

APPENDICES

APPENDIX 1

Science and Resource Assessment staff publications 2016/17

Scientific Papers

- Ashworth, E.C., Hall, N.G., Hesp, S.A., Coulson, P.G., and Potter, I.C.** (2017). Age and growth rate variation influence the functional relationship between somatic and otolith size. *Canadian Journal of Fisheries and Aquatic Sciences*. 74: 680–692
- Ashworth, E.C., Hesp, S.A. and Hall, N.G.** (2017) A new proportionality-based back-calculation approach, which employs traditional forms of growth equations, improves estimates of length at age. *Canadian Journal of Fisheries and Aquatic Sciences*. 74: 1088–1099
- Braccini, M.** (2016) Temporal patterns in the size of the main commercial shark species of Western Australia. *Marine and Freshwater Research* <https://doi.org/10.1071/MF16117>
- Braccini, M. & Taylor, S.** (2016) The spatial segregation patterns of sharks from Western Australia. *Royal Society Open Science* 3: 160306.
- Caputi, N., Kangas, M., Denham, A., Feng, M., Pearce, A., Hetzel, Y. & Chandrapavan, A.** (2016) Management adaptation of invertebrate fisheries to an extreme marine heat wave event at a global warming hotspot. *Ecology and Evolution*. doi: 10.1002/ece3.2137 <http://onlinelibrary.wiley.com/doi/10.1002/ece3.2137/full>
- Coulson, P.G., Hall, N.G., and Potter, I.C.** (2017). Variations in biological characteristics of temperate gonochoristic species of Platycephalidae and their implications: A review. *Estuarine, Coastal and Shelf Science*, 190: 50–68.
- Coulson, P.G., Hall, N.G., and Potter, I.C.** (2016). Biological characteristics of three co-occurring species of armorhead from different genera vary markedly from previous results for the Pentacerotidae. *Journal of Fish Biology*, 89: 1393–1418.
- Dias, P.J., Fotedar, S., Munoz, J., Hewitt, M.J., Lukehurst, S., Hourston, M., Wellington, C., Duggan, R., Bridgwood, S., Massam, M., Aitken, V., de Lestang, P., McKirdy, S., Willan, R., Kirkendale, L., Giannetta, J., Corsini-Foka, M., Pothoven, S., Gower, F., Viard, F., Buschbaum, C., Scarcella, G., Strafella, P., Bishop, M.J., Sullivan, T., Buttino, I., Madduppa, H., Huhn, M., Zabin, C.J., Bacela-Spychalska, K., Wójcik-Fudalewska, D., Markert, A., Maximov, A., Kautsky, L., Jaspers, C., Kotta, J., Pärnoja, M., Robledo, D., Tsiamis, K., Küpper, F.C., Žuljević, A., McDonald, J.I. and Snow, M.** (2017) Establishment of a taxonomic and molecular reference collection to support the identification of species regulated by the Western Australia Prevention List for Introduced Marine Pests. *Management of Biological Invasions*, 8(2): 215–225. DOI: 10.3391/mbi.2017.8.2.09
- Fletcher, W.J.** (2016). Changes in fisheries production following large scale expansion of no-take closures within the Great Barrier Reef, Australia: the results, the debate and implications for policies related to food security. In: *Marine Protected Areas: Interactions with Fishery Livelihoods and Food Security. FAO Fisheries and Aquaculture Technical Paper. No. 603.* pp 51-56.
- Gardner, M.J., Chaplin, J.A., Potter, I., Fairclough, D.V. and Jackson, G.** (2017). The genetic structure of a marine teleost, *Chrysophrys auratus*, in a large marine embayment. *Environmental Biology of Fishes* <https://doi.org/10.1007/s10641-017-0652-8>
- Hastings, K. and Ryan, K.L.** (2017). Differences in perception of a newly created Marine Park in south-west Western Australia by boat-based recreational fishers and the broader community. *Marine Policy* 77, 65–77.
- Jaiteh, V., Hordyk, A.R., Braccini, M., Warren, C., & Loneragan, N.R.** (2016) Shark finning in eastern Indonesia: Assessing the sustainability of a data-poor fishery. *ICES Journal of Marine Science* doi:10.1093/icesjms/fsw170
- Lenanton, R.C.J., Dowling, C.E., Smith, K.A., Fairclough, D. and Jackson, G.** (2017). Potential influence of a marine heatwave on range extensions of tropical fishes in the eastern Indian Ocean - invaluable contributions from amateur observers. *Regional Studies in Marine Science* <https://doi.org/10.1016/j.rsma.2017.03.005>
- Lukehurst, S.S., Dias, P.J., Huhn, M., Madduppa, H.H., Lee, S.S.C., Teo, S., Gardner, M.G. and McDonald, J.I.** (2017) Isolation and characterization of 16 polymorphic microsatellite loci for the Asian green mussel *Perna viridis* (Mollusca, Mytilidae). *Management of Biological Invasions*, 8(1):85–88.
- Newman, S.J., Wakefield, C.B., Williams, A.J., O'Malley, J.M., Taylor, B.M., Nicol, S.J., Nichols, R.S., Hesp, S.A., Hall, N.G., Hill, N., Ong, J.J.L., Andrewse, A.H., Wellington, C.M., Harvey, E.S., Mous, P., Oyafusol, Z.S., Pardee, C., Bunce, M., DiBattista, J.D. and Moore, B.R.** (2017) International workshop on advancing methods to overcome challenges associated with

- life history and stock assessments of data-poor deep-water snappers and groupers. *Marine Policy* 79:78-83
- Partridge, G.J., Ginbey, B.M., Woolley, L.D., Fairclough, D.V., Crisafulli, B., Chaplin, J., Prokop, N., Dias, J., Bertram, A. and Jenkins, G.I.** (2017) Development of techniques for the collection and culture of wild-caught fertilised snapper (*Chrysophrys auratus*) eggs for stock enhancement purposes. *Fisheries Research*. Vol 186 p 524-530 Elsevier
- Pitcher, C.R., Ellis, N., Jennings, S., Hiddink, J.G., Mazor, T., Kaiser, M.J., Kangas, M.I., McConnaughey, R.A., Parma, A.M., Rijnsdorp, A.D., Suuronen, P., Collie, J.S., Amoroso, R., Hughes, K.M. and Hilborn, R.** (2017). Estimating the sustainability of towed fishing-gear impacts on seabed habitats: a simple quantitative risk assessment method applicable to data-limited fisheries. *Methods in Ecology and Evolution* 8: 472-480. Doi:10.1111/2041-210X.12705.
- Simpson, T.J.S., Dias, P.J., Snow, M., Muñoz, J. and Berry, T.** (2016) Real-time PCR detection of *Didemnum perlucidum* (Monniot, 1983) and *Didemnum vexillum* (Kott, 2002) in an applied routine marine biosecurity context. *Molecular Ecology Resources*, 17 (3) 443-453
- Simpson, T.S., Smale, D.A., McDonald, J.I. and Wernberg, T.** (2017) Large scale variability in the structure of sessile invertebrate assemblages in artificial habitats reveals the importance of local-scale processes. *Journal of Experimental Marine Biology and Ecology*, 494: 10-19.
- Wakefield, C. B., Potter, I. C., Hall, N. G., Lenanton, R. C. J., and Hesp, S. A.** (2016) Timing of growth zone formations in otoliths of the snapper, *Chrysophrys auratus*, in subtropical and temperate waters differ and growth follows a parabolic relationship with latitude. – *ICES Journal of Marine Science*, doi:10.1093/icesjms/fsw137.
- Wellington, C., Wakefield, C. and White, W.** (2017) First record of *Odontaspis ferox* (Risso, 1810) in the temperate south-eastern Indian Ocean from in situ observations in a deep-water canyon using baited video. *Journal of Applied Ichthyology* 33:133-135
- Harris, D., Johnston, D., Baker, J. and Foster, M.** (2017). Adopting a Citizen Science approach to develop cost-efficient methods that will deliver annual information for managing small-scale recreational fisheries: The Southwest Recreational Crabbing Project. Fisheries Research Report No. 281, Department of Fisheries, Western Australia. 121pp.
- Hart, A., Strain, L., Hesp, A., Fisher, E., Webster, F., Brand-Gardner, S. and Walters, S.** (2017). Marine Stewardship Council Full Assessment Report Western Australian Abalone Managed Fishery. Marine Stewardship Council Series No. 8. Department of Fisheries, Western Australia. 288pp.
- Hobday, A.J., Ling, S.D., Holbrook, N.J., Caputi, N., McDonald Madden, E., McDonald, J. & Munday, P.** (2017). National Climate Change Adaptation Research Plan Marine Biodiversity and Resources: Update 2017. National Climate Change Adaptation Research Facility, Gold Coast, 75 pp. Available at <https://www.nccarf.edu.au/content/narp-marine-biodiversity-resources/>
- Price, E., Melville-Smith, R., King, D., Green, T., Dixon, W., Lambert, S. and Spencer, T.** (2016). Measurement of Fisheries Compliance Outcomes: A Preliminary National Study Project No. 2014/206. Fisheries Research Report No. 275, Department of Fisheries, Western Australia, 113pp.
- Strain, L.W.S., Hesp, S.A., Fabris, F. and Hart, A.M.** (2017). Demographic performance of Brownlip abalone: exploration of wild and cultured harvest potential. FRDC Project No. 2012/016. Fisheries Research Report No. 280, Department of Fisheries, Western Australia, 100pp.
- Stewardson, C., Andrews, J., Ashby, C., Haddon, M., Hartmann, K., Hone, P., Horvat, P., Mayfield, S., Roelofs, A., Sainsbury, K., Saunders, T., Stewart, J., Stobutzki, I. and Wise, B.** (eds) 2016, Status of Australian fish stocks reports 2016, Fisheries Research and Development Corporation, Canberra. Contributors – Braccini, M., de Lestang, S., Fairclough, D., Hart, A., How, J., Jackson, G., Johnston, D., Kangas, M., Lewis, P., Molony, B., Newman, S., Norriss, J., Smith, K., Strain, L., Wakefield, C.

Reports

- Braccini, M., McAuley R. & A. Harry.** (2017) Spatial and temporal dynamics of Western Australia's commercially important sharks. FRDC Project No 2010/003. *Fisheries Research Report No. 282*. Department of Fisheries, Western Australia. 160pp.

Popular Articles

- Caputi, N, Wahle, R. and Moore, J.** 2017 (Ed.) The Lobster Newsletter. 30(1). Department of Fisheries, Western Australia. January 2017
http://www.fish.wa.gov.au/Documents/rock_lobster/the_lobster_newsletter/lobster_newsletter_v30_no1.pdf

APPENDIX 2

The following tables contain data reported for commercial catches, estimated recreational and charter catches, aquaculture production, reported bycatch of protected and listed species from commercial fisheries and fish prices reported from land based processors. The reporting period is dependent on the most recent data available.

Table of catches from commercial fishers' statutory returns for 2015/16

This table contains the estimated live weight¹ of species recorded in the compulsory catch and fishing effort returns provided by commercial fishers each month. These data include the catch taken as by-product as well as the targeted catch.

These catch data may differ slightly from some of the catch estimates presented for specific fisheries as the latter may include additional data from other sources, such as research log books and processors. The figures may also differ slightly from previously reported figures, as additional data may have been received by the Department of Primary Industries and Regional Development. The table represents the latest year for which a complete set of data is available.

While scientific names have been included wherever possible, it should be noted that many fish recorded under a common name cannot be identified as belonging to a particular single species and therefore must be reported as being part of a commercial grouping of several species. For example, the common name 'Redfish' may be used for several species of the genus *Centroberyx*.

Data for species with live weight catches of less than 500 kg have been combined into the general or 'other' category within each class. Data for the Marine Aquarium fish Fishery, Specimen Shell Fishery and Hermit Crab Fishery are presented in the next table. Data for the Indian Ocean Territories Fishery have not been included.

Category	Common Name	Scientific Name	Live Weight (tonnes)
Family Scientific Name			
FISH			
SCALEFISH			
Acropomatidae, Percichthyidae, Serranidae, Polyprionidae, Moronidae, Callanthiidae, Centrogeniidae, Ostracoberycidae	Temperate Basses & Rockcods	<i>Percichthyidae, Serranidae - undifferentiated</i>	59
Ariidae	Forktail Catfishes	<i>Ariidae - undifferentiated</i>	17
	Silver Cobbler	<i>Neoarius midgleyi</i>	112
Arripidae	Australian Herring	<i>Arripis georgianus</i>	81
	Western Australian Salmon	<i>Arripis truttaceus</i>	104
Balistidae, Monacanthidae	Triggerfishes & Leatherjackets	<i>Balistidae, Monacanthidae - undifferentiated</i>	23
Berycidae	Bight Redfish	<i>Centroberyx gerrardi</i>	55
	Redfishes	<i>Berycidae - undifferentiated</i>	7
	Yelloweye Redfish	<i>Centroberyx australis</i>	3
Caesionidae, Lutjanidae, Symphysanodontidae	Fusiliers, Tropical Snappers & Slopefishes	<i>Caesionidae, Lutjanidae, Symphysanodontidae - undifferentiated</i>	2
Carangidae	Amberjack	<i>Seriola dumerili</i>	17
	Golden Trevally	<i>Gnathanodon speciosus</i>	5
	Samsonfish	<i>Seriola hippos</i>	29
	Silver Trevallies	<i>Pseudocaranx georgianus, Pseudocaranx sp. "dentex" & Pseudocaranx wrighti</i>	2

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Category Family Scientific Name	Common Name	Scientific Name	Live Weight (tonnes)
	Trevallies	<i>Carangidae - undifferentiated</i>	167
	Yellowtail Kingfish	<i>Seriola lalandi</i>	1
	Yellowtail Scad	<i>Trachurus novaezelandiae</i>	23
Centrolophidae	Blue-Eye Trevalla	<i>Hyperoglyphe antarctica</i>	5
Cheilodactylidae	Blue Morwong	<i>Nemadactylus valenciennesi</i>	39
Clupeidae	Australian Sardine	<i>Sardinops sagax</i>	2,161
	Perth Herring	<i>Nematalosa vlaminghi</i>	2
	Sandy Sprat	<i>Hyperlophus vittatus</i>	34
	Scaly Mackerel	<i>Sardinella lemuru</i>	1,242
Flat Fishes (multi-family groups)	Flounders	<i>Bothidae, Psettodidae & Pleuronectidae</i>	7
Glucosomatidae	Northern Pearl Perch	<i>Glucosoma buergeri</i>	27
	West Australian Dhufish	<i>Glucosoma hebraicum</i>	46
Haemulidae	Grunter Breems	<i>Haemulidae - undifferentiated</i>	45
	Javelinfishes	<i>Pomadasyd spp.</i>	31
	Painted Sweetlips	<i>Diagramma labiosum</i>	53
Hemiramphidae	Southern Garfish	<i>Hyporhamphus melanochir</i>	10
Labridae	Baldchin Groper	<i>Choerodon rubescens</i>	9
	Pigfishes	<i>Bodianus spp.</i>	2
	Tuskfishes	<i>Choerodon spp.</i>	9
	Western Blue Groper	<i>Achoerodus gouldii</i>	43
	Wrasses	<i>Labridae - undifferentiated</i>	1
Latidae	Barramundi	<i>Lates calcarifer</i>	51
Lethrinidae	Bluespotted Emperor	<i>Lethrinus punctulatus</i>	305
	Drab Emperor	<i>Lethrinus ravus</i>	3
	Grass Emperor	<i>Lethrinus laticaudis</i>	4
	Longnose Emperor	<i>Lethrinus olivaceus</i>	15
	Mozambique Seabream	<i>Wattsia mossambica</i>	6
	Redspot Emperor	<i>Lethrinus lentjan</i>	25
	Redthroat Emperor	<i>Lethrinus miniatus</i>	51
	Robinson's Seabream	<i>Gymnocranius grandoculis</i>	30
	Spangled Emperor	<i>Lethrinus nebulosus</i>	83
	Yellowtail Emperor	<i>Lethrinus atkinsoni</i>	8
Lutjanidae	Brownstripe Snapper	<i>Lutjanus vitta</i>	92
	Chinamanfish	<i>Symphorus nematophorus</i>	7
	Crimson Snapper	<i>Lutjanus erythropterus</i>	230
	Darktail Snapper	<i>Lutjanus lemniscatus</i>	13
	Goldband Snapper	<i>Pristipomoides multidens</i>	627
	Golden Snapper	<i>Lutjanus johnii</i>	1
	Indonesian Snapper	<i>Lutjanus bitaeniatus</i>	6
	Mangrove Jack	<i>Lutjanus argentimaculatus</i>	13
	Moses' Snapper	<i>Lutjanus russellii</i>	49
	Red Emperor	<i>Lutjanus sebae</i>	281
	Rosy Snapper	<i>Pristipomoides filamentosus</i>	12
	Ruby Snapper	<i>Etelis carbunculus</i>	23
	Saddletail Snapper	<i>Lutjanus malabaricus</i>	188
	Sharptooth Snapper	<i>Pristipomoides typus</i>	20

Category	Common Name	Scientific Name	Live Weight (tonnes)
Family Scientific Name			
	Stripey Snapper	<i>Lutjanus carponotatus</i>	1
	Tropical Snappers	<i>Lutjanus spp.</i>	50
Mugilidae	Sea Mullet	<i>Mugil cephalus</i>	218
	Yelloweye Mullet	<i>Aldrichetta forsteri</i>	9
Mullidae	Goatfishes	<i>Mullidae - undifferentiated</i>	24
Nemipteridae	Rainbow Monocle Bream	<i>Scolopsis monogramma</i>	10
	Threadfin Breams	<i>Nemipteridae - undifferentiated</i>	119
Oplegnathidae	Knifefjaw	<i>Oplegnathus woodwardi</i>	1
Pentacerotidae	Boarfishes	<i>Pentacerotidae - undifferentiated</i>	5
Platycephalidae	Flatheads	<i>Platycephalidae - undifferentiated</i>	23
Plotosidae	Estuary Cobbler	<i>Cnidoglanis macrocephalus</i>	70
Polynemidae	King Threadfin	<i>Polydactylus macrochir</i>	20
	Threadfin Salmons	<i>Polynemidae - undifferentiated</i>	1
Polyprionidae	Bass Groper	<i>Polyprion americanus</i>	2
	Hapuku	<i>Polyprion oxygeneios</i>	30
Pomatomidae	Tailor	<i>Pomatomus saltatrix</i>	18
Priacanthidae	Bigeyes	<i>Priacanthidae - undifferentiated</i>	53
Rachycentridae	Cobia	<i>Rachycentron canadum</i>	14
Scaridae	Parrotfishes	<i>Scaridae - undifferentiated</i>	5
Sciaenidae	Black Jewfish	<i>Protonibea diacanthus</i>	2
	Mulloway	<i>Argyrosomus japonicas</i>	25
Scombridae	Australian Bonito	<i>Sarda australia</i>	8
	Blue Mackerel	<i>Scomber australasicus</i>	1
	Grey Mackerel	<i>Scomberomorus semifasciatus</i>	8
	Spanish Mackerel	<i>Scomberomorus commerson</i>	311
Scorpididae	Sea Sweep	<i>Scorpis aequipinnis</i>	1
Serranidae	Banded Grouper	<i>Epinephelus amblycephalus</i>	6
	Barcheek Coral Trout	<i>Plectropomus maculatus</i>	20
	Birdwire Rockcod	<i>Epinephelus merra</i>	1
	Blackspotted Rockcod	<i>Epinephelus malabaricus</i>	21
	Breaksea Cod	<i>Epinephelides armatus</i>	5
	Chinaman Rockcod	<i>Epinephelus rivulatus</i>	1
	Common Coral Trout	<i>Plectropomus leopardus</i>	2
	Duskytail Grouper	<i>Epinephelus bleekeri</i>	19
	Eightbar Grouper	<i>Hyporthodus octofasciatus</i>	14
	Goldspotted Rockcod	<i>Epinephelus coioides</i>	39
	Radiant Rockcod	<i>Epinephelus radiatus</i>	1
	Rankin Cod	<i>Epinephelus multinotatus</i>	169
	Spotted Cod	<i>Epinephelus Microdon/Areolatus/Bilobatus</i>	67
	Tomato Rockcod	<i>Cephalopholis sonnerati</i>	2
	Yellowspotted Rockcod	<i>Epinephelus areolatus</i>	1
Sillaginidae	King George Whiting	<i>Sillaginodes punctata</i>	20
	Whitings	<i>Sillaginidae - undifferentiated</i>	91
	Yellowfin Whiting	<i>Sillago schomburgkii</i>	68
Sparidae	Black Bream	<i>Acanthopagrus butcheri</i>	44
	Frypan Bream	<i>Argyrops spinifer</i>	40

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Category Family Scientific Name	Common Name	Scientific Name	Live Weight (tonnes)
	Pink Snapper	<i>Chrysophrys auratus</i>	279
	Tarwhine	<i>Rhabdosargus sarba</i>	9
	Western Yellowfin Bream	<i>Acanthopagrus morrisoni</i>	17
Sphyraenidae	Pikes	<i>Sphyraenidae - undifferentiated</i>	8
	Snook	<i>Sphyraena novaehollandiae</i>	5
Terapontidae	Striped Grunters	<i>Terapontidae - undifferentiated</i>	2
TOTAL SCALEFISH			8,596
SHARKS & RAYS			
Carcharhinidae	Bronze Whaler	<i>Carcharhinus brachyurus</i>	57
	Dusky Whaler	<i>Carcharhinus obscurus</i>	162
	Sandbar Shark	<i>Carcharhinus plumbeus</i>	42
	Spinner Shark	<i>Carcharhinus brevipinna</i>	48
	Tiger Shark	<i>Galeocerdo cuvier</i>	4
Lamnidae	Shortfin Mako	<i>Isurus oxyrinchus</i>	3
Orectolobidae	Wobbegong	<i>Orectolobidae - undifferentiated</i>	29
Pristiophoridae	Common Sawshark	<i>Pristiophorus cirratus</i>	6
Rajidae	Skates	<i>Rajidae, Arhynchobatidae - undifferentiated</i>	16
Rhinobatidae	Guitarfishes	<i>Rhinobatidae - undifferentiated</i>	1
Sphyrnidae	Hammerhead Sharks	<i>Sphyrnidae - undifferentiated</i>	48
Triakidae	Gummy Shark	<i>Mustelus antarcticus</i>	419
	Pencil Shark	<i>Hypogaleus hyugaensis</i>	1
	Whiskery Shark	<i>Furgaleus macki</i>	143
	Other Sharks	<i>Sharks - undifferentiated</i>	8
TOTAL SHARKS & RAYS			987
OTHER FISH	Other Fish		137
TOTAL FISH			9,720
INVERTEBRATES			
CRABS			
Geryonidae	Crystal Crab	<i>Chaceon bicolor</i>	161
Hypothalassiidae	Champagne Crab	<i>Hypothalassia spp.</i>	3
Menippidae	Giant Crab	<i>Pseudocarcinus gigas</i>	7
Portunidae	Blue Swimmer Crab	<i>Portunus armatus</i>	494
TOTAL CRABS			665
LOBSTERS			
Palinuridae	Southern Rock Lobster	<i>Jasus edwardsii</i>	38
	Western Rock Lobster	<i>Panulirus cygnus</i>	5,674
Scyllaridae	Bug	<i>Ibacus & Thenus spp.</i>	13
TOTAL LOBSTERS			5,725

Category	Common Name	Scientific Name	Live Weight (tonnes)
MOLLUSCS			
Cephalopoda	Squid	<i>Order Teuthoidea - undifferentiated</i>	35
Haliotidae	Brownlip Abalone	<i>Haliotis rubra conicopora</i>	22
	Greenlip Abalone	<i>Haliotis laevigata</i>	99
	Roe's Abalone	<i>Haliotis roei</i>	46
Octopodidae	Octopuses	<i>Octopodidae - undifferentiated</i>	270
Sepiidae	Cuttlefish	<i>Sepia spp.</i>	59
Veneridae	Ballot's Saucer Scallop	<i>Amusium balloti</i>	601
TOTAL MOLLUSCS			1,132
PRAWNS			
Penaeidae	Banana Prawn	<i>Penaeus merguensis</i>	166
	Blue Endeavour Prawn	<i>Metapenaeus endeavouri</i>	345
	Brown Tiger Prawn	<i>Penaeus esculentus</i>	1,071
	Velvet Prawn	<i>Metapenaeopsis spp.</i>	131
	Western King Prawn	<i>Melicertus latisulcatus</i>	1,496
Stomatopoda	Mantis Shrimps	<i>Order Stomatopoda - undifferentiated</i>	17
TOTAL PRAWNS			3,226
OTHER INVERTEBRATES	Other Invertebrates		46
TOTAL INVERTEBRATES			10,794
GRAND TOTAL			20,514

Live weight: refers to the landings converted to a live weight basis. This is often referred to as the 'live weight equivalent of the landings', shortened to the 'live weight'. Although live weight may be the preferred unit it is rarely obtained as a direct measure. Live weight has to be derived and this is usually done by applying a conversion factor to the landed weight. *Landed weight*: refers to the mass (or weight) of a product at the time of landing, regardless of the state in which it is landed. That is, the fish may be whole, gutted or filleted etc. This unit is of limited use for further analysis except where it is known that the product is very homogenous in nature. Where more detailed analysis of the data is required the landed weight is generally converted to a more meaningful measure, the most frequently used being termed live or whole weight or 'nominal catch'.

- Weight figures are round off to the nearest tonnage.
- Common names are from the CAAB – Codes for Australian Biota database.

More information may be obtained from the 'CWP Handbook of Fishery Statistical Standards' at the website <http://www.fao.org/fishery/cwp/handbook/B/en>.

Table of catches from marine aquarium fish, specimen shell and hermit crab commercial fishers' statutory returns for 2015/16

Common Name	Quantity (numbers)	Weight (kg)	Volume (litres)
MARINE AQUARIUM FISH FISHERY			
Fish	18,293		
Syngnathidae (not included in Fish)	257		
Invertebrates (not including Corals)	45,845		
Hard Coral		4,802.17	
Soft Coral ¹		6,471.00	
Living Rock & Living Sand		13,139.00	
Sponges	4,104		
Algae/Seagrasses			197
SPECIMEN SHELL FISHERY			
Specimen Shells - Mollusca	9,806		
HERMIT CRAB FISHERY			
Land Hermit Crabs only - <i>Coenobita variabilis</i>	92,982		

¹ The 'Soft coral' category for the Marine Aquarium Fish Fishery includes 5,154 kg of coral like anemone groups such as corallimorphs and zoanthids in the Class Anthozoa. These are harvested under an invertebrate Ministerial Exemption and are not part of the annual coral TAC.

Table of catches from boat-based recreational fishers and charter returns for 2015/16

This table contains the estimated number¹ and weight² of species retained in the state-wide survey of boat-based recreational fishers and charter returns for 2015/16 (1 September 2015 – 31 August 2016). These estimates include catch from targeted and non-targeted recreational fishing. Estimates are reported at species level where adequate sample size and precision were

obtained, otherwise species were grouped to general or 'other' categories within each class. Uncertainty around estimates from the state-wide survey is not included in this table (refer to Ryan *et al.* 2017 for this information). Estimates of shore-based recreational catches are not available. The table represents the latest year for which a complete set of data is available.

Category Family	Common Name	Scientific Name	Est Kept Catch (number)	Est Kept Catch (tonnes)	Charter Kept Catch (number)	Charter Est Kept Catch (tonnes)
FISH						
SCALEFISH						
Acropomatidae, Percichthyidae, Serranidae, Polyprionidae, Moronidae, Callanthiidae, Centrogeniidae, Ostracoberycidae	Temperate Basses & Rockcods	Percichthyidae, Serranidae - undifferentiated	3,991	N/A	1,375	N/A
Apistidae, Neosebastidae, Pteroidae, Scorpaenidae, Sebastidae, Setarchidae, Synanceiidae, Tetrarogidae	Scorpionfishes	Apistidae, Neosebastidae, Pteroidae, Scorpaenidae, Sebastidae, Setarchidae, Synanceiidae & Tetrarogidae - undifferentiated	id	id	93	N/A
Ariidae	Forktail Catfishes	Ariidae - undifferentiated	130	N/A	78	N/A
Arripidae	Australian Herring	<i>Arripis georgianus</i>	104,468	19	32	Neg
	Western Australian Salmon	<i>Arripis truttaceus</i>	4,568	18	41	< 0.5
Aulopidae	Sergeant Baker	<i>Latropiscis purpurissatus</i>	2,784	3	171	< 0.5
Berycidae	Bight Redfish	<i>Centroberyx gerrardi</i>	11,592	15	3,910	5
	Swallowtail	<i>Centroberyx lineatus</i>	2,402	2	1,042	< 1
Caesionidae, Lutjanidae, Symphysanodontidae	Fusiliers, Tropical Snappers & Slopefishes	Caesionidae, Lutjanidae, Symphysanodontidae - undifferentiated	id	id	389	N/A
Carangidae	Amberjack	<i>Seriola dumerili</i>	id	id	38	< 0.5
	Golden Trevally	<i>Gnathanodon speciosus</i>	1,205	6	167	< 1
	Queenfish	<i>Scomberoides spp.</i>	202	N/A	201	N/A
	Samsonfish	<i>Seriola hippos</i>	1,962	15	425	3
	Silver Trevally	<i>Pseudocaranx georgianus</i>	32,776	29	1,172	1

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Category Family	Common Name	Scientific Name	Est Kept Catch (number)	Est Kept Catch (tonnes)	Charter Kept Catch (number)	Charter Est Kept Catch (tonnes)
	Trevallies	Carangidae - undifferentiated	3,955	N/A	679	N/A
	Yellowtail Kingfish	<i>Seriola lalandi</i>	1,167	7	101	< 1
Cheilodactylidae	Blue Morwong	<i>Nemadactylus valenciennesi</i>	5,308	17	773	2
Clupeidae & Pristigasteridae	Herrings & Ilishas	Clupeidae, Pristigasteridae - undifferentiated	id	id	220	N/A
Glaucosomatidae	Northern Pearl Perch	<i>Glaucosoma buergeri</i>	681	1	767	2
	West Australian Dhufish	<i>Glaucosoma hebraicum</i>	23,818	137	2,650	15
Haemulidae	Grunter Breems	Haemulidae - undifferentiated	id	id	76	< 0.5
	Painted Sweetlips	<i>Diagramma labiosum</i>	733	2	322	1
Hemiramphidae	Garfishes	Hemiramphidae - undifferentiated	id	id	140	Neg
Labridae	Baldchin Groper	<i>Choerodon rubescens</i>	16,612	52	4,314	13
	Blackspot Tuskfish	<i>Choerodon schoenleinii</i>	1,584	5	202	< 1
	Blue Tuskfish	<i>Choerodon cyanodus</i>	1,563	5	0	N/A
	Brownspotted Wrasse	<i>Notolabrus parilus</i>	4,431	3	8	Neg
	Foxfish	<i>Bodianus frenchii</i>	1,777	2	395	< 0.5
	Western King Wrasse	<i>Coris auricularis</i>	6,317	3	63	Neg
	Wrasses	Labridae - undifferentiated	2,860	N/A	391	N/A
Latidae	Barramundi	<i>Lates calcarifer</i>	1,425	6	700	3
Lethrinidae	Bluespotted Emperor	<i>Lethrinus punctulatus</i>	id	id	842	< 0.5
	Emperors	Lethrinidae - undifferentiated	id	id	159	< 0.5
	Grass Emperor	<i>Lethrinus laticaudis</i>	9,659	12	3,794	5
	Longnose Emperor	<i>Lethrinus olivaceus</i>	id	id	968	N/A
	Redthroat Emperor	<i>Lethrinus miniatus</i>	5,412	6	4,585	5
	Robinson's Seabream	<i>Gymnocranius grandoculis</i>	id	id	722	2
	Spangled Emperor	<i>Lethrinus nebulosus</i>	8,310	20	3,641	9
Lutjanidae	Chinamanfish	<i>Symphorus nematophorus</i>	id	id	379	2
	Crimson Snapper	<i>Lutjanus erythropterus</i>	1,065	2	968	2
	Goldband Snapper	<i>Pristipomoides multidens</i>	3,716	15	2,205	9
	Golden Snapper	<i>Lutjanus johnii</i>	2,133	3	3,314	5
	Mangrove Jack	<i>Lutjanus argentimaculatus</i>	2,336	2	1,324	1

Category Family	Common Name	Scientific Name	Est Kept Catch (number)	Est Kept Catch (tonnes)	Charter Kept Catch (number)	Charter Est Kept Catch (tonnes)
	Moses' Snapper	<i>Lutjanus russellii</i>	id	id	296	N/A
	Red Emperor	<i>Lutjanus sebae</i>	5,831	21	2,304	8
	Rosy Snapper	<i>Pristipomoides filamentosus</i>	id	id	1,210	2
	Ruby Snapper	<i>Etelis carbunculus</i>	id	id	24	< 0.5
	Saddletail Snapper	<i>Lutjanus malabaricus</i>	id	id	1,491	3
	Sharptooth Snapper	<i>Pristipomoides typus</i>	id	id	672	1
	Stripey Snapper	<i>Lutjanus carponotatus</i>	4,965	4	1,284	1
Mullidae	Goatfishes	Mullidae - undifferentiated	id	id	177	N/A
Nemipteridae	Threadfin Breams	Nemipteridae - undifferentiated	id	id	8	N/A
	Western Butterfish	<i>Pentapodus vitta</i>	6,660	3	0	N/A
Platycephalidae	Flatheads	Platycephalidae - undifferentiated	6,333	N/A	166	N/A
Polynemidae	Threadfin Salmons	Polynemidae - undifferentiated	3,562	13	869	N/A
Pomatomidae	Tailor	<i>Pomatomus saltatrix</i>	8,215	6	16	Neg
Rachycentridae	Cobia	<i>Rachycentron canadum</i>	1,644	11	500	3
Scaridae	Parrotfishes	Scaridae - undifferentiated	id	id	7	N/A
Sciaenidae	Black Jewfish	<i>Protonibea diacanthus</i>	id	id	62	< 0.5
	Mulloway	<i>Argyrosomus japonicas</i>	709	3	552	2
Scombridae	Bonitos	<i>Sarda australis</i> & <i>Cybiosarda elegans</i>	id	id	17	N/A
	Longtail Tuna	<i>Thunnus tonggol</i>	id	id	128	< 1
	Mackerel Tuna	<i>Euthynnus affinis</i>	583	3	59	< 0.5
	Mackerels	Scombridae - undifferentiated	1,749	N/A	289	N/A
	School Mackerel	<i>Scomberomorus queenslandicus</i>	1,853	4	163	< 0.5
	Shark Mackerel	<i>Grammatorcynus bicarinatus</i>	470	4	24	< 0.5
	Southern Bluefin Tuna	<i>Thunnus maccoyii</i>	2,009	9	65	< 0.5
	Spanish Mackerel	<i>Scomberomorus commerson</i>	4,788	44	1,614	15
	Spotted Mackerel	<i>Scomberomorus munroi</i>	id	id	100	< 0.5
	Yellowfin Tuna	<i>Thunnus albacares</i>	442	4	162	2
Scorpididae	Sea Sweep	<i>Scorpis aequipinnis</i>	2,069	3	484	< 1
	Sweep	Scorpididae - undifferentiated	803	< 1	74	N/A
Serranidae	Breaksea Cod	<i>Epinephelides armatus</i>	16,963	22	3,236	4
	Chinaman Rockcod	<i>Epinephelus rivulatus</i>	6,092	4	647	< 0.5

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Category Family	Common Name	Scientific Name	Est Kept Catch (number)	Est Kept Catch (tonnes)	Charter Kept Catch (number)	Charter Est Kept Catch (tonnes)
	Coral Trout	<i>Plectropomus maculatus</i> & <i>P leopardus</i>	4,827	13	2,063	6
	Goldspotted Rockcod	<i>Epinephelus coioides</i>	2,697	13	323	2
	Harlequin Fish	<i>Othos dentex</i>	2,246	5	126	< 0.5
	Rankin Cod	<i>Epinephelus multinotatus</i>	4,479	18	3,351	13
Sillaginidae	King George Whiting	<i>Sillaginodes punctata</i>	35,820	25	342	< 0.5
	School Whiting	<i>Sillago bassensis, vittata and schomburgkii</i>	173,989	22	0	N/A
	Whitings	Sillaginidae - undifferentiated	752	N/A	512	Neg
Sparidae	Black Bream	<i>Acanthopagrus butcheri</i>	15,979	9	id	id
	Breams	Sparidae - undifferentiated	152	N/A	311	N/A
	Pink Snapper	<i>Chrysophrys auratus</i>	28,030	67	10,715	26
	Tarwhine	<i>Rhabdosargus sarba</i>	1,624	1	35	Neg
	Western Yellowfin Bream	<i>Acanthopagrus morrisoni</i>	id	id	4	Neg
Sphyraenidae	Pikes	Sphyraenidae - undifferentiated	1,117	N/A	5	N/A
	Snook	<i>Sphyraena novaehollandiae</i>	1,820	2	17	Neg
SHARKS & RAYS						
Carcharhinidae, Hemigaleidae	Whaler & Weasel Sharks	Carcharhinidae, Hemigaleidae - undifferentiated	900	N/A	164	N/A
	Sharks	Sharks - undifferentiated	1,278	N/A	94	N/A
INVERTEBRATES						
CRABS						
Portunidae	Blue Swimmer Crab	<i>Portunus armatus</i>	197,050	46	0	N/A
	Mud Crab	<i>Scylla spp.</i>	4,876	4	1,278	N/A
LOBSTERS						
Palinuridae	Tropical Rock Lobster	<i>Panulirus spp. except P. cygnus</i>	Id	Id	20	N/A
	Western Rock Lobster	<i>Panulirus cygnus</i>	250,337	156	2,912	2
MOLLUSCS						
Cephalopoda	Squid	Order Teuthoidea - undifferentiated	62,173	N/A	122	N/A

Category Family	Common Name	Scientific Name	Est Kept Catch (number)	Est Kept Catch (tonnes)	Charter Kept Catch (number)	Charter Est Kept Catch (tonnes)
Octopodidae	Octopuses	Octopodidae - undifferentiated	1,159	N/A	id	id
Sepiidae	Cuttlefish	<i>Sepia spp.</i>	1,963	N/A	20	N/A

Kept catch (number): refers to the estimated number of retained fish in the state-wide survey of boat-based recreational fishing (Ryan *et al*, 2017), or reported number of retained fish in the Tour Operator Returns (Charter Logbooks). "id" indicates insufficient data where relative standard error > 40% (i.e. standard error > 40% of estimate) and < 30 diarists recorded catches of the species for the state-wide survey, or <3 licensees for the Tour Operator Returns.

Kept catch (tonnes): refers to the kept catch (number) converted to a weight from estimates of average weight based on state-wide biological surveys or the Tour Operator Returns. Weight estimates are round off to the nearest tonnage. N/A indicates estimate of average weight is unavailable. "Neg" indicates negligible catch (< 0.1 tonnes).

3. Common names are from the CAAB – Codes for Australian Biota database.

Table of growout production for the Western Australian aquaculture industry in 2015/16

This table contains the data collected on quarterly production returns received from all Western Australian aquaculture licence holders.

Some species produced in Western Australian aquaculture have been grouped together and reported under 'Other' as they are produced by less than three

contributing licences, so making the data confidential. Species in this category produced in the last ten years include artemia, abalone, black bream, Mahi mahi, live rock, mullet, Murray cod, pink snapper, prawns, rotifers, western rock oysters and yellowtail kingfish.

Common name	Productive licences	Quantity	Units*	Average price/ kg or individual	Value
Barramundi	5	422	Tonnes	\$11.14	\$4,697,015
Marron	190	51	Tonnes	\$31.64	\$1,608,565
Mussels	3	198	Tonnes	\$4.02	\$796,325
Yabbies	8	11	Tonnes	\$28.57	\$326,731
Silver Perch	10	25	Tonnes	\$21.35	\$525,136
Goldfish & Koi carp	4	83,383	No.	n/a	\$188,928
Ornamental Invertebrates	10	11,177	No.	n/a	\$112,127
Ornamental Fish	6	17,441	No.	n/a	\$80,581
Rainbow Trout	5	8	Tonnes	\$8.74	\$73,918
Other Species**	< 3	87	Tonnes	n/a	\$2,435,798
Algae	< 3	**			**
Total (not including algae or pearls)					\$10,845,124

* Tonnes refer to whole weight.

** Industry figures have not been included to protect the confidentiality of individual producers, as there are less than three productive licensees.

Table of reported bycatch of protected and listed species from commercial fisheries for 2016

This table contains the numbers of accidental captures of protected and listed animals by commercial fishers, as reported in statutory fishing returns and Catch Disposal Records, during calendar year 2016¹. To the extent possible, other types of recorded interactions with protected and listed species² have been excluded. For the purpose of this report, protected and listed species (or taxa) are defined as those listed as: Totally Protected Fish³ under the WA Fish Resources Management Act 1994 (FRMA); Specially Protected

Fauna under the WA Wildlife Conservation Act 1950 (WCA) and Threatened species and cetaceans that are listed under the Australian Environment Protection and Biodiversity Conservation Act 1999 (EPBC). These data do not include interactions with species that may be afforded other forms of general protection or conditions under these (or other) Acts, international agreements or conventions⁴. As other reports may include records that do not meet these definitions, these data may differ from other accounts.

Class	Common Name	Scientific Name	Release Condition		
			ALIVE (number)	DEAD (number)	UNKNOWN (number)
Birds	Shearwater (unspecified)		374	48	-
Fishes	Devilray (unspecified)	Family Mobulidae	6	-	-
	Sawfish (unspecified)	Family Pristidae	19	1	24
	Green Sawfish	<i>Pristis zijsron</i>	41	10	-
	Narrow Sawfish	<i>Anoxypristis cuspidata</i>	10	2	-
	White Shark	<i>Carcharodon carcharias</i>	13	2	-
	Grey Nurse Shark	<i>Carcharias taurus</i>	13	11	-
	Seahorses, Seadragons & Pipefish	Family Syngnathidae	287	43	16
	Reptiles	Crocodile (unspecified)	<i>Crocodylus</i> spp.	18	1
	Freshwater Crocodile	<i>Crocodylus johnstoni</i>	3	1	-
	Sea Snake (unspecified)	Family Hydrophiidae or Laticaudidae	6,180	888	11
	Turtle (unspecified)		8	2	65
	Green Turtle	<i>Chelonia mydas</i>	6	1	17
	Loggerhead Turtle	<i>Caretta caretta</i>	-	-	14
Mammals	Dolphin (unspecified)	Family Delphinidae	3	28	1
	Australian humpbacked dolphin	<i>Sousa sahulensis</i>	-	2	-
	Total all species		6,981	1,040	148

1. Reports by other sources (eg. members of public and Government officials) of whale entanglements in fishing gear, dead seabirds that have washed ashore, etc. are usually not attributable to particular fishers, fisheries, dates or locations. Although these ancillary interaction records are reported in Annual Reports to Parliament and elsewhere, they are inconsistent with the more-detailed information from statutory fishing records and are therefore not included here.
2. e.g. shark sightings by abalone divers, dugong interactions with trap fisheries, etc.
3. Except those listed as Totally Protected Fish in reference to their sex, size, weight, reproductive cycle, area from which they are taken or specific period of time.
4. For example, unless listed under Schedule 5 of the WCA or as Threatened species under EPBC, these include: listed migratory and marine species under the EPBC Act and international agreements: the Convention on the Conservation of Migratory Species of Wild Animals 1979 (CMS; Bonn Convention); the Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment, 1974; the Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment, 1986; the Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds, 2007; the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES); for which special conditions may also apply.

Table of Fish Prices for 2015/16

This table contains the average price per kilogram paid for each marine species caught in Western Australia in 2015/16. The prices are based on prices reported by WA land based processors; the average prices reported are weighted and are based on whole weight. Where prices aren't available for a financial year a default

price, based on the average of prices reported in previous years, is used. The prices have been adjusted to reflect the beach price paid. That is, the beach price is the price paid per kilogram to commercial fishers for their catch when they first land and excludes any marketing, transport or handling costs.

Category Family	Common Name	Scientific Name	Price per Kilogram
FISH			
SCALEFISH			
Acanthuridae, Zanclidae	Surgeonfishes & Moorish Idols	<i>Acanthuridae, Zanclidae - undifferentiated</i>	\$4.49
Acropomatidae, Percichthyidae, Serranidae, Polyprionidae, Moronidae, Callanthiidae, Centrogeniidae, Ostracoberycidae	Temperate Basses & Rockcods	<i>Percichthyidae, Serranidae - undifferentiated</i>	\$6.81
Apistidae, Neosebastidae, Pteroidae, Scorpaenidae, Sebastidae, Setarchidae, Synanceiidae, Tetrarogidae	Scorpionfishes	<i>Apistidae, Neosebastidae, Pteroidae, Scorpaenidae, Sebastidae, Setarchidae, Synanceiidae & Tetrarogidae - undifferentiated</i>	\$10.32
Ariidae	Forktail Catfishes	<i>Ariidae - undifferentiated</i>	\$2.35
	Silver Cobbler	<i>Neoarius midgleyi</i>	\$4.46
Arripidae	Australian Herring	<i>Arripis georgianus</i>	\$2.44
	Western Australian Salmon	<i>Arripis truttaceus</i>	\$0.91
Balistidae, Monacanthidae	Triggerfishes & Leatherjackets	<i>Balistidae, Monacanthidae - undifferentiated</i>	\$3.94
Belonidae	Longtoms	<i>Belonidae - undifferentiated</i>	\$4.49
Berycidae	Bight Redfish	<i>Centroberyx gerrardi</i>	\$6.20
	Redfishes	<i>Berycidae - undifferentiated</i>	\$7.55
	Swallowtail	<i>Centroberyx lineatus</i>	\$3.40
	Yelloweye Redfish	<i>Centroberyx australis</i>	\$4.25
Caesionidae, Lutjanidae, Symphysanodontidae	Fusiliers, Tropical Snappers & Slopefishes	<i>Caesionidae, Lutjanidae, Symphysanodontidae - undifferentiated</i>	\$3.80
Carangidae	Amberjack	<i>Seriola dumerili</i>	\$1.82
	Black Pomfret	<i>Parastromateus niger</i>	\$8.79
	Bludger Trevally	<i>Carangoides gymnostethus</i>	\$3.37
	Common Dart	<i>Trachinotus botla</i>	\$4.49
	Giant Queenfish	<i>Scomberoides commersonianus</i>	\$8.07
	Golden Trevally	<i>Gnathanodon speciosus</i>	\$2.79
	Samsonfish	<i>Seriola hippos</i>	\$2.82
	Silver Trevallies	<i>Pseudocaranx georgianus, Pseudocaranx sp. "dentex" & Pseudocaranx wrighti</i>	\$2.78
	Trevallies	<i>Carangidae - undifferentiated</i>	\$3.37

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Category Family	Common Name	Scientific Name	Price per Kilogram
	Turrum	<i>Carangoides fulvoguttatus</i>	\$1.49
	Yellowtail Kingfish	<i>Seriola lalandi</i>	\$3.96
	Yellowtail Scad	<i>Trachurus novaezelandiae</i>	\$0.71
Centrolophidae	Blue-Eye Trevalla	<i>Hyperoglyphe antarctica</i>	\$7.73
Cheilodactylidae	Blue Morwong	<i>Nemadactylus valenciennesi</i>	\$3.82
	Morwongs	<i>Cheilodactylidae - undifferentiated</i>	\$1.02
Clupeidae	Australian Sardine	<i>Sardinops sagax</i>	\$0.93
	Blue Sprat	<i>Spratelloides robustus</i>	\$5.95
	Perth Herring	<i>Nematalosa vlaminghi</i>	\$2.98
	Sandy Sprat	<i>Hyperlophus vittatus</i>	\$2.76
	Scaly Mackerel	<i>Sardinella lemuru</i>	\$1.05
Coryphaenidae	Mahi Mahi	<i>Coryphaena hippurus</i>	\$4.64
Elopidae	Hawaiian Giant Herring	<i>Elops hawaiiensis</i>	\$4.49
Engraulidae	Australian Anchovy	<i>Engraulis australis</i>	\$0.54
Fishes (multi-family groups)	Flounders	<i>Bothidae, Psettodidae & Pleuronectidae</i>	\$13.43
Gempylidae	Gemfish	<i>Rexea solandri</i>	\$3.30
Gerreidae	Common Silverbidy	<i>Gerres subfasciatus</i>	\$4.49
Glaucosomatidae	Northern Pearl Perch	<i>Glaucosoma buergeri</i>	\$6.82
	West Australian Dhufish	<i>Glaucosoma hebraicum</i>	\$14.84
Haemulidae	Grunter Breams	<i>Haemulidae - undifferentiated</i>	\$4.88
	Javelinfishes	<i>Pomadasys spp.</i>	\$4.13
	Painted Sweetlips	<i>Diagramma labiosum</i>	\$4.88
Hemiramphidae	Southern Garfish	<i>Hyporhamphus melanochir</i>	\$7.85
Labridae	Baldchin Groper	<i>Choerodon rubescens</i>	\$12.20
	Pigfishes	<i>Bodianus spp.</i>	\$6.82
	Tuskfishes	<i>Choerodon spp.</i>	\$7.10
	Western Blue Groper	<i>Achoerodus gouldii</i>	\$4.84
	Wrasses	<i>Labridae - undifferentiated</i>	\$5.52
Latidae	Barramundi	<i>Lates calcarifer</i>	\$8.64
Lethrinidae	Bluespotted Emperor	<i>Lethrinus punctulatus</i>	\$4.16
	Drab Emperor	<i>Lethrinus ravus</i>	\$4.49
	Emperors	<i>Lethrinidae - undifferentiated</i>	\$4.49
	Grass Emperor	<i>Lethrinus laticaudis</i>	\$6.66
	Longnose Emperor	<i>Lethrinus olivaceus</i>	\$5.73
	Mozambique Seabream	<i>Wattsia mossambica</i>	\$6.38
	Redspot Emperor	<i>Lethrinus lentjan</i>	\$4.93
	Redthroat Emperor	<i>Lethrinus miniatus</i>	\$7.34
	Robinson's Seabream	<i>Gymnocranius grandoculis</i>	\$4.15
	Seabreams	<i>Gymnocranius spp.</i>	\$4.49
	Spangled Emperor	<i>Lethrinus nebulosus</i>	\$5.73
	Spotcheek Emperor	<i>Lethrinus rubrioperculatus</i>	\$4.49
	Yellowtail Emperor	<i>Lethrinus atkinsoni</i>	\$4.42
Lobotidae	Tripletail	<i>Lobotes surinamensis</i>	\$4.49
Lutjanidae	Brownstripe Snapper	<i>Lutjanus vitta</i>	\$3.67
	Chinamanfish	<i>Symphorus nematophorus</i>	\$5.68

Category Family	Common Name	Scientific Name	Price per Kilogram
	Crimson Snapper	<i>Lutjanus erythropterus</i>	\$5.19
	Darktail Snapper	<i>Lutjanus lemniscatus</i>	\$5.42
	Fiveline Snapper	<i>Lutjanus quinquelineatus</i>	\$3.67
	Goldband Snapper	<i>Pristipomoides multidentis</i>	\$8.92
	Golden Snapper	<i>Lutjanus johnii</i>	\$6.66
	Indonesian Snapper	<i>Lutjanus bitaeniatus</i>	\$3.80
	King Snappers	<i>Pristipomoides spp.</i>	\$8.50
	Mangrove Jack	<i>Lutjanus argentimaculatus</i>	\$5.49
	Maori Snapper	<i>Lutjanus rivulatus</i>	\$4.49
	Moses' Snapper	<i>Lutjanus russellii</i>	\$5.69
	Red Emperor	<i>Lutjanus sebae</i>	\$11.02
	Rosy Snapper	<i>Pristipomoides filamentosus</i>	\$8.57
	Ruby Snapper	<i>Etelis carbunculus</i>	\$6.66
	Saddletail Snapper	<i>Lutjanus malabaricus</i>	\$5.33
	Sharptooth Snapper	<i>Pristipomoides typus</i>	\$8.51
	Stripey Snapper	<i>Lutjanus carponotatus</i>	\$3.67
	Tang's Snapper	<i>Lipocheilus carnolabrum</i>	\$6.07
	Tropical Snappers	<i>Lutjanus spp.</i>	\$3.67
Mugilidae	Bluetail Mullet	<i>Valamugil buchanani</i>	\$4.49
	Mullets	<i>Mugilidae - undifferentiated</i>	\$4.69
	Sea Mullet	<i>Mugil cephalus</i>	\$2.14
	Yelloweye Mullet	<i>Aldrichetta forsteri</i>	\$1.58
Mullidae	Goatfishes	<i>Mullidae - undifferentiated</i>	\$3.34
Nemipteridae	Rainbow Monocle Bream	<i>Scolopsis monogramma</i>	\$2.09
	Rosy Threadfin Bream	<i>Nemipterus furcosus</i>	\$4.04
	Threadfin Breams	<i>Nemipteridae - undifferentiated</i>	\$4.04
Neosebastidae	Bighead Gurnard Perch	<i>Neosebastes pandus</i>	\$4.62
Ophidiidae	Pink Ling	<i>Genypterus blacodes</i>	\$4.49
Oplegnathidae	Knifejaw	<i>Oplegnathus woodwardi</i>	\$1.91
Pentacerotidae	Boarfishes	<i>Pentacerotidae - undifferentiated</i>	\$4.05
Platycephalidae	Flatheads	<i>Platycephalidae - undifferentiated</i>	\$5.84
	Rock Flathead	<i>Platycephalus laevigatus</i>	\$8.66
Plotosidae	Estuary Cobbler	<i>Cnidoglanis macrocephalus</i>	\$3.99
Polynemidae	Blue Threadfin	<i>Eleutheronema tetradactylum</i>	\$5.51
	King Threadfin	<i>Polydactylus macrochir</i>	\$5.51
	Threadfin Salmons	<i>Polynemidae - undifferentiated</i>	\$5.51
Polyprionidae	Bass Groper	<i>Polyprion americanus</i>	\$8.51
	Hapuku	<i>Polyprion oxygeneios</i>	\$7.37
Pomatomidae	Tailor	<i>Pomatomus saltatrix</i>	\$3.99
Priacanthidae	Bigeyes	<i>Priacanthidae - undifferentiated</i>	\$1.79
Psettodidae	Australian Halibut	<i>Psettodes erumei</i>	\$5.65
Rachycentridae	Cobia	<i>Rachycentron canadum</i>	\$3.71
Salmonidae	Trout	<i>Oncorhynchus mykiss & Salmo trutta</i>	\$4.49
Scaridae	Parrotfishes	<i>Scaridae - undifferentiated</i>	\$6.16
Scatophagidae	Striped Scat	<i>Selenotoca multifasciata</i>	\$4.49
Sciaenidae	Black Jewfish	<i>Protonibea diacanthus</i>	\$5.50

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Category Family	Common Name	Scientific Name	Price per Kilogram
	Mulloway	<i>Argyrosomus japonicas</i>	\$4.67
Scombridae	Australian Bonito	<i>Sarda australia</i>	\$7.55
	Bigeye Tuna	<i>Thunnus obesus</i>	\$10.89
	Blue Mackerel	<i>Scomber australasicus</i>	\$8.50
	Grey Mackerel	<i>Scomberomorus semifasciatus</i>	\$7.68
	Longtail Tuna	<i>Thunnus tonggol</i>	\$2.69
	Mackerels	<i>Scombridae spp. (tribes Scomberomorini & Scombrini)</i>	\$2.55
	Shark Mackerel	<i>Grammatorcynus bicarinatus</i>	\$2.19
	Skipjack Tuna	<i>Katsuwonus pelamis</i>	\$5.95
	Spanish Mackerel	<i>Scomberomorus commerson</i>	\$8.08
	Spotted Mackerel	<i>Scomberomorus munroi</i>	\$4.25
	Tunas	<i>Scombridae spp. (tribes Sardini & Thunnini)</i>	\$2.97
	Wahoo	<i>Acanthocybium solandri</i>	\$4.19
	Yellowfin Tuna	<i>Thunnus albacares</i>	\$10.11
Scorpididae	Banded Sweep	<i>Scorpis georgiana</i>	\$0.96
	Sea Sweep	<i>Scorpis aequipinnis</i>	\$2.69
Serranidae	Banded Grouper	<i>Epinephelus amblycephalus</i>	\$6.81
	Barcheek Coral Trout	<i>Plectropomus maculatus</i>	\$15.28
	Birdwire Rockcod	<i>Epinephelus merra</i>	\$6.81
	Blackspotted Rockcod	<i>Epinephelus malabaricus</i>	\$7.11
	Breaksea Cod	<i>Epinephelides armatus</i>	\$8.64
	Chinaman Rockcod	<i>Epinephelus rivulatus</i>	\$5.58
	Common Coral Trout	<i>Plectropomus leopardus</i>	\$15.28
	Coral Rockcod	<i>Cephalopholis miniata</i>	\$6.81
	Coral Trout	<i>Plectropomus spp. & Variola spp.</i>	\$15.28
	Duskytail Grouper	<i>Epinephelus bleekeri</i>	\$6.90
	Eightbar Grouper	<i>Hyporthodus octofasciatus</i>	\$8.34
	Flowery Rockcod	<i>Epinephelus fuscoguttatus</i>	\$5.90
	Goldspotted Rockcod	<i>Epinephelus coioides</i>	\$6.77
	Harlequin Fish	<i>Othos dentex</i>	\$4.49
	Radiant Rockcod	<i>Epinephelus radiatus</i>	\$7.27
	Radiant Rockcod/Comet Grouper	<i>Epinephelus Radiatus/Morrhua</i>	\$7.27
	Rankin Cod	<i>Epinephelus multinotatus</i>	\$8.18
	Spotted Cod	<i>Epinephelus Microdon/Areolatus/Bilobatus</i>	\$5.90
	Striped Grouper	<i>Epinephelus latifasciatus</i>	\$6.81
	Tomato Rockcod	<i>Cephalopholis sonnerati</i>	\$7.00
	Yellowedge Coronation Trout	<i>Variola louti</i>	\$6.81
	Yellowspotted Rockcod	<i>Epinephelus areolatus</i>	\$5.90
Siganidae	Goldlined Rabbitfish	<i>Siganus lineatus</i>	\$4.49
	Rabbitfish	<i>Siganus spp.</i>	\$4.49
Sillaginidae	Goldenline Whiting	<i>Sillago analis</i>	\$4.49
	King George Whiting	<i>Sillaginodes punctata</i>	\$13.41
	Whittings	<i>Sillaginidae - undifferentiated</i>	\$6.94

Category Family	Common Name	Scientific Name	Price per Kilogram
	Yellowfin Whiting	<i>Sillago schomburgkii</i>	\$4.10
Sparidae	Black Bream	<i>Acanthopagrus butcheri</i>	\$7.38
	Breams	<i>Sparidae - undifferentiated</i>	\$4.49
	Frypan Bream	<i>Argyrops spinifer</i>	\$5.16
	Pink Snapper	<i>Chrysophrys auratus</i>	\$7.99
	Tarwhine	<i>Rhabdosargus sarba</i>	\$4.79
	Western Yellowfin Bream	<i>Acanthopagrus morrisoni</i>	\$4.47
	Yellowback Bream	<i>Dentex spariformis</i>	\$6.80
Sphyraenidae	Pikes	<i>Sphyraenidae - undifferentiated</i>	\$1.78
	Snook	<i>Sphyraena novaehollandiae</i>	\$2.62
Terapontidae	Striped Grunters	<i>Terapontidae - undifferentiated</i>	\$1.77
	Yellowtail Grunter	<i>Amniataba caudavittata</i>	\$4.49
Zeidae	John Dory	<i>Zeus faber</i>	\$8.24
SHARKS & RAYS			
Carcharhinidae	Bronze Whaler	<i>Carcharhinus brachyurus</i>	\$2.36
	Dusky Whaler	<i>Carcharhinus obscurus</i>	\$4.20
	Sandbar Shark	<i>Carcharhinus plumbeus</i>	\$3.58
	Spinner Shark	<i>Carcharhinus brevipinna</i>	\$1.09
	Tiger Shark	<i>Galeocerdo cuvier</i>	\$0.65
Hexanchidae	Sevengill Sharks	<i>Heptanchias spp.</i>	\$1.71
Lamnidae	Shortfin Mako	<i>Isurus oxyrinchus</i>	\$0.52
Orectolobidae	Wobbegong	<i>Orectolobidae - undifferentiated</i>	\$1.51
Pristiophoridae	Common Sawshark	<i>Pristiophorus cirratus</i>	\$0.64
Rajidae	Skates	<i>Rajidae, Arhynchobatidae - undifferentiated</i>	\$1.39
Rhinobatidae	Guitarfishes	<i>Rhinobatidae - undifferentiated</i>	\$0.38
Sphyrnidae	Hammerhead Sharks	<i>Sphyrnidae - undifferentiated</i>	\$0.99
Triakidae	Gummy Shark	<i>Mustelus antarcticus</i>	\$4.49
	Pencil Shark	<i>Hypogaleus hyugaensis</i>	\$1.33
	School Shark	<i>Galeorhinus galeus</i>	\$4.49
	Whiskery Shark	<i>Furgaleus macki</i>	\$3.84
	Shark Fins		\$11.64
	Other Sharks	<i>Sharks - undifferentiated</i>	\$1.71
OTHER FISH			
	Other Fish		\$4.49
INVERTEBRATES			
CRABS			
Geryonidae	Crystal Crab	<i>Chaceon bicolor</i>	\$31.05
Hypothalassiidae	Champagne Crab	<i>Hypothalassia spp.</i>	\$8.50
Menippidae	Giant Crab	<i>Pseudocarcinus gigas</i>	\$51.81
Portunidae	Blue Swimmer Crab	<i>Portunus armatus</i>	\$5.41
	Brown Mud Crab	<i>Scylla olivacea</i>	\$36.43

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Category Family	Common Name	Scientific Name	Price per Kilogram
	Green Mud Crab	<i>Scylla serrata</i>	\$36.43
LOBSTERS			
Palinuridae	Southern Rock Lobster	<i>Jasus edwardsii</i>	\$60.00
	Western Rock Lobster	<i>Panulirus cygnus</i>	\$69.06
Scyllaridae	Bug	<i>Ibacus & Thenus spp.</i>	\$14.28
MOLLUSCS			
Cephalopoda	Squid	<i>Order Teuthoidea - undifferentiated</i>	\$14.18
Haliotidae	Brownlip Abalone	<i>Haliotis rubra conicopora</i>	\$36.68
	Greenlip Abalone	<i>Haliotis laevigata</i>	\$43.81
	Roe's Abalone	<i>Haliotis roei</i>	\$23.81
Octopodidae	Octopuses	<i>Octopodidae - undifferentiated</i>	\$8.29
Sepiidae	Cuttlefish	<i>Sepia spp.</i>	\$4.57
Veneridae	Ballot's Saucer Scallop	<i>Amusium balloti</i>	\$7.77
PRAWNS			
Penaeidae	Banana Prawn	<i>Penaeus merguensis</i>	\$12.69
	Black Tiger Prawn	<i>Penaeus monodon</i>	\$18.00
	Blue Endeavour Prawn	<i>Metapenaeus endeavouri</i>	\$9.52
	Brown Tiger Prawn	<i>Penaeus esculentus</i>	\$15.91
	Velvet Prawn	<i>Metapenaeopsis spp.</i>	\$4.41
	Western King Prawn	<i>Melicertus latisulcatus</i>	\$13.55
Stomatopoda	Mantis Shrimps	<i>Order Stomatopoda - undifferentiated</i>	\$6.00
SEA CUCUMBERS			
Holothuriidae	Sandfish (Sea Cucumber)	<i>Holothuria scabra</i>	\$5.00

APPENDIX 3

INDIAN OCEAN TERRITORIES RESOURCE STATUS REPORT 2017

S. Newman, L. Bellchambers, C. Skepper, S. Evans and P. Kalinowski

OVERVIEW

In November 2002, the territorial seas (out to 12 nautical miles) of the Cocos (Keeling) Islands and Christmas Island were declared as ‘excepted waters’ from the *Fisheries Management Act 1991*.

Management responsibilities were transferred from the Australian Fisheries Management Authority to the Commonwealth Government, and the Government of Western Australia has now taken on management responsibilities for the marine territorial waters of the Indian Ocean Territories (IOT) on behalf of the Commonwealth Department of Infrastructure and Regional Development. The location of the Indian Ocean Territories and their proximity to the Western Australian coast are illustrated in Indian Ocean Territories Figure 1.

Under a Service Delivery Agreement with the Department of Infrastructure and Regional Development, the Western Australian Department of Primary Industries and Regional Development, Fisheries Division (Fisheries) manages commercial, recreational and aquaculture activities at Cocos (Keeling) Islands and Christmas Island, and also provides fish health diagnostic, biosecurity, fish pathology and licensing services. The Commonwealth Minister for the Department of Infrastructure and Regional Development holds responsibility for these excepted waters under the *Fish Resources Management Act 1994 (WA) (CI/CKI)* (the ‘Applied Acts’).

The commercial Christmas Island Line Fishery (CILF) primarily targets pelagic species, mainly wahoo (*Acanthocybium solandri*) and yellowfin tuna (*Thunnus albacares*). In addition, demersal fishing activities are also undertaken targeting deepwater demersal fish, mainly the deepwater snappers.

The Cocos (Keeling) Islands Marine Aquarium Fish Fishery (CKIMAFF) primarily targets the endemic Cocos Angelfish or Yellowheaded Angelfish (*Centropyge jocularis*), and to a lesser extent the lemonpeel angelfish (*Centropyge flavissima*).

Recreational and artisanal fishing are undertaken around the Cocos (Keeling) and Christmas Islands targeting both finfish and invertebrate species. The Cocos (Keeling) Islands consist of a diverse range of aquatic environments that include a sheltered lagoon, fringing reefs and offshore ‘blue water’. These environments support a range of demersal and pelagic finfish species, as well as various crustaceans (e.g. lobsters, crabs) and molluscs (e.g. gong gong, clams) that are highly sought after by fishers for both individual and community purposes. Christmas Island has no lagoon and a limited range of environments available for fishing; these are the fringing reef surrounding the island and offshore ‘blue water’, both of which primarily support pelagic fish species, a limited range of demersal finfish species and some invertebrates (e.g. lobster, clams).

SUMMARY FEATURES 2017

Fishery Performance		Commercial	Recreational
Total Catch 2016		4.6 t	NA
Fishing Level		Not Assessed	NA
Stock/Resource Performance		Stock Status	Assessment Indicators
IOT Finfish		Some species at risk	Annual: CILF Catch, CKIMAFF Catch Periodic: Independent surveys
IOT Invertebrate		Some species at risk	Periodic: Independent surveys
EBFM Performance			
Asset	Level	Asset	Level
Bycatch	Negligible Risk	Listed Species	Negligible Risk
Habitat	Negligible Risk	Ecosystem	Not assessed
Social	Low Risk	Economic	Not assessed
Governance	Stable	External Drivers	Negligible Risk

CATCH AND LANDINGS

Pelagic species dominate the catch of the CILF, comprising 97% of the total reported catch in 2016. Wahoo (*Acanthocybium solandri*) is the main target species of the CILF, comprising 88% of the total reported catch in 2016. Other pelagic species are also targeted during the trolling operations and primarily include yellowfin tuna (*Thunnus albacares*) and other tunas (except southern bluefin tuna (*Thunnus maccoyii*), which may not be taken), and to a lesser extent mahi mahi (*Coryphaena* spp.). Some commercial fishing activities are also undertaken for demersal fish species, mainly deep slope species such as ruby snapper (*Etelis* spp.) and these species comprised ~3% of the total reported catch in 2016. The commercial catch for Christmas Island usually consists of catch data from only two vessels and the exact catch data in many years is not reportable due to confidentiality provisions. The total reported catch for this fishery has been less than 10 tonnes per annum over the last ten years.

There is no commercial line fishery at the Cocos (Keeling) Islands.

The CKIMAFF targets the endemic Cocos Angelfish or Yellowheaded Angelfish (*Centropyge jocularis*), and to a lesser extent the lemonpeel angelfish (*Centropyge flavissima*). As there is only one license in the CKIMAFF the catch data is not reportable due to confidentiality provisions.

Recreational and artisanal fishing vessels operate around the Cocos (Keeling) Islands and Christmas Island. The amount and magnitude of the recreational fishing catch and effort at these islands has not been assessed.

INDICATOR SPECIES ASSESSMENTS AND STOCK STATUS

IOT Finfish & IOT Invertebrate (Some species at risk)

Finfish:

Data on the abundance of finfish species is being collected and collated to determine changes over time.

The pelagic species that are targeted by the CILF (e.g. wahoo, yellowfin tuna) are likely to be part of a wider Indian Ocean stock. However, the demersal species are likely to be localised stocks that are reliant upon self-recruitment.

There is anecdotal evidence of localised depletion of some deep slope species like rosy snapper (*Pristipomoides filamentosus*) and ruby snapper (*Etelis carbunculus*) around Christmas Island. Recreational fishers use electric-powered lines to target deep-slope demersal finfish species at the Indian Ocean Territories, thereby increasing the fishing efficiency for these species.

The primary target of the CKIMAFF is *Centropyge jocularis* which is endemic to the Cocos (Keeling) Islands and Christmas Island, inhabiting fringing reefs between 15 and 70 m. The biology of *C. jocularis* has not been examined, although Allen *et al.* (2007) describe this species as being abundant on Christmas Island.

Invertebrates:

Holothurians: The holothurian community is strongly influenced by habitat and although some species are wide-ranging and found in relatively high densities, they tend to be of low economic value. In contrast, species of moderate to high economic value were recorded at densities too low to support commercial fisheries and typically had very restricted distributions. The holothurian community found at the Cocos (Keeling) Islands is near to pristine due to a lack of historical fishing pressure. Holothurian stocks are sensitive to fishing exploitation and have been overexploited in other areas of the Indian and Pacific Oceans.

Gong Gong: The common spider conch or gong gong (*Lambis lambis*) is a recreationally-targeted gastropod inhabiting shallow waters of the lagoon of Cocos (Keeling) Islands. This species is vulnerable to over-fishing as it is highly accessible and presumably shares biological traits with other exploited conch species, including slow growth and late maturity. Monitoring data indicates that the current abundance of gong gong is lower than historically recorded. While heavy fishing pressure has presumably contributed to the reduction in gong gong numbers, further monitoring is required to determine the role of recruitment variability in maintaining gong gong populations at the Cocos (Keeling) Islands and changes in the lagoon system.

Giant Clams: Three species of giant clams (*Tridacna gigas*, *Tridacna derasa* and *Tridacna maxima*) have historically been reported at the Cocos (Keeling) Islands. Monitoring data indicates that currently only *T. maxima* occurs in sufficient numbers to be assessed. This data also shows a decline in relative stock abundance of *T. maxima* before they reach a size of sexual maturity. Heavy fishing pressure is presumed to contribute to this reduction, with further monitoring required to monitor sustainability of these stocks.

Reef Health: On-going reef monitoring has been established to monitor natural and anthropogenic impacts on the reef and lagoon communities at Cocos (Keeling) Islands and Christmas Island.

BYCATCH AND PROTECTED SPECIES INTERACTIONS

Fishing in the CILF for pelagic species such as wahoo uses specialised trolling gear to target the fish and involves limited discarding. Species occasionally caught but generally discarded include billfish, barracuda, shark and trevally. A high proportion of the

above species are expected to survive capture and release by the fishery. Consequently, it is considered likely that the pelagic fishery has a **negligible** impact on stocks of discarded species.

Fishing for demersal species in the CILF particularly those in the deep slope waters involves limited discarding as most species are retained for processing. However, catches can be lost to sharks (depredation).

The line fishing methods used in CILF are not known to interact with any listed species. However, there is some potential for low levels of seabird bycatch at Christmas Island.

The fishing techniques used to capture fish in the CKIMAFF involves using hand or scoop nets, or a small seine net of specific dimensions (the seine net cannot exceed 16 metres in length, must have a mesh of less than or equal to 28mm and a drop of not more than 3 metres) and fishers may use SCUBA equipment. Thus, the CKIMAFF has **negligible** bycatch due to the highly selective nature of fishing activities.

No listed species interactions have been reported for the CKIMAFF.

HABITAT AND ECOSYSTEM INTERACTIONS

Habitat impacts are considered **negligible**. The line fishing methods used in the CILF and the hand collection method used in the CKIMAFF are likely to have minimal impact on the habitat. Ecosystem impacts have not been assessed.

SOCIAL AND ECONOMIC OUTCOMES

Social

At least three people were employed in the CILF around Christmas Island during 2016. This estimate is based on the number of vessels reporting catches and the average number of crew on each boat.

At least two people were employed in the CKIMAFF around Cocos (Keeling) Islands during 2016.

Due to their sport fishing and eating qualities, wahoo and other pelagic species are popular target species for recreational anglers and fishing charter operators at the Indian Ocean Territories, particularly at Christmas Island. They are usually captured from small boats, although shore-based fishing is also undertaken.

A large variety of demersal and lagoon finfish and invertebrate species are caught by artisanal and recreational fishers at Cocos (Keeling) Islands involving the use of a large number of small vessels. Similarly, recreational fishers at Christmas Island undertake fishing activities from small vessels and also from the shore and catch a large variety of demersal finfish species, including a large number of deep slope species.

Economic

The value of the CILF is not known. The value of the CKIMAFF is also unknown, although *C. joculator* commands a high price on the international market (reported retail prices in excess of \$1000.00 each in 2016).

GOVERNANCE SYSTEM

The potential recreational fishing effort for both pelagic and demersal fish species at both the Cocos (Keeling) Islands and at Christmas Island is high with a capacity to operate over the entire extent of the fishable area at each island group. Given the restricted amount of habitat and fishing area available it is expected that fishing pressure on some species at Cocos (Keeling) Islands or Christmas Island may be above sustainable levels.

The catch of the CKIMAFF has been small since its inception in 1993. There is little incentive for the single licensee to increase catch or effort since market viability and high prices are maintained by only having small numbers of fish available for sale. The current level of fishing activity has not been assessed.

Harvest Strategy

Recreational fishing rules and limitations have been developed using a constant catch strategy (maintaining but not increasing catches), although a formal harvest strategy is not currently in place for this resource.

Compliance

Operators in the CILF and CKIMAFF are required to complete statutory catch and effort returns on a monthly basis. The low risks to the sustainability of the stocks imposed by these fisheries results in a **low risk** and low level of compliance.

Consultation

Extensive community engagement and consultation has taken place to develop the first proposed set of dedicated recreational fishing arrangements for the IOTs. More recently community engagement has focussed on the development and agreement to the Cocos Malay Cultural Fishing Arrangements and commercial fishing policy and arrangements.

For the CILF and CKIMAFF consultation occurs directly with operators at Christmas Island and the Cocos (Keeling) Islands, with additional community consultation undertaken where applicable.

Direct community consultation is undertaken regularly at the Cocos (Keeling) Islands and Christmas Island in regard to fisheries science and resource assessment, recreational fishing rules and regulations.

Management Initiatives/Outlook Status

The key IOTs management initiative is the sustainable management of the aquatic resources at the IOTs for the benefit of the on-island communities.

Island-specific recreational fisheries management arrangements for the Indian Ocean Territories are currently being progressed and are expected to be legislated in 2018.

Cocos-Malay Cultural Fishing arrangements and a Commercial Fishing policy have also been finalised during 2016/17.

expected to experience highly variable recruitment due to environmental fluctuations.

In February 2012, the MV Tycoon was grounded in Flying Fish cove on Christmas Island spilling phosphate and fuel oils into the Cove and surrounding areas.

In the summer of 2015/16 widespread thermal coral bleaching was recorded at Christmas Island. No coral bleaching was recorded at Cocos (Keeling) Islands over the same period. Monitoring is ongoing to assess the long-term impact of this event on the coral reef, finfish and invertebrate communities of Christmas Island.

EXTERNAL DRIVERS

The demersal fish and invertebrate populations of Cocos (Keeling) Islands and Christmas Island are likely to consist of small, isolated populations that are

Negligible risk.



INDIAN OCEAN TERRITORIES FIGURE 1

Location of the Cocos (Keeling) Islands and Christmas Island comprising the Indian Ocean Territories within the Indian Ocean, illustrating their proximity to the Western Australian coast.

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APPENDIX 4

Science and Resource Assessment staff adjunct positions and supervision of students

Staff Member	Position
Lynda Bellchambers	Adjunct Researcher, Faculty of Natural and Agricultural Sciences, University of Western Australia.
	PhD co-supervision, University of Western Australia, supervises Scott Evans - "Understanding the relationships between fishery recruitment and essential benthic habitats within an ecosystem based fisheries management framework for prawn fisheries"
Matias Braccini	PhD co-supervision, University of Mar del Plata, Argentina, supervises Marcelo Perez – 'Movement patterns of <i>Mustelus schmitti</i> in the coastal Bonaerense ecosystem based on the use of conventional mark recapture. Implications for management and sustainable exploitation'.
	PhD co-supervision, Murdoch University, supervises Brenton Pember - 'A multi-disciplinary analysis of connectivity of the sandbar shark (<i>Carcharhinus plumbeus</i>) in the Indo-West Pacific'
	Adjunct Senior Lecturer, Murdoch University.
Cécile Dang	Adjunct Associate Professor, School of Veterinary and Life Sciences, Murdoch University.
	Adjunct Associate professor, School of Biological Sciences, UWA.
Simon de Lestang	Adjunct Research Fellow initially within the School of Biological Sciences, UWA
	PhD co- supervision, University of Western Australia, supervises Jean Dumas - 'Investigating sperm limitation in the Western Rock Lobster Fishery'.
	PhD co- supervision, University of Western Australia, supervises Emma Jade-Tuffley ' Determining variation in catchability of western rock lobsters (<i>Panulirus cygnus</i>)'.
	PhD co- supervision, University of Western Australia, supervises Michael Brooker - ' An investigation into unexpectedly low catch rates of <i>Panulirus cygnus</i> from an area of historical high catch rates'.
	Masters co- supervision, University of Western Australia, supervises Oscar Canon - Influence of environmental and spatial variables on population estimates and size structure of the western rock lobster <i>Panulirus cygnus</i> (George, 1962) within the centre of their biogeographic range in Western Australia'.
	Honours co- supervision, University of Western Australia, supervises Brock Keymer - Assessing gregariousness in juvenile western rock lobsters and its implications for stock assessment'.
	Honours co- supervision, University of Western Australia, supervises Dan Lindstedt - Will lobster wariness is a more sensitive indicator of fishing pressure than abundance, length or biomass?'
David Fairclough	Adjunct Senior Lecturer. School of Veterinary and Life Sciences, Murdoch University.
	Adjunct Senior Lecturer. Department of Environment and Agriculture, Faculty of Science and Engineering. Curtin University.
	Honours co-supervision, Jake Daviot, Murdoch University, Has the composition and abundances of fishes changed in response to natural and human-induced events in Cockburn Sound?
	Masters co-supervision, Casper Avenant, Edith Cowan University, Dietary comparison of the tropical herbivore <i>Siganus fuscescens</i> and a range of temperate seagrass-associated omnivorous fishes

Staff Member	Position
Norman Hall	Emeritus Professor, Murdoch University.
Alastair Harry	Adjunct Research Associate, College of Science and Engineering, James Cook University.
Alex Hesp	PhD co-supervision, Murdoch University, Rachel Marks – “Key factors affecting the biology and population dynamics of the blue swimmer crab (<i>Portunus armatus</i>) in southwest Western Australia.”
Danielle Johnston	PhD co-supervision, Murdoch University, Rachel Marks – “Key factors affecting the biology and population dynamics of the blue swimmer crab (<i>Portunus armatus</i>) in southwest Western Australia.” Honours co-supervision, Murdoch University, Theodore Campbell – “Dietary composition of the Blue Swimmer Crab, <i>Portunus armatus</i> , and life history characteristics of related species.”
Mervi Kangas	PhD co-supervision Murdoch University, supervises Inigo Koefoed – “The biology and life history of the endeavour prawn <i>Metapenaeus endeavouri</i> , and the influence of the environment on the life histories and stock dynamics of three species of Penaeid prawn in arid Western Australia.
Craig Lawrence	Adjunct Associate Professor, The University of Western Australia. Honours supervision, University of Western Australia. Jesse Wansbrough. The Reproduction and Early Development of the Western Pygmy Perch <i>Nannoperca vittata</i> Castelnau 1873 (Percichthyidae) MSc. supervision, University of Western Australia. Derik Aquary. An evaluation of three aquaponic techniques for growing lettuce (<i>Lactuca sativa</i>) using water from rainbow trout (<i>Oncorhynchus mykiss</i>) growth tanks MSc. supervision, University of Western Australia. Isobel Sewel. Insect meal as a dietary additive for rainbow trout.
Justin McDonald	Adjunct Professor – Murdoch University, Harry Butler Institute, School of Veterinary and Life Sciences. Adjunct Research Fellow – Curtin University, Department of Environment and Agriculture, Faculty of Science and Engineering. Adjunct Senior Lecturer – University of Western Australia, Faculty of Natural and Agricultural Sciences. Technical Advisor and committee member IMarEST Biofouling Expert Management Group. California State Lands Commission - Biofouling Technical Advisory Group member. Ministry for Primary Industries New Zealand - Biofouling Technical Advisory Group member. Associate Editor Management of Biological Invasions – International Journal.
Terry Miller	Adjunct Senior Lecturer, Centre for Sustainable Tropical Fisheries and Aquaculture, College of Marine and Environmental Sciences, James Cook University.
Brett Molony	Member of Marine and Freshwater Course Consultative Committee, Edith Cowan University.
Stephen Newman	Adjunct Associate Professor – Marine Ecology Group, School of Plant Biology, University of Western Australia. Adjunct Professor – Department of Environment and Agriculture, Faculty of Science and Engineering, Curtin University.
Karina Ryan	Adjunct Supervisor, Eric Aidoo “Spatial Modelling of Recreational Boat-Based Fishing in Western Australia”. PhD, Edith Cowan University. Thesis Completed October 2016. Adjunct Supervisor, Eva Lai “Integrating multiple sources of data to construct a time series of recreational catch/effort for the West Coast Bioregion of Western Australia”. PhD, Edith Cowan University.

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Staff Member	Position
	Adjunct Supervisor, Alissa Tate “Assessing variability in standardised harvest rates from shore-based recreational fishing surveys”. Masters, Edith Cowan University.
	Adjunct Supervisor, Matthew Navarro “Evaluating the impacts of implementing marine protected areas on Western Australian marine recreators using integrated bio-economic modelling”. PhD, The University of Western Australia.
Lachlan Strain	Adjunct Research Fellow, Faculty of Science and Engineering, Department of Environment and Agriculture, Curtin University of Technology. PhD co-supervision, Curtin University of Technology, supervises Aisling Fontanini – ‘Impacts of marine climate change on two commercially and recreationally important Western Australian species: <i>Pagrus auratus</i> and <i>Haliotis roei</i> ’.
Michael Travers	Adjunct Research Scientist, Australian Institute of Marine Science. Honours Co-supervision, University of Western Australia, supervises Elisabeth Myers. Day-night differences in temperate reef fish assemblages.
Corey Wakefield	Adjunct Senior Lecturer, Marine Ecology Group, School of Plant Biology, University of Western Australia. Honorary Research Fellow, Victoria University of Wellington, New Zealand. Adjunct Senior Lecturer, Curtin University of Technology. Masters co-supervision, Curtin University of Technology, supervises Claire Wellington – ‘Description and comparison of demersal fish ecology of the continental slope of Western Australia’. Masters co-supervision, Curtin University of Technology, supervises Dion Boddington – ‘Comparison of the life history characteristics, habitat partitioning and stock status of three groupers off the north-western coast of Australia’. Masters co-supervision, Victorian University of Wellington New Zealand, supervises Natalie Stewart – ‘The population structure of Polyprionidae from Australia and New Zealand’.
Brent Wise	Adjunct Associate Professor, School of Engineering, Faculty of Health, Engineering and Science, Edith Cowan University.

APPENDIX 5

GLOSSARY OF ACRONYMS

AFMA	Australian Fisheries Management Authority	CSIRO	Commonwealth Scientific and Industrial Research Organisation
AFZ	Australian Fishing Zone	CSLPMF	Cockburn Sound (Line and Pot) Managed Fishery
AIAWA	Abalone Industry Association of Western Australia	CW	Carapace Width
AIMS	Australian Institute of Marine Science	DBCA	Department of Biodiversity, Conservation and Attractions (formerly DPAW)
AIMWTMF	Abrolhos Islands and Mid West Trawl Managed Fishery	DFAC	Developing Fisheries Assessment Committee
ALC	Automatic Location Communicator	DOE	Department of the Environment (Commonwealth Government) (formerly Department of Sustainability, Environment, Water, Population and Communities)
ARMA	Aquatic Resources Management Act	DPAW	Department of Parks and Wildlife (formerly Department of Environment and Conservation)
ASL	Australian Sea Lion	EBFM	Ecosystem Based Fisheries Management
BPMF	Broome Prawn Managed Fishery	ECU	Edith Cowan University
BRD	Bycatch Reduction Device	EEZ	Exclusive Economic Zone
BRUVS	Baited Remote Underwater Video System	ENSO	El Niño/Southern Oscillation
CAES	Catch and Effort Statistics	EPBC	(Commonwealth Government) Environment Protection and Biodiversity Conservation (Act 1999)
CDR	Catch and disposal record	ERLF	Esperance Rock Lobster Managed Fishery
CI	Confidence Interval	ESD	Ecologically Sustainable Development
CI/CKI	Christmas Island and Cocos (Keeling) Island	ETP	Endangered, Threatened and Protected
CILF	Christmas Island Line Fishery	FAO	The Food and Agriculture Organisation of the United Nations
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora	FED	Fish escapement device
CKIMAFF	Cocos (Keeling) Islands Marine Aquarium Fish Fishery		
CL	Confidence Limits		
CPUE	Catch Per Unit Effort		

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FFS	Flesh-footed Shearwaters
FHPA	Fish Habitat Protection Area
FL	Fork Length
FMO	Fisheries and Marine Officer
FRDC	Fisheries Research and Development Corporation
FRMA	Fish Resources Management Act
FRR	Fisheries Research Report
GAB	Great Australian Bight
GCB	Gascoyne Coast Bioregion
GDSMF	Gascoyne Demersal Scalefish Managed Fishery
GVP	Gross Value of Product
HMAS	Her Majesty's Australian Ship
IBSS	Independent Breeding Stock Survey
IFM	Integrated Fisheries Management
IMCRA	Interim Marine and Coastal Regionalisation for Australia
IMP	Introduced Marine Pests
IMS	Introduced Marine Species
ISO	International Organisation for Standardisation
ITQ	Individually Transferable Quota
IUCN	International Union for the Conservation of Nature
IVR	Integrated Voice Response
JANSF	Joint Authority Northern Shark Fishery
JASDGDLF	Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery

KGBF	Kimberley Gillnet and Barramundi Managed Fishery
KPMF	Kimberley Prawn Managed Fishery
LASCF	Lake Argyle Silver Cobbler Fishery
MAFMF	Marine Aquarium Fish Managed Fishery
MBP	Marine Bioregional Plan
MFL	Managed Fishery Licence
MLL	Minimum Legal Length
MOP	Mother-of-Pearl
MOU	Memorandum of Understanding
MPA	Marine Protected Area
MSC	Marine Stewardship Council
MSY	Maximum Sustainable Yield
NBPMF	Nickol Bay Prawn Managed Fishery
NCB	North Coast Bioregion
NDSMF	Northern Demersal Scalefish Managed Fishery
NPF	Northern Prawn Fishery
NRM	Natural Resource Management
NTAC	Notional Target Total Allowable Catch
OCL	Orbital Carapace Length
OIMF	Octopus Interim Managed Fishery
OPMF	Onslow Prawn Managed Fishery
PDSF	Pilbara Demersal Scalefish Fisheries
PFRC	Pemberton Freshwater Research Centre
PFTIMF	Pilbara Fish Trawl Interim Managed Fishery

RAP	Research Angler Program	TACC	Total Allowable Commercial Catch
RCL	Rostrum Carapace Length	TAE	Total Allowable Effort
RFBL	Recreational Fishing from Boat Licence	TARC	Total Allowable Recreational Catch
RFSS	Recreational Freshwater Fisheries Stakeholder Subcommittee	TDGDLF	Western Australian Temperate Demersal Gillnet and Demersal Longline Fisheries
RRAMF	Ranked Risk Assessment of Multiple Fisheries	UWA	University of Western Australia
SAFS	Status of Australian Fish Stocks	TPSA	Tiger Prawn Spawning Area
SBBSMNF	Shark Bay Beach Seine and Mesh Net Managed Fishery	VFAS	Voluntary Fisheries Adjustment Schemes
SBCIMF	Shark Bay Crab Interim Managed Fishery	VMS	Vessel Monitoring System
SBSF	Shark Bay Snapper Managed Fishery	WAFIC	Western Australian Fishing Industry Council
SCB	South Coast Bioregion	WAFMRL	Western Australian Fisheries and Marine Research Laboratories
SCCMF	South Coast Crustacean Managed Fishery	WAMSI	Western Australian Marine Science Institute
SCRIP	Strategic Criteria for Rural Investments in Productivity	WANCSF	Western Australian North Coast Shark Fishery
SCTF	South Coast Trawl Fishery	WCB	West Coast Bioregion
SFD	Standard Fishing Day	WCDGDLF	West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery
SIEV	Suspected Illegal Entry Vessel	WCDSF	West Coast Demersal Scalefish Fishery
SLED	Sea Lion Exclusion Device	WCDSIMF	West Coast Demersal Scalefish (Interim) Managed Fishery
SMFG	Size Management Fish Ground	WCEMF	West Coast Estuarine Managed Fishery
SSMF	Specimen Shell Managed Fishery	WCRLMF	West Coast Rock Lobster Managed Fishery
SST	Sea Surface Temperature	WDWTF	Western Deepwater Trawl Fishery
SWCC	South West Catchment Council	WTO	Wildlife Trade Operation
SWTMF	South West Trawl Managed Fishery		
TAC	Total Allowable Catch		

