Appendix D Social and Economic Matrices

		Recreation, General - includes swimming and visiting beaches and rocky shores; wave and wind surfing; diving & snorkelling; driving vehicles on beaches; hiking; picknicking, barbecuing and visiting parks; pyhysical recreation; wildlife watching; camping; and events										Temporal				
		Social benefits						Economic benefits			Spatial					Confidence
	Tier 1 benefits	Participation		Enjoyment		Cultural heritage & use		Indirect values	Viability of businesses	Direct values						
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (e.g.doing the recreational activities as listed above)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	# → ← Trend	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour)	Recreational fishing	1 Moderate x Likely	2 Moderate x Likely	3 Moderate x Likely	4 Moderate x Likely	5 Moderate x Likely	6 Moderate x Likely	7 Moderate x Likely		9 Moderate x Likely	R	X			# / ?	L
	Commercial fishing	10 Minor x Likely	11 Minor x Likely	12 Minor x Likely	13 Minor x Likely	14 Minor x Likely	15 Minor x Likely	16 Minor x Likely		18 Minor x Likely						
	Cultural fishing	19 Minor x Possible	20 Minor x Possible	21 Minor x Possible	22 Minor x Possible	23 Minor x Possible	24 Minor x Possible			27 Minor x Possible						
	Aquaculture	28 Minor x Likely	29 Minor x Likely	30 Minor x Likely	31 Minor x Likely	32 Minor x Likely	33 Minor x Likely			36 Minor x Likely						
	Recreational boating	37 Moderate x Likely	38 Moderate x Likely	39 Moderate x Likely	40 Moderate x Likely	41 Moderate x Likely	42 Moderate x Likely	43 Moderate x Likely		45 Moderate x Likely	S	X			↑	L
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)	46 Moderate x Likely	47 Moderate x Likely	48 Moderate x Likely	49 Moderate x Likely	50 Moderate x Likely	51 Moderate x Likely			54 Moderate x Likely	S	X			↑	L
	Shipping	55 Minor x Possible	56 Minor x Possible	57 Minor x Possible	58 Minor x Possible	59 Minor x Possible	60 Minor x Possible			63 Minor x Possible						
	Foreshore/urban development	64 Moderate x Likely	65 Moderate x Likely	66 Moderate x Likely	67 Moderate x Likely	68 Moderate x Likely	69 Moderate x Likely	70 Moderate x Likely		72 Moderate x Likely	S	X			↑	L
Environmental	Water pollution/litter	73 Moderate x Almost Certain (primary contact); Moderate x Likely for secondary contact;	74 Moderate x Likely	75 Moderate x Likely	76 Moderate x Likely	77 Moderate x Likely	78 Moderate x Likely	79 Moderate x Likely		81 Moderate x Likely	S	X			↑	L
	Habitat disturbance (loss of fish habitat)	82 Moderate x Possible	83 Moderate x Possible	84 Moderate x Likely	85 Moderate x Likely	86 Moderate x Possible	87 Moderate x Possible	88 Moderate x Possible		90 Moderate x Possible	S	X			↑	L
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)		92 Moderate x Possible	93 Moderate x Likely	94 Moderate x Likely	95 Moderate x Possible	96 Moderate x Possible	97 Moderate x Possible		99 Moderate x Possible	S	X			↑	L
	Pests/diseases		101 Minor X Possible	102 Minor X Possible	103 Minor X Possible	104 Minor X Possible	105 Minor X Possible	106 Minor X Possible		107 Minor X Possible						
	Modified freshwater flows															
	Sediment contamination/ water pollution	118 Moderate x Likely	119 Moderate x Likely	120 Moderate x Likely	121 Moderate x Likely	122 Moderate x Likely	123 Moderate x Likely	124 Moderate x Likely		126 Moderate x Likely	S	X			↑	L
	Climate change	127 Moderate x Almost Certain	128 Moderate x Almost Certain	129 Moderate x Almost Certain	130 Moderate x Almost Certain	131 Moderate x Almost Certain	132 Moderate x Almost Certain	133 Moderate x Possible		135 Moderate x Possible	S	X			↑	I
Public saftey	Adverse wildlife interaction	136 Moderate x Likely	137 Moderate x Likely	138 Minor X Possible	139 Minor X Possible	140 Minor X Possible	141 Minor X Possible	142 Minor x Possible		144 Moderate x Possible	S	X			↑	I
	Health & safety (injury, illness, death)	145 Minor x Possible	146 Minor x Possible	147 Minor x Possible	148 Minor x Possible	149 Minor and Possible	150 Minor and Possible	151 Minor x Possible		153 Minor x Possible						
MEMA related regulation & costs	Effect of Regualtion	154 Minor x Possible	155 Minor x Possible	156 Minor x Possible	157 Minor x Possible	158 Minor and Possible	159 Minor and Possible	160 Minor x Possible		162 Minor x Possible						
	Access Availability	163 Moderate x Possible	164 Moderate x Possible	165 Moderate x Possible	166 Moderate x Possible	167 Moderate x Possible	168 Moderate x Possible	169 Minor x Possible		171 Minor x Possible						
	Funding	172 Moderate x Unlikely	173 Moderate x Unlikely	174 Moderate x Unlikely	175 Moderate x Unlikely	176 Minor and Possible	177 Minor and Possible	178 Moderate x Unlikely		180 Moderate x Unlikely						

Hawkesbury Shelf Bioregion - Recreation (1-180)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Consequence**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence**	**Confidence A, L, I**	**Spatial extent State-wide Regional Local**	**Temporal 1-2 years 10 years 20 years**	**Trend Decreasing Stable Increasing**
• Recreational fishing	1-7	Mod	Likely	Mod	**Social experts:** Vanderkooi Consulting (2015)[1] focuses on safety in the assessment, but in addition to that we argue that conflict over coastal area uses threatens the full range of social and economic benefits. Conflict between competing uses as populations in coastal NSW continue to expand already occur and will increase. Social benefits and values cannot be considered as homogenously applicable across regional communities. Different sections of the community seek different benefits from their recreational activities, some of the activities are incompatible (e.g., jet skis vs quiet contemplation), and increased population and increasing competition for use of the marine estate is likely to impact some individuals/groups more than others. Justification includes: • Report: Anti-social behaviour is seen as a key social threat to the safety and enjoyment of people that use the marine estate in the Sweeney Research (2014)[2] Marine Estate Community Survey report. The notion of what constitutes anti-social behaviour is likely to differ significantly across the community.	L	R	1-2 years	Stable/ increasing

[1] Vanderkooi Consulting (2015) *Social and economic background information report on the NSW marine estate*. Sydney, 209 pp.

[2] Sweeney Research (2014), *Marine Estate Community Survey – Final Report*. Sweeney Research, Sydney, 393 pp.

					Therefore anti-social behaviour can be seen as a direct consequence of competing uses and competition for space amongst a variety of recreational uses. • Literature: Extensive literature contained within leisure studies (e.g. recreational opportunity spectrums/tourism opportunity spectrums etc.). Models of this nature are commonly used in the US but is also employed in QLD national parks to provide a range of visitor experiences from wilderness to active use.[1] We are unaware of any high level strategic thinking across the NSW marine estate which employs this or other similar tools to ensure recreational uses are managed in a way to provide for a range of opportunities and minimise conflict, however it may be occurring at a local or regional scale in some areas. • Expert opinion: Extensive interviews with NSW marine estate users over the last 6-7 years by M Voyer & K Barclay: conflict between competing uses/users is commonly discussed. More data is required on the nature of these conflicts but this experience suggests areas of conflict already exist between powered and non-powered vessels/other recreational uses (e.g. surfers/swimmers and jet skis, ski boats and sail/fishers/residents, etc.) as well as 4WD and passive users. Conflict between resource users, especially recreational fishers/boaters and commercial fishers are recurring problems in wealthy, highly populated				

					coastal areas internationally, including Japan, North America and Europe. • The Hawkesbury Shelf Marine Bioregion (HSB) has a higher risk due to higher population density and increased competition for use. **Agency:** Overcrowding and antisocial behaviour from recreational fishers can become a threat across all other recreation benefits in localised areas subject to high tourist numbers and population centres. Example: The Entrance over summer holidays, Hawkesbury River, Sydney and Illawarra regions in the HSB. Vanderkooi Consulting (2015) report [25]: See Chapter 1 Table 10 for more information on the threats identified in the report as anti-social behaviour, overcrowding and competing uses.				
	9	Mod	Likely	Mod	As above – social conflict affects community consumer surplus. As above - Vanderkooi Consulting (2015) report.				
• Commercial fishing	10-16	Min	Likely	Low	**Workshop:** Beach haul and estuary interactions with passive users; low for State and Hawkesbury. Impacts are lower than recreational fishing because commercial is highly regulated. Despite regulation aimed at reducing conflict, there is still anecdotal evidence of social conflict between recreational and commercial fishers in several regions. Examples include Pittwater where recreational fishers are calling for an end to commercial fishing as well as the 'remove netting' campaigns in other estuaries e.g. Clarence, Macleay, Shoalhaven, Lake Illawarra, Coila Lake.				

					See social expert comments above in recreational fishing. Vanderkooi Consulting (2015) report [25]: See Chapter 1 and Table 10 for more information on the threats identified in the report as anti-social behaviour, overcrowding and competing uses.				
	18	Min	Likely	Low	As above – social conflict affects community consumer surplus. As above - Vanderkooi Consulting (2015) report.				
• Cultural fishing	19-24	Min	Possible	Min					
	27	Min	Possible	Min	**Workshop:** Loss of opportunity due to abandoned oyster wracks and existing infrastructure.				
• Aquaculture	28-33	Minor	Likely	Low	See social expert comments above in recreational fishing. Vanderkooi Consulting (2015) report [25]: See Chapter 1 and Table 10 for more information on the threats identified in the report as anti-social behaviour, overcrowding and competing uses.				
	36	Minor	Likely	Low	As above - Vanderkooi Consulting (2015) report.				
• Recreational boating	37-42	Mod	Likely	Mod	**Workshop:** Motorised vessels and powered water craft (PWCs); overcrowding and antisocial behaviour; Moderate for seasonal periods in busy waterways. See social expert comments above in recreational fishing. Vanderkooi Consulting (2015) report [25]: See Chapter 1 and Table 10 for more information on the threats identified in the report as anti-social behaviour, overcrowding and competing uses.	L	S	1-2 years	Increasing

	43,45	Mod	Likely	Mod	As above - Vanderkooi Consulting (2015) report.	L	S	1-2 years	Increasing
• Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)	46-51	Mod	Likely	Mod	**Workshop:** 4WD and overcrowding; shift in patterns of use on beaches; Moderate for seasonal periods in busy waterways. See social expert comments above in recreational fishing. Vanderkooi Consulting (2015) report [25]: See Chapter 1 and Table 10 for more information on the threats identified in the report as anti-social behaviour, overcrowding and competing uses.	L	S	1-2 years	Increasing
	54	Mod	Likely	Mod	**Economic expert**: Some beaches remain a possible site of conflict and anti-social behaviour at several scales e.g. the Cronulla beach riots had significant economic impacts in police overtime expenditure, civil disturbance with vehicle and property damage. (Ref- NSW Police: Strike Force Niel - Review of the Cronulla riots - 4 volumes) Transport for NSW have noted that the economic impact of the Cronulla riots is unclear. They note that even if patterns shift, people will still go to another beach or local pool. The economic outcome is likely to be neutral. As above - Vanderkooi Consulting (2015) report.				
• Shipping	55-60	Min	Possible	Min					
	63	Min	Possible	Min					

• Foreshore/ urban development	64-69	Mod	Likely	Mod	**Workshop:** Threat identified as urban development in Vanderkooi Consulting (2015); also issues around seawalls and coastal protection and further coastal development. Crown Lands Review indicates that divested land may lead to increased development or changes in tenure. **Agency**: Impact on enjoyment of cultural landscape. The importance of cultural landscapes as a social benefit is recognised through heritage listing (e.g. Bondi beach cultural landscape which includes the beach and the pavilion). People place a high level of importance on a particular environment with which they associate 'going to the beach'. Privatisation of the foreshore; legacy issues; seawalls an issue for the future; moderate for both State-wide and Hawkesbury Vanderkooi Consulting (2015) report [25]: See Chapter 1 and Table 10 for more information on the threat identified in the report as urban development				
	70,72	Mod	Likely	Mod	**Workshop:** Privatisation of the foreshore; legacy issues; seawalls are an issue for future				
• Water pollution/ litter • Sediment contaminatio n/ water pollution	73-78 118-123	Mod	Likely	Mod	**Workshop:** For cell 73 – Moderate x Almost Certain (Moderate) for primary contact, Moderate x Likely for secondary contact. Temporal impacts following storms and is localised in several estuaries (Richmond; Brunswick; Shoalhaven). Based on current management of water pollution and marine debris. Beaches are often temporarily closed or	L	S	1-2 years	Increasing

					notifications given by Councils to avoid swimming in estuaries or at beaches affected by stormwater runoff or river discharges after flooding. This threat reduces the social benefit that people derive from swimming, snorkelling, diving and other recreational activities that involve primary contact with the water. **Agency:** The threat from water pollution/litter/marine debris has the potential to impact on the social and economic benefits. Further, the Marine Estate Community Estate Survey (Sweeney Research (2014)) identified that pollution of the marine estate, from littering, spills and land-based runoff, is perceived as the major threat. Water pollution well documented to effect human health. Repeated comments in the Community Survey from stakeholders that water pollution and litter can affect their enjoyment of the marine estate Vanderkooi Consulting (2015) report [25]: See Chapter 1 and Table 10 for more information on the threat identified in the report as water pollution/ litter and marine debris / climate change.				
	79,81 124,126	Mod	Likely	Mod	**Workshop**: based on current management of water pollution and marine debris, this threat has the potential to reduce the incentive for people to participate in commercial and charter boating, such as scuba, snorkelling, charter trips and marine mammal observation. As above - Vanderkooi Consulting (2015) report.				
• Habitat	82-83 86-87	Mod	Possible	Low	**Workshop:** Diving and snorkelling	L	S	1-2 years	Increasing

disturbance	84, 85	Mod	Likely	Mod					
	88, 90	Mod	Possible	Low					
• Reductions in abundances of top and lower order trophic levels	92, 95,96	Mod	Possible	Low	**Workshop:** Higher expectation outside of Hawkesbury bioregion in places like Julian Rocks; Solitary Islands. **Agency:** The threats associated with overfishing, or the localised depletion of fish stocks, may contribute to measurable and ongoing negative economic impacts for the commercial/recreational fishing industry. This threat may have further implications for other industries, who are reliant upon healthy and biodiverse ecosystems, such as the dolphin watch industry, scuba diving, snorkelling and charter vessels. This may threaten the future social benefits and economic viability of some, or all, of these industries.	L	S	1-2 years	Increasing
	93-94	Mod	Likely	Mod	**Workshop:** Localised				
	97, 99	Mod	Possible	Low					
• Pests/ diseases	101-105	Mino r	Possible	Min					
	106, 107	Mino r	Possible	Min					
• Climate change	127 - 132	Mod	Almost certain	Mod	**Workshop:** Moderate for 20 years; high for 50 years; happening now (moderate); but there is some adaptation and substitutability values which is why economic values are lower. **Social experts:** Loss of beach amenity highlighted in Vanderkooi Consulting (2015) report would have significant social and economic implications. Data cited relating to actual beach use (stating that many visitors do	I	S	1-2 years Moderate for 20 years 50 years – threat is likely to increase	Increasing

					not go onto the beach) is limited in its relevance given high levels of importance placed on bequest values in Sweeney Research (2014) report and the visual amenity issues that would result in lost beaches and likely increased levels of beach hardening. **Agency:** Coastal erosion and changes to beach morphology associated with storm surge/damage, sea level rise will affect beach and foreshore amenity/access and coastal vistas at various locations along the NSW coast. Coastal reforms program is currently tackling this issue at a state-wide scale. Climate change is affecting ocean temperatures, the supply of nutrients, ocean chemistry, food chains, wind systems, ocean currents and extreme events such as cyclones. All of these variables have the potential to affect the distribution, abundance, breeding cycles and migrations of marine plants and animals that people rely on for food, income and enjoyment. Evidence is emerging that marine organisms may be responding faster to climate change than land-based plants and animals. As the climate warms, marine plants and animals are shifting towards the poles changing marine food webs and impacting the plants, and animals (including people and the corresponding social and economic benefits) that depend on them. Vanderkooi Consulting (2015) report [25]: See Chapter 1 and Table 10 for more information on the threat identified in the report as water pollution/ litter and marine debris / climate change.			to HIGH	

	133, 135	Mod	Possible	Low	As above - Vanderkooi Consulting (2015) report.				
• Adverse wildlife interaction	136-137	Mod	Likely	Mod	**Workshop:** Sharks and others; cumulative and threshold effect (hysteria and builds from a political and news perspective).	I ?	S	1-2 years	Increasing
	138-141	Min	Possible	Min	**Agency:** Wildlife interactions are a threatening process for many threatened and endangered marine species. Vessel collisions contribute to the anthropogenic mortality of several threatened marine species including turtles, dolphins, dugongs and whales. There is a potential threat that inappropriate commercial boating activities, such as jet boats, jet skis, hovercraft and/or seaplanes, in enclosed waters may impact on the social and economic benefits derived from other commercial boating activities, such as dolphin watching. This issue is most prevalent for small entrapped/resident populations in enclosed waters, such as dolphins in Jervis Bay and Port Stephens, who may in turn be threatened by these and other commercial activities. The additional threat posed by commercial boating is based on the speed and intensity of some commercial vessels and the potential for boat strike and other impacts on marine fauna. Multiple published papers on this issue, including: http://www.sciencedirect.com/science/article/pii/S0301479711004002 Information is needed to ascertain whether risks to personal safety (real or perceived) operate as a threat or deterrent to beach users. Risk to personal safety may have a high consequence				

					either moderate or major over short temporal intervals, such as following shark sightings or attacks. This would increase overall risk rating and may be important to how the shark meshing programs and other public safety issues are managed. Recent spate of shark incidents on the North Coast near Ballina in 2015 have resulted in reduced surfing activity, impacts on scheduling of surf lifesaving activities and implementation of shark research ($250,000 response) to address regional concerns/media hysteria. Justification based on anecdotal and media reports in local and State media. Vanderkooi Consulting (2015) report [25]: See Chapter 1 and Table 10 for more information on the threat identified in the report as adverse wildlife interaction.				
	142	Min	Possible	Min	**Agency:** There is evidence that collisions between vessels and whales, dolphins and turtles may be happening more frequently than previously suspected and, in the case of endangered, endemic or geographically-isolated populations in particular, may pose a significant conservation threat, which has the potential to impact on economic benefits derived from wildlife-related boating industries. This threat to social and economic benefits from enjoyment and employment in nature-related industry should be assessed across multiple threat categories.				
	144	Mod	Possible	Low					
• Health & safety	145-150	Min	Possible	Min	Vanderkooi Consulting (2015) report [25]: See Chapter 1 and Table 10 for more information on				

(injury, illness, death)	151, 153	Min	Possible	Min	the threat identified in the report as public health and safety.				
• Effect of Regulation	154-159	Min	Possible	Min	Vanderkooi Consulting (2015) report [25]: See Chapter 1 and Table 10 for more information on the threat identified in the report as over-regulation or increased compliance costs				
	160, 162	Min	Possible	Min					
• Access Availability	163 - 168	Mod	Possible	Low	Vanderkooi Consulting (2015) report [25]: See Chapter 1 and Table 10 for more information on the threat identified in the report as dredging.				
	169	Min	Possible	Min	As above - Vanderkooi Consulting (2015) report.				
	171	Min	Possible	Low	As above - Vanderkooi Consulting (2015) report.				
• Funding	172-177	Mod	Unlikely	Min	Vanderkooi Consulting (2015) report [25]: See Chapter 1 and Table 10 for more information on the threat identified in the report as reduced government funding for events.				
	178, 180	Mod	Unlikely	Min					

		Recreational fishing - includes shore-based line and trap fishing; boat-based line and trap fishing; spearfishing and hand gathering														
		Social benefits						Economic benefits			Spatial	Temporal				Confidence
	Tier 1 benefits	Participation		Enjoyment		Cultural heritage & use		Indirect values	Viability of businesses	Direct values						
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (e.g.catching a fish)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production (bait and tackle shops - boating, tourism, accommodation addressed elsewhere)	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	Trend # ➔ ➔	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour)	Recreational fishing	181 Moderate x Likely	182 Moderate x Likely	183 Moderate x Likely	184 Moderate x Likely			187 Moderate x Likely		189 Moderate x Likely	S	X			#🡅?	A
	Commercial fishing	190 Moderate x Likely	191 Major x Likely	192 Moderate x Likely	193 Major x Likely			196 Major x Likely		198 Moderate x Likely		X			#?	L
	Cultural fishing	199 Moderate x Unlikely	200 Moderate x Unlikely	201 Moderate x Unlikely	202 Moderate x Almost Certain			205 Moderate x Unlikely		207 Moderate x Unlikely	L	X			🡅	L
	Aquaculture	208 Moderate x Unlikely	209 Moderate x Unlikely	210 Moderate x Unlikely	211 Moderate x Unlikely			214 Moderate x Unlikely		216 Moderate x Unlikely						
	Recreational boating	217 Jet skis/rec boats/oercrowding	218 Moderate x Unlikely	219 Moderate x Unlikely	220 Moderate x Unlikely			223 Moderate x Unlikely		225 Moderate x Unlikely						
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)	226 wrecks and divers; 4WD	227 Moderate x Unlikely	228 Moderate x Unlikely	229Moderate x Unlikely			232 Moderate x Unlikely		234 Moderate x Unlikely						
	Shipping															
	Foreshore/urban development															
Environmental	Water pollution/litter	253 Moderate x Likely;	254 Moderate x Likely	255 Moderate x Likely	256 Moderate x Likely			259 Moderate x Likely		261 Moderate x Likely	S	X			🡅	L
	Habitat disturbance (loss of fish habitat)	262 Moderate x Likely	263 Moderate x Likely	264 Moderate x Likely	265 Moderate x Likely			268 Moderate x Likely		270 Moderate x Likely						
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)	271 Moderate x Likely	272 Moderate x Likely	273 Moderate x Likely	274 Moderate x Likely			277 Moderate x Likely		279 Moderate x Likely	S	X			🡅	L
	Pests/diseases	280 Moderate x Possible	281 Moderate x Possible	282 Moderate x Possible	283 Moderate x Possible			286 Moderate x Possible		288 Moderate x Possible						
	Estuary Openings/Modified freshwater flows	289 Moderate x Likely	290Moderate x Likely	291 Moderate x Likely	292 Moderate x Likely			295 Moderate x Likely		297 Moderate x Likely	S	X			🡅	L
	Sediment contamination/ water pollution	298 Moderate x likely	299 Moderate x Likely	300 Moderate x Likely	301 Moderate x Likely			304 Moderate x Likely		306 Moderate x Likely						
	Climate change	307 Minor x Likely	308 Minor x Likely	309 Minor x Likely	310 Minor x Likely			313 Minor x Likely		315 Minor x Likely						
Public saftey	Adverse wildlife interaction															
	Health & safety (injury, illness, death) falling off rocks and rocky boats	325 Minor x Possible	326 Minor x Possible	327 Minor x Possible	328 Minor x Possible			331 Minor x Possible		333 Minor x Possible						
MEMA related regulation & costs	Effect of Regulation	334 Minor x Likely	335 Minor x Likely	336 Minor x Likely	337 Minor x Likely			340 Minor x Likely		342 Minor x Likely						
	Availability of Access	343 Moderate x Likely	344 Moderate x Likely	345 Moderate x Likely	346 Moderate x Likely			349 Moderate x Likely		351 Moderate x Likely	S	X			🡅	L
	Funding															

Hawkesbury Shelf Bioregion - Recreational fishing (181-360)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Consequence**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence**	**Confidence A, L, I**	**Spatial extent State-wide Regional Local**	**Temporal 1-2 years 10 years 20 years**	**Trend Decreasing Stable Increasing**
• Recreational fishing	181-184 187-189	Mod Mod	Likely Likely	Mod Mod	**Social experts:** • Threat identified as overcrowding in Vanderkooi Consulting (2015) report. • <u>Literature:</u> Extensive literature around the heterogeneity that exists within the recreational fishing community, including how motivations and consumptive orientation influence levels of satisfaction with fishing experience (and the social benefits derived from fishing). This research is significant in that it provides insights into the range of fishing experiences that can be impacted by conflict, overcrowding or regulation [2-8]. E.g., fishers seeking solitude and escape are more likely to be negatively impacted by overcrowding or conflict with other users. • <u>Expert opinion</u>: Extensive interviews with NSW marine estate users over the last 6-7 years by M Voyer & K Barclay highlights that conflict between competing uses/users is commonly discussed. More data is required on the nature of these conflicts but this experience suggests two main areas of conflict exists and largely relate to competition for limited fishing resources: 1. Commercial fishers: there is a high level of 'blame attribution' already existing in the	A	S	1-2 years	Stable/ increasing

					community particularly between recreational and commercial fishers around fish stocks. 2. Intra-activity competition with other users (e.g. line base and spear fishers, or other users employing the same fishing grounds). Of particular concern here is conflict between different cultural groups within the community – e.g. animosity towards Asian, European and Pacific Island nationalities around different conceptions of what constitutes acceptable fishing practices (e.g. see [9]). • In addition illegal fishing and marketing across all sectors is potentially having consequences on recreational fishing benefits, although the extent and nature of these consequences is unknown. • More relevant to **Hawkesbury Shelf Bioregion (HSB)** due to higher population density, increased competition for use and greater cultural diversity. Vanderkooi Consulting (2015) report [25]: See Chapter 2 and Table 16 for more information on the threat identified in the report as overcrowding.				
• Commercial fishing	190, 192	Mod	Likely	Mod	**Workshop:** Threat identified as overcrowding in report. Risk relates to equitable resource allocation and particularly to community attitudes and beliefs around which sectors should be prioritised in resource allocation exercises. For example interviews and other interactions with recreational fishers indicate that some feel there are equity issues around fishing methods and fishing regulations (e.g. allowable gear/allowable catch) between the recreational and commercial sectors. Government policy in 2001 to create	L	R	1-2 years	Stable?
	191, 193	Major	Likely	High					

					Recreational Fishing Havens (RFHs) and re-allocate resources to the recreational sector possibly contributed to conflict because some players within the recreational fishing sector now see excluding commercial fisheries from spatial areas as a reasonable objective, rather than working towards sharing areas more successfully with commercial fisheries. See social expert comments above in recreational fishing. Vanderkooi Consulting (2015) report [25]: See Chapter 2 and Table 16 for more information on the threat identified in the report as overcrowding.				
	196	Maj	Likely	High	**Economic expert:** Commercial fishing and recreational fishing activities compete to differing extents for fish resources (i) Segmented use through recreational fishing havens has reduced conflict. However for some species the competition may be high, hence an overall moderate across all species. (ii) The question of maximising economic benefits from altering sectoral access is contentious. Where many commercial fishers are unprofitable, the value of the marginal fish to recreationalists could support increased allocation of access to recreational fishers to increase community economic benefit. The extent of optimal allocation is unknown. Recreational fishing havens have gone some way to achieve more optimal allocation and fish stock recovery in those areas. See social expert comments above in recreational fishing. As above - Vanderkooi Consulting (2015) report.				
	198	Mod	Likely	Mod					
• Cultural	199-201	Mod	Unlikely	Min	**Workshop:** Cell 202 Local South Coast Abalone	L	L	1-2 years	Increasing

fishing	202	Mod	Almost certain	Mod	Issue and some issues with pipis on the north coast. Risk relates to equitable resource allocation and particularly to community attitudes and beliefs around which sectors should be prioritised in resource allocation exercises. For example interviews and other interactions with recreational fishers indicate that some feel there are equity issues around fishing regulations (e.g. allowable catch) between the recreational and cultural fishing sectors which may increase the risk of social conflict in relation to this issue. Resource allocation issues occur on the South Coast with abalone and pippies on the north coast. See social expert comments above in recreational fishing.				
	205, 207	Mod	Unlikely	Min					
• Aquaculture • Recreational boating • Recreation and tourism	208-211 217-220 226-229	Mod	Unlikely	Min	**Workshop:** Risk relates to equitable resource allocation and particularly to community attitudes and beliefs around which sectors should be prioritised in resource allocation exercises. Aquaculture, boating and tourism all compete with recreational fishing for access to popular areas and may increase the risk of social conflict in relation to this issue. Vanderkooi Consulting (2015) report [25]: See Chapter 2 and Table 16 for more information on the threat identified in the report as overcrowding.				
	214,216 223,225 232,234	Mod	Unlikely	Min	As above - Vanderkooi Consulting (2015) report.				
• Water pollution/litter • Habitat	253-256 262-265 271-274 289-292 298-301	Mod	Likely	Mod	**Workshop:** Closures in the northern rivers fisheries following flooding and run off from agriculture and urban areas. Vanderkooi Consulting (2015) report [25]: See	L	S	1-2 years	Increasing

disturbance • Reductions in abundances of top and lower order trophic levels (depletion of fish stocks) • Estuary openings/Modified freshwater flows • Sediment contamination/water pollution	259,261 268,270 277,279 295,297 304,306				Chapter 2 and Table 16 for more information on the threat identified in the report as water pollution / litter and marine debris/climate change, depletion of fish stocks through overfishing and wildlife connectivity.				
• Pests/ diseases	280-283	Mod	Possible	Low	Vanderkooi Consulting (2015) report [25]: See Chapter 2 and Table 16 for more information on the threat identified in the report as pests/diseases.				
	286, 288	Mod	Possible	Low					
• Climate change	307-310	Min	Likely	Low	**Workshop:** Shore and rock platform modes of recreational fishing most likely to be affected Vanderkooi Consulting (2015) report [25]: See Chapter 2 and Table 16 for more information on the threat identified in the report as identified in the report as water pollution / litter and marine debris/climate change.				
	313,315	Min	Likely	Low					
• Health & safety (injury, illness, death) being swept off rocks by	325-328	Min	Possible	Min	**Workshop:** Falling off rocks is major issue with recreational fishers being concerned about being swept off rocks Vanderkooi Consulting (2015) report [25]: See Chapter 2 and Table 16 for more information on the threat identified in the report as public health				
	331,333	Min	Possible	Min					

waves					and safety.				
• Effect of Regulation	334-337	Min	Likely	Low	**Social experts:** • Literature: Research by Voyer *et al*. identified loss of some social benefits of recreational fishing through restrictions from MPAs, including loss of enjoyment and inconvenience [10]. In addition research following the GBRMP rezoning identified changes in fishing frequency and satisfaction, reduced fishing quality, restricted access to areas considered to be of high quality for recreational fishing, increased crowding in areas that remain open to fishing, and increased likelihood of localized depletions in popular recreational fishing locations [11]. • In addition research on recreational fishing motivations provides some insight into the likely impacts of fishing regulations to fishing satisfaction and is an area of future research need. **Workshop**: Threat identified as over-regulation or increased compliance costs in Vanderkooi Consulting (2015); licencing deterring occasional users and regulation of safety for rock fishers. Vanderkooi Consulting (2015) report [25]: See Chapter 2 and Table 16 for more information on the threat identified in the report as over-regulation or increased compliance costs				
	340,342	Min	Likely	Low	As above - Vanderkooi Consulting (2015) report.				

• Availability of Access	343-346	Mod	Likely	Mod	**Workshop**: Threat identified as limited access infrastructure; foreshores and development constraints; marine protected areas and closures (fishing or green zones) Vanderkooi Consulting (2015) report [25]: See Chapter 2 and Table 16 for more information on the threat identified in the report as limited access infrastructure.	L	S	1-2 years	Increasing
	349, 351	Mod	Likely	Mod	**Economic expert:** Foreshore development has reduced angler access and is an issue where high density developments unofficially "privatise the shore line" and curtail access to fishing spots. An example is Barangaroo Park which has opened with no recreational fishing allowed from the foreshore. The recent national Recreational Fishing Conference (Aug 2015) noted this trend in Qld and NSW where intensive property development (e.g. canal estates, gated communities) had on occasions closed shoreline access for anglers. As above - Vanderkooi Consulting (2015) report.	L	S	1-2 years	Increasing

Cultural fishing - includes Aboriginal cultural access and use of marine resources for sustenance and cultural purposes, aquaculture and subsistence economy opportunities for provision of food to the broader Aboriginal community and employment opportunities in marine estate businesses/management

		Social benefits						Economic benefits			Spatial	Temporal				Confidence
	Tier 1 benefits	**Participation**		**Enjoyment**		**Cultural heritage & use**		**Indirect values**	**Viability of businesses**	**Direct values**						
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (e.g.catching a fish)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	# ➔ ➔ Trend	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
	Commercial fishing	370 Moderate x Likely	371 Moderate x Likely	372 Moderate x Likely	373 Moderate x Likely	374 Moderate x Likely	375 Moderate x Likely	376 Minor x Unlikely	377 Minor x Unlikely		S	X			➔	L
	Aquaculture							385 Moderate x Likely	386 Moderate x Likely	387 Moderate x Likely	S	X			➔	L
	Recreational boating															
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)															
	Shipping															
	Foreshore/urban development					419 Moderate x Almost certain	420 Major v Likely				S	X			➔	L
Environmental	Water pollution/litter	424 Moderate x Possible	425 Moderate x Possible	426 Moderate x Possible	427 Moderate x Possible	428 Moderate x Possible	429 Moderate x Possible	430 Moderate x Possible	431 Moderate x Possible	432 Moderate x Possible	S	X			➔	L
	Habitat disturbance (loss of fish habitat)					437 Moderate x Possible	438 Moderate x Possible									
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)	442 Minor x Unlikely	443 Minor x Unlikely	444 Minor x Unlikely	445 Minor x Unlikely	446 Minor x Unlikely		448 Minor x Unlikely	449 Minor x Unlikely							
	Pests/diseases															
	Modified freshwater flows	460 Moderate x Possible	461 Moderate x Possible	462 Moderate x Possible	463 Moderate x Possible	464 Moderate x Possible	465 Moderate x Possible									
	Sediment contamination/ water pollution	469 Moderate x Possible	470 Moderate x Possible	471 Moderate x Possible	472 Moderate x Possible	473 Moderate x Possible	474 Moderate x Possible									
	Climate change	478 Moderate x Likely	479 Moderate x Likely	480 Moderate x Likely	481 Moderate x Likely	482 Moderate x Likely	483 Moderate x Likely	484 Moderate x Likely	485 Moderate x Likely	486 Moderate x Likely	S	X			➔	I
Public saftey	Adverse wildlife interaction															
	Health & safety (injury, illness, death, adverse wildlife interaction)															
MEMA related regulation & costs	Effect of regulation	505 Moderate x Likely	506 Moderate x Likely	507 Moderate x Likely	508 Major x Likely	509 Major x Likely	510 Moderate x Likely	511 Moderate x Likely	512 Moderate x Likely	513 Moderate x Likely	S	X			#?	I
	Restriction of Access	514 Moderate x Likely	515 Moderate x Likely	516 Moderate x Likely	517 Major x Likely	518 Major x Likely	519 Moderate x Likely	520 Moderate x Likely	521 Moderate x Likely	522 Moderate x Likely	S	X			➔	I
	Funding & support								530 Moderate x Possible							

Hawkesbury Shelf Bioregion - Cultural fishing (361-531)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Consequence**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence** **Note: Please see Dr Sue Feary (2015) report [26] and A/Prof. Schnierer peer review report [27] for further information.**	**Confidence A, L, I**	**Spatial extent** **State-wide Regional Local**	**Temporal** **1-2 years 10 years 20 years**	**Trend** **Decreasing Stable Increasing**
• Recreational fishing • Commercial fishing	361-366 370-375	Mod	Likely	Mod	**Workshop:** Diminishing resources. • More apparent during peak periods. Abalone on the South Coast is a localised issue. • Broader issue related to regulation and trading of commercial fishing shares etc. Cultural fishing catch cannot currently be traded however there are examples of illegal marketing. **Social experts:** Report and expert opinion: Conflict over resource use and allocation is already occurring between the recreational, commercial and cultural fishing sectors. Aspirations around improved cultural fishing rights are almost certain to be resisted by other sectors and conflict will increase as these rights are pursued. **Agency:** The number of recreational anglers, particularly during holiday periods where levels swell, would place greater pressure on the resource than the Aboriginal community. Added potential for social conflict and competition for resources at peak holiday times. Ability for commercial fishing to undertake major harvest in a localised sense, impacts on cultural resources in important seasonal times e.g. mullet run.	L	S	1-2 years	Increasing
		Mod	Likely						

					OEH: Reduced fish stocks was raised by Aboriginal people who were consulted in the Hawkesbury bioregion as an impact on cultural fishing particularly evident around Lake Macquarie (Cox Inall Ridgeway, 2015).				
	367-368	Min	Unlikely	Min					
	376-377	Min	Unlikely	Min					
• Aquaculture	385-387	Mod	Likely	Mod	**Dr Sue Feary (2015) report [26]:** Notes that there are limited sites suitable for aquaculture ventures; site availability. DPI Fisheries: Access to aquaculture sites and other commercial fisheries related opportunities is provided by the existing management framework. Existing aquaculture sites are available to any participant through the free market. Sites that are not currently used for aquaculture may be applied for by any person. NSW DPI offers oyster leases by public tender on two occasions each year. In 2015 three new lease areas in Jervis Bay were offered by public tender and the local aboriginal community was invited to participate in that tender. This issue may be related more to a lack of resources rather than a lack of site availability. Resources such as finance, technical advice and management support are not a function of aquaculture and therefore aquaculture is not the threat for the purpose of this assessment. NSW DPI would assess the threat from aquaculture to cultural fishing as low. NSW DPI and the Department of Aboriginal Affairs have worked cooperatively with indigenous communities from Wollongong to Eden through the Southern NSW Aquaculture	L	S	1-2 years	Increasing

					Aboriginal Corporation (SNAAC) to promote indigenous participation in aquaculture. Projects investigated through this group have included oyster farming, offshore sea cages, land based abalone farming, mussel farming, marine hatcheries and land based marine finfish developments.				
• Foreshore/ urban development	419	Mod	Almost certain	Mod	**Workshop:** Destruction of tangible Aboriginal cultural heritage. Part 6 of the *National Parks and Wildlife Act 1974* applies to aboriginal places, objects, activities etc. Section 90 of that Act specifies that Aboriginal heritage impact permits can be issued for specified people, places, activities or land and this is linked into the "integrated development assessment" process under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Aboriginal heritage is not explicitly considered in the objects of the EP&A Act or the principles of ecologically sustainable development and therefore development application and planning and policy development processes could be overlooking its consideration.	L	S	1-2 years	Increasing
	420	Maj	Likely	High					
• Water pollution/ litter	424-429	Mod	Possible	Low	**Workshop:** Contamination of resources Toxicity of fish caught was raised by Aboriginal people consulted in the Hawkesbury bioregion as of particular concern in Sydney Harbour and also reported in Lake Macquarie (Cox Inall Ridgeway, 2015)	L	S	1-2 years	Increasing
	430-432	Mod	Possible	Low					
• Habitat disturbance	437-438	Mod	Possible	Low	**Workshop:** Degraded landscape				

• Reductions in abundances of top and lower order trophic levels	442-446	Min	Unlikely	Min	**Workshop:** Degraded landscape	L	S	1-2 years	Increasing
	448-449	Min	Unlikely	Min					
• Modified freshwater flows • Sediment contaminatio n/ water pollution	460-465 469-474	Mod	Possible	Low	**Workshop:** Degraded landscape Aboriginal people consulted in the Hawkesbury bioregion noted that modified flows have negatively affected fish stocks especially in the Newcastle/Worimi area (Cox Inall Ridgeway, 2015).				
• Climate change	478-483	Mod	Likely	Mod	**Workshop:** Timescale 20 - 50 years. Includes loss of sites. There may be some benefits as well as impacts. **Dr Sue Feary (2015) report [26]:** highlights the threat of 'sea level rise' (due to climate change) as a cause for the benefit of tangible cultural heritage not being realised. **Agency**: Sea level rise, temperature changes etc. associated with climate change could affect species distribution, abundance etc. which would have flow on affects to the social and economic benefits.	I	S	1-2 years	Increasing
	484-486	Mod	Likely	Mod					
• Effect of regulation* • Restriction of Access	505-507 510 514-516 519	Mod	Likely	Mod	**Workshop:** Native Title rights increased. Restrictions on resource collection for social events. Hawkesbury bioregion - restriction on pipis for consumption via regulation. The Crown Land review may result in divestment of public lands and possible impacts on public access. Restrictions on access to camping/collecting places where social events occur. **Dr Sue Feary (2015) report [26]:** highlights that	I	S	1-2 years	Stable / Increasing
	508-509 517-518	Maj	Likely	Major					

					inadequate regulation to protect significant species has impacted in the benefit of religious/spiritual significance being realised.				
	511-513 520-522	Mod	Likely	Mod	**Economic expert:** Currently access for Indigenous fishers is in a vacuum between as yet unspecified rights under native title and little recognition in statutory rights for fishing that would meet the aspirations of the Indigenous community. A "Community fisheries management framework" is required to meet the aspiration of Indigenous fishers in NSW. The Torres Strait Regional Authority (TSRA) are currently investigating such an approach. Aboriginal people consulted in the Hawkesbury bioregion noted that pipis across the bioregion and abalone on the south coast are particular issues where regulation of cultural fishing/recourse collection is affecting economic benefits (Cox Inall Ridgeway, 2015 [28]).				
• Funding & support	530	Mod	Possible	Low	**Workshop:** Government funding and support for employment/businesses				

		Commercial fishing - includes Ocean Trap and Line Fishery; Estuary General Fishery; Ocean Haul Fishery; and Ocean Trawl Fishery + abalone and rock lobster + estuary prawn trawl													
		Social benefits						Economic benefits			Spatial	Temporal				Confidence
	Tier 1 benefits	Participation		Enjoyment		Cultural heritage & use		Indirect values	Viability of businesses	Direct values						
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (e.g.catching a fish)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	# → ← Trend	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour); + illegal fishing and black market	Recreational fishing	532 Major x Likely	533 Major x Almost Certatin	534 Moderate x Almost Certatin	535 Major x Likely			538 Moderate x Almost Certain	539 Moderate x Almost Certain		S	X			#?	A
	Commercial fishing (need to pick up stealing mub crabs on the north coast)	541 Major x Likely	542 Major x Almost Certatin	543 Minor x Unlikely	544 Minor x Unlikely			547 Moderate x Almost Certain	548 Major x Likely		S	X			#?	A
	Cultural fishing	550 Minor x Unlikely	551 Minor x Unlikely	552 Minor x Unlikely	553 Moderate x Almost Certain			556 Minor x Unlikely	557 Moderate x Almost Certain		L	X			#?	A
	Aquaculture															
	Recreational boating															
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)	577 Major x Unlikely			580 Moderate x Possible			583 Moderate x Possible	584 Moderate x Possible							
	Shipping	586 Miinor x Possible	587 Miinor x Possible	588 Miinor x Possible	589 Miinor x Possible			592 Minor x Possible	593 Minor x Possible							
	Mining and extraction	Miinor x Possible	Miinor x Possible	Miinor x Possible	Miinor x Possible			Miinor x Possible	Miinor x Possible							
	Foreshore/urban development	595 Moderate x Possible	596 Moderate x Possible	597 Moderate x Possible	598 Moderate x Possible			601 Moderate x Possible	602 Moderate x Possible							
Environmental	Water pollution/litter	604 Moderate x Likely	605 Moderate x Likely	606 Moderate x Likely	607 Moderate x Likely			610 Moderate x	611 Moderate x Likely		S	X			↑	A
	Habitat disturbance (loss of fish habitat)	613 Moderate x Likely	614 Moderate x Likely	615 Moderate x Likely	616 Moderate x Likely			619 Moderate x Likely	620 Moderate x Likely		S	x			↑	A
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)	622 Moderate x Likely	623 Moderate x Likely	624 Moderate x Likely	625 Moderate x Likely			628 Moderate x Possible	629 Moderate x Possible		S				↑	A
	Pests/diseases	631 Moderate x Possible	632 Moderate x Possible	633 Moderate x Possible	634 Moderate x Possible			637 Moderate x Possible	638 Moderate x Possible							
	Estuary openings/Modified freshwater flows	640 Moderate x Likely	641 Moderate x Likely	642 Moderate x Likely	643 Moderate x Likely			646 Moderate x Likely	647 Moderate x Likely		S	X			↑	L
	Sediment contamination/ water pollution	649 Moderate x Likely	650 Moderate x Likely	651 Moderate x Likely	652 Moderate x Likely			655 Moderate x Likely	656 Moderate x Likely							
	Climate change	658 Minor x Likely	659 Minor x Likely	660 Minor x Likely	661 Minor x Likely			664 Minor x Likely	665 Minor x Likely							
Public saftey	Adverse wildlife interaction															
	Health & safety (injury, illness, death)															
MEMA related regulation & costs	Effect of Regulation (including access restrictions)	685 Major x Almost Certain	686 Major x Almost Certain	687 Moderate x Unlikely	688 Major x Almost Certain			691 Major x Likely	692 Major x Likely		S	X			↓	I
	Availability of Access (maintenance of shipping and boating channels to access resource)	694 Minor x Possible	695 Minor x Possible	696 Minor x Possible	697 Minor x Possible			700 Minor x Possible	701 Minor x Possible							
	Funding															

Hawkesbury Shelf Bioregion - Commercial fishing (532-711)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Con sequ ence**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence**	**Conf iden ce A, L, I**	**Spatial extent State-wide Regional Local**	**Temporal 1-2 years 10 years 20 years**	**Trend Decreasing Stable Increasing**
• Recreational fishing	532,535	Maj	Likely	High	**Social experts:** • Report: Evidence supplied in the Vanderkooi Consulting (2015) report on recreational fishers lobbying for commercial fishing closures. • Literature: FRDC study by King *et al.* highlighted the impact of conflict between recreational and commercial fishers on the mental health of fishers. In addition lack of bonding social capital within the industry is having a detrimental impact on fisher health and ability to engage with the community and policy makers [12]. • Expert opinion: Current research on the NSW commercial fishing industry by Barclay, McIlgorm and Voyer indicate that substantial problems already exist within the community based around social licence largely stemming from perceptions about poor fishing practices and conflicts with the recreational fishing sector. This includes incidences of vandalism and abuse between the two parties. In some cases it could be seen as a form of bullying of commercial fishers. In addition illegal fishing and marketing across all sectors is also	A	State Bioregion	1-2 years	Stable/?
	534	Mod	Almost certain	Mod					
	533	Maj	Almost certain	High					

					potentially having consequences on commercial fishing benefits although the extent of these consequences is unknown. • There is significant evidence of conflict already occurring in this area including calls for commercial fishing bans in the Tuggerah Lakes and Hawkesbury River. Vanderkooi Consulting (2015) [25] report: See Chapter 13 and Table 80 for more information on the threat identified in the report as loss of social licence.				
	538,539	Mod	Almost certain	Mod	As above Vanderkooi Consulting (2015) report.				
• Commercial fishing	541	Maj	Likely	Major	Conflict within commercial fishing industry currently exists which threatens social benefits. This especially relates to a lack of bonding and bridging social capital. Vanderkooi Consulting (2015) report [25]: See Chapter 13 and Table 80 for more information on the threat identified in the report as loss if social licence	A	State Bioregion	1-2 years	Stable/?
	542	Maj	Almost certain	Major					
	543-544	Min	Unlikely	Min					
	547	Mod	Almost certain	Mod					
	548	Maj	Likely	Major	**Workshop:** Regulatory congestion affecting business viability				
• Cultural fishing	550-552	Min	Unlikely	Min	**Workshop:** Inadequate recognition of right to benefit economically from commercial fishing or via the informal economy; abalone illegal take, cultural take, native title access restrictions	A	R	1-2 years	Stable/?
	553	Mod	Almost certain	Mod	**Workshop:** Localised to South coast abalone				
	556	Min	Unlikely	Min					
	557	Mod	Almost certain	Mod	**Workshop:** Localised to South coast abalone				
• Recreation and tourism	577, 580	Maj Mod	Unlikely Possible	Low	**Workshop:** Recreational uses interfere with beach haul and hand gathering.				

(including snorkelling and diving, swimming and surfing, 4WD)									
	583 584	Mod	Possible	Low	As above				
Shipping	586-589	Min	Possible	Min	**Social experts:** • Expert opinion: Conflicts between shipping and industrial use of the marine estate is currently a topic of interest with the commercial fishing industry – particularly seismic testing for oil and gas and anchor damage from large tankers off Newcastle and Wollongong.				
	592-593	Min	Possible	Min					
• Mining and extraction		Min	Possible	Min	**Workshop:** Seismic testing exploration off Newcastle. No current exploration or extraction underway.				
		Min	Possible	Min					
• Foreshore/ urban development	595-598	Mod	Possible	Low	**Workshop:** Haul grounds in nearshore areas - ability to access fish shots is restricted due to maritime infrastructure in estuaries				
	601-602	Mod	Possible	Low					
• Water pollution/ litter • Habitat disturbance • Reductions in abundances of top and lower order trophic levels • Estuary	604-607 613-616 622-625 640-643 649-652	Mod	Likely	Mod	**Workshop:** Closures and fish kills in northern rivers following flooding events. Threat identified as wildlife connectivity in Vanderkooi Consulting (2015) and applies to Hawkesbury bioregion. Sydney Harbour suffers from modified water flows in a number of locations. **Social experts:** Expert opinion: Ongoing research by Voyer & Barclay on NSW commercial fisheries suggests that the wider NSW public puts a high value on locally caught	A	S	1-2 years	Increasing

openings/Modified freshwater flows • Sediment contamination/ water pollution					seafood, including as a tourism product associated with coastal holidays. This will be quantified in upcoming community surveys. Conflict with recreational uses, environmental damage, depletion of fish stocks and regulatory changes all have significant potential to impact on the availability of seafood to consumers. Of particular concern is the aging of fishing workforce, regulatory and financial constraints which inhibit new entrants and the loss of fishing knowledge as fishers leave the industry. Another inhibiting factor highlighted in the interviews was safe navigable access (ie dangerous bar crossings) that is impacted by decisions to dredge/not to dredge – especially relevant to Richmond River. Proximity to Sydney markets may make **HSB** more important, but Sydney Fish Market sources from all over the state and outside the state already. Vanderkooi Consulting (2015) report [25]: See Chapter 13 and Table 80 for more information on the threat identified in the report as depletion of fish stocks through overfishing and wildlife connectivity.				
	610-611 619-620 646-647 655-656	Mod	Likely	Mod	**Agency:** Commercial fishers changed fishing locations post Deep Ocean Outfall installation (**HSB**); similar for state-wide coastal outfalls.	A	S	1-2 years	Increasing
	628-629	Mod	Possible	Low					

• Pests/diseases	631-634	Mod	Possible	Low	Vanderkooi Consulting (2015) report [25]: See Chapter 13 and Table 80 for more information on the threat identified in the report as pests and diseases.				
	637-638	Mod	Possible	Low					
• Climate change	658-661	Min	Likely	Low	**Workshop:** Threat will increase over time; adaptation to changes in stocks; over time; more conservative approach to zonation Vanderkooi Consulting (2015) report [25]: See Chapter 13 and Table 80 for more information on the threat identified in the report as climate change.				
	664-665	Min	Likely	Low					
• Effect of Regulation (including access restrictions)	685-686 688	Maj	Almost certain	High	**Workshop:** Safety implications in crews (limit to one member); uncertainty in regulation leading to mental health issues; no business certainty; concentration of effort in areas (particularly estuaries) as more areas progressively closed through fisheries, RFH and marine protected area closures; beach hauls are precluded from involving people creating additional barriers between fishers and the public (loss of social licence); lack of trust in the regulators, marine parks and other closures concentrate use. **Social experts:** • <u>Report:</u> The Vanderkooi Consulting report [25] highlights some of the safety implications of current restrictions on commercial fishing activities (e.g. crew limits in Estuary General). • <u>Literature:</u> There is growing evidence around some of the consequences of regulatory approaches which have focused principally on ecological sustainability at the expense of social	I	S	1-2 years	Decreasing

					and economic considerations, leading to conflict, and in some cases damaging economic viability. In Australia and overseas the wellbeing of fishers and fishing families and communities has been highlighted as a matter of significant concern [12-16]. • <u>Expert opinion:</u> Barclay & Voyer are currently analysing an extensive qualitative data set that suggests that current wellbeing amongst commercial fishers in NSW is low. Commercial fishing infrastructure (e.g., co-ops) on some parts of the coast has limited capacity to withstand further reductions in fisher numbers or fishing effort. The costs and complexity associated with meeting current regulatory requirements are impacting the financial viability of fishing businesses. Current regulatory changes proposed by the NSW government are having and will continue to have substantial social impacts on fishers and fishing families state-wide. • More relevant to Hawkesbury due to threat of rec fishing havens and marine park possibility but risk similar to state-wide Social experts in relation to cultural heritage and use: • <u>Report, Literature and Expert Opinion:</u> Past regulatory changes have impacted on the ability of the Aboriginal community to obtain/maintain commercial fishing licences despite strong historic links to the industry. Commercial fisheries have historically been a significant contributor to the				

					community health and wellbeing and cultural lives of Aboriginal communities. Current restrictions inhibit community involvement in Aboriginal commercial fishing, practices particularly the beach haul fishery, and place considerable constraints on the ability of Aboriginal commercial fishers to pass on their cultural and environmental knowledge to the next generation, causing reductions in wellbeing. Licences in the commercial fishing industry are now largely out of reach for many within Indigenous communities of NSW despite the likely social and economic benefits of engaging more Aboriginal people in the fishing industry – including post-harvest [10, 17-20].				
	687	Mod	Unlikely	Min					
	691-692	Maj	Likely	High	**Social experts:** • <u>Report, Expert Opinion:</u> Non-Indigenous: Regulatory changes and restrictions on access are already having substantial impacts on business viability and employment. The current reform process is intended to reduce business numbers in this sector. Barclay and Voyer's ongoing research in this area indicates that commercial fishing provides employment opportunities for disadvantaged sectors of the community including people with low academic qualifications or learning difficulties. **Dr Sue Feary (2015) report [26]:** Indigenous: Aspirational benefits threatened as per non-Indigenous but with greater disadvantage	I	S	1-2 years	Decreasing

					meeting entry costs and sustaining businesses. Vanderkooi Consulting (2015) report [25]: See Chapter 13 and Table 80 for more information on the threat identified in the report as over-regulation or increased compliance costs.				
• Availability of Access (maintenance of shipping and boating channels to access resource)	694-697	Min	Possible	Min	**Workshop:** Not as applicable to the Hawkesbury, but is an issue in the Richmond River and some other estuaries. Less dredging of the river entrance reduces the number of days commercial users can go fishing offshore. **Social experts:** • <u>Expert opinion:</u> Ongoing research by Voyer & Barclay on NSW commercial fisheries suggests that the wider NSW public puts a high value on locally caught seafood, including as a tourism product associated with coastal holidays. This will be quantified in upcoming community surveys. Conflict with recreational uses, environmental damage, depletion of fish stocks and regulatory changes all have significant potential to impact on the availability of seafood to consumers. Of particular concern is the aging of fishing workforce, regulatory and financial constraints which inhibit new entrants and the loss of fishing knowledge as fishers leave the industry. Another inhibiting factor highlighted in the interviews was safe navigable access (ie dangerous bar crossings) that is impacted by decisions to dredge/not to dredge – especially relevant to Richmond River. Vanderkooi Consulting (2015) report [25]: See				

					Chapter 13 and Table 80 for more information on the threat identified in the report as access rights.				

		Aquaculture - includes oyster production; prawns and yabbies; fish farms; and mussels														
		Social benefits						Economic benefits			Spatial	Temporal				Confidence
	Tier 1 benefits	Participation		Enjoyment		Cultural heritage & use		Indirect values	Viability of businesses	Direct values						
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (e.g.operating aquaculture facility)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	Trend # ➔ ➔	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour); + illegal fishing and black market	Recreational fishing	712 Moderate x Almost Certatin	713 Moderate x Almost Certatin		715 Moderate x Possible				719 Moderate x Almost Certatin		S	X			🡅	I
	Commercial fishing	721 Moderate x Almost Certatin	722 Moderate x Almost Certatin		724 Moderate x Possible				728 Moderate x Almost Certatin		S	X			🡅	I
	Cultural fishing										S	X			🡅	I
	Aquaculture								746 Moderate x Possible		S	X			🡅	I
	Recreational boating	748 Moderate x Almost Certatin	749 Moderate x Almost						755 Moderate x Almost Certatin		S	X			🡅	I
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)	757 Moderate x Almost Certatin	758 Moderate x Almost Certatin		760 Moderate x Possible				764 Moderate x Almost Certatin		S	X			🡅	I
	Shipping															
	Foreshore/urban development	775 Moderate x Almost Certatin	776 Moderate x Almost Certatin						782 Moderate x Almost Certatin		S	X			🡅	L
Environmental	Water pollution/litter	784 Major x Likely			787 Major x Likely				791 Major x Likely		S	X			🡅	L
	Habitat disturbance (loss of fish habitat)															
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)															
	Pests/diseases	811 Major x Likely			814 Major x Likely				818 Major x Likely		L	X			🡅	L
	Modified freshwater flows															
	Sediment contamination/ water pollution	829 Major x Likely			832 Major x Likely				836 Major x Likely		S	X			🡅	L
	Climate change	838 Moderate x Likely			841 Moderate x Likely				845 Moderate x Likely		S	X			🡅	I
Public saftey	Adverse wildlife interaction															
	Health & safety (injury, illness, death, adverse wildlife interaction)															
MEMA related regulation & costs	Effect of Regulation	865 Moderate x Likely			868 Moderate x Likely				872 Major x Likely		S	X			#	I
	Availability of Access	874 Moderate x Likely			877 Moderate x Likely				881 Moderate x Likely		S	X			🡅	I
	Funding															

Hawkesbury Shelf Bioregion - Aquaculture (712-891)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Consequence**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence**	**Confidence A, L, I**	**Spatial extent State-wide Regional Local**	**Temporal 1-2 years 10 years 20 years**	**Trend Decreasing Stable Increasing**
• Recreational fishing • Commercial fishing • Recreation and tourism	712-713 721-722 757-758	Mod	Almost certain	Mod	**Social experts:** • <u>Report & Expert opinion:</u> public submissions regarding new leases at Jervis Bay and community response to Port Stephens pearl farm proposal show social acceptability problems with aquaculture development in foreshore areas. Some tourism operators and owners of foreshore housing have been particularly vocal against aquaculture. Incidences of conflict between recreational boaters and aquaculture farmers also evident in qualitative research conducted in this area (Vanderkooi Consulting (2015)). It is possible that this conflict also occurs with commercial and cultural fishers. Planning approvals for aquaculture development require these environmental impacts (where deemed to be significant) to be mitigated prior to any approval (e.g. Jervis Bay State Significant Infrastructure approval/assessment report on the Department of Planning's website). **Agency:** • Oyster theft is an on-going issue for all oyster growing areas. In some cases relatively small quantities (enough for a	I	S	1-2 years	Increasing
	715,724 760	Mod	Possible	Low					
	719, 728, 764	Mod	Almost certain	Mod					

					feed) are taken opportunistically often around holiday times and particularly near Christmas. In other cases large commercial quantities of spat or market ready oysters are stolen either for on-growing (i.e. the theft involves oyster farmers) or for illegal market sales. Operation Trident is a joint NSW DPI, RMS and NSW Police operation targeting oyster theft. In the 2014/15 25 reports of oyster theft were recorded with an estimated value of $64,000. It is likely that the majority of oyster theft is unreported. Currently there is a very low level of aquaculture production in the Hawkesbury Bioregion of the marine estate so the likelihood of theft is commensurately reduced. • Illegal market sales of aquaculture product presents a serious risk to consumer safety and the reputation of seafood. The extent of illegal market sales is not known, but the impact of seafood safety incident associated with such sales would extend not only to legitimate aquaculture produce but to seafood in general. This flow-on effect to the wider seafood industry was seen during the Wallis Lake hepatitis outbreak in 1997 where seafood sales nationally were seriously impacted. Vanderkooi Consulting (2015) report [25]: See Chapter 14 and Table 83 for more information on the threat identified in the report as physical damage, theft and black marketing and loss of social licence				
• Aquaculture	746	Mod	Possible	Low	**Workshop:** With more pressure on wild catch, there will be more competition for aquaculture;	I	S	1-2 years	Increasing

					overstocking of oysters; historic siting issues and social licence. **Economic expert**: Aquaculture development faces significant issues in respect of site access, availability, competition and public resistance in specific sites. *Productivity Commission 2004, Assessing Environmental Regulatory Arrangements for Aquaculture, Canberra.* Example past proposed pearl farm in Port Stephens. The MEM Act object (1) "….facilitates economic opportunities for the people of New South Wales, including opportunities for regional communities…" Aquaculture is such an opportunity. Past experiences as per Port Stephens pearl episode has dissuaded some investors. Some investments in offshore mussel farming may indicate site specific nature of the issue. (see 764) This site availability issue also occurs in the conserving environment and heritage section (cell 1277). **DPI Fisheries**: Since the Productivity Commission (2004) NSW DPI has implemented a series of whole of government aquaculture strategies specifically designed to reduce risk in the approval process for aquaculture development. Strategies for the oyster industry and land based aquaculture industry were finalised in 2006 and 2009 respectively. These strategies have a track record of reducing access issues for these two aquaculture industries. Currently, a joint NSW Government agency working group is preparing a Marine Waters Sustainable Aquaculture Strategy which would be applicable to non-estuarine waters of the marine estate.				

					These strategies are given effect under State Environmental Planning Policy 62 – Sustainable Aquaculture and the *Fisheries Management Act 1994*. The current management arrangements provided in these strategies substantially meet the recommendations of the Productivity Commission (2004) report. The Productivity Commission announced in 2015 that it would undertake another review of the regulatory environment for aquaculture.				
• Recreational boating • Foreshore urban development	748-749 775-776	Mod	Almost certain	Mod	**Social experts:** • <u>Report & Expert opinion:</u> public submissions to Jervis Bay to new leases and community response to Port Stephens pearl farm proposal show social acceptability problems with aquaculture development in foreshore areas. Some tourism operators and owners of foreshore housing have been particularly vocal against aquaculture. Incidences of conflict between recreational boaters and aquaculture farmers also evident in qualitative research conducted in this area (Vanderkooi Consulting (2015)). It is possible that this conflict also occurs with commercial and cultural fishers.	I	S	1-2 years	Increasing
	755 782	Mod	Almost certain	Mod					
• Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)	757-758	Mod	Almost certain	Mod	Vanderkooi Consulting (2015) report [25]: See Chapter 14 and Table 83 for more information on the threat identified in the report as loss of social licence and theft and black marketing.	I	S	1-2 years	Increasing
	760	Mod	Possible	Low					
	764	Mod	Almost certain	Mod	**Economic expert:** Aquaculture development faces “social licence” issues depending on the location and nature of the proposal. Example past proposed pearl farm in Port Stephens…site specific visual amenity concerns. As above Vanderkooi Consulting (2015) report.				

• Water pollution/litter • Pests/ diseases • Sediment contamination/ water pollution	784 787 811 814 829 832 791 818 836	Maj Maj	Likely Likely	High High	**Agency:** Water Quality • Aquaculture production, employment and the quality and reputation of seafood is seriously affected by water quality in the Hawkesbury Bioregion. The NSW oyster industry is routinely affected by poor sanitary water quality that prevents harvest of product after rainfall. Brisbane Water is severely affected by closures as a result of sewer spills during rainfall events. In 2012 and 2013 Brisbane Water was closed to oyster harvest for 139 and 146 days respectively. This means that Brisbane Water oyster businesses could not sell product for 40% of time in these years. • The Georges River industry is also vulnerable to sewer spills from the trunk main that crosses the Cooks River at Mascot and the Cronulla STP and sewerage system. This was evident during the 5 ML spill from the Cronulla sewerage system on the 14th August 2015. • The NSW Oyster Industry Sustainable Aquaculture Strategy sets the goal of having all oyster harvest areas at the direct harvest standard. All the harvest areas in the Hawkesbury River are direct harvest and have export approval. Both the Georges River and Brisbane Waters have a restricted classification which requires depuration of oysters for 36 hours prior to sale. The effect of poor water quality on production employment and product reputation is likely to continue for a long time as it is dependent on the remediation of diffuse	I	S L for pests/ diseases	1-2 years	Increasing

					sources. Pest and Disease • There is a history of pest and disease outbreaks in the Hawkesbury Bioregion having major adverse impacts on aquaculture, production, employment and the quality and reputation of seafood. QX is active, and has caused the almost complete collapse of production in the Hawkesbury River and Georges River. This effect has been on-gong since 1994 in the Georges River and in the Hawkesbury since 2004. • Pacific Oyster Mortality Syndrome (POMS) affected growers in the Georges River in 2010. More recently, POMS caused a second major collapse in production in the Hawkesbury River in 2013. The agent that causes POMS has been detected in Brisbane Waters leading to a quarantine closure but the disease has not been observed in the wild populations of Pacific Oysters. The Brisbane Waters oyster industry is anticipating growing sterile triploid Pacific Oysters but runs the risk of adverse impacts from POMS. POMS was first detected in Sydney Harbour and it is assumed that this disease remains prevalent in this estuary. • These impacts are likely to continue until disease resistant stock is developed through breeding programs or alternate species are commercialised. The history of the impact of pest and disease on the NSW aquaculture industry indicates that the current impacts are likely to continue for a long				

					time and that new impacts from previously unknown pests and diseases is highly likely. **Economic expert:** Sediment contamination and pollution will continue to restrict aquaculture development. Past industrial contamination, pesticides, heavy metals and current agricultural high nutrient risk, eutrophic episodes, fish kills etc. Vanderkooi Consulting (2015) report [25]: See Chapter 14 and Table 83 for more information on the threat identified in the report as water pollution / litter and marine debris / climate change and pests and diseases.				
• Climate change	838, 841	Mod	Likely	Mod	**Workshop:** Acidification of shells, temperature change, increasing storms (damage to racks), sea level rise, flood contamination.	I	S	1-2 years	Increasing
	845	Mod	Likely	Mod					
• Effect of Regulation	865, 868	Mod	Likely	Mod	**Workshop:** Threat identified as economically and bureaucratically inefficient regulation or increased compliance costs in report; cost of EIS to establish an aquaculture operation; accreditation of operations (clean waters) may have positive effects.	I	S	1-2 years	Stable
	872	Maj	Likely	High	**Economic expert:** Facilitating aquaculture's economic opportunities requires wider regulatory reform among multiple government departments involved in approvals for aquaculture ventures. The system needs to be simplified to assist economic investment. *Productivity Commission 2004, Assessing Environmental Regulatory Arrangements for Aquaculture, Canberra.* **Social experts**:				

					• Report, Expert opinion: Indigenous: Aspirational benefits threatened as per non-indigenous but with greater disadvantage meeting entry costs and sustaining businesses as noted in the Feary report. See comment from DPI Fisheries at 746. Vanderkooi Consulting (2015) report [25]: See Chapter 14 and Table 83 for more information on the threat identified in the report as economically inefficient regulation or increased compliance costs				
• Availability of Access	874, 877	Mod	Likely	Mod	Threat identified as adverse changes to lease and access rights in report; limited access	I	S	1-2 years	Stable
	881	Mod	Likely	Mod	**Economic expert:** Clear lease and access rights are required to maintain and promote aquaculture development in the marine estate. An offshore framework for aquaculture development is required to meet the MEM Act opportunities object. E.g. See South Australian government approach. Also Productivity Commission 2004 op cit. above) See comment from DPI Fisheries at 746. Vanderkooi Consulting (2015) report [25]: See Chapter 14 and Table 83 for more information on the threat identified in the report as adverse changes to lease and access rights.				

		Recreational boating - includes non commercial human powered boats, sailboats, powered vessels (excludes boat storage)														
		Social benefits						Economic benefits			Spatial	Temporal				Confidence
	Tier 1 benefits	Participation		Enjoyment		Cultural heritage & use		Indirect values	Viability of businesses	Direct values						
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (e.g.operating a vessel)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	Trend #	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour)	Recreational fishing															
	Commercial fishing	892 Moderate x Possible	893 Moderate x Possible	894 Moderate x Possible	895 Moderate x Possible					900 Moderate x Possible						
	Cultural fishing															
	Aquaculture	919 Moderate x Possible	920 Moderate x Possible	921 Moderate x Possible	922 Moderate x Possible					927 Moderate x Possible						
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)	928 Moderate x Possible	929 Moderate x Likely	930 Moderate x Possible	931 Moderate x Possible					936 Moderate x Possible	S	X			↑	L
	Shipping	937 Minor x Possible	938 Minor x Possible	939 Minor x Possible	940 Minor x Possible					945 Minor x Possible						
	Foreshore/urban development	946 Minor x Possible	947 Minor x Possible	948 Minor x Possible	949 Minor x Possible					954 Minor x Possible						
Environmental	Water pollution/litter	955 Minor x Possible	956 Minor x Possible	957 Minor x Possible						963 Minor x Possible						
	Habitat disturbance (loss of fish habitat)	964 Minor x Possible	965 Minor x Possible	966 Minor x Possible	977 Minor x Possible											
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)															
	Pests/diseases															
	Modified freshwater flows															
	Sediment contamination/ water pollution															
	Climate change	1009 Minor x Possible	1010 Minor x Possible	1011 Minor x Possible	1012 Minor x Possible					1017 Minor x Possible						
Public saftey	Adverse wildlife interaction	1018 Minor x Unlikely														
	Health & safety (injury, illness, death)	1027 Insignificant x Likely	1028 Insignificant x Likely	1029 Insignificant x Likely						1035 Minor x Possible	S	X			?	I
MEMA related regulation & costs	Effect of Regulations	1036 Moderate x Likely	1037 Moderate x Likely	1038 Moderate x Likely						1044 Moderate x Likely	S	X			?	L
	Avaiability of Access	1045 Moderate x Likely	1046 Moderate x Likely	1047 Moderate x Likely	1048 Moderate x Likely					1053 Moderate x Likely	S	X			↑	A
	Funding															

Hawkesbury Shelf Bioregion - Recreational boating (892-1062)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Consequence**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence**	**Confidence A, L, I**	**Spatial extent State-wide Regional Local**	**Temporal 1-2 years 10 years 20 years**	**Trend Decreasing Stable Increasing**
• Commercial fishing • Aquaculture	892-895 919-922	Mod	Possible	Low	**Agency:** Commercial fishing, aquaculture, water sports, shipping and foreshore development are known to conflict with recreational boating. Conflicts are noted in Regional Boating Plans: http://maritimemanagement.transport.nsw.gov.au/projects/regional-boating-plans/ Conflicts are likely to be greatest in the Hawkesbury Bioregion due to larger boating population where conflicting on-water activities are more prevalent. Vanderkooi Consulting (2015) report [25]: See Chapter 3 and Table 23 for more information on the threat identified in the report as anti-social behaviour and competing uses / overcrowding.	L	S	1-2 years	Increasing
	900 927	Mod	Possible	Low					
• Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)	928 930 931	Mod	Possible	Low	**Social experts:** The Vanderkooi Consulting (2015) report focuses on safety in the assessment, but in addition to that we argue that conflict over coastal area uses threatens the full range of social and economic benefits. Conflict between competing uses as populations in coastal NSW continue to expand already occur and will increase. Social benefits and values cannot be considered as homogenously applicable across regional communities. Different sections of the community seek	L	S	1-2 years	Increasing
	929	Mod	Likely	Mod					
	936	Mod	Possible	Low					

					different benefits from their recreational activities, some of the activities are incompatible (e.g. jet skis vs quiet contemplation), and increased population and increasing competition for use of the marine estate is likely to impact some individuals/groups more than others. Justification includes: • Report: Anti-social behaviour is seen as a key social threat to the safety and enjoyment of people that use the marine estate in Sweeney Research (2014). The notion of what constitutes anti-social behaviour is likely to differ significantly across the community. Therefore anti-social behaviour can be seen as a direct consequence of competing uses and competition for space amongst a variety of recreational uses. • Literature: Extensive literature contained within leisure studies (e.g. recreational opportunity spectrums/tourism opportunity spectrums etc.). Models of this nature are commonly used in the US but is also employed in QLD national parks to provide a range of visitor experiences from wilderness to active use.[1] We are unaware of any high level strategic thinking across the NSW marine estate which employs this or other similar tools to ensure recreational uses are managed in a way to provide for a range of opportunities and minimise conflict, however it may be occurring at a local or regional scale in some areas. • Expert opinion: Extensive interviews				

					with NSW marine estate users over the last 6-7 years by M Voyer & K Barclay: conflict between competing uses/users is commonly discussed. More data is required on the nature of these conflicts but this experience suggests areas of conflict already exist between powered and non-powered vessels/other recreational uses (e.g. surfers/swimmers and jet skis, ski boats and sail/fishers/residents, etc.) as well as 4WD and passive users. Conflict between resource users, especially recreational fishers/boaters and commercial fishers are recurring problems in wealthy, highly populated coastal areas internationally, including Japan, North America and Europe. • **HSB** - The issues are more serious in the Hawkesbury bioregion due to higher population density, proximity to Sydney and higher diversity of users. **Agency:** negative interactions are low in Vanderkooi Consulting (2015) report [25]: See Chapter 3 and Table 23 for more information on the threat identified in the report as anti-social behaviour and competing uses / overcrowding.				
• Shipping • Foreshore/ urban development	937-940 946-949	Min	Possible	Min	Vanderkooi Consulting (2015) report [25]: See Chapter 3 and Table 23 for more information on the threat identified in the report as anti-social behaviour and competing uses / overcrowding.				
	945 954	Min	Possible	Min					
• Water pollution/litte r	955-957 964-977	Min	Possible	Min	**Workshop:** Boat wash investigations in several estuaries state-wide; Councils banning boats on boat wash grounds in some locations.				
	963	Min	Possible	Min					

• Habitat disturbance					Vanderkooi Consulting (2015) report [25]: See Chapter 3 and Table 23 for more information on the threat identified in the report as water pollution / litter and marine debris / climate change.				
• Climate change	1009-1012	Min	Possible	Min	Vanderkooi Consulting (2015) report [25]: See Chapter 3 and Table 23 for more information on the threat identified in the report as water pollution / litter and marine debris / climate change.				
	1017	Min	Possible	Min					
• Adverse wildlife interaction • Health and safety	1018 1027-1029	Min Insig	Unlikely Likely	Min	**Social experts:** • <u>Expert opinion:</u> Increased boat traffic and recovery of many marine species is likely to result in increased interactions with, turtles, as well as whales, dolphins and other marine mammals and the safety of people participating . Transport for NSW have noted that there is no evidence of increased recreational boating safety risks due to interactions with wildlife from their boating safety data. Vanderkooi Consulting (2015) report [25]: See Chapter 3 and Table 23 for more information on the threat identified in the report as public health and safety	I	S	1-2 years	?
	1035	Min	Possible	Min	**Economic expert:** Concern over small recreational boat safety practices, such as competence to use VHS radios. Potential for loss of life with economic consequences ref. "*Australian Communications and Media Authority (ACMA) (2012). A new approach for recreational boaters who operate VHF marine radios: Outcomes of the review of VHF marine radio operator qualification arrangements—recreational (non-commercial) vessels, September. The Australian Communications and Media Authority, Canberra"*.				

					Transport for NSW have noted that there is no evidence to support lack of radio competency being linked to increased safety risk for recreational boating or to the economic benefits derived from the activity. Boating fatalities are trending down. See http://maritimemanagement.transport.nsw.gov.au/documents/boating-incident-report-2002-2012.pdf Vanderkooi Consulting (2015) report [25]: See Chapter 3 and Table 23 for more information on the threat identified in the report as public health and safety.				
• Effect of Regulations • Availability of Access	1036-1036 1045-1048	Mod	Likely	Mod	**Agency:** Threat identified as regulation or increased compliance costs in Vanderkooi Consulting (2015) report. Threat identified as economically inefficient regulation. Vanderkooi Consulting (2015) report [25]: See Chapter 3 and Table 23 for more information on the threat identified in the report as over-regulation or increased compliance costs and limited access and storage infrastructure.	L A (for access)	S	1-2 years	? Increasing for access
	1044-1053	Mod	Likely	Mod					

		Research and education - includes research and eduaction/community engagement														
		Social benefits						Economic benefits			Spatial	Temporal				Confidence
	Tier 1 benefits	Participation		Enjoyment		Cultural heritage & use		Indirect values	Viability of businesses	Direct values						
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (note that the scores below are only in relation to the loss of scientific (background) reference sites)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	# ➔ ➔ Trend	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour)	Recreational fishing				1066 Major x Almost Certain				1070 Moderate x Likely		S	X			➔	A
	Commercial fishing				1075 Major x Almost Certain				1079 Moderate x Likely		S	X			➔	A
	Cultural fishing				1084 Major x Almost Certain				1088 Moderate x Likely		S	X			➔	A
	Aquaculture				1093 Major x Almost Certain				1097 Moderate x Likely		S	X			➔	A
	Recreational boating				1102 Major x Almost Certain				1106 Moderate x Likely		S	X			➔	A
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)				1111 Moderate x Likely				1115 Moderate x Likely		S	X			➔	A
	Shipping				1120 Minor x Likely				1124 Moderate x Likely		S	X			➔	A
	Foreshore/urban development				1129 Major x Almost Certain				1133 Moderate x Likely		S	X			➔	A
Environmental	Water pollution/litter				1138 Major x Almost Certain						S	X			➔	A
	Habitat disturbance (loss of fish habitat)				1147 Major x Almost Certain						S	X			➔	A
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)				1156 Major x Almost Certain						S	X			➔	A
	Pests/diseases				1165 Moderate x Likely						S	X			➔	A
	Modified freshwater flows				1174 Moderate x Likely						S	X			➔	A
	Sediment contamination/ water pollution				1183 Major x Almost Certain						S	X			➔	A
	Climate change				1192 Major x Almost Certain						S			X	➔	A
Public saftey	Adverse wildlife interaction															
	Health & safety (injury, illness, death)															
MEMA related regulation & costs	Effect of Regulation	1216 Minor x Likely	1217 Minor x Likely		1219 Minor x Likely				1223 Minor x Likely							
	Availability of Access	1225 Minor x Likely	1226 Minor x Likely		1228 Minor x Likely				1232 Minor x Likely							
	Funding	1234 Major x Likely							1241 Major x Likely		s	X			➔	A

Hawkesbury Shelf Bioregion - Research & Education (1063-1242)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Consequence**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence**	**Confidence A, L, I**	**Spatial extent State-wide Regional Local**	**Temporal 1-2 years 10 years 20 years**	**Trend Decreasing Stable Increasing**
• Recreational fishing • Commercial fishing • Cultural fishing • Aquaculture • Recreational boating • Foreshore/ urban development	1066 1075 1084 1093 1102 1129	Major	Almost certain	High	**Agency:** • Alternative/competing resource uses, particularly extractive uses such as dredging and some forms of development pose significant risks to 'undisturbed' control sites required for scientific research, marine estate management, and approval processes. Relatively undisturbed scientific reference sites are a key means of understanding 'natural' dynamics of the marine environment, and provide 'experimental controls' to establish a baseline for monitoring impacts of activities and climate change, and supporting approval processes and decision making. • Undisturbed / relatively natural sites are important to marine education, providing areas where marine life can be experienced and studied. Scientific reference sites were an important consideration in the Ocean Beaches and Headlands Assessment done recently by the NSW Marine Estate Expert Knowledge Panel (http://www.marine.nsw.gov.au/__data/assets/pdf_file/0004/537610/INT14-	A	Bioregion	1-2 years	Increase with increasing population.

					116531-MEEKP-Summary-Report-OBH_final-web-accessible.pdf). • Moderated by existing marine parks on NSW North Coast and South Coast, but uncertainties around whether existing arrangements are adequate for scientific research. Aquatic reserves in the Hawkesbury bioregion are unlikely to be adequate for scientific research or marine education. See http://www.abc.net.au/news/2015-08-23/call-for-more-no-fishing-zones-at-sydney-harbour/6718008				
	1070 1079 1088 1097 1106 1133	Mod	Likely	Mod	**Economic expert:** Education- What part of the marine estate planning process is intended to enhance capacity development to meet the objects of the MEM Act? (a) The tertiary education system nationally currently produces a surplus of marine biology graduates with limited capacity to contribute to the economic opportunities of the marine estate. This skills shortage limits innovation. (b) Education of industry and the public for the sustainable use of the marine estate and its community benefit opportunities.	L	Statewide	Current and ongoing	Increasing
• Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)	1111	Mod	Likely	Mod	Same as recreational fishing justification above except risk level is not as high due to passive recreational activities	A	Bioregion	1-2 years	Increase with increasing population.
	1115	Mod	Likely	Mod	Same as recreational fishing justification above	L	State	Current and ongoing	Increasing
• Shipping	1120	Minor	Likely	Low		A	Bioregion	1-2 years	Increase with increasing population.
	1124	Mod	Likely	Mod	Same as recreational fishing justification above				
• Water pollution/	1138 1147	Major	Almost certain	High	**Agency:** • Environmental threats can disturb	A	Bioregion	1-2 years	Increase with increasing

litter • Habitat disturbance (loss of fish habitat) • Reductions in abundances of top and lower order trophic levels • Sediment contamination/ water pollution • Climate change	1155 1183 1192				scientific research sites and marine education sites, and/or confound scientific research results. • Note that environmental threats are also the subject/focus of some scientific research. • Environmental threats are likely to be greater in the Hawkesbury Bioregion due to larger population and greater levels of resource use and pollution which are widely documented.				population.
• Pests/diseases • Modified freshwater flows	1165 1174	Mod	Likely	Mod	Same as water pollution above.	A	Bioregion	1-2 years	Increase with increasing population.
• Effect of Regulation • Availability of Access	1216 1217 1219 1225 1226 1228	Minor	Likely	Low	**Social experts:** • Literature: Citizen Science provides benefits to communities through improving connections to and understanding and appreciation of natural systems. (It also provides benefits to policy makers and scientists which should be considered in the Environmental threat and risk assessment). These benefits can be inhibited by ineffective engagement with regulators and scientists, lack of funding and perceptions that it has low scientific value [21]. **Workshop:** Threat identified as over-regulation				

					or increased compliance costs in Vanderkooi Consulting (2015) report; need basic information to inform management (example of fishing licences) Vanderkooi Consulting (2015) report [25]: See Chapter 4 and Table 28 for more information on the threat identified in the report as over-regulation or increased compliance costs.				
• Funding	1234	Major	Likely	High	**Workshop:** Threat identified as change in government funding priorities in Vanderkooi Consulting report for research and education Vanderkooi Consulting (2015) report [25]: See Chapter 4 and Table 28 for more information on the threat identified in the report as change in government funding priorities.	A	State	1-2 years	Increasing
	1241	Major	Likely	High		A	State	1-2 years	Increasing

		Conserving environment and heritage - includes aboriginal heritage, maritime heritage, other NSW marine estate heritage, coastal and marine conservation									Spatial	Temporal				Confidence
		Social benefits						Economic benefits								
	Tier 1 benefits	Participation		Enjoyment		Cultural heritage & use		Indirect values	Viability of businesses	Direct values						
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (e.g.conserving heritage)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	Trend # ➔ ➔	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour)	Recreational fishing	1243 Moderate x Likely	1244 Moderate x Likely	1245 Moderate x Likely	1246 Moderate x Likely	1247 Minor x Likely	1248 Major x likely	1249 Minor x Unlikely	1250 Moderate x Likely		S	X			?	L
	Commercial fishing	1252 Moderate x Likely	1253 Moderate x Likely	1254 Moderate x Likely	1255 Moderate x Likely	1256 Minor x Likely	1257 Major x likely	1258 Minor x Unlikely	1259 Moderate x Likely		S	X			➔	A
	Cultural fishing	1261 Moderate x Likely	1262 Moderate x Likely	1263 Moderate x Likely	1264 Moderate x Likely		N/A	1267 Moderate x Likely	1268 Moderate x Likely		S	X			➔	L
	Aquaculture					1274 Minor x Likely	1275 Major x likely		1277 Moderate v Likely		?	X			➔	I
	Recreational boating						1284 Major x likely				S	X			➔	I
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)		1289 Moderate x Likely	1290 Moderate x Likely	1291 Moderate x Likely	1292 Minor x Likely	1293 Major x likely				S	X			➔	I
	Shipping				1300 Minor x Likely		1302 Moderate x Likely									
	Foreshore/urban development	1306 Moderate x Likely	1307 Moderate x Likely	1308Moderate x Likely	1309 Moderate x Likely	1310 Moderate x Likely	1311 Major x likely	1312 Moderate x Likely	1313 Minor x Likely	1314 Minor x Likely	L	X			➔	A
Environmental	Water pollution/litter	1315 Moderate x Likely	1316 Moderate x Likely	1317 Moderate x Likely	1318 Moderate x Possible	1319 Moderate x Possible	1320 Moderate x Possible	1321 Moderate x Likely	1322 Moderate x Likely	1323 Moderate x Likely	S	X			➔	L
	Habitat disturbance (loss of fish habitat)					1328 Moderate x Possible	1329 Moderate x Possible	1330 Moderate x Possible								I
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)			1335 Major x Likely		1337 Moderate x Possible	1338 Moderate x Possible	1339 Moderate x Possible								
	Pests/diseases					1346 Moderate x Possible	1347 Moderate x Possible	1348 Moderate x Possible								
	Modified freshwater flows					1355 Moderate x Possible	1356 Moderate x Possible	1357 Moderate x Possible								
	Sediment contamination/ water pollution					1364 Moderate x Possible	1365 Moderate x Possible	1366 Moderate x Possible								
	Climate change	1369 Minor x Likely	1370 Minor x Likely	1371 Major x Likely		1373 Moderate x Possible	1374 Moderate x Possible	1375 Moderate x Possible	1376 Moderate x Possible	1377 Moderate x Possible	S			X	➔	I
Public safety	Adverse wildlife interaction															
	Health & safety (injury, illness, death)				1390 Moderate x Possible											
MEMA related regulation & costs	Effect of regulation				1399 Moderate x Likely	1400 Moderate x Likely	1401 Moderate x Likely	1402 Moderate x Likely			S				➔	I
	Restriction of access															
	Funding								1421 Moderate x Possible							

Hawkesbury Shelf Bioregion - Conserving environment and heritage (1243-1422)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Consequence**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence** **Note: Please see Dr Sue Feary (2015) report [26] and A/Prof. Schnierer peer review report [27] for further information.**	**Confidence A, L, I**	**Spatial extent** **State-wide Regional Local**	**Temporal** **1-2 years 10 years 20 years**	**Trend** **Decreasing Stable Increasing**
• Recreational fishing • Commercial fishing	1243-1246 1252-1255 1261-1264	Mod	Likely	Mod	**Dr Sue Feary (2015) report [26]and A/Prof. Schnierer peer review report [27]:** • Threat identified as degradation of heritage sites from human activity such as dredging, fishing, boat anchors and other human activities that can cause damage to heritage sites such as shipwrecks in Vanderkooi Consulting (2015) report [25] and to Aboriginal totemic species in Dr Feary's report. A/Prof. Stephan Schnierer notes threat is non-Indigenous use and management that fails to accommodate Aboriginal connections to Sea country. • Depletion of marine resources for cultural use, lack of recognition of rights to benefit from commercial fishing. Stephan Schnierer notes threat is non-Indigenous use and management that fails to accommodate Aboriginal connections to Sea country. **Social experts:** • <u>Expert opinion:</u> Voyer's doctoral research indicated that conservation management (especially marine parks) can come into conflict with existing recreational fishing uses and this can impact on the social acceptability of those measures, cause conflict and	L	S	1-2 years	?
	1247 1256	Min	Likely	Low					
	1248 1257	Maj	Likely	High					
	1249 1258	Min	Unlikely	Min					
	1250 1259	Mod	Likely	Mod					

					division within the community and exacerbate existing tensions between users[23] • Barclay & Voyer are currently analysing an extensive qualitative data set which suggests that the heritage values of the commercial fishing industry is a significant contributor to the character and amenity of many regional and metropolitan coastal communities. This concept will be explored in greater detail in upcoming community surveys. With declines in the commercial fishing fleet across the state care needs to be taken to ensure some of the cultural heritage values of the industry and particularly its role in the development of many coastal communities is recognised. At present there is little formal recognition of the role of commercial fishing although there has been some effort by local historians in a number of communities to capture some of the stories and knowledge of fishing families (e.g. [22], other references available on request). Of particular concern is the changing use (current or potential) of many of the ports and related infrastructure from working class fishing harbours to largely private, recreational facilities. Any transition of this nature should be done with an awareness of the potential impact on areas of future heritage significance. • Voyer's doctoral research indicated impacts of marine parks were concentrated largely on small-scale commercial fishers and Indigenous				

					fishers. Recent follow up interviews with a number of the fishers involved in the initial research indicate many are still struggling to maintain their livelihoods and culture in the face of cumulative regulatory restrictions aimed at improving conservation management. Reported flow-on effects have negative implications for both communities and the marine environment and include overfishing in areas that remain open (particularly in estuarine areas on the south coast) and active defiance of fisheries regulations. • **HSB** - heritage value of commercial fishing. Places of particular relevance in Hawkesbury bioregion include Patonga, Brooklyn, SFM, and Wollongong Harbour. **Agency:** • Harvest of fish across recreational, commercial, cultural and illegal sectors is widely considered a threat to marine biodiversity and social benefits to conservation and passive users. • Moderated by existing marine parks on NSW North Coast and South Coast and fisheries management, but uncertainties around whether existing arrangements are adequate, particularly given they are widespread and pervasive, to deliver social economic benefits to conservation and passive users.				
• Cultural fishing	1261-1264	Mod	Likely	Mod	**Workshop:** As above	L	S	1-2 years	Decreasing
	1267 1268	Mod	Likely	Mod					

• Aquaculture	1274 1275 1277	Min Maj Mod	Likely Likely Likely	Low High Mod	A/Prof Stephan Schnierer peer review report [27] notes threat is non-Indigenous use and management that fails to accommodate Aboriginal connections to Sea country. Dr Sue Feary (2015) report [26] notes lack of access to aquaculture venture opportunities. **DPI Fisheries**: notes that access to aquaculture sites and other commercial fisheries related opportunities is provided by the existing management framework. Existing aquaculture sites are available to any participant through the free market. Sites that are not currently used for aquaculture may be applied for by any person. NSW DPI offers oyster leases by public tender on two occasions each year. In 2015 three new lease areas in Jervis Bay were offered by public tender and the local aboriginal community was invited to participate in that tender. This issue may be related more to a lack of resources rather than a lack of site availability. NSW DPI would assess the threat from aquaculture to conserving environment and heritage and cultural fishing as low. NSW DPI and the Department of Aboriginal Affairs have worked cooperatively with indigenous communities from Wollongong to Eden through the Southern NSW Aquaculture Aboriginal Corporation (SNAAC) to promote indigenous participation in aquaculture. Projects investigated through this group have included oyster farming, offshore sea cages, land based abalone farming, mussel farming, marine hatcheries and land based marine finfish developments.	I	S	1-2 years	Increasing

• Recreational boating	1284	Maj	Likely	High	A/Prof Stephan Schnierer peer review report [27] notes threat is non-Indigenous use and management that fails to accommodate Aboriginal connections to Sea country.**HSB** - Moderate x Likely impacts from Shellharbour Marina on tangible heritage and social benefits.	I	S	1-2 years	Increasing
• Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)	1289 1290 1291	Mod	Likely	Mod	**Agency:** Impacts on cultural heritage sites from recreational activities and shoreline visitors (e.g. 4WD on beaches, looting of wrecks by divers) Anchors are considered to cause more damage to wrecks than the other impacts of diving. Impact of boat anchors on historic wreck sites. It is a common practice among divers to “grapple” or drop an anchor into a shipwreck in order to position a dive boat over a wreck site. The practice damages fragile shipwrecks sites and can be unsafe for divers. See references[3]	I	S	1-2 years	Increasing
	1292	Min	Likely	Low					
	1293	Maj	Likely	High	A/Prof Stephan Schnierer peer review report [27] notes threat is non-Indigenous use and management that fails to accommodate Aboriginal connections to Sea country.				
• Shipping	1300	Min	Likely	Low	**OEH**: There have been a number of reports (from the diving community including charter operators) of damage by large shipping mooring chains or anchors on the many historic shipwreck sites between Newcastle and Sydney. There is a current investigation underway by OEH following evidence of an ASIS (GIS shipping locator) screenshot which showed a commercial ship located on top of an historic shipwreck for two days.				

[3] http://sanctuaries.noaa.gov/science/assessment/pdfs/tbnms_anchoring_damage.pdf
http://www.academia.edu/1858371/Impacts_of_recreational_scuba_diving_on_shipwrecks_in_Australia_and_the_Pacific_a_review
http://www.environment.nsw.gov.au/resources/heritagebranch/maritime/AnchoringonShipwrecksGuidelines.pdf

• Shipping	1302	Mod	Likely	Mod	A/Prof Stephan Schnierer peer review report [27] notes threat is non-Indigenous use and management that fails to accommodate Aboriginal connections to Sea country.	L	S	1-2 years	Increasing
• Foreshore/ urban development	1306-1310	Mod	Likely	Mod	A/Prof Stephan Schnierer peer review report [27] notes threat is non-Indigenous use and management that fails to accommodate Aboriginal connections to Sea country.**HSB** - Moderate x Likely impacts from Shellharbour Marina on tangible heritage and social benefits. Changes from fishing port to marina, character of fishing village lost. 1311 – There have been reports of damage to Aboriginal graves on the coastline/beaches from coastal development. Lack of specific consideration of all aspects of Aboriginal cultural heritage in planning and development applications. Inadequate consultation with Aboriginal communities affected. Vanderkooi Consulting (2015) report [25]: See Chapter 5 and Table 34 for more information on the threat identified in the report as urban and coastal development	A	L	1-2 years	Increasing
	1311	Maj	Likely	High					
	1312	Mod	Likely	Mod					
	1313-1314	Min	Likely	Low					
• Water pollution/ litter	1315-1317	Mod	Likely	Mod	**Dr Sue Feary (2015) report [26]:** Contamination of marine resources. Environmental degradation can impact on spiritual connections. See above - Vanderkooi Consulting (2015) report.	A	L	1-2 years	Increasing
	1318, 1319	Mod	Possible	Low					
	1320	Mod	Possible	Low					
	1321-1323	Mod	Likely	Mod	**Economic expert:** Observation- In the Conserving environment and heritage sheet the pollution risk is of “Contamination of marine resources” as an economic threat. Pollution does not discriminate between resource users,				

					though it is often site related. However the ranking here could likely be applied to many of the other tables also?				
• Habitat disturbance	1328 1329	Mod	Possible	Low	**Dr Sue Feary (2015) report [26]:** Cultural landscape damaged, environmental degradation can impact on spiritual connections.				
	1330	Mod	Possible	Low					
• Reductions in abundances of top and lower order trophic levels	1335	Maj	Likely	High	**Dr Sue Feary (2015) report [26]:** Environmental degradation can impact on spiritual connections (e.g. totemic species, culturally significant species, links to Country, food sources).				
	1337-1338	Mod	Possible	Low					
	1339	Mod	Possible	Low					
• Pests/ disease • Modified freshwater flows • Sediment contaminatio n/ water pollution	1346-1347 1355-1356 1364-1365	Mod	Possible	Low	**Dr Sue Feary (2015) report [26]:** Environmental degradation can impact on spiritual connections (as above).				
	1330 1339 1348 1357 1366	Mod	Possible	Low					
• Climate change	1369 1370	Min	Likely	Low	**Dr Sue Feary (2015) report [26]:** Environmental degradation can impact on spiritual connections. **Agency:** Major impacts directly on marine flora and fauna (including ocean acidification) which will ultimately impact upon enjoyment of marine estate. Also potential for more severe and more frequent storm events. Impacts associated with sea level rise and predicted increased storm events and severity. Many coastal sites damaged or lost. Vanderkooi Consulting (2015) report [25]: See Chapter 5 and Table 34 for more information on	I	S	Next 20 years	Increasing
	1371	Maj	Likely	High					
	1373-1374	Mod	Possible	Low					
	1375	Maj	Possible	High					
	1376-1377	Mod	Possible	Low					

					the threat identified in the report as water pollution / litter and marine debris / climate change.				
• Health & safety (injury, illness, death)	1390	Mod	Possible	Low	**Workshop:** Contamination of marine resources				
• Effect of regulation	1399-1400	Maj	Likely	High	**Workshop:** Restriction on access to marine resources for cultural purposes	I	S	?	Increasing
	1401	Mod	Likely	Mod					
	1402	Mod	Likely	Mod					
• Funding	1421	Mod	Possible	Low	Lack of government or industry support for Aboriginal commercial fishing, businesses such as ecotourism or employment opportunities in the marine estate.				

		Cruise shipping (large passenger ships used for pleasure voyages)														
		Social benefits						Economic benefits			Spatial	Temporal				Confidence
	Tier 1 benefits	Participation		Enjoyment		Cultural heritage & use		Indirect values	Viability of businesses	Direct values						
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (eg. Operating a cruise ship)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	Trend # ➔ ➔	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour)	Recreational fishing															
	Commercial fishing															
	Cultural fishing															
	Aquaculture															
	Recreational boating															
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)															
	Shipping			1479 Minor x Unlikely												
	Foreshore/urban development															
Environmental	Water pollution/litter			1497 Minor x Unlikely												
	Habitat disturbance (loss of fish habitat)															
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)															
	Pests/diseases															
	Modified freshwater flows															
	Sediment contamination/ water pollution															
	Climate change															
Public saftey	Adverse wildlife interaction															
	Health & safety (injury, illness, death)								1565 Minor x likely							
MEMA related regulation & costs	Effect of Regulation			1577 Minor x Unlikely					1583 Minor x Unlikely							
	Availability of Access	1585 Moderate x Likely	1586 Moderate x Likely	1587 Minor x Unlikely					1592 Moderate x Likely	1593 Moderate x Likely	S		X		➔	A
	Funding															

Hawkesbury Shelf Bioregion - Cruise shipping (1423-1602)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Con**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence**	**Conf A, L, I**	**Spatial extent State-wide Regional Local**	**Temporal 1-2 years 10 years 20 years**	**Trend Decreasing Stable Increasing**
• Shipping	1479	Min	Unlikely	Min					
• Water pollution/ litter	1497	Min	Unlikely	Min					
• Health and safety	1565	Min	Likely	Low	**Workshop:** Sydney White Bay residents air quality and noise issues - leading to increased costs for consumers and port operators as a result of new regulationS to reduce the harmful effects of emissions on residents' health and enjoyment. Vanderkooi Consulting (2015) report [25]: See Chapter 6 and Table 39 for more information on the threat identified in the report as loss of social licence.				
• Effect of Regulations	1577	Min	Unlikely	Min	**Economic expert**: Perception of Australian/ Sydney based cruises marred by passenger incidents at sea (assaults, deaths, coroners proceedings) not good for industry reputation). Impact may be that prospective passenger choose to leave from non NSW ports. ref: *http://www.sbs.com.au/guide/video/473418819625/Murky-waters-The-dark-side-of-the-cruise-industry* Transport for NSW note that they are unaware of any evidence that such perceptions are affecting cruise shipping participation in NSW.				
	1583	Min	Unlikely	Min					

• Availability of Access	1585 1586	Mod	Likely	Mod	Threat identified as limited access infrastructure in Vanderkooi Consulting (2015) report and applies mainly to the Hawkesbury bioregion and social licence to operate. Infrastructure limitations stop passengers from disembarking e.g. Eden Vanderkooi Consulting (2015) report [25]: See Chapter 5 and Table 34 for more information on the threat identified in the report as limited access infrastructure.	A	S	Next 10 years	Increasing
	1587	Min	Unlikely	Min					
	1592 1593	Mod	Likely	Mod					

		Ports and shipping - includes Ports in NSW, trading ships, tugs and pilot boats, port dredging (capital and maintenance)													
		Social benefits						Economic benefits			Spatial	Temporal				Confidence
	Tier 1 benefits	Participation		Enjoyment		Cultural heritage & use		Indirect values	Viability of businesses	Direct values						
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (e.g.operating a port)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	Trend # ➔ ➔	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour)	Recreational fishing				Postitive											
	Commercial fishing															
	Cultural fishing															
	Aquaculture															
	Recreational boating								1646 Minor x Unlikely							
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)															
	Shipping								1664 Moderate x Likely		L	X			➔	A
	Foreshore/urban development								1673 Moderate x Likely		L	X			➔	A
Environmental	Water pollution/litter								1682 Minor x Likely							
	Habitat disturbance (loss of fish habitat)															
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)															
	Pests/diseases								1709 Minor x Likely							
	Modified freshwater flows															
	Sediment contamination/ water pollution															
	Climate change								1736 Moderate X Likely		S			X	➔	L
Public saftey	Adverse wildlife interaction															
	Health & safety (injury, illness, death)								1754 Minor x Unlikely							
MEMA related regulation & costs	Effect of Regulation								1763 Minor x Almost Certain							
	Availability of Access								1772 Moderate x Likely		S	X			➔	A
	Funding								1781 Minor x Possible							

Hawkesbury Shelf Bioregion - Ports and shipping (1603-1782)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Consequence**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence**	**Confidence A, L, I**	**Spatial extent State-wide Regional Local**	**Temporal 1-2 years 10 years 20 years**	**Trend Decreasing Stable Increasing**
• Recreational boating	1646	Min	Unlikely	Min					
• Shipping	1664	Mod	Likely	Mod	**Workshop:** Increased ship numbers and size affecting port operations. **Economic expert**: Number of visits to ports by ship will double in next 15 years (ie. the meaning of 5% annual growth rate in report). Threat of congestion and pollution incidents will increase significantly. *Ref- Bureau of Infrastructure, Transport and Regional Economics (BITRE 2013), Australian maritime activity to 2029–30, Statistical report*	A	L	1-2 years	Increasing
• Foreshore/ urban development	1673	Mod	Likely	Mod	**Workshop:** Threat identified as availability of land and competing land use and demand for port land for non-port related activities and mainly applies to the Hawkesbury bioregion. The social benefit of safety, health & wellbeing is in regards to reduced congestion on the road and rail networks and access to a wide range of goods. Port land is protected for port use by the Three Ports SEPP, which specifically sets aside and maintains land for port purposes. However there is pressure for commercial use on the fringes of these areas. Ports as a key driver of economic growth in NSW are influential in the development of new infrastructure to provide economic efficiency e.g. WestConnex, Moorebank Intermodal)	A	L	1-2 years	Increasing

					Vanderkooi Consulting (2015) report [25]: See Chapter 7 and Table 45 for more information on the threat identified in the report as availability of land and competing land use.				
• Water pollution/ litter	1682	Min	Likely	Low	**Workshop:** Dredging, oil spills; introduced pests surveys **Economic expert:** Number of visits to ports by ship will double in next 15 years risk of pollution incidents will increase significantly. *(BITRE 2013 op cit above).* Potential deregulation of the coastal shipping trade may also increase the number of vessels in state waters.				
• Pests & diseases	1709	Min	Likely	Low	Vanderkooi Consulting (2015) report [25]:- responding to a marine pest incursion through requirements such as dry docking vessel, quarantine and pest surveillance could increase compliance costs. Report assessed impact as (minor x possible = minimal) **DPI Fisheries** – notes that there is a risk to economic benefits if a pest incursion occurs in NSW and further proactive surveillance is required in high risk areas (e.g. major ports) – see Glasby & Lobb (2008) – ref 23.	L	R	10-20 years	Increasing
• Climate change	1763	Mod	Likely	Mod	**Workshop:** Applies mainly to the Hawkesbury bioregion but other ports across the State will also be affected) Vanderkooi Consulting (2015) report [25]: See Chapter 5 and Table 34 for more information on the threat identified in the report as climate change.	A	L	Next 20 years	Increasing
• Health and safety	1754	Min	Unlikely	Min	**Workshop:** Applies mainly to the Hawkesbury bioregion Vanderkooi Consulting (2015) report [25]: See				

					Chapter 5 and Table 34 for more information on the threat identified in the report as public health and safety.				
• Effect of Regulations •	1763	Min	Almost certain	Low	**Workshop:** In relation to increased compliance costs. Applies mainly to the Hawkesbury bioregion in report. The Three Ports SEPP allows Botany, Kembla and Newcastle ports significant flexibility in undertaking low risk activities without consent. Vanderkooi Consulting (2015) report [25]: See Chapter 5 and Table 34 for more information on the threat identified in the report as increased compliance costs.				
• Availability of Access	1772	Mod	Likely	Mod	**Workshop:** Increased ship numbers and size affecting port operations; goes down to low at State-wide level Vanderkooi Consulting (2015) report [25]: See Chapter 5 and Table 34 for more information on the threat identified in the report as inability to undertake dredging activities.	A	L	1-2 years	Increasing
• Funding	1781	Min	Possible	Min	**Workshop:** Threat identified as inability to access funds for infrastructure upgrades and applies mainly to the Hawkesbury bioregion in report. Vanderkooi Consulting (2015) report [25]: See Chapter 5 and Table 34 for more information on the threat identified in the report as inability to access funds for infrastructure upgrades.				

Boating - commercial and charter - includes compliance, enforcement and surveillance activity; search and rescue; commercial fishing vessels; harbour cruises; scuba diving, snorkelling, kayak tours, and surf/paddleboard lessons; charter vessels (except fishing); Charter fishing; general hire and drive; hire and dive houseboats; adventure sports; whale and dolphin watching tours; naval vessels and facilities

		Social benefits						Economic benefits			Spatial	Temporal				Confidence
	Tier 1 benefits	**Participation**		**Enjoyment**		**Cultural heritage & use**		**Indirect values**	**Viability of businesses**	**Direct values**						
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (e.g.operating a vessel or charter)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	# ➔ ➔ Trend	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour)	Recreational fishing	1783 Moderate x Unlikely	1784 Moderate x Unlikely	1785 Moderate x Unlikely	1786 Moderate x Unlikely				1790 Moderate x Unlikely							
	Commercial fishing	1792 Moderate x Unlikely	1793 Moderate x Unlikely	1794 Moderate x Unlikely	1795 Moderate x Possible				1799 Moderate x Possible							
	Cultural fishing	1801 Moderate x Unlikely	1802 Moderate x Unlikely	1803 Moderate x Unlikely	1804 Moderate x Unlikely				1808 Moderate x Unlikely							
	Aquaculture	1810 Moderate x Unlikely	1811 Moderate x Unlikely	1812 Moderate x Unlikely	1813 Moderate x Unlikely				1817 Moderate x Unlikely							
	Recreational boating	1819 Moderate x Unlikely	1820 Moderate x Unlikely	1821 Moderate x Unlikely	1822 Moderate x Unlikely				1826 Moderate x Unlikely							
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)	1828 Moderate x Unlikely	1829 Moderate x Unlikely	1830 Moderate x Unlikely	1831 Moderate x Unlikely				1835 Moderate x Unlikely							
	Shipping			1839 Moderate x Possible	1840 Moderate x Possible				1844 Moderate x Possible		S	X			?	I
	Foreshore/urban development								Positive							
Environmental	Water pollution/litter	1855 Moderate x Likely	1856 Minor x Likely	1857 Moderate x Likely	1858 Moderate x Likely				1862 Moderate x Likely		S	X			➔	L
	Habitat disturbance (loss of fish habitat)			1866 Moderate x Likely	1867 Moderate x Likely				1871 Moderate x Likely		S	X			➔	L
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)	1873 Insignificant x Possible	1874 Minor x Possible	1875 Moderate x Possible	1876 Moderate x Likely				1880 Moderate x Likely		S	X			➔	L
	Pests/diseases			1884 Moderate x Possible	1885 Moderate x Possible				1889 Moderate x Possible							
	Modified freshwater flows															
	Sediment contamination/ water pollution	1900 Minor x Likely	1901 Minor x Likely	1902 Moderate x Likely	1903 Moderate x Likely				1907 Moderate x Likely		S	X			➔	L
	Climate change	1909 Moderate x Unlikely	1910 Moderate x Unlikely	1911 Moderate x Unlikely	1912 Moderate x Unlikely				1916 Moderate x Unlikely							
Public saftey	Adverse wildlife interaction	1918 Moderate x Unlikely														
	Health & safety (injury, illness, death)	1927 Moderate x Unlikely	1928 Moderate x Unlikely	1929 Moderate x Unlikely	1930 Moderate x Unlikely				1934 Moderate x Unlikely							
MEMA related regulation & costs	Effect of Regulation	1936 Minor x Likely	1937 Minor x Likely	1938 Minor x Likely	1939 Minor x Likely				1943 Moderate x Likely		S	X			➔,	I
	Availability of Access	1945 Minor x Likely	1946 Minor x Likely	1947 Minor x Likely	1948 Minor x Likely				1952 Minor x Likely							
	Funding															

Hawkesbury Shelf Bioregion – Boating, commercial and charter (1783-1962)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Consequence**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence**	**Confidence A, L, I**	**Spatial extent State-wide Regional Local**	**Temporal 1-2 years 10 years 20 years**	**Trend Decreasing Stable Increasing**
• Recreational fishing • Cultural fishing • Aquaculture • Recreational boating • Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)	1783-1786 1801-1804 1810-1813 1819-1822 1828-1831	Mod	Unlikely	Min	Vanderkooi Consulting (2015) report [25]: See Chapter 8 and Table 52 for more information on the threat identified in the report as market saturation / overcrowding.				
	1790 1808 1817 1826 1835	Mod	Unlikely	Min					
• Commercial fishing	1792-1794	Mod	Unlikely	Min	**Workshop:** Charter fishing vs commercial fishing				
	1795	Mod	Possible	Low					
	1799	Mod	Possible	Low					
• Shipping •	1839 1840	Mod	Possible	Low	**OEH:** Healthy and abundant populations of whales are important to support a large and diverse whale watching industry and to enhance the intensity of the tourism experience in a particular location. Climate change, prey depletion, habitat degradation and marine activities such as shipping or geological exploration all place pressure on whales in their natural environment. Knowles and Campbell (2011) (ref 24) describes	I?	S	1-2 years	Increasing as shipping activity increases

					the value of whales and the whale watching industry. The report identifies shipping as one of the key threats to whale populations and subsequently provides the following summary of its impact on whale watching "What is clear … is that the value of an individual whale is dependent on two variables – whale numbers and tourism revenue – both of which are in turn dependent on a number of other variables. The factors that determine whale populations and tourism revenue are not connected, although a relationship between whale populations and tourism revenue exists. Clearly a whale watching industry is not possible without a strong population of whales." The potential for growth of the shipping industry and possible wildlife interactions can impact associated industries. Transport have noted that they are unaware of complaints about shipping impacts on whale watching operations in NSW.				
	1844	Mod	Possible	Low					
• Water pollution/litter	1855 1857 1858	Mod	Likely	Mod	Applies to whole of NSW marine estate but particularly to the Hawkesbury bioregion. This threat has the potential to reduce the incentive for people to participate in commercial and charter boating, such as scuba, snorkelling, charter trips and marine mammal observation. **Agency:** People are less likely to pay to go on a commercial charter if the water is polluted. This has participation and therefore economic impacts. Vanderkooi Consulting (2015) report [25]: See Chapter 8 and Table 52 for more information on	L	S	1-2 years	Increasing

					the threat identified in the report as water pollution / litter and marine debris / climate change				
	1856	Min	Likely	Low	As above - Vanderkooi Consulting (2015) report				
	1862	Mod	Likely	Mod	As above - Vanderkooi Consulting (2015) report				
• Habitat disturbance	1866 1867	Mod	Likely	Mod	People are less likely to pay to go on a commercial charter if the habitat is disturbed or degraded. This has participation and therefore economic impacts, except potentially for adventure sports.	L	S	1-2 years	Increasing
	1871	Mod	Likely	Mod					
• Reductions in abundances of top and lower order trophic levels	1873 1874	Insig Min	Possible	Min	People are less likely to pay to go on a fishing or snorkelling and diving commercial charter if there are reductions in biodiversity. This has participation and therefore economic impacts. Vanderkooi Consulting (2015) report [25]: See Chapter 8 and Table 52 for more information on the threat identified in the report as decreasing biodiversity.	L	S	1-2 years	Increasing
	1875	Mod	Possible	Low					
	1876	Mod	Likely	Mod					
	1880	Mod	Likely	Mod					
• Pests/ diseases	1884 1885	Mod	Possible	Low					
	1889	Mod	Possible	Low					
• Sediment contamination/ water pollution	1900-1901	Min	Likely	Low	Applies to whole of NSW marine estate but particularly to the Hawkesbury bioregion. This threat has the potential to reduce the incentive for people to participate in commercial and charter boating, such as scuba, snorkelling, charter trips and marine mammal observation. **Agency:** People are less likely to pay to go on a commercial charter if the water is polluted. This has participation and therefore economic impacts. Vanderkooi Consulting (2015) report [25]: See	L	S	1-2 years	Increasing
	1902-1903	Mod	Likely	Mod					
	1907	Mod	Likely	Mod					

					Chapter 8 and Table 52 for more information on the threat identified in the report as water pollution / litter and marine debris / climate change				
• Climate change	1909-1912	Mod	Unlikely	Min	**Workshop:** Applies to whole of NSW marine estate but particularly to the Hawkesbury bioregion; search and rescue operations **Agency:** Climate change unlikely to directly impact on safety, health and wellbeing other than increased storm events however boaters will avoid bad weather therefore minimising associated risks Vanderkooi Consulting (2015) report [25]: See Chapter 8 and Table 52 for more information on the threat identified in the report as water pollution / litter and marine debris / climate change.				
	1916	Mod	Unlikely	Min					
• Adverse wildlife interaction	1918	Mod	Unlikely	Min					
• Health and safety	1927-1930	Mod	Unlikely	Min					
	1934	Mod	Unlikely	Min					
• Effect of Regulations	1936-1939	Min	Likely	Low	Vanderkooi Consulting (2015) report [25]: See Chapter 8 and Table 52 for more information on the threat identified in the report as economically inefficient regulation or increased compliance costs.	I	S	1-2 years	Increasing
	1943	Mod	Likely	Mod	**Economic expert:** Whale/dolphin and recreational charter fishing operator numbers require management to meet the optimum economic long term sustainable activity level within environmental constraints. This will ensure more stable and profitable vessel enterprises with long term benefits to credible				

					and sustainable marine tourism. ***McIlgorm,*** *A. and J. Pepperell (2014). An economic survey of the Recreational fishing Charter boat industry in NSW. A report to the NSW Recreational Fishing Trust, NSW Department of Primary Industries by Dominion Consulting Pty Ltd.* Vanderkooi Consulting (2015) report [25]: See Chapter 8 and Table 52 for more information on the threat identified in the report as economically inefficient regulation or increased compliance costs.				
• Availability of Access	1945-1948	Min	Likely	Low	Vanderkooi Consulting (2015) report [25]: See Chapter 8 and Table 52 for more information on the threat identified in the report as limited access infrastructure / cost of access infrastructure.				
	1952	Min	Likely	Low					

		Water transport services - includes ferries, vehicular ferries, water taxis, charter transport vessels														
		Social benefits						Economic benefits			Spatial	Temporal				Confidence
	Tier 1 benefits	Participation		Enjoyment		Cultural heritage & use		Indirect values	Viability of businesses	Direct values						
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (e.g.providing water transport services)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	Trend # ➔ ➔	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour)	Recreational fishing															
	Commercial fishing															
	Cultural fishing															
	Aquaculture															
	Recreational boating															
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)															
	Shipping															
	Foreshore/urban development															
Environmental	Water pollution/litter								2042 Moderate x Unlikely							
	Habitat disturbance (loss of fish habitat)															
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)															
	Pests/diseases															
	Modified freshwater flows															
	Sediment contamination/ water pollution															
	Climate change								2096 Moderate x Possible							
Public saftey	Adverse wildlife interaction															
	Health & safety (injury, illness, death)	2107 Moderate x Unlikely	2108 Moderate x Unlikely	2109 Moderate x Unlikely					2114 Moderate x Unlikely							
MEMA related regulation & costs	Effect of Regulation	2116 Minor x Possible	2117 Minor x Possible	2118 Minor x Possible	2119 Moderate x Likely				2123 Moderate x Likely		L	X			?	L
	Availability of Access								2132 Moderate x Likely		L	X			➔	L
	Funding															

Hawkesbury Shelf Bioregion - Water transport services (1963-2142)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Consequence**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence**	**Confidence A, L, I**	**Spatial extent State-wide Regional Local**	**Temporal 1-2 years 10 years 20 years**	**Trend Decreasing Stable Increasing**
• Water pollution/ litter	2042	Mod	Unlikely	Min	**Workshop:** Litter affecting machinery and operations has a very minor economic impact but no social impact. **Economic expert:** Ferries and water transport can suffer damage from interaction and ingestion of plastics. *McIlgorm, A., H Campbell and M. Rule (2011). The economic cost and control of marine debris damage in the Asia-Pacific region, Ocean &Coastal Management, 54 (2011) 643-651*.				
• Climate change	2096	Mod	Possible	Low	Some ferry wharves in Sydney Harbour (e.g. Balmain) are already unable to be used during king tides – see Witness King Tides (http://www.witnesskingtides.org/) and http://www.climatechange.environment.nsw.gov.au/~/media/NARCLim/Files/PDF%20resources/09722KingTide.pdf also affecting CONSUMPTIVE USE in those locations (social benefits). See availability of access below.	L	L - Sydney Harbour	10 years	Increasing
• Health and safety	2107-2109	Mod	Unlikely	Min	Vanderkooi Consulting (2015) report [25]: See Chapter 9 and Table 59 for more information on the threat identified in the report as public health and safety				
	2114	Mod	Unlikely	Min					
• Effect of Regulations	2116-2118	Min	Possible	Min	**Workshop:** Threat identified as economically inefficient regulation or increased compliance costs in report and applies to the Hawkesbury bioregion; Parramatta River being the relevant example (consumption of catching a ferry) - Hawkesbury bioregion moderate; State-wide	L	L	1-2 years	?
	2119	Mod	Likely	Mod					
	2123	Mod	Likely	Mod					

					minimal. Vanderkooi Consulting (2015) report [25]: See Chapter 9 and Table 59 for more information on the threat identified in the report as economically inefficient regulation or increased compliance costs				
• Availability of Access	2132	Mod	Likely	Mod	**Workshop:** Threat identified as limited access infrastructure/costs of access infrastructure and applies to the Hawkesbury bioregion. Threat related to lack of storage/berthing facilities. Vanderkooi Consulting (2015) report [25]: See Chapter 9 and Table 59 for more information on the threat identified in the report as limited access infrastructure/costs of access infrastructure.	L	L	1-2 years	?

Maritime related activities - includes minor ports and harbours; boat and ship building repairs and maintenance; slipways and vessel launching facilities; refuelling facilities; aids to navigation provision and maintenance; boat ramps, jetties wharves, pontoons and courtesy moorings; breakwaters, training walls and revetments; ancillary facilities on land; and dredging. Also includes boat storage.

		Social benefits						Economic benefits			Spatial	Temporal				Confidence
	Tier 1 benefits	**Participation**		**Enjoyment**		**Cultural heritage & use**		**Indirect values**	**Viability of businesses**	**Direct values**						
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (e.g.providing maritime related services)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	Trend # → ←	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour)	Recreational fishing		2144 Moderate x Likely		Positive						S	X			↑	L
	Commercial fishing		2153 Moderate x Likely						2159 Moderate x Likely		S	X			↑	L
	Cultural fishing															
	Aquaculture															
	Recreational boating															
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)															
	Shipping															
	Foreshore/urban development															
Environmental	Water pollution/litter															
	Habitat disturbance (loss of fish habitat)															
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)															
	Pests/diseases															
	Modified freshwater flows															
	Sediment contamination/ water pollution															
	Climate change	2269 Moderate x Likely							2276 Moderate x Likely		S			X	↑	L
Public saftey	Adverse wildlife interaction															
	Health & safety (injury, illness, death)	2287 Minor x Likely							2294 Minor x Likely							
MEMA related regulation & costs	Effect of Regulation	2296 Moderate x Likely							2303 Moderate x Likely		S	X			#	A
	Availability of Access	2305 Moderate x Likely							2313 Moderate x Likely		S	X			?	A (Hawkesbury BR); L (Statewide)
	Funding	2314 Moderate x Likely							2322 Moderate x Likely		S	X			↑	S

Hawkesbury Shelf Bioregion - Maritime related activities (2143-2322)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Consequence**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence**	**Confidence A, L, I**	**Spatial extent State-wide Regional Local**	**Temporal 1-2 years 10 years 20 years**	**Trend Decreasing Stable Increasing**
• Recreational fishing	2144	Mod	Likely	Mod	**Workshop:** Negative interactions/overcrowding on boat ramps; recreational fishing on wharves and antisocial behaviour; could be positive where recreational fishing rights and access are being provided at marine facilities and infrastructure.	L	S	1-2 years	Increasing
• Commercial fishing	2153	Mod	Likely	Mod	**Workshop:** Potential decline in provision/maintenance of public marine infrastructure as a result of downturn in commercial fishing industry	L	S	1-2 years	Increasing
	2159	Mod	Likely	Mod					
• Climate change	2269	Mod	Likely	Mod	Vanderkooi Consulting (2015) report [25]: See Chapter 10 and Table 66 for more information on the threat identified in the report as climate change.	L	S	Next 20 years	Increasing
	2276	Mod	Likely	Mod					
• Health and safety	2287	Min	Likely	Low	Vanderkooi Consulting (2015) report [25]: See Chapter 10 and Table 66 for more information on the threat identified in the report as public health and safety.				
	2294	Min	Likely	Low					
• Effect of Regulations • Funding	2296 2314	Mod	Likely	Mod	**Workshop:** Maritime related activities are regulated, and potentially subject to further regulation, to mitigate environmental impact such as, sediment quality issues in marinas/slipways; dredging monitoring/assessment costs; moorings in seagrass and land use planning. **Agency:** Maritime Industry has identified planning regulation as the biggest constraint to	A	S	1-2 years	Stable Increasing for funding
	2303 2322	Mod	Likely	Mod					

					growth. This was identified as an issue in the Sydney Harbour Boat Harbour Strategy 2013, and through industry submissions to DP&E Planning Reforms in 2013.				
• Availability of Access	2305	Mod	Likely	Mod	**Workshop:** Threat identified as limited access and storage infrastructure in report and applies to Hawkesbury bioregion in particular. Crown Lands review- implications for local co-ops Vanderkooi Consulting (2015) report [25]: See Chapter 10 and Table 66 for more information on the threat identified in the report as limited access and storage infrastructure.	A L (state-wide)	S	1-2 years	Increasing
	2313	Mod	Likely	Mod					

		Tourism and accommodation within and neighbouring the foreshore/coastal zone 50km (dependancy with marine estate)														
		Social benefits						Economic benefits			Spatial	Temporal				Confidence
	Tier 1 benefits	Participation		Enjoyment		Cultural heritage & use		Indirect values	Viability of businesses	Direct values						
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (e.g.undertaking or providing a tourism activity)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	Trend # ➔ ➔	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour)	Recreational fishing		Positive													
	Commercial fishing		Positive		Positive											
	Cultural fishing															
	Aquaculture				Positive											
	Recreational boating															
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)	2368 Moderate x Likely	2369 Moderate x Likely	2370 Moderate x Likely	2371 Moderate x Likely			2374 Moderate x Likely	2375 Moderate x Likely		S	X			↑	L
	Shipping															
	Foreshore/urban development	2386 Moderate x Likely	2387 Moderate x Likely	2388 Moderate x Likely	2389 Moderate x Likely			2392 Moderate x Likely	2393 Moderate x Likely		S	X			↑	L
Environmental	Water pollution/litter	2395 Moderate x Possible	2396 Moderate x Possible	2397 Moderate x Possible	2398 Moderate x Possible			2401 Moderate x Possible	2402 Moderate x Possible	2403 Moderate x Possible						
	Habitat disturbance (loss of fish habitat)															
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)				2146 Moderate x Possible					2421 Moderate x Possible						
	Pests/diseases															
	Modified freshwater flows															
	Sediment contamination/ water pollution	2440 Moderate x Possible	2441 Moderate x Possible	2442 Moderate x Possible	2443 Moderate x Possible			2446 Moderate x Possible	2447 Moderate x Possible	2448 Moderate x Possible						
	Climate change	2449 Moderate x Almost certain	2450 Moderate x Almost certain	2451 Moderate x Almost certain	2452 Moderate x Almost certain			2455 Moderate x Almost certain	2456 Moderate x Almost certain		S			X	↑	I
Public saftey	Adverse wildlife interaction	2458 Minor x Unlikely	2459 Minor x Unlikely	2460 Minor x Unlikely	2461 Minor x Unlikely				2465 Minor x Unlikely							
	Health & safety (injury, illness, death)	2467 Minor x Unlikely	2468 Minor x Unlikely	2469 Minor x Unlikely	2470 Minor x Unlikely				2474 Minor x Unlikely							
MEMA related regulation & costs	Effect of Regulation				2479 Moderate x Possible					2484 Moderate x Possible						
	Access Availability (disabiled access)	2485 Major x Likely	2486 Major x Likely	2487 Major x Likely	2488 Major x Likely			2491 Moderate x Possible		2493 Major x Likely	L	X			↓	I
	Funding															

Hawkesbury Shelf Bioregion - Tourism and accommodation (2323-2502)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Consequence**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence**	**Confidence A, L, I**	**Spatial extent State-wide Regional Local**	**Temporal 1-2 years 10 years 20 years**	**Trend Decreasing Stable Increasing**
• Recreation and tourism • Foreshore/ urban development	2368-2371 2386-2839	Mod	Likely	Mod	**Workshop:** Threat identified as environmental impact of the activities - but only for nature based tourism and accommodation providers. Motorised versus passive uses; overcrowding. **OEH**: Impact on users who are seeking a sense of remoteness and separation from the urban environment. Data from the International Visitor Survey shows that Australia's *natural environment and wildlife* and *diverse coastal and beach experiences* are both important drivers of visitation for the inbound market. These two also rank highest in the most memorable experiences.	L	S	1-2 years	Increasing
	2374, 2375 2392 2393	Mod	Likely	Mod					
• Water pollution/ litter • Sediment contamination	2395-2398 2440-2443	Mod	Possible	Low	**Economic expert:** Loss of expenditure by tourists (local, domestic and international) and reduction in non-monetary values due to pollution, reduced amenity and perceptions of the marine estate. Such risks would be higher following oil spill incidents.				
	2401-2403 2446-2448	Mod	Possible	Low					
• Reductions in abundances of top and lower order	2446	Mod	Possible	Low	**Workshop:** Possible impact if there are no large fish for seafood providers **Social experts:** • Literature: A number of studies by				
	2421	Mod	Possible	Low					

trophic levels					McIlgorm have pointed to the importance of recreational fishing as a tourism product in coastal communities of NSW. • <u>Expert opinion:</u> Barclay & Voyer are currently analysing an extensive qualitative data set which suggests that the commercial fishing and aquaculture industries are also significant tourism products in NSW coastal communities, in 3 key ways: 1. Seafood product and the desire of tourists and domestic visitors to eat fresh local seafood while holidaying. 2. As a tourism experience – eg watching fishers unload their catches, visiting working harbours and aquaculture farms (eg SFM is in the top 5 tourist destinations for Chinese tourists in Sydney, Snug Cove at Eden is recognised as the number 1 tourism asset of the Bega Valley region). 3. Provision of bait for recreational fishers including recreational fishing tourists – recent interviews suggest locally sourced bait is sought after by recreational fishers. • The importance of these 3 aspects of the industries for tourism will be quantified in upcoming surveys.				
• Climate change	2449-2452	Mod	Almost certain	Mod	**Workshop:** Increased flooding risk and storms **Economic expert:** The likelihood of social and economic threats are ranked as almost certain. Previous tables have Climate Change as “likely” or “possible”. The risks for tourism and accommodation from climate change will take time and both activities can adapt in the 50 year	I	S	Next 20 years	Increasing
	2455-2456	Mod	Almost certain	Mod					

					view. This may reduce economic impacts. Vanderkooi Consulting (2015) report [25]: See Chapter 11 and Table 71 for more information on the threat identified in the report as climate change.				
• Adverse wildlife interaction • Health and safety	2458-2461 2467-2470	Min	Unlikely	Min	Vanderkooi Consulting (2015) report [25]: See Chapter 11 and Table 71 for more information on the threat identified in the report as public health and safety				
	2465 2474	Min	Unlikely	Min					
• Effect of Regulations	2479	Mod	Possible	Low	**Workshop:** Possible impact if there are no large fish for seafood providers				
	2484	Mod	Possible	Low					
• Availability of Access	2485-2488	Maj	Likely	High	**Workshop: HSB** only - Disabled access issue for islands in the bioregion	L	S	1-2 years	Decreasing
	2491	Mod	Possible	Low					
	2493	Maj	Likely	High					

		Coastal urban settlement - includes residential property; commercial property; Surf Life Saving Clubs; and services such as water and electricity infrastructure														
		Social benefits						Economic benefits			Spatial	Temporal				Confidence
	Tier 1 benefits	Participation		Enjoyment		Cultural heritage & use		Indirect values	Viability of businesses	Direct values						
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (e.g. ocupying the coastal zone as urban settlement)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	Trend # ➔ ➔	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour)	Recreational fishing															
	Commercial fishing															
	Cultural fishing															
	Aquaculture			2532 Minor x Possible												
	Recreational boating															
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)															
	Shipping															
	Foreshore/urban development	Positive	Positive	Positive												
Environmental	Water pollution/litter															
	Habitat disturbance (loss of fish habitat)															
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)															
	Pests/diseases															
	Modified freshwater flows															
	Sediment contamination/ water pollution															
	Climate change	2629 Major x Likely	2630 Major x Likely	2631 Major x Likely					2636 Major x Likely		S			X	↑	I
Public saftey	Adverse wildlife interaction															
	Health & safety (injury, illness, death)															
MEMA related regulation & costs	Effect of Regulation	2656 Minor x Likely	2657 Minor x Likely	2658 Minor x Likely					2663 Minor x Likely							
	Access Availaiblity	2665 Minor x Likely	2666 Minor x Likely	2667 Minor x Likely					2672 Minor x Likely							
	Funding															

Hawkesbury Shelf Bioregion - Coastal urban settlement (2503-2682)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Consequence**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence**	**Confidence A, L, I**	**Spatial extent State-wide Regional Local**	**Temporal 1-2 years 10 years 20 years**	**Trend Decreasing Stable Increasing**
• Aquaculture	2532	Min	Possible	Min	**Agency**: New marine aquaculture lease application in Jervis Bay - views were a key social concern but were mitigated by the proponent.	L	L	10 years	Increasing
• Climate change	2629-2631	Maj	Likely	High	**Workshop:** This benefit is highly vulnerable to future climate change with limited adaptation/retreat options and the long design life/functional life of many assets **Economic expert:** There are several different economic considerations in valuing climate change impacts on urban settlement. Example- the economic vulnerability of assets, rail lines, versus domestic residences built on the shore. Some economic approaches consider the market to price in uncertainties like climate change, particularly as the economic activity associated with urban development happens at the time of construction. Others seek to provide remedy to those coastal properties impacted (who pays?). For current planning the envisaged time to fuller climate change impacts (20-50 years) discounts the value of future losses significantly. There is also possible future adaptations to reduce losses. Following adaptive cost-benefit approaches in Dobes (2012) would reduce	I	S	Next 20 years	Increasing
	2636	Maj	Likely	High					

					estimates of climate change impact in the decades ahead. See different approaches in ***Kirkpatrick S (2012)*** *The Economic Value of Natural and Built Assets. Coastal Discussion Paper – Node 1 Coastal Settlements-Australian Climate Change Adaptation Research Network for Settlements and Infrastructure (ACCARNSI). And* ***Dobes, L.*** *(2012) Productivity Commission Draft Report: Barriers To Effective Climate Change Adaptation.* Vanderkooi Consulting (2015) report [25]: See Chapter 12 and Table 77 for more information on the threat identified in the report as climate change.				
• Effect of Regulations • Availability of Access	2656-2658 2665-2667	Min	Likely	Low	**Workshop:** Regulation and planning controls limit development Depending on location there may be some displacement of marine dependant uses with urban settlement that does not require a coastal location to function				
	2663 2672	Min	Likely	Low					

Retail and trade - includes cafes, restaurants and other food outlets; surf shops, dive shops and coastal retailers; and outdoor exercise classes

Discussed and agreed by the group that this benefit class is adequately captured by the 'Viability of businesses' in the other sheets; and on that basis it was agreed not to present risk scores for Retail and Trade

		Social benefits						Economic benefits			
	Tier 1 benefits	**Participation**		**Enjoyment**		**Cultural heritage & use**		**Indirect values**	**Viability of businesses**	**Direct values**	
	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (e.g.catching a fish)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	**Comments/Narrative**
Social and Economic Threats											
Tier 1 threats	**Tier 2 threats**										
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour)	Recreational fishing										
	Commercial fishing										
	Cultural fishing										
	Aquaculture										
	Recreational boating										
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)										
	Shipping										
	Foreshore/urban development										
Environmental	Water pollution/litter										
	Habitat disturbance (loss of fish habitat)										
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)										
	Pests/diseases										
	Modified freshwater flows										
	Sediment contamination/ water pollution										
	Climate change										
Public saftey	Adverse wildlife interaction										
	Health & safety (injury, illness, death)										
MEMA related regulation & costs	Effect of Regulation										
	Access Availability										
	Funding										

		Extractive industries - includes marine (sand) aggregates and exploration and extraction of other mineral resources														
		Social benefits						Economic benefits			Spatial	Temporal				Confidence
	Tier 1 benefits	Participation		Enjoyment		Cultural heritage & use		Indirect values	Viability of businesses	Direct values						
The workshop participants noted that in the long term (10-20 Years) the risk rating would increase to HIGH (Major x Likely) due to increasing demand for marine (sand) aggregate for construction purposes, particularly in the Hawkesbury bioregion	Tier 2 benefits	Safety, health & wellbeing (including relaxation)	Socialising & sense of community	Enjoying the biodiversity & beauty of the marine estate	Consumptive use (e.g.undertaking extraction industry)	Tangible Aboriginal cultural heritage (historic objects, places, items, and source of food)	Intangible Aboriginal heritage (traditions, practices, knowledge, spiritual values)	Intrinsic & bequest values	Employment & value of production	Individual enjoyment value (consumer surplus)	Statewide / regional / local	Current 1-2years	Next 10 years	Next 20 years	Trend # ➔ ➔	(Adequate, Limited or Inferred)
Social and Economic Threats																
Tier 1 threats	**Tier 2 threats**															
Alternative/competing resource uses (including intra-activity competition) & social conflicts (e.g. overcrowding, anti-social behaviour)	Recreational fishing															
	Commercial fishing															
	Cultural fishing															
	Aquaculture															
	Recreational boating															
	Recreation and tourism (including snorkelling and diving, swimming and surfing, 4WD)															
	Shipping															
	Foreshore/urban development															
Environmental	Water pollution/litter															
	Habitat disturbance (loss of fish habitat)															
	Reductions in abundances of top and lower order trophic levels (depletion of fish stocks)															
	Pests/diseases															
	Modified freshwater flows															
	Sediment contamination/ water pollution															
	Climate change															
Public saftey	Adverse wildlife interaction															
	Health & safety (injury, illness, death)															
MEMA related regulation & costs	Effect of Regulation	3016 Minor x Likely			3019 Minor x Likely			3022 Minor x Likely	3023 Minor x Likely		R	X			➔	A
	Availability of Access															
	Funding															

Hawkesbury Shelf Bioregion - Extractive Industries (2863-3042)									
Threat	**Cell no. Social benefit = pink Econ benefit = grey**	**Consequence**	**Likelihood**	**Risk rating (C x L)**	**Justification narrative/evidence**	**Confidence A, L, I**	**Spatial extent State-wide Regional Local**	**Temporal 1-2 years 10 years 20 years**	**Trend Decreasing Stable Increasing**
• Effect of Regulation	3016 3019	Min	Likely	Low	**Workshop:** Noted there was limited if any extractive industries currently in operation within the marine estate currently. However, the participants noted that the threat is likely to increase to HIGH in the next 10-20 years as demand for marine sands increases for construction purposes. Department of Planning note that beach nourishment is also increasingly being seen as a more palatable option for protection of foreshore development. Justification in numerous media articles and Coastal Zone Management Plans (e.g. Warringah, Jimmy's Beach) which may also increase demand for marine sands over the coming years. **Department of Resources & Energy:** The extraction of marine sand has a number of social aspects, including: that regulation of exploration activities would likely be tied to community views on the costs and benefits of this activity (notably the consideration of environmental impacts); beyond any decrease in construction costs, there may also be social benefits associated with reduced housing costs, improved infrastructure, etc; and local sourcing of construction materials has the potential to	L	R	1-2 years	Increasing

					greatly reduce truck movements (which can impact social amenity).				
• Effect of Regulations	3022 3023	Min	Likely	Low	**Workshop:** Noted there was limited if any extractive industries currently in operation within the marine estate currently. However, the participants noted that the threat is likely to increase to HIGH in the next 10-20 years as demand for marine (sand) aggregates increases for construction purposes. **Department of Resources & Energy:** This rating is based on no current extraction (and therefore no economic benefits) currently being derived from the marine estate (including coal, petroleum, methane, marine (sand) aggregates and mineral sands etc). However, it should be noted that, in the longer term there may be greater demand for the extraction of these resources. This may significantly increase the economic benefits associated with this activity (and therefore the significance of the risk to these potential benefits). In relation to the extraction of marine (sand) aggregates, the current regulatory arrangements are complex and potentially contain impediments. For example, it has previously been indicated that the entire State Waters are covered by a reserve block (deemed under the *Offshore Minerals Act 1999*) prohibiting the granting of mining leases. Should this be the case, then areas would need to be 'opened-up' before extraction (and possibly exploration) could occur. It should also be noted that, historically, there has been no government	L	R	1-2 years	Increasing

					support for offshore sand mining. Vanderkooi Consulting (2015) report [25]: See Chapter 16 and Table 94 for more information on the threat identified in the report as regulatory barriers to extraction				

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