



Oyster Reef Restoration

Oyster Reef Mapping Criteria – Definitions and guidelines for practitioners undertaking field-based mapping of NSW's oyster reefs

Marine Estate Management Authority

Oyster reef restoration – improves water quality, enhances fish habitat and helps to support healthy, vibrant coastal communities.

Oyster reefs are complex, intertidal or subtidal living structures which are formed from clusters of living oysters and old shell. Oyster reefs are a distinct ecological community which provide a wide range of ecosystem services to coastal communities. Australia's coastal environments have changed considerably since European arrival and it is estimated that 99% of our natural oyster reefs have been lost'. In NSW, small oyster populations still exist in most bays and estuaries but at very low densities compared to the pre-European period.

MAPPING OYSTER REEFS IN NSW ESTUARIES

Assessments on the global condition and abundance of oyster reefs in ecoregions have been widely published ^{1,2}. However, little data exists at a local scale to guide regional or estuary-specific oyster reef restoration or contribute to other aspects of coastal management.

To assist with this data gap, a key activity of the NSW Marine Estate Management Strategy's Oyster Reef Restoration Project is to identify and map current and historical reef sites. This information will be used to better understand the current state of oyster reef habitat in NSW. It will also assist in identifying areas that may need focused protection, provide research and monitoring sites and help plan for future restoration projects.

The process developed for mapping historical oyster reefs in priority estuaries uses a multi-step identification and validation process including:

- 1) Desktop analysis of historical and local stakeholder information to identify likely locations of reefs;
- 2) Desktop analysis of satellite and aerial imagery to identify likely reefs >5m²;
- 3) Field validation of the digitised data and collection of additional reef characteristics; and
- 4) Desktop amendment following field assessments.

DEFINITIONS FOR FIELD-BASED MAPPING

NSW Department of Primary Industries (DPI) have developed the following criteria and definitions for capturing oyster reef characteristics in the field. These criteria are based on existing oyster reef definitions ³, modified classification systems used for other estuarine habitat mapping (e.g. descriptors for estuarine macrophyte mapping ⁴) and practical field-based testing of criteria appropriate for oyster populations in NSW estuaries. Use of these criteria by all projects undertaking oyster reef mapping in NSW is encouraged to ensure consistency in descriptions, methodology and outcomes.

CRITERIA AND OPTIONS	DESCRIPTION
1. REEF TYPE	
	only areas with at least 1 patch $\geq 5\text{m}^2$ in size is determined to be reef
(a) <i>low profile</i>	0.05 - 0.15m in height compared to surrounding substrate (adapted from ³)
(b) <i>high profile</i>	0.15 - 0.5m in height compared to surrounding substrate (adapted from ³)
(c) <i>clumping</i>	small aggregations of oysters surrounded by sediment within a continuous area of oyster reef at least 5m^2 in size
(d) <i>shell bed</i>	traditional shell beds including historic cultivation type and middens
(e) <i>oyster veneer</i>	only 5cm or ≤ 2 layers thick
(f) <i>combination</i>	reefs which contain a combination of types e.g. a few high-profile beds and clumps and encrusted pneumatophores
(g) <i>other</i>	describe in notes
2. ESTUARY LOCATION	
(a) <i>fringing (on foreshore)</i>	band of reef along the foreshore edge, total area needs to $\geq 5\text{m}^2$
(b) <i>independent (island)</i>	reef patches surrounded by sediment/water channels
(c) <i>combination</i>	if large area of reef extending well beyond the shoreline with mix of islands and fringing reef
3. PRIMARY OYSTER SETTLEMENT SUBSTRATE	
(a) <i>legacy oyster farming structures</i>	includes collapsed rack and rail and historic 'peg' rocks which were farmed
(b) <i>anthropogenic rock</i>	includes ballast rock
(c) <i>natural rock</i>	includes bedrock and areas with cobble/large loose rock
(d) <i>seawall</i>	includes training walls
(e) <i>mangrove</i>	includes thick aggregations on pneumatophores
(f) <i>sediment</i>	sand or mud
(g) <i>unknown</i>	possibly rock underneath but too difficult to determine
4. TIDAL PLANE (ELEVATION)	
(a) <i>intertidal</i>	if emerged at low tide
(b) <i>subtidal</i>	if totally submerged at low tide
5. REEF STRUCTURE/ DENSITY	
(a) <i>continuous dense</i>	single large bed or reef structure which is $\geq 5\text{m}^2$ with $\geq 60\%$ oyster coverage
(b) <i>continuous sparse</i>	single large bed or reef structure which is $\geq 5\text{m}^2$ with $< 60\%$ oyster coverage
(c) <i>patchy dense</i>	series of reef patches interspersed with sand or rock, at least one of which is $\geq 5\text{m}^2$. Total coverage of patches within the reef $\geq 60\%$
(d) <i>patchy sparse</i>	series of reef patches interspersed with sand or rock, at least one of which is $\geq 5\text{m}^2$. Total coverage of patches within the reef $< 60\%$
6. SPECIES	
(a) <i>Sydney Rock Oyster</i>	<i>Saccostrea glomerata</i>
(b) <i>Pacific Oyster</i>	<i>Crassostrea gigas</i>
(c) <i>Angasi (Flat) Oyster</i>	<i>Ostrea angasi</i>
(d) <i>Leaf Oyster</i>	<i>Isognomon ehippium</i>
(e) <i>Cockles</i>	Cardiidae (<i>Katelysia scalarina</i> , <i>Anadara trapezius</i>)
(f) <i>Mussels</i>	e.g. <i>Trichomya hirsute</i> , <i>Brachidontes rostratus</i> , <i>Xenostrobus pulex</i>
(g) <i>other</i>	

7. STATUS OF SHELL IN REEF	
(a) live oyster	
(b) dead shell	
(c) other	
8. TIDE (at time of data collection)	
(a) high tide	
(b) low tide	
(c) mid tide	
(d) non-tidal	
9. FIELD SOURCE	
(a) stakeholder	
(b) DPI assessor	
(c) other	

Other metadata should also be collected, including river, region, latitude/longitude, date/time and any map reference/source, and scale.

WHO CAN I CONTACT FOR MORE INFORMATION?

For advice about oyster reef mapping in your area contact one of the Oyster Reef Restoration Team's Fisheries Managers

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¹ Beck, W.B., Brumbaugh, R.D., Airoidi, L., Carranza, A., Coen, L.D., Crawford, C., Defeo, O., Edgar, G. J., Hancock, B., Kay, M.C., Lenihan, H.S., Luckenbach, W.L., Toropova, C.L., Zhang, G. and Guo, X. (2011) Oyster Reefs at Risk and Recommendations for Conservation, Restoration and Management. *Bioscience* Vol 61(2): 107-116

² Gillies C, McLeod I, Alleway H, Cook P, Crawford C, Creighton C, Diggles B, Ford J, Hamer P, Heller-Wagner G, Lebrault E, Le Port A, Russell K, Sheaves M and Warnock B. (2018) Australian shellfish ecosystems: Past distribution, current status and future direction

³ Gillies, C. Threatened Ecological Community Nomination – 'Native flat oyster and Sydney rock oyster ecosystems of temperate Australian marine and estuarine waters'. 2018 Assessment Period.

⁴ Creese RG, Glasby TM, West G and Gallen C (2009) Mapping the habitats of NSW estuaries. Industry & Investment NSW Fisheries Final Report Series 113. Port Stephens, NSW, Australia.

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Disclaimer: The information contained in this publication is based on knowledge and understanding at the time of writing (May 2020). However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up to date and to check currency of the information with the appropriate officer of the Department of Primary Industries or the user's independent adviser.

PHOTO GUIDE FOR DIFFERENT REEF TYPES

1(a) *Low-profile* - 0.05 - 0.15m in height compared to surrounding substrate (adapted from ³)



1(b) *High-profile* - 0.15 - 0.5m in height compared to surrounding substrate (adapted from ³)



1(c) *Clumping* - small aggregations of oysters surrounded by sediment within a continuous area of oyster reef at least 5m² in size



1(d) *Shellbed* - traditional shell beds including historic cultivation type and middens



1(e) *Oyster veneer* - only 5cm or \leq 2 layers thick



1(f) *Combination* - reefs which contain a combination of types e.g. a few high-profile beds and clumps and encrusted pneumatophores



PHOTO GUIDE FOR DIFFERENT PRIMARY OYSTER SETTLEMENT SUBSTRATES

3(a) *Legacy oyster farming structures* - includes collapsed rack and rail and historic 'peg' rocks



3(b) *Anthropogenic rock* - includes ballast rock



3(c) *Natural rock* - includes bedrock and areas with cobble/ large loose rock



3(d) *Seawall* - includes training walls



3(e) *Mangrove* - includes thick aggregations on pneumatophores



3(f) *Sediment* - sand or mud



PHOTO GUIDE FOR DIFFERENT REEF STRUCTURES/ DENSITIES

5(a) *Continuous dense* - single large bed or reef structure which is $\geq 5\text{m}^2$ with $\geq 60\%$ oyster coverage



5(b) *Continuous sparse* - single large bed or reef structure which is $\geq 5\text{m}^2$ with $< 60\%$ oyster coverage



5(c) *Patchy dense* - series of reef patches interspersed with sand or rock, at least one of which is $\geq 5\text{m}^2$. Total coverage of patches within the reef $\geq 60\%$



5(d) *Patchy sparse* - series of reef patches interspersed with sand or rock, at least one of which is $\geq 5\text{m}^2$. Total coverage of patches within the reef $< 60\%$

