daniel O. B. Jones. 2019. "Ecological Role of an Offshore Industry Artificial Structure." *Frontiers in Marine Science* (Frontiers Media SA) 6. doi:10.3389/fmars.2019.00675.

Henry, Lea-Anne, Claudia G. Mayorga-Adame, Alan D. Fox, Jeff A. Polton, Joseph S. Ferris, Faron McLellan, Chris McCabe, Tina Kutti, and J. Murray Roberts. 2018. "Ocean sprawl facilitates dispersal and connectivity of protected species." *Scientific Reports* (Springer Science and Business Media LLC) 8. doi:10.1038/s41598-018-29575-4.

Henry, Lea-Anne, Dan Harries, Paul Kingston, and J. Murray Roberts. 2017. "Historic scale and persistence of drill cuttings impacts on North Sea benthos." *Marine Environmental Research* (Elsevier BV) 129: 219–228. doi:10.1016/j.marenvres.2017.05.008.

Hooper, Tara, Matthew Ashley, and Melanie Austen. 2015. "Perceptions of fishers and developers on the co-location of offshore wind farms and decapod fisheries in the UK." *Marine Policy* (Elsevier BV) 61: 16–22. doi:10.1016/j.marpol.2015.06.031.

JNCC. 2016. "Protected fish in offshore MPAs – WMS layers." *Protected fish in offshore MPAs – WMS layers.* https://ows.jncc.gov.uk/mpa_mapper/wms?

Jørgensen, Terje, Svein Løkkeborg, and Aud Vold Soldal. 2002. "Residence of fish in the vicinity of a decommissioned oil platform in the North Sea." *ICES Journal of Marine Science* (Oxford University Press (OUP)) 59: S288–S293. doi:10.1006/jmsc.2001.1165.

Kerckhof, Francis, Bob Rumes, and Steven Degraer. 2018. "Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea: Assessing and Managing Effect Spheres of Influence." Chap. 6: A closer look at the fish fauna of artificial hard substrata of offshore renewables in Belgian waters, 79–89. Ed. by S. Degraer, R. Brabant, B. Rumes & L. Vigin. Royal Belgian Institute of Natural Sciences, Brussels, Belgium.

Kerckhof, Francis, Joop W. P. Coolen, Bob Rumes, and Steven Degraer. 2018. "Recent findings of wild European flat oysters Ostrea edulis (Linnaeus, 1758) in Belgian and Dutch offshore waters: new perspectives for offshore oyster reef restoration in the southern North Sea." *Belgian Journal of Zoology* (Royal Belgian Institute of Natural Sciences (RBINS)) 148. doi:10.26496/bjz.2018.16.

Kirchgeorg, T., I. Weinberg, M. Hörnig, R. Baier, M. J. Schmid, and B. Brockmeyer. 2018. "Emissions from corrosion protection systems of offshore wind farms: Evaluation of the potential impact on the marine environment." *Marine Pollution Bulletin* (Elsevier BV) 136: 257–268. doi:10.1016/j.marpolbul.2018.08.058.

Krone, R., G. Dederer, P. Kanstinger, P. Krämer, C. Schneider, and I. Schmalenbach. 2017. "Mobile demersal megafauna at common offshore wind turbine foundations in the German Bight (North Sea) two years after deployment - increased production rate of Cancer pagurus." *Marine Environmental Research* (Elsevier BV) 123: 53–61. doi:10.1016/j.marenvres.2016.11.011.

Krone, Roland, Lars Gutow, Tanja J. Joschko, and Alexander Schröder. 2013. "Epifauna dynamics at an offshore foundation – Implications of future wind power farming in the North Sea." *Marine Environmental Research* (Elsevier BV) 85: 1–12. doi:10.1016/j.marenvres.2012.12.004.

Lacey, Nichola C., and Peter Hayes. 2020. "Epifauna associated with subsea pipelines in the North Sea." Edited by Silvana Birchenough. *ICES Journal of Marine Science* (Oxford University Press (OUP)) 77: 1137–1147. doi:10.1093/icesjms/fsy196.

Luttikhuizen, P. C., J. Beermann, R. P. M. A. Crooijmans, R. G. Jak, and J. W. P. Coolen. 2019. "Low genetic connectivity in a fouling amphipod among man-made structures in the southern North Sea." *Marine Ecology Progress Series* (Inter-Research Science Center) 615: 133–142. doi:10.3354/meps12929.

Mestdagh, Sebastiaan, Tom Ysebaert, Tom Moens, and Carl Van Colen. 2020. "Dredging-induced turbid plumes affect bio-irrigation and biogeochemistry in sediments inhabited by Lanice conchilega (Pallas, 1766)." Edited by Joanna Norkko. *ICES Journal of Marine Science* (Oxford University Press (OUP)) 77: 1219–1226. doi:10.1093/icesjms/fsy122.

Oil & Gas Authority. 2020a. *Oil and Gas infrastructure - Surface.* Accessed Official public reference dataset. Retrieved from [last accessed 30 October 2020]. https://data.ogauthority.co.uk/arcgis/rest/services/OGA_Public_WGS84/OGA_Infrastructure_WGS84/FeatureServer.

Osiecka, Anna N., Owen Jones, and Magnus Wahlberg. 2020. "The diel pattern in harbour porpoise clicking behaviour is not a response to prey activity." *Scientific Reports* (Springer Science and Business Media LLC) 10. doi:10.1038/s41598-020-71957-0.

OSPAR Commission. 2019a. *OSPAR MPA Network filtered for United Kingdom.* Accessed Offcial public reference dataset. Retrieved from [last accessed 30 October 2020]. https://carto.maia-network.org/en/1/ospar.map.

—. 2018. "OSPAR threatened and/or declining habitats." *OSPAR threatened and/or declining habitats.* https://www.emodnet-seabedhabitats.eu/access-data/download-data/?linkid=ospar2018_poly.

Petroleum Act 1987. . "UK Government, London, United Kingdom." *UK Government, London, United Kingdom.*

Picken, Gordon, Tim Curtis, and Alan Elliott. 1997. "An Estimate of the Cumulative Environmental Effects of the Disposal in the Deep Sea of Bulky Wastes from the Offshore Oil and Gas Industry." *Offshore Europe.* Aberdeen, United Kingdom, 9-12 September: Society of Petroleum Engineers. doi:10.2118/38510-ms.

Pors, Janneke, Stephanie Verbeek, George Wurpel, Piet Briët, Anne-Mette Jørgensen, and Wouter van Dieren. 2011. "Decommissioning of North Sea oil and gas facilities: An introductory assessment of potential impacts, costs and opportunities." Tech. rep., LNS_{2}{0}{0}, (107 pp.), for IMSA Amsterdam provided by Living North Sea Initiative, Amsterdam, Netherlands.

Reubens, J. T., S. Degraer, and M. Vincx. 2014. "The ecology of benthopelagic fishes at offshore wind farms: a synthesis of 4 years of research." *Hydrobiologia* (Springer Science and Business Media LLC) 727: 121–136. doi:10.1007/s10750-013-1793-1.

Reubens, Jan T., Francesca Pasotti, Steven Degraer, and Magda Vincx. 2013. "Residency, site fidelity and habitat use of Atlantic cod (Gadus morhua) at an offshore wind farm using acoustic telemetry." *Marine Environmental Research* (Elsevier BV) 90: 128–135. doi:10.1016/j.marenvres.2013.07.001.

Rouse, Sally, Andronikos Kafas, Rui Catarino, and Hayes Peter. 2018. "Commercial fisheries interactions with oil and gas pipelines in the North Sea: considerations for decommissioning." Edited by Steven Degraer. *ICES Journal of Marine Science* (Oxford University Press (OUP)) 75: 279–286. doi:10.1093/icesjms/fsx121.

Rouse, Sally, Joanne S. Porter, and Thomas A. Wilding. 2020. "Artificial reef design affects benthic secondary productivity and provision of functional habitat." *Ecology and Evolution* (Wiley) 10: 2122–2130. doi:10.1002/ece3.6047.

Rouse, Sally, Peter Hayes, and Thomas A. Wilding. 2020. "Commercial fisheries losses arising from interactions with offshore pipelines and other oil and gas infrastructure and activities." Edited by Silvana Birchenough. *ICES Journal of Marine Science* (Oxford University Press (OUP)) 77: 1148–1156. doi:doi:10.1093/icesjms/fsy116.

Russell, Deborah J. F., Sophie M. J. M. Brasseur, Dave Thompson, Gordon D. Hastie, Vincent M. Janik, Geert Aarts, Brett T. McClintock, Jason Matthiopoulos, Simon E. W. Moss, and Bernie McConnell. 2014. "Marine mammals trace anthropogenic structures at sea." *Current Biology* (Elsevier BV) 24: R638–R639. doi:10.1016/j.cub.2014.06.033.

Schutter, Miriam, Martijn Dorenbosch, Floor M. F. Driessen, Wouter Lengkeek, Oscar G. Bos, and Joop W. P. Coolen. 2019. "Oil and gas platforms as artificial substrates for epibenthic North Sea fauna: Effects of location and depth." *Journal of Sea Research* (Elsevier BV) 153: 101782. doi:10.1016/j.seares.2019.101782.

Shell U.K. Limited. 2017. "Brent Decommissioning Programmes Environmental Statement." Tech. rep., (444 pp.), for Shell U.K. Limited provided by DNV GL LTD., Aberdeen, United Kingdom.

Soldal, A. 2002. "Rigs-to-reefs in the North Sea: hydroacoustic quantification of fish in the vicinity of a ``semi-cold" platform." *ICES Journal of Marine Science* (Oxford University Press (OUP)) 59: S281–S287. doi:10.1006/jmsc.2002.1279.

Stenberg, C., J. G. Støttrup, M. van Deurs, C. W. Berg, G. E. Dinesen, H. Mosegaard, T. M. Grome, and S. B. Leonhard. 2015. "Long-term effects of an offshore wind farm in the North Sea on fish communities." *Marine Ecology Progress Series* (Inter-Research Science Center) 528: 257–265. doi:10.3354/meps11261.

Sühring, R., A. Cousins, L. Gregory, C. Moran, A. Papachlimitzou, C. Phillips, R. Rowles, S. Supple, M. Wilczynska, and S. N. R. Birchenough. 2020. "The past, present, and future of the regulation of offshore chemicals in the North Sea—a United Kingdom perspective." Edited by Mark Gibbs. *ICES Journal of Marine Science* (Oxford University Press (OUP)) 77: 1157–1166. doi:10.1093/icesjms/fsz172.

Tidbury, Hannah, Nick Taylor, Johan Molen, Luz Garcia, Paulette Posen, Andrew Gill, Susana Lincoln, Adrian Judd, and Kieran Hyder. 2020. "Social network analysis as a tool for marine spatial planning: Impacts of decommissioning on connectivity in the North Sea." Edited by Nessa O\textquotesingleConnor. *Journal of Applied Ecology* (Wiley) 57: 566–577. doi:10.1111/1365-2664.13551.

Todd, Victoria L. G., Edward W. Lavallin, and Peter I. Macreadie. 2018. "Quantitative analysis of fish and invertebrate assemblage dynamics in association with a North Sea oil and gas installation complex." *Marine Environmental Research* (Elsevier BV) 142: 69–79. doi:10.1016/j.marenvres.2018.09.018.

Todd, Victoria L. G., Jane Clare Warley, and Ian Boyer Todd. 2016. "Meals on Wheels? A Decade of Megafaunal Visual and Acoustic Observations from Offshore Oil & Gas Rigs and Platforms in the North and Irish Seas." Edited by Michael L. Fine. *PLOS ONE* (Public Library of Science (PLoS)) 11. doi:10.1371/journal.pone.0153320.

Todd, Victoria L. G., Laura D. Williamson, Sophie E. Cox, Ian B. Todd, and Peter I. Macreadie. 2020. "Characterizing the first wave of fish and invertebrate colonization on a new offshore petroleum platform." Edited by Silvana Birchenough. *ICES Journal of Marine Science* (Oxford University Press (OUP)) 77: 1127–1136. doi:10.1093/icesjms/fsz077.

Todd, Victoria L. G., Laura Lazar, Laura D. Williamson, Ingrid T. Peters, Aimee L. Hoover, Sophie E. Cox, Ian. B. Todd, Peter I. Macreadie, and Dianne L. McLean. 2020. "Underwater Visual Records of Marine Megafauna Around Offshore Anthropogenic Structures." *Frontiers in Marine Science* (Frontiers Media SA) 7. doi:10.3389/fmars.2020.00230.

Todd, Victoria L. G., William D. Pearse, Nick C. Tregenza, Paul A. Lepper, and Ian B. Todd. 2009. "Diel echolocation activity of harbour porpoises (Phocoena phocoena) around North Sea offshore gas installations." *ICES Journal of Marine Science* (Oxford University Press (OUP)) 66: 734–745. doi:10.1093/icesjms/fsp035.

Tornero, Victoria, and Georg Hanke. 2016. "Chemical contaminants entering the marine environment from sea-based sources: A review with a focus on European seas." *Marine Pollution Bulletin* (Elsevier BV) 112: 17–38. doi:10.1016/j.marpolbul.2016.06.091.

van der Molen, Johan, Luz María García-García, Paul Whomersley, Alexander Callaway, Paulette E. Posen, and Kieran Hyder. 2018. "Connectivity of larval stages of sedentary marine communities between hard substrates and offshore structures in the North Sea." *Scientific Reports* (Springer Science and Business Media LLC) 8. doi:10.1038/s41598-018-32912-2.

van der Stap, Tim, Joop W. P. Coolen, and Han J. Lindeboom. 2016. "Marine Fouling Assemblages on Offshore Gas Platforms in the Southern North Sea: Effects of Depth and Distance from Shore on Biodiversity." Edited by Andrew Davies. *PLOS ONE* (Public Library of Science (PLoS)) 11. doi:10.1371/journal.pone.0146324.

van Hal, R., A. B. Griffioen, and O. A. van Keeken. 2017. "Changes in fish communities on a small spatial scale, an effect of increased habitat complexity by an offshore wind farm." *Marine Environmental Research* (Elsevier BV) 126: 26–36. doi:10.1016/j.marenvres.2017.01.009.

Wright, Serena R., Christopher P. Lynam, David A. Righton, Julian Metcalfe, Ewan Hunter, Ainsley Riley, Luz Garcia, Paulette Posen, and Kieran Hyder. 2020. "Structure in a sea of sand: fish abundance in relation to man-made structures in the North Sea." Edited by Steven Degraer. *ICES Journal of Marine Science* (Oxford University Press (OUP)) 77: 1206–1218. doi:10.1093/icesjms/fsy142.