Marine Conservation Zone Assessment

Site name:	Tamar Estuary MCZ UKMO 20130023
Protected feature(s):	Intertidal biogenic reefs Intertidal coarse sediment Blue mussel (*Mytilus edulis*) beds Native oyster (*Ostrea edulis*)

Fishing activities assessed at this site:
Stage 1 Assessment
Miscellaneous: Crab tiling

Devon & Severn IFCA
Inshore Fisheries and Conservation Authority

D&S IFCA Reference
TAM-MCZ-003

Contents

1. Introduction

This assessment has been undertaken by Devon & Severn Inshore Fisheries and Conservation Authority (IFCA) in order to document and determine whether management measures are required to achieve the conservation objectives of marine conservation zones (MCZs). The IFCA's responsibilities in relation to management of MCZs are laid out in Sections 124 to 126, & 154 to 157 of the Marine and Coastal Access Act 2009.

2. MCZ site name(s), and location

The Tamar Estuary MCZs are located in two spatially separate areas. The MCZs cover an area of approximately 15km² and include the upper reaches of the Tamar and Lynher estuaries of South Devon and Cornwall. As this site crosses the border between Devon & Severn IFCA and Cornwall IFCA, this assessment will be solely for the Tamar Estuary MCZ in Devon & Severn IFCA district.

Further information regarding the MCZ and its protected feature can be found in the Tamar Estuary MCZ Factsheet[1].

3. Feature(s) / habitat(s) of conservation importance (FOCI/HOCI) and conservation objectives

Table 1 - Protected features relevant to this assessment

Feature	General management approach
Intertidal biogenic reefs	Maintain to favourable condition
Intertidal coarse sediment	Maintain to favourable condition
Blue mussel (*Mytilus edulis*) beds	Maintain to favourable condition
Native oyster (*Ostrea edulis*)	Recover to favourable condition

The conservation objectives for these features are that they are brought to, and remain in, favourable condition.

4. Gear/feature interaction in the MCZ categorised as 'red' risk and overview of management measure

None – this site has no gear-feature interactions categorised as "red" risk. Under the Devon and Severn IFCA Mobile Fishing Permit Byelaw, which came into place on 1st January 2014, vessels using mobile fishing gear are prohibited from Plymouth Sound and Estuaries SAC. This protects the reef feature of the EMS and as the Tamar MCZ co-locates with the site, the MCZ features are protected from demersal towed gear.

5. Activities under consideration

- Miscellaneous: Crab tiling

A baseline survey of crab tiles in the Tamar Estuary was undertaken in 2000/2001 and then further surveys were carried out in 2003/2004, 2012 and 2016. These surveys have identified the activity is occurring at a high level within certain areas of the MCZ. The overall number of crab tiles

[1] MCZ Factsheet http://publications.naturalengland.org.uk/category/1721481

increased by 63% in 2012 but has since decreased by 22% in 2016, see Table 2 for more information.

Figure 2 and Figure 3, in Annex 1: Site Map(s) shows the location of crab tiles in the MCZ.
All crab tiles counted were deemed to be in recent use. The material used for the majority of crab tiles was plastic piping and roof tiles. Most had seaweed and barnacle coverage on the tiles.

Referenced information detailed in Section 8 has identified the potential for crab tiles to impact the infauna of intertidal sediments.

Table 2 - Crab tile survey distribution, counts and comparison; data from Noble (2013) and Black (2004)

Location	Estuary Area	2016 Tiles	2012 Tiles	2003/04 Tiles	2000/01 Tiles	Tile number difference (2012 to 2003/04)	Tile number difference (2016 to 2012)
Tavy	TAM07	0	0	0	20	0	
Tavy	TAM08	184	181	360	284	-179	+3
Tavy	TAM09	726	816	980	442	-164	-90
Tamerton Lake	TAM10	1,129	938	470	490	+468	+191
Tamerton Lake	TAM11	0	0	0	112	0	0
Tamar	TAM12	701	1,581	344	1,068	+1,237	-880
TOTALS:		**2,740**	**3,516**	**2,154**	**2,416**	**+1,362**	**-776**
Percentage change:						63%↑	22% ↓

See Davies (2016) for more information regarding fishing activities occurring in Torbay MCZ.

6. Is there a risk that activities are hindering the conservation objectives of the MCZ?

Yes,
Evidence:
To determine whether each pressure is capable of affecting (other than insignificantly) the site's feature(s), the sensitivity assessments and risk profiling of pressures from the advice on operations section of the Natural England conservation advice package were used (Natural England, 2015). Table 3 shows the fishing activities and pressures included for assessment. The justifications for the pressures chosen for inclusion in this assessment can be seen in **Error! Reference source not found.**.

Table 3 - Fishing activities and pressures included in this assessment.

Activity	Pressures
Shore-based activities (Crab tiling)	Abrasion/disturbance of the substrate on the surface of the seabed
	Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion
	Removal of non-target species
	Removal of target species

The relevant targets for favourable condition were identified within Natural England's conservation advice supplementary advice tables (Natural England, 2015). Table 4 shows which targets were identified as relevant to the activity assessed. The impacts of pressures on features were

assessed against these targets to determine whether the activities causing the pressures are compatible with the site's conservation objectives.

Table 4 - Relevant favourable condition targets for identified pressures.

Feature	Attribute	Target
Intertidal biogenic reef	Extent and distribution	Maintain the total extent and spatial distribution of mussel beds
	Structure: population density	Maintain the density of mussels
	Structure: species composition of component communities	Maintain the species composition of the mussel bed community
Intertidal coarse sediment	Distribution: presence and spatial distribution of intertidal coarse sediment communities	Maintain the presence and spatial distribution of intertidal coarse sediment communities
	Structure: opportunistic macroalgae cover	Reduce the opportunistic macroalgae cover (where it's encouraged from anthropogenic activity) to a level where epifauna and infauna are not adversely impacted
	Structure: sediment composition and distribution	Maintain the distribution of sediment composition types across the feature
	Structure: sediment total organic content	Maintain total organic content (TOC) in the sediment at existing levels
	Structure: species composition of component communities	Maintain the species composition of component communities
Blue mussel (*Mytilus edulis*) beds	Extent of subtidal biogenic reef	When mussel beds develops within the site, their extent and persistence should not be compromised by human activities, accepting that, due to the naturally dynamic nature of the feature its extent will fluctuate over time.
	Supporting processes: areas with conditions suitable for reef formation	Maintain the environmental conditions in those locations that are known, or which become known, to be important for mussel bed formation.
Native oyster (*Ostrea edulis*)	Presence and spatial distribution of the species	Recover the presence and spatial distribution of the species.
	Population: population size	Recover the population size within the site.
	Population: recruitment and reproductive capability	Maintain the reproductive and recruitment capability of the species.
	Supporting habitats: extent and distribution	Maintain the extent and spatial distribution of the following supporting habitats: [subtidal rock; subtidal sediment].

Section 8 provides detail on the activity and a literature review to support this assessment.

7. Can D&S IFCA exercise its functions to further the conservation objectives of the site?

Yes,

Evidence: Monitoring and Control Arrangements

- Devon and Severn IFCA undertake crab tile surveys every four years in the Tamar Estuary MCZ to determine the current number of crab tiles and to see if there have been any changes since previous surveys.
- Through the IFCA's Byelaw Review process, D&S IFCA will be reviewing all byelaws relating to hand-gathering. There is the intention to create a permitting byelaw that covers hand-gathering (including crab tiling activity), which would allow the IFCA to monitor levels of

this activity in the future, and adapt permit conditions to changes in effort/ environmental conditions if necessary.

8. Referenced supporting information to inform assessment

Sheehan et al. (2010b) looked at the effects of crab tiling on three estuaries (Yealm, Erme and Avon) which had previously been unexposed to crab tiles. The study manipulated sites for a month with controls, tiled only, trampled only, crab tiled to determine the impact on macro-infaunal diversity. Trampling and crab tiling was conducted three times a week. They found the organic content of the sediment and sediment particle size was unaffected by crab tiling. Crab tiling made sediments more penetrable and infaunal assemblages differed most in the muddiest estuaries (Yealm and Erme). Non-trampled sites (controlled and tiled only) had similar measure of sediment stability and similar abundance to each other, whereas, the sediments in trampling only were least stable and had the lowest infaunal abundance. Crab tiled and trampled sites, which were more stable than trampling only sites, also had a greater abundance. Sheehan et al. (2010b) suggested that tramping was the mechanism that contributed most to the decrease in infaunal abundance rather than the insertion of the tiles.

Johnson et al. (2007) examined the effects of trampling from crab tiling activity on nematodes in mudflats in the Yealm Estuary. Plots were trampled six times over a two week period, which significantly reduced nematode abundance. This might have been caused by meiofauna burrowing deeper into the sediment. However, 12-36 hours after activity ceased, species numbers had returned to control levels. Johnson et al. (2007) attributed the fast recovery to the dynamic nature of intertidal mudflats, which frequently experience natural disturbance. Additionally, abiotic factors (grain size, total organic content and penetrability) indicated that crab tiling made no significant changes to habitat structure.

Sheehan et al. (2010a) used fixed underwater video cameras in tiled and non-tiled sites on Yealm estuary to determine crab distribution during high tide. They found crabs were significantly more abundant in tiled sites. Sheehan et al. (2008) assessed the effects of crab tiling on the population of the green crab *Carcinus maenas* in tiled (Plym, Teign and Exe) and non-tiled (Yealm, Fowey and Salcombe) estuaries. Crabs were caught by baited drop nets, sexed and measured. Tiled estuaries had significantly 63% more crabs than non-tiled estuaries. Crab populations were found to have different size structure such that tiled estuaries had a smaller proportion of large crabs and a smaller modal size call of 20-29mm compared to 30-39mm in non-tiled estuaries. The greater abundance of crabs in tiled estuaries could have adverse effects for associated estuarine fauna. Sheehan et al. (2010a) noted that oysters *Ostrea edulis* and mussels *Mytilus edulis* are an important part of adult *C. maenas* diet and therefore changes in crab population could potentially have an effect on the abundance of their prey species.

9. In-combination assessment

Table 5 - Relevant activities occurring in or close to the site

Plans and Projects		
Activity	**Description**	**Potential Pressure(s)**
MBA research vessel trawling to fish for scientific purposes within the Tamar	Dispensation for annual Marine Biological Association (MBA) scientific survey work on research vessel Sepia within the EMS to fish for scientific purposes. Activity involving 4m beam trawl in West Mud (Tamar) and Yealm Mouth, demersal otter trawl in Bigbury bay, and rectangle dredge in New Ground (Plymouth Sound), Mewstone and Stoke Point.	Removal of target species Removal of non-target species Abrasion, disturbance and penetration of the substrate
MBA and EA trawling for smelt within the Tamar	Dispensation for the MBA and Environment Agency (EA) for shad and smelt monitoring on behalf of Natural England within the EMS. Adult density of shad and smelt will be sampled by a light 4m beam trawl or a small (6ftm) 4 panel demersal trawl between West Mud and Morwellham Island by MBA Sepia. They intend to carry out this sampling monthly (on high water springs) between July 2015 and August 2016.	Removal of target species Removal of non-target species Abrasion, disturbance and penetration of the substrate
Outside of the MCZ	Maintenance dredging at HMNB Devonport	Abrasion, disturbance and penetration of the substrate Resuspension of sediment (smothering)
Outside of the MCZ	Thanckes Oil Jetty demolition and construction of Yonderberry Jetty, Torpoint	Abrasion, disturbance and penetration of the substrate Resuspension of sediment (smothering)
No other plans or projects known to be occurring within Tamar Estuary MCZ	The impact of future plans or projects will require assessment in their own right, including accounting for any in-combination effects, alongside existing activities.	N/A
Other activities being considered		
Fishing Activity	**Description**	**Potential Pressure(s)**
Bait digging	Bait digging has not currently been assessed but it is thought there is no in-combination effect as crab tiles are not occurring on the features assessed. However, the interaction of in-combination effect for bait digging will be taken into account at a later date (See TAM-MCZ-004).	Abrasion, disturbance and penetration of the substrate Removal of target and non-target species

It is believed there is no likelihood of significant adverse effect on the interest features from in-combination effects with other plans or projects.

10. NE consultation response

N/A Natural England has not been consulted at this stage.

11. Conclusion

Crab tiling occurs within certain areas of the MCZ, namely north of the Tamar Bridge up to the mouth of the Tavy and near Tamerton Lake. A total of 3,516 crab tiles were counted in 2012 and a further survey carried out this year (2016) found 2,740 crab tiles, which is a decrease in 22% since 2012. Devon and Severn IFCA will continue to monitor the number and distribution of crab tiles every four years, the next survey is due in 2020, unless there are reports of a significant change or new areas tiled. The literature detailed in section 8 found that crab tiles could have an effect through trampling making sediments more penetrable and reducing infaunal abundance. Additionally, crab tiles were found to increase the abundance of crabs and this could have detrimental effects for prey species such as mussels, which form the intertidal biogenic reef in the MCZ. Crab tiles in the Tamar Estuary MCZ occur mostly on A2.2 Iittoral sand and muddy sand and occasionally on A2.3 littoral mud and A2.4 littoral mixed sediments. Currently crab tiling does not occur in the vicinity intertidal coarse sediment (located in upper Tavy). Intertidal biogenic reefs can be found on the Tamar, a mussel bed north of the mouth of the Tavy and a large mussel bed located near to the Royal Naval Armaments Depot Ernesettle (Natural England, 2015). The mussel beds are located at the lower shore away from the crab tiles (Annex 1, Figure 3) so it is believed that no trampling of the mussel beds from crab tiling would occur. Therefore, the direct impacts and associated effects of trampling that are associated with crab tiling will not have a significant adverse effect on the features.

12. Summary table

Feature or habitat of Conservation interest	**Conservation objectives / Target attributes** (Natural England, 2015)	**Potential pressures from activity and sensitivity of habitats to pressures.** (Natural England, 2015)	**Potential exposure to pressures and mechanism of impact significance**	**Is there a risk that the activity could hinder the achievement of conservation objectives of the site?**	**Can D&S IFCA exercise its functions to further the conservation objectives of the site? If Yes, list management options**
Intertidal biogenic reefs	Maintain the extent and distribution	• Abrasion/disturbance of the substrate on the surface of the seabed • Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion • Removal of target species • Removal of non-target species	Crab tiling occurs north of the Tamar Bridge up to the mouth of the Tavy and near Tamerton Lake. A total of 2,740 crab tiles were counted in 2016. A 22% decrease from 3,516 crab tiles in 2012. Section 8 identified that trampling associated with crab tiling makes sediments more penetrable and reduces infaunal abundance. Crab tiles were found to increase the abundance of crabs and this could have detrimental effects for prey species such as oysters and mussels.	Currently crab tiling does not occur in the vicinity of the features assessed.	Yes, Management measures could include: 1. Monitor activity levels through future crab tile surveys 2. Monitoring and review of byelaw 3. Enforcement of byelaw
Intertidal coarse sediment	Maintain the presence and spatial distribution Maintain the distribution of sediment composition Maintain species composition of component communities	• Abrasion/disturbance of the substrate on the surface of the seabed • Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion • Removal of target species • Removal of non-target species	See above	See above	See above

Blue mussel (*Mytilus edulis*) beds	Extent of subtidal biogenic reef Maintain the environmental conditions important for mussel bed formation.	No pressures were identified in Annex 2, although the activity could include: • Abrasion/disturbance of the substrate on the surface of the seabed • Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion • Removal of target species • Removal of non-target species	See above	See above	See above
Native oyster (*Ostrea edulis*)	Recover the presence and spatial distribution Recover the population size Maintain the reproductive and recruitment capability Maintain the extent and distribution of supporting habitats	No pressures were identified in Annex 2, although the activity could include: • Removal of target species	See above	See above	See above

13. References

Black, G (2004) Report on surveys in 2003/04 of crab tiling activities on Devon's estuaries, and comparison with 2000/01 crab tile survey data. Devon Biodiversity Records Centre, Shirehampton House, 35-37 St David's Hill, Exeter, EX4 4DA

Davies, S. (2016) Tamar Estuary MCZ Fishing Activity Report. Devon and Severn IFCA Report.

Johnson, G.E.L., Attrill, M.J., Sheehan, E.V. and Somerfield, P.J., (2007) Recovery of meiofauna communities following mudflat disturbance by trampling associated with crab-tiling. Marine Environmental Research, 64: 409-416.

Natural England (2015) Draft Conservation Advice for Tamar Estuary Marine Conservation Zone (MCZ)

Noble, T. (2013) Devon & Severn IFCA report: Tamar Estuaries Complex Crab Tile Survey 2012

Sheehan, E.V., Thompson, R.C., Coleman, R.A., and Attrill, M.J. (2008) Positive feedback fishery: Population consequences of 'crab-tiling' on the green crab *Carcinus maenas*. Journal of Sea Research, 60: 303-309

Sheehan, E.V., Coleman, R.A., Attrill, M.J., and Thompson, R.C. (2010a) A quantitative assessment of the response of mobile estuarine fauna to crab-tiles during tidal immersion using remote underwater video cameras. Journal of Experimental Marine Biology and Ecology, 387: 68-74

Sheehan, E.V., Coleman, R.A., Thompson, R.C., and Attrill, M.J. (2010b) Crab tiling reduces the diversity of estuarine infauna. Marine Ecology Progress Series, 411: 137 -148

Annex 1: Site Map(s)

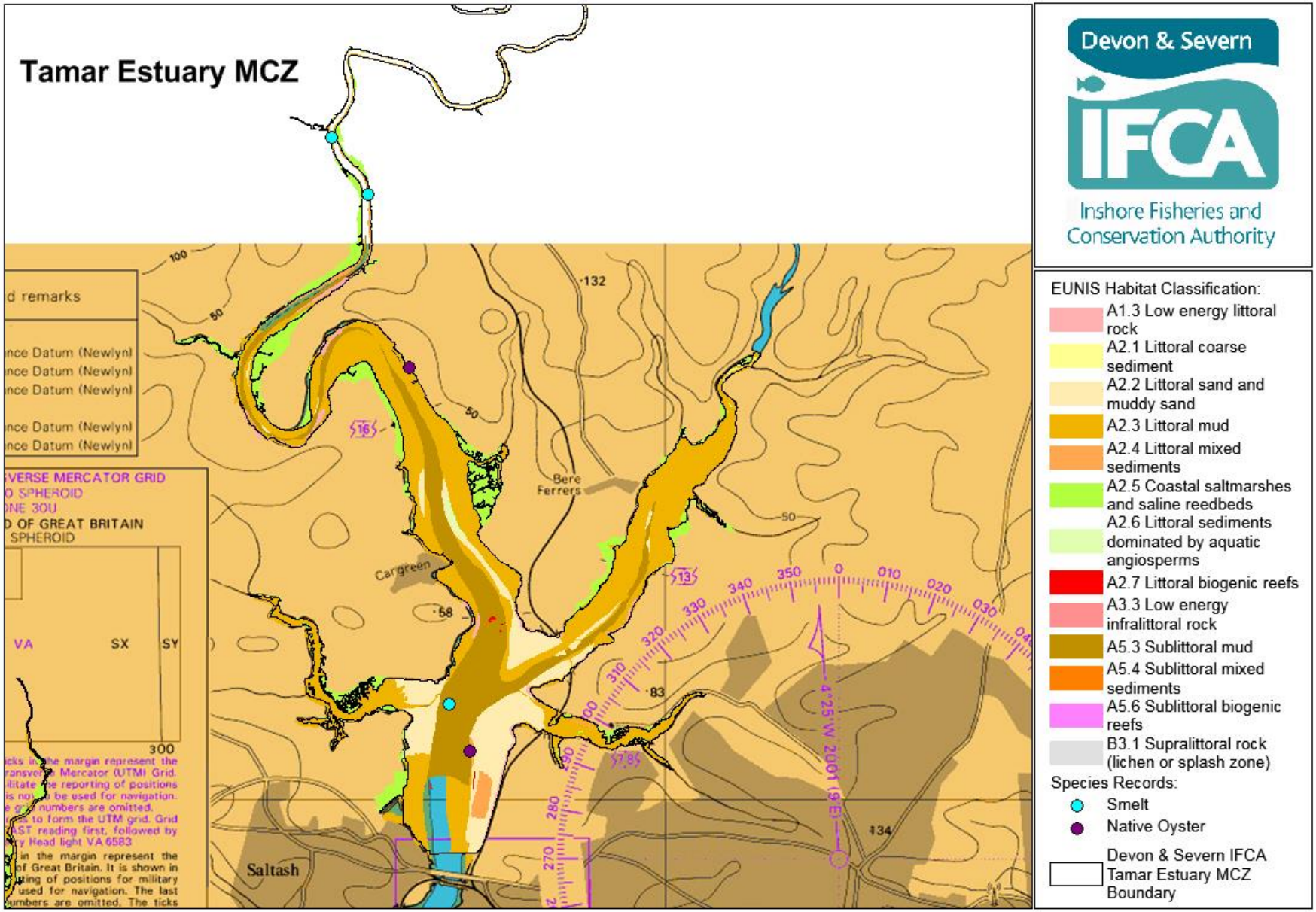

Figure 1 – Tamar Estuary MCZ showing habitat types and species records

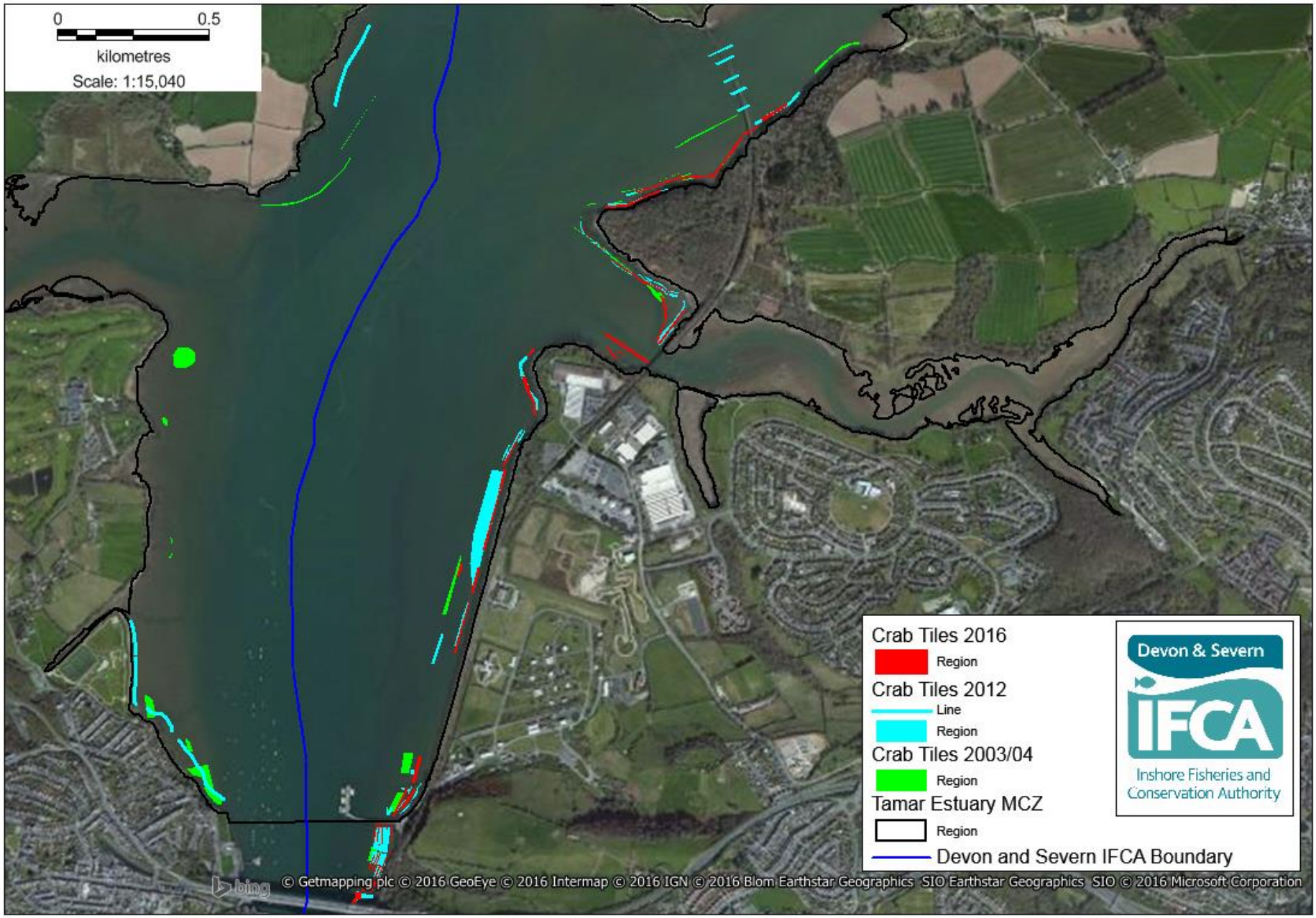

Figure 2 - Crab tiles recorded in the Tamar Estuary MCZ

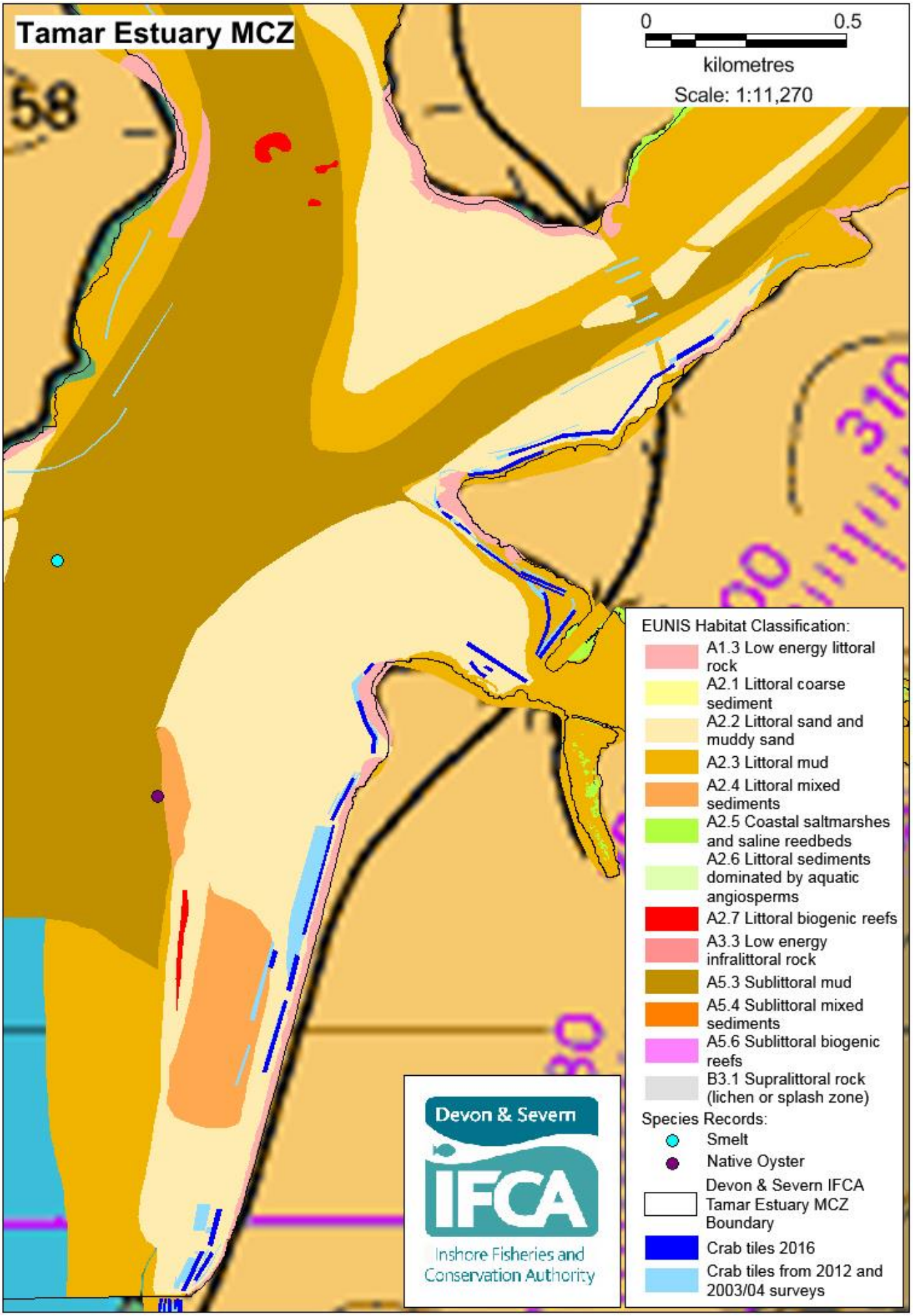

Figure 3 - Crab tiles distribution on the Tamar Estuary MCZ in reference to habitats

Annex 2: Pressures Audit Trail

Fishing Activity Pressures: Shore-based activities	**Intertidal biogenic reefs**	**Intertidal coarse sediment**	**Blue mussel (*Mytilus edulis*) beds**	**Native oyster (*Ostrea edulis*)**	**Screening Justification**
Abrasion/disturbance of the substrate on the surface of the seabed	S	NS			**IN** – Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure
Deoxygenation	NS	NS			**OUT** – Insufficient activity levels to pose risk at level of concern
Genetic modification & translocation of indigenous species	IE				**OUT** - the fleet operates in local area only so risk considered extremely low
Hydrocarbon & PAH contamination. Includes those priority substances listed in Annex II of Directive 2008/105/EC.	NS	NS			**OUT** - Insufficient activity levels to pose risk of large scale pollution event
Introduction or spread of non-indigenous species	S	IE			**OUT** - the fleet operates in local area only so risk considered extremely low
Litter	IE	IE			**OUT** – Insufficient activity levels to pose risk at level of concern
Penetration and/or disturbance of the substrate below the surface of the seabed, including abrasion	S	NS			**IN** – Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure
Physical change (to another seabed type)	S	S			**OUT** – Activity not occurring within close vicinity of features to pose risk at level of concern
Removal of non-target species	S				**IN** – Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure
Removal of target species	S				**IN** – Need to consider spatial scale/intensity of activity to determine likely magnitude of pressure