Anchoring & Mooring in MPAs: impacts, risk & management

Olivia Langmead & Heidi Tillin

Marine Biological Association

Anchoring & Mooring in MPAs

Background

Anchoring and mooring activities are widespread through inshore waters. They arise from both recreational use and commercial operations.

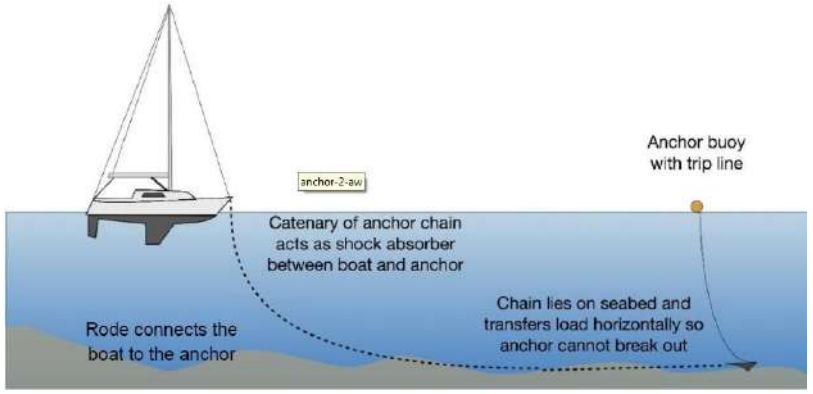
Yachts on moorings in the Cattewater, Plymouth

Small recreational vessels anchoring at Cawsand, Plymouth

Anchoring & Mooring in MPAs

Anchoring

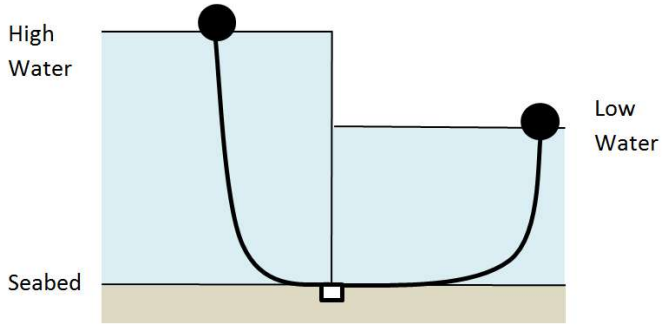
- tackle kept onboard vessel
- secure vessel temporarily to seabed



Adapted from Jollands 2015

Moorings

- gears deployed on seabed with a riser that a vessel attaches to
- permanent or semi-permanent (seasonal)



Image, J. Readman

Anchoring & Mooring in MPAs

Pressures

Recreational and commercial anchoring and mooring has the potential to damage MPA features through

- **abrasion** of the surface of the seabed
- **penetration** of the seabed (anchoring only)
- **habitat change** to another habitat type (mooring only)

Anchoring & Mooring in MPAs

Management

- legislation is completely different for anchoring and mooring
- arisen over centuries of maritime activity
- involvement of many organisations / legislative instruments
- statutory & voluntary measures

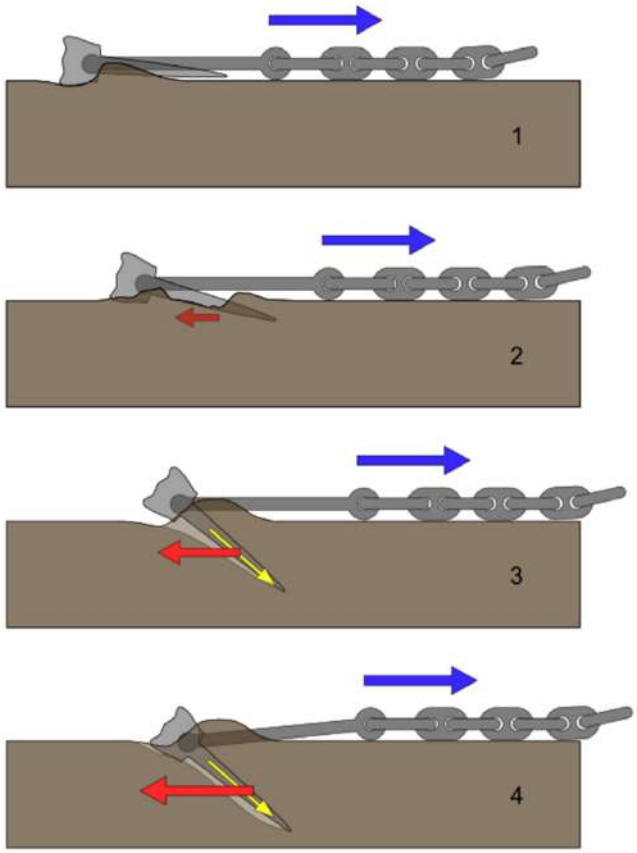
Anchoring & Mooring in MPAs

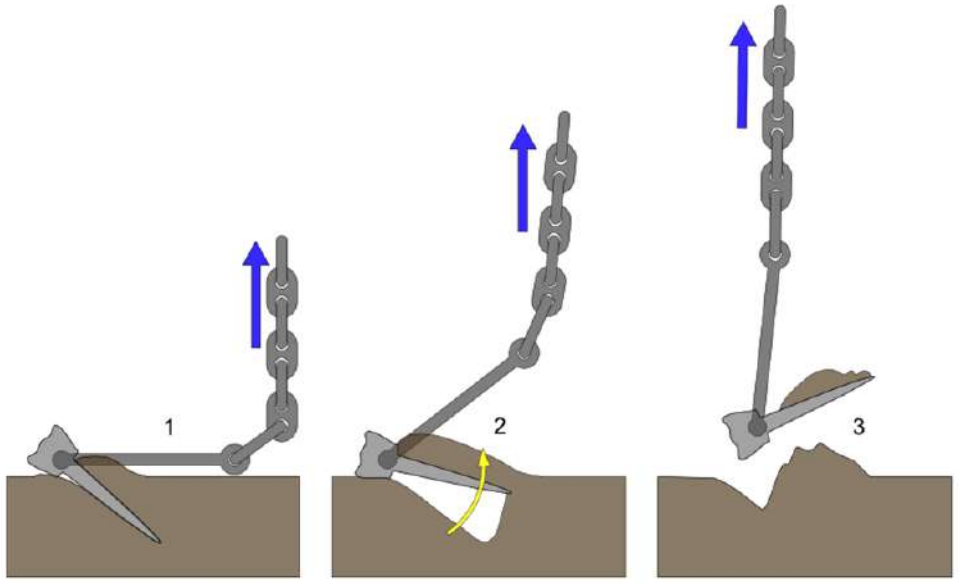
Objectives

1. Assess UK protected features for sensitivity to anchoring and mooring and identify MPAs with sensitive features
2. Quantify exposure to anchoring and mooring
3. Develop a risk assessment method to identify risk at protected sites
4. Review management of anchoring and mooring at selected MPAs
5. Summarise organisational responsibilities for control of anchoring and mooring

Anchoring & Mooring in MPAs

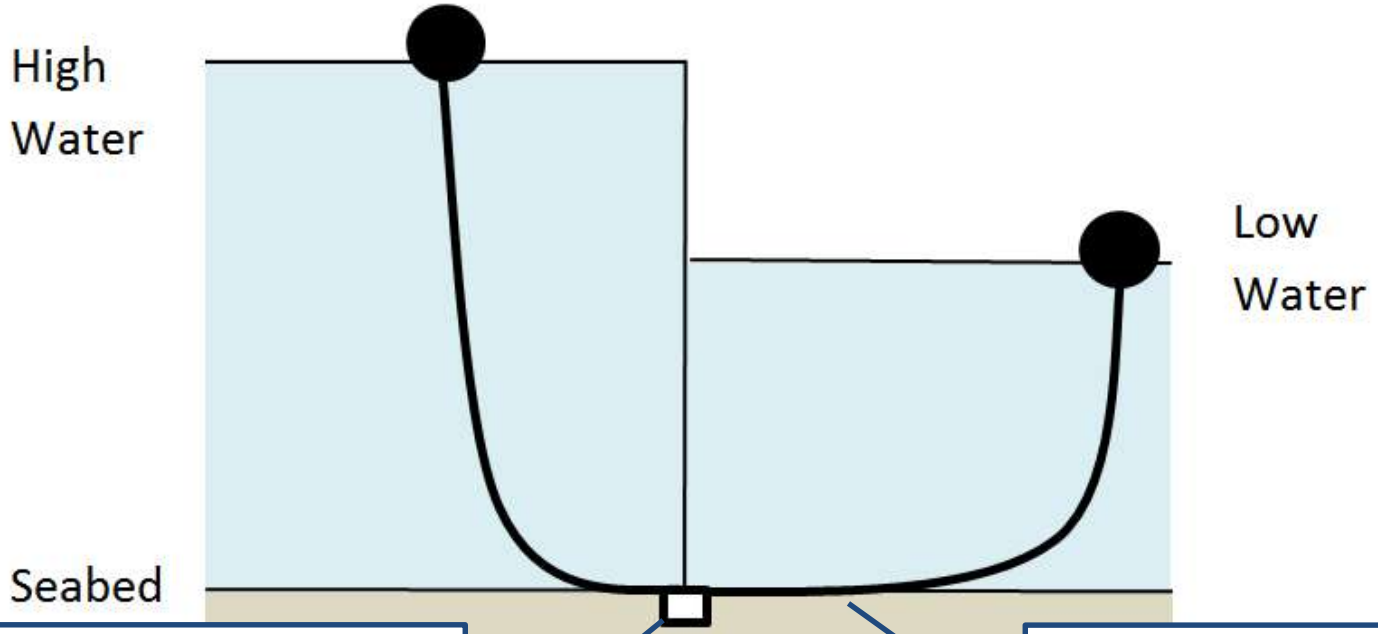
Objective 1: Sensitivity assessment





Anchoring & Mooring in MPAs

Objective 1: Sensitivity assessment



Physical change of habitat – mooring block overlies and smothers, introducing new habitat type – hard substratum to seabed

Abrasion from mooring chains as they shift with changing wind and tide

Objective 1: Sensitivity assessment

MarESA Sensitivity assessment methodology

A. Define the key elements of the feature
B. Assess the feature resistance (tolerance) to the pressure
C. Assess the resilience (recovery) of the feature after pressure has ceased
D. Combine resistance and resilience scores to derive an overall sensitivity rank

59 features assessed – 41 intertidal and subtidal seabed habitats plus 18 species

Anchoring & Mooring in MPAs

Objective 1: Sensitivity assessment

Resistance (Tolerance)	Description
None	Severe decline (>75%) and/or physico-chemical parameters are also affected
Low	Significant mortality (25-75%) with some effects on physico-chemical character of habitat
Medium	Some mortality of species (<25%) without change to habitat type.
High	No significant effects to the physico-chemical character of habitat and no effect on population viability of key/characterising species but may affect feeding, respiration and reproduction rates.

Step B

Resilience (Recovery)	Description
Very Low	Negligible or prolonged recovery possible; at least 25 years to recover structure and function
Low	Full recovery within 10-25 years
Medium	Full recovery between 2- 10 years
High	Full recovery within 2 years

Step C

Step D	Resistance			
Resilience	None	Low	Medium	High
Very Low	High	High	Medium	Low
Low	High	High	Medium	Low
Medium	Medium	Medium	Medium	Low
High	Medium	Low	Low	Not sensitive

Step D

- Presented as proformas by feature
- Accompanied by confidence assessment

Objective 1: Sensitivity assessment

Sensitivity to **abrasion** and **penetration** ranged widely from

- **not significant** for highly dynamic environments e.g. mobile sands
- to **high** for features with low resilience and recovery such as biogenic features (seagrass, maerl)

Sensitivity to **habitat change** was high for all features as the pressure represents a loss of habitat in the impact footprint


Mobile sands – not sensitive

Seagrass – high sensitivity

2. Exposure to anchoring and mooring

Activity Datasets collated and analysed –

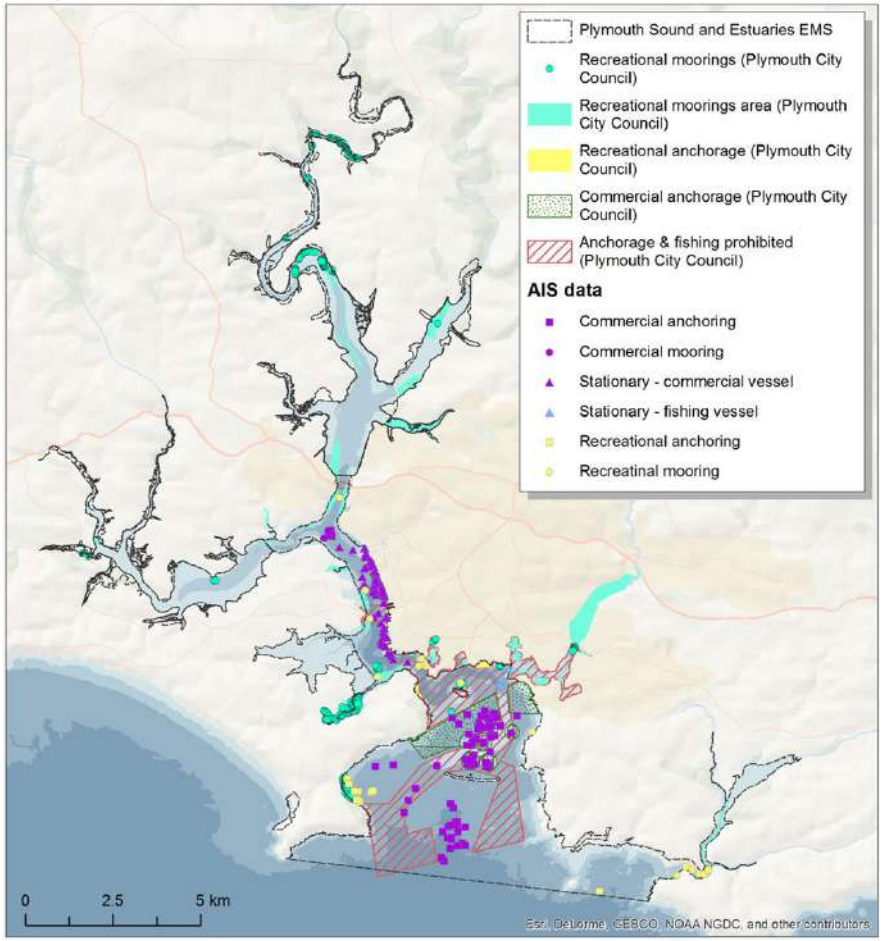
	Vessel category	Dataset
Anchoring	Commercial	**Automatic Identification System (AIS)** vessel track end points - commercial vessel categories **UKHO S57** vector data - location of commercial anchorages Aids to and other moored installations) **UKHO S5** Navigation (AtoNs) - Trinity House **UKHO S57** - (AtoNs 7 - (Mooring areas, administration boundaries)
	Recreation	**Automatic Identification System (AIS)** vessel track end points - yacht, or non commercial vessel less than 65m **StakMap** - RecMap anchoring layer **UKHO S57** - anchorages

2. Exposure to anchoring and mooring

- Anchoring and mooring activities assessed for each MPA
- **Exposure highly variable**
- No / little evidence for anchoring and mooring at some sites
- Other sites had areas that were intensely used

PSE EMS ranks #10 out of 178 MPAs with data for exposure to A&M activity

Plymouth Sound and Estuaries EMS



2. Exposure to anchoring and mooring

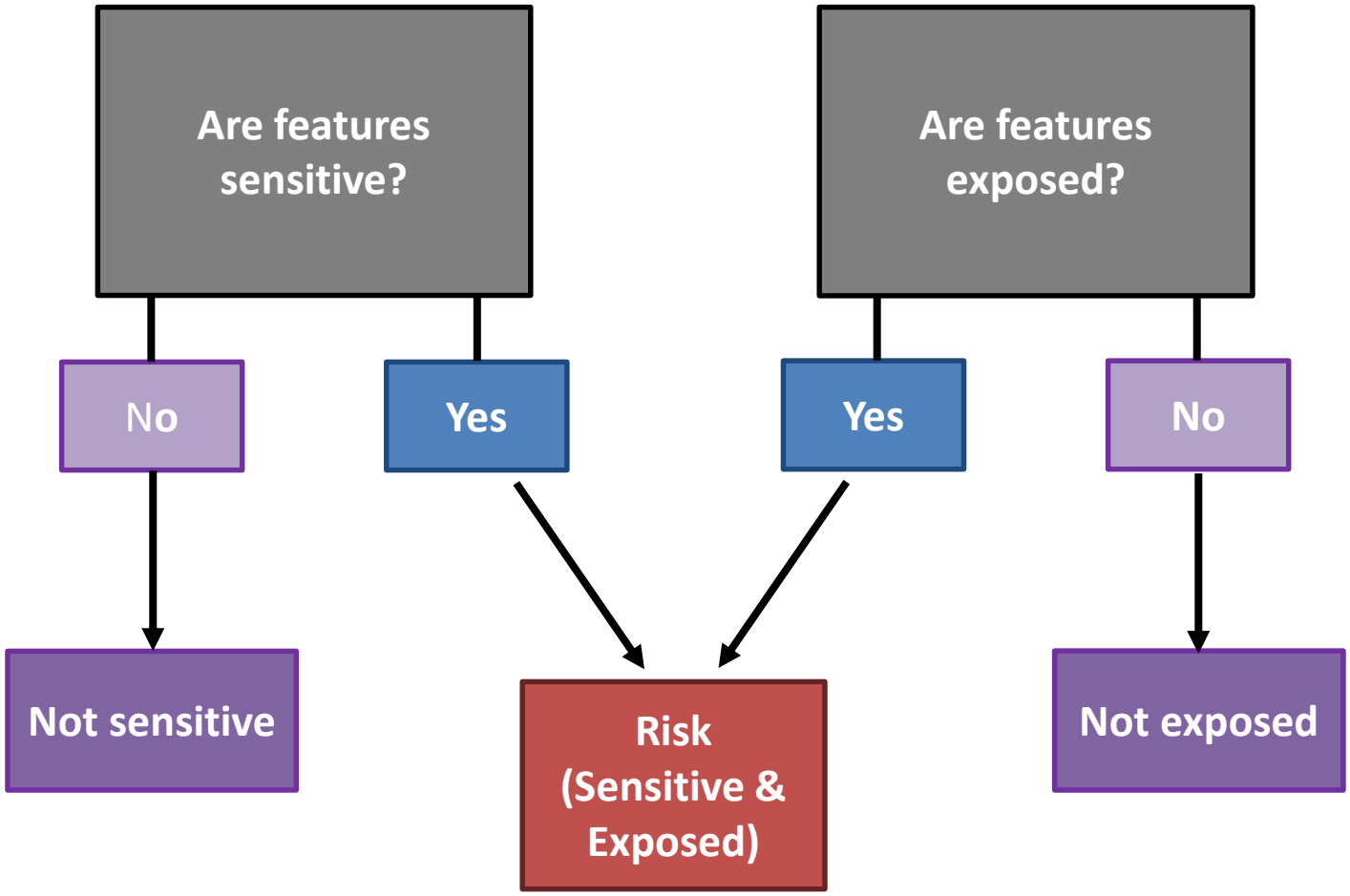
192 MPAs assessed

- 109 affected by **both activities** (57%)
- 19 affected by **anchoring** only (10%)
- 31 affected by **mooring** only (16%)
- 33 **not exposed** to anchoring or mooring (17%)

2,987 biotope polygons risk assessed

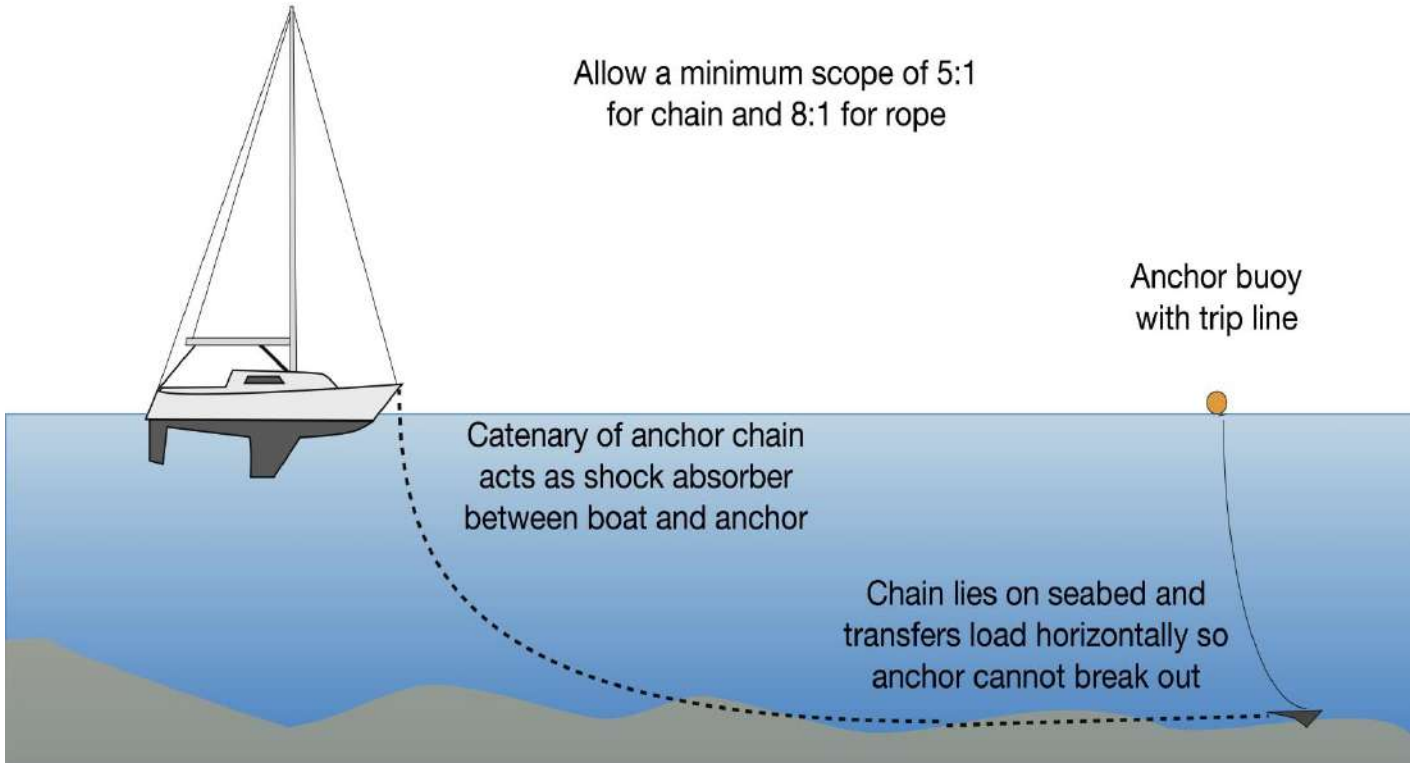
- 369 exposed to **both activities** (12%)
- 176 exposed to **anchoring** only (6%)
- 559 exposed to **mooring** only (19%)
- 1,883 (63%) biotope polygons **not exposed**

3. Risk assessment



3. Risk assessment

Anchoring abrasion estimate – catenary chain calculations

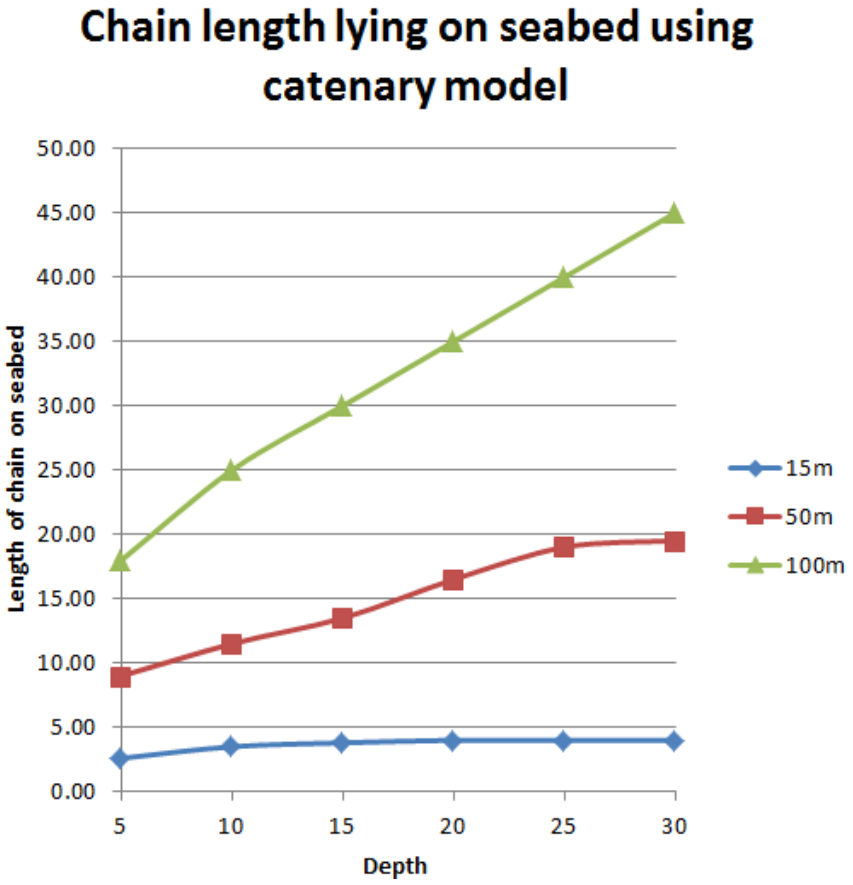


Adapted from Jollands 2015

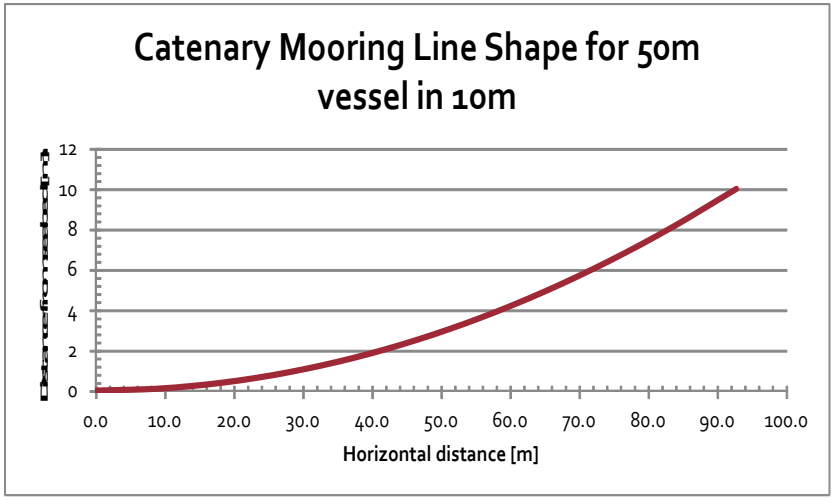
Anchoring & Mooring in MPAs

3. Risk assessment

Modelled catenary curves



Input parameters			
waterdepth plus the distance between sealevel and the fairlead	d	10.00	[m]
force applied to the mooring line at the fairlead	F	53.1	[t]
normalized thread diameter	D	0.15	[m]
submerged density of the line material (steel in air = 7,8)	ρ	6.8	[t/m^3]
Results			
horizontal distance between the fairlead and the touchdown point of the mooring line on the seabed	X	92.78	[m]
weight of the suspended chain	V	11.2	[t]
cross sectional area of the thread	A	0.02	[m^2]
unit weight of the mooring line in water	w	0.12	[t/m]
normalized horizontal tension component	T_H	37.4	[t]
length of the suspended mooring line	S	93.50	[m]
catenary shape parameter	a	0.03150	[-]



3. Risk assessment

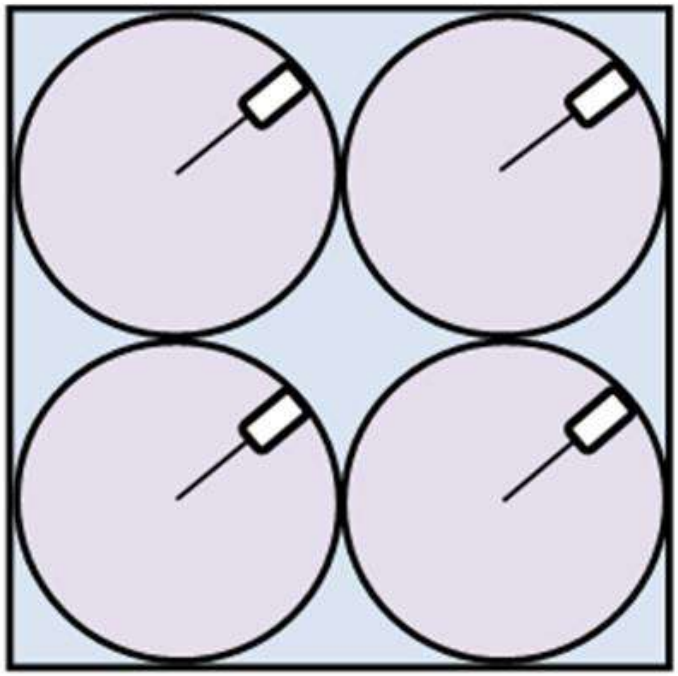
Penetration of the seabed – footprint related to vessel size

Larger vessels need larger anchors resulting in larger footprint

Estimated exposure footprints ranged from 0.5m^2 to 18m^2

3. Risk assessment

Estimating number of moorings (density)



Number of individual moorings used to weight:

- chain abrasion estimates
- number of mooring blocks to estimate physical change

3. Risk assessment

Habitat change from mooring blocks

Estimated for recreational and commercial mooring areas and navigation markers

- **Recreational mooring** block footprint estimated as **2.4 m²**
- **Commercial mooring** block footprint estimated as **19 m²**

3. Risk assessment

Chain Abrasion (anchoring & mooring)

1,883 (63%) designated habitats were not exposed to anchoring / mooring

Conservative abrasion estimate

- 21 MPAs, 35 designated habitats (biotope polygons) at **high risk**

Worst case abrasion estimate

- 23 MPAs, 92 designated habitats at **high risk**

Designated features at high risk include intertidal and subtidal seagrass beds, maerl beds, and subtidal sediments

3. Risk assessment

Penetration and disturbance (anchoring only)

- 2,442 (82%) biotope polygons not exposed
- 533 (18%) biotope polygons at low risk
- 12 (0.4%) biotope polygons at medium risk
- 0 biotope polygons at high risk

Physical change (mooring only)

- 2,059 (69%) biotope polygons not exposed
- 909 (30%) biotope polygons at low risk
- 17 (0.6%) biotope polygons at medium risk
- 1 (0.03%) biotope polygons at high risk

Anchoring & Mooring in MPAs

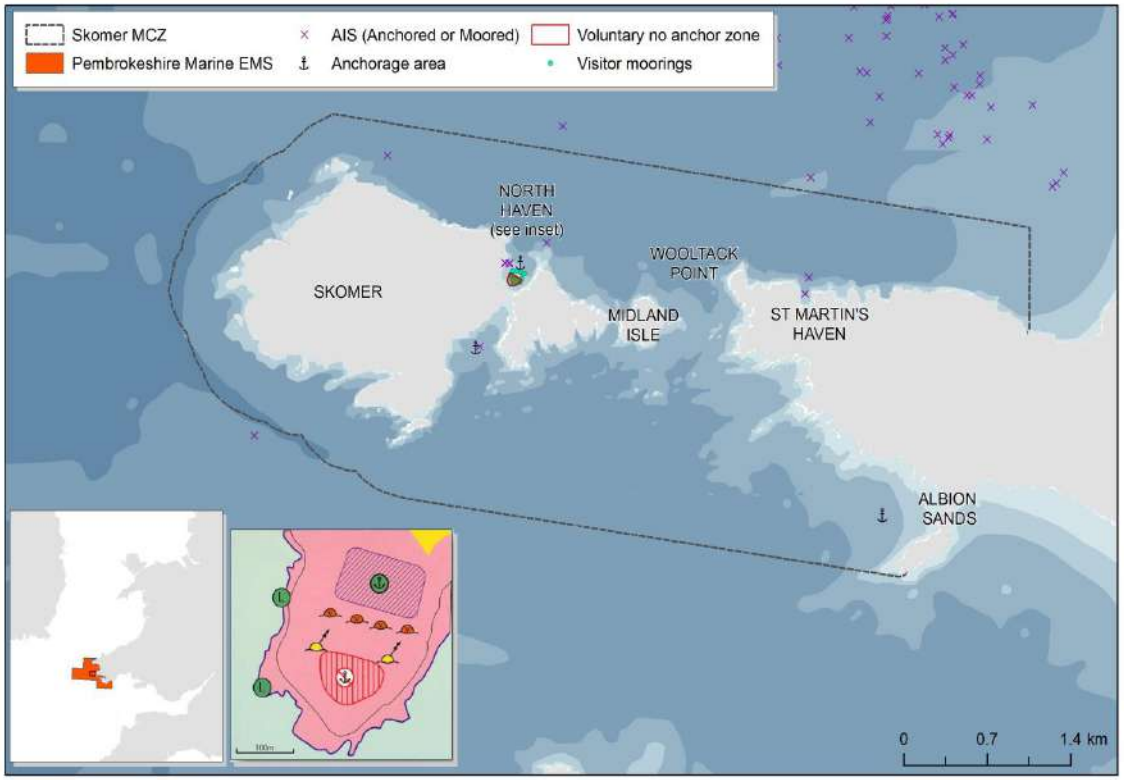
4. Review management at selected MPAs

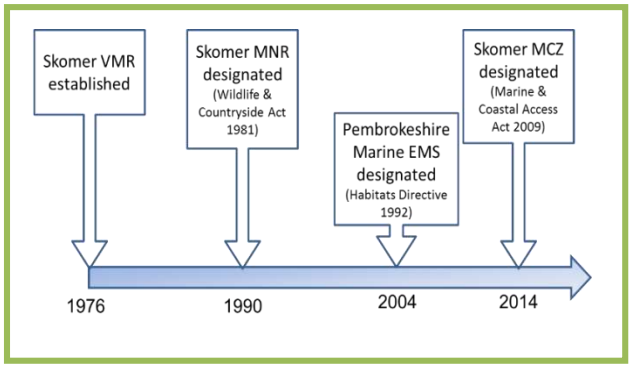
Site	Feature	Activity	Designation	Management measures
Skomer	Seagrass	Recreational anchoring	Marine Conservation Zone, European Marine Site (Pembrokeshire Marine SAC)	Voluntary No-Anchoring Zone, visitor moorings, information provision
Kingmere	Chalk & infra-littoral rock, black bream nests	Recreational anchoring (angling), commercial black bream fishery (rod and line), recreational diving	Tranche 1 Marine Conservation Zone	Engagement, Voluntary code of conduct, byelaw, zoning plan of site
Studland	Seagrass, seahorses, fan mussel	Recreational anchoring and mooring	Recommended Tranche 3 Marine Conservation Zone	Voluntary No-Anchoring Zone trials, code of conduct, engagement at site
Bembridge	Seagrass, seagrass associated features, sublittoral mud	Recreational and commercial anchoring	Recommended Tranche 3 Marine Conservation Zone	None known
Milford Haven	Seagrass, maerl	Recreational anchoring	European Marine Site (Pembrokeshire Marine SAC)	Voluntary agreement/code of conduct, visitor moorings, information provision

Anchoring & Mooring in MPAs

4. Review management at selected MPAs

Skomer MCZ (part of PM EMS)



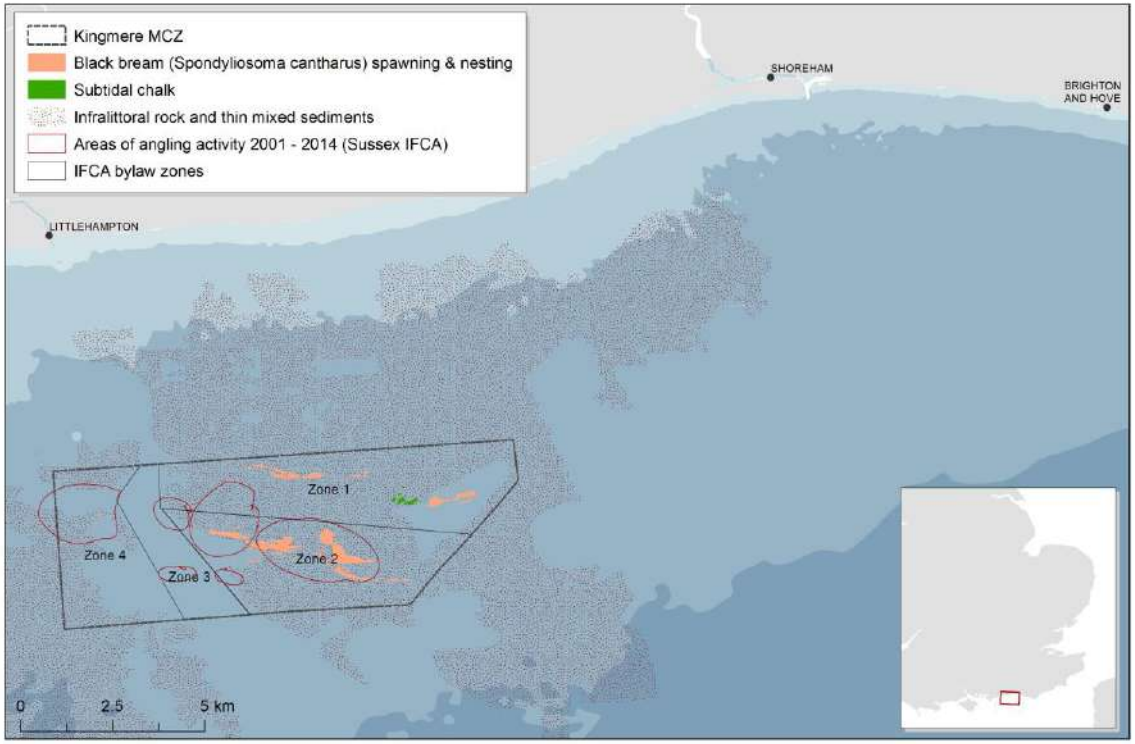


Measures

- VNAZ & AZ (zoning plan)
- Visitors moorings (seasonal)
- Water liaison patrols
- Voluntary code of conduct

4. Review management at selected MPAs

Kingmere MCZ



Anchoring of recreational angling vessels targeting black bream by both fishing charter vessels and private vessels

Features

- Black bream nesting
- Subtidal chalk
- Infralittoral mixed

Measures

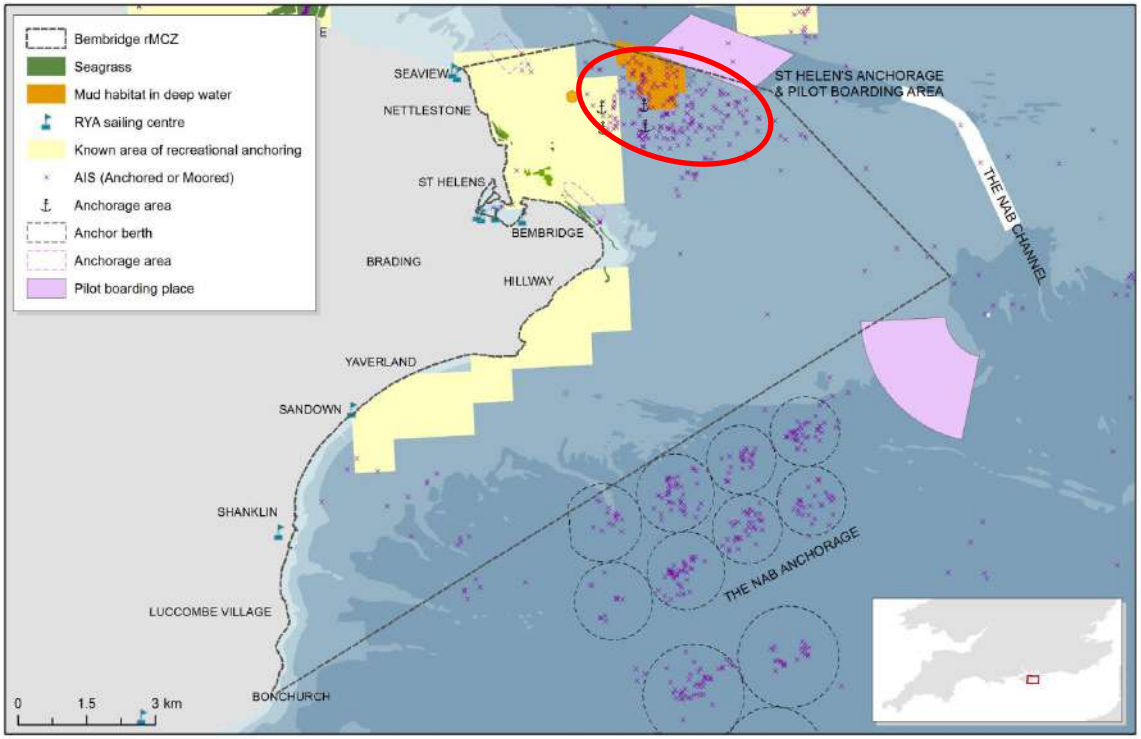
- Site zoning (SxIFCA)
- Byelaws to manage fishing (recreational & commercial, SxIFCA)
- Code of Conduct AT & SxIFCA

Anchoring & Mooring in MPAs

4. Review management at selected MPAs

Bembridge cMCZ

St Helens Road



St Helens Road – only sheltered anchorage in Solent with >1.16k vessels anchoring pa. Used by vessels awaiting instruction to proceed into Port of Southampton (ABP) or Dockyard Port of Portsmouth (QHM)

Features

- Seagrass & maerl beds
- Subtidal mud (BSH)
- Seapens with burrowing megafauna

Measures

- None known
- Proposed options include compensation for users for economic impact if anchorage closed (£22m pa)

5. Organisational responsibilities

Approach

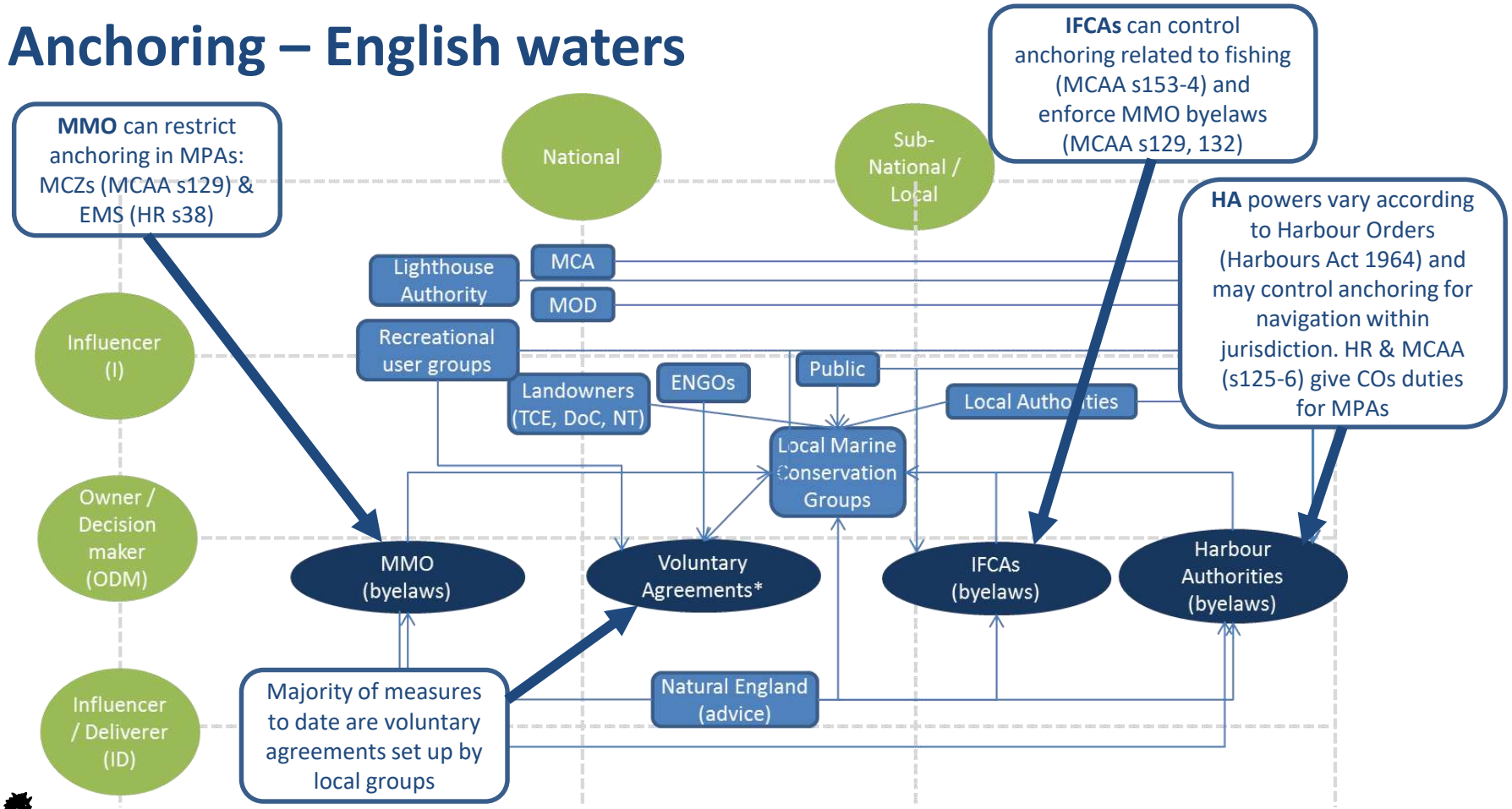
- Collate and analyse relevant legislation surrounding management of A&M
- Engage with key organisations (RYA, P&H, MMO, NRW, TCE, LAs, IFCAS)
- Rapid Policy Network Mapping (Bainbridge et al. 2011)
- Legislative mapping (across different scales of governance)

Actor	Definition
Influencer (I)	Organisation morally or practically required, invited or involved in the management decision making process. Influencers affect the outcome of the process using legitimate means based on opinions and views eg RYA, Wildlife Trusts.
Owner Decision maker (ODM)	An organisation, entity or individual which has the authority to make a management decision. Decisions may be made by Owner/Decision Makers following consultation and/or negotiation. They have the ultimate authority to decide outcomes or power to make byelaws. eg Local Authorities, IFCAs, and central licensing authorities such as the MMO and Welsh Government.
Influencer / Deliverer (ID)	An organisation, entity or individual which is legally or practically required, invited or obliged to be involved in the management process. These include statutory conservation advisors to Government (e.g. Natural England, NRW and JNCC) that develop conservation objectives for MPA features and the advice on operations and activities.

Anchoring & Mooring in MPAs

5. Organisational responsibilities

Anchoring – English waters

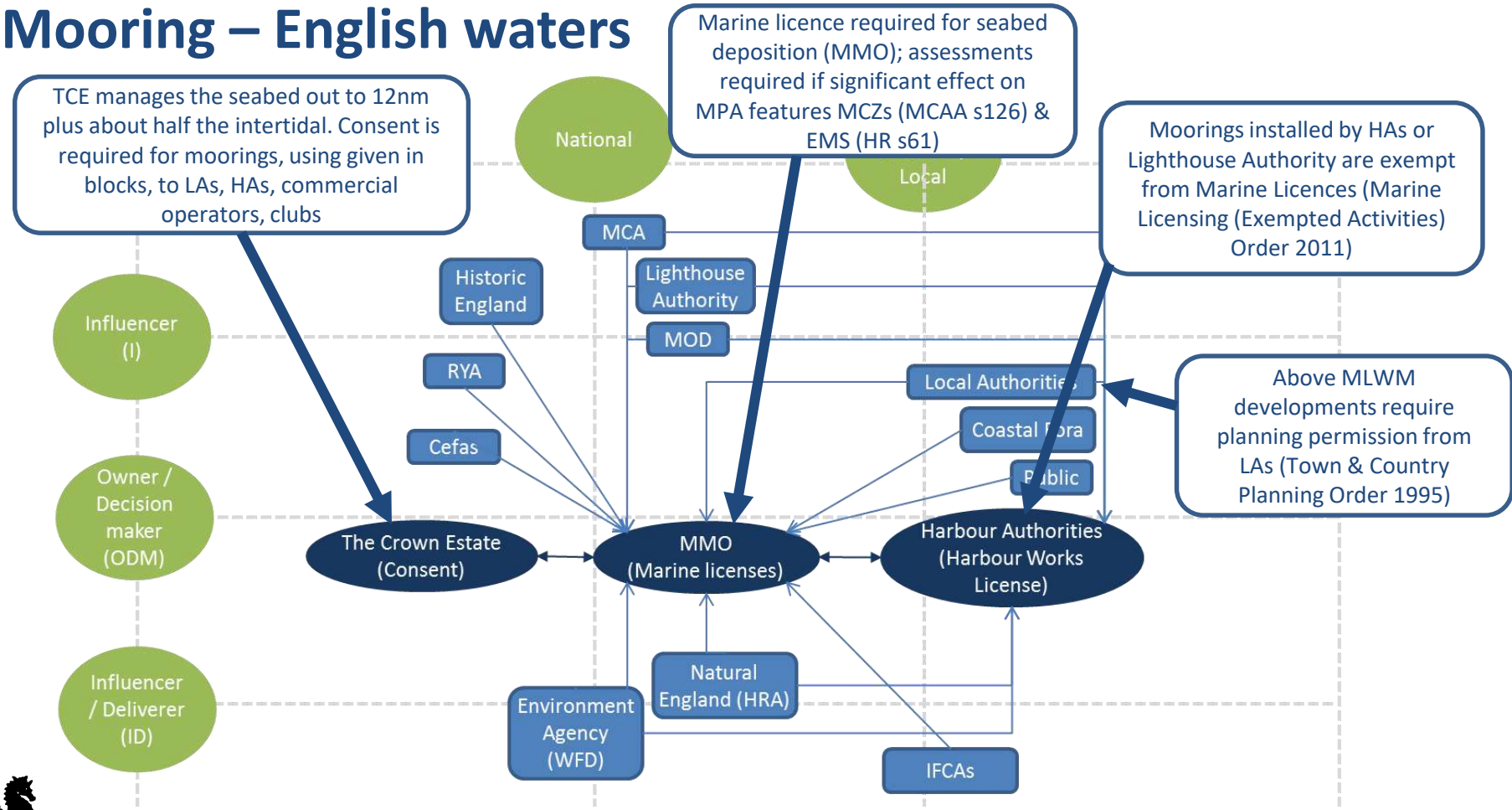


* voluntary agreements informed this diagram: Helford and Skomer VNAZs

Anchoring & Mooring in MPAs

5. Organisational responsibilities

Mooring – English waters



Anchoring & Mooring in MPAs

Conclusions

- 41 seabed habitats and 18 species were assessed for sensitivity; ranged from highly sensitive to not significant.
- Exposure to anchoring and mooring within sites was generally low, and extremely patchy.
- Risk generally low (large features, small footprint) but in some cases sensitive features may be exposed to very high levels of exposure (e.g. Bembridge, St Helen's Road Anch.)

Anchoring & Mooring in MPAs

Conclusions cont.

- Management – complex!
- No one solution
- mostly voluntary measures for anchoring (few organisations have statutory power to manage anchoring of either recreational or commercial vessels)
- Voluntary measures for the management of anchoring generally involve a diversity of sea users including responsible authorities plus recreational and commercial interests and may be ‘owned’ locally or by national organisations
- Licensing for mooring (MMO, TCE, LAs) takes into account for site designations